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A Handbook on
Image Processing and Wireless Communication

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A HANDBOOK ON

Image Processing and Wireless Communication
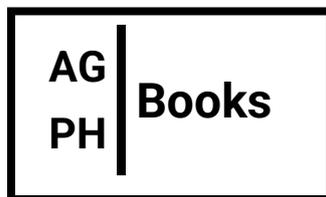
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About the Book

A book is stated as authors way of presenting their thought on the topic with evidence. Wireless communication is one of the most vibrant areas in the communication field today. The past decade has seen many advances in physical-layer wireless communication theory and their implementation in wireless systems. This book takes a unified view of the fundamentals of wireless communication and image processing. This book includes articles which have been contributed by eminent scientists, academicians and research scholars is intended for use on graduate courses in electrical and computer engineering and will also be of great interest to practicing engineers. This book comprises of several papers written by researchers in the form of chapters. In the book we will see the impact of these features on the appropriate choice of communication techniques.

This book aims to present modern wireless communication concepts in a coherent and unified manner and to illustrate the concepts in the broader context of the wireless systems on which they have been applied. Research methodology is an important aspect of business and this book comprises of different methods and process of research that are brought in use.

Preface

We are delighted to publish our book entitled "A Handbook on Image Processing and Wireless Communication". This book is the compilation of esteemed articles of acknowledged experts in the fields of business management.

This book covers state-or-the-art applications in both signal and image processing, which include chapters like optical communication and sensing, wireless communication management, face recognition and facial imaging, solar imaging and feature detection, fractal analysis, and video processing.

The articles in the book have been contributed by eminent scientists, academicians and research scholars. Our special thanks and appreciation go to experts and research workers whose contributions have enriched this book. We thank our publisher AGPH BOOKS (Academic Guru Publishing House), India for taking efforts in bringing out the book.

Finally, we will always remain a debtor to all our well-wishers for their blessings, without which this book would not have come into existence.

- Editorial Team

A Handbook On: Image Processing and Wireless Communication

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CONTENT

A-State-Of-Art Review on The Recent Developments in Vehicular Metropolitan Network and Communication Systems

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Abstract

There are a variety of transportation-related technologies in use today. There are signs that the intelligent transportation systems are on the verge of a paradigm change thanks to recent initiatives in academia and business. The city's transportation network requires a cutting-edge management as well as control architecture. This covers a wide range of topics, including as traffic control, road safety, and the connectivity and communication of moving vehicles. Enhanced sensor as well as computing platforms will be integrated into vehicles. In addition to improving transit safety including efficiency, this new technology will also offer entertainment. Vehicle communication systems and networks in urban areas are the focus of this article, which examines the most current ideas, solutions, and technology in the field.

Keywords: Internet of vehicles (IoV), Vehicular ad hoc network (VANET), Intelligent transportsystem (ITS), Trust management

1. INTRODUCTION

Traffic congestion, deaths, as well as injuries are only some of the social costs associated with the increasing mobility of the people and things. We presently use a variety of solutions to address these issues, such as FM radio broadcasts of traffic including the hazardous situations that interrupt user-tuned receptions; the variable message signs that are spaced some few kilometres apart or even at the strategic

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points (— for example, merging highways, bridges, tunnels,) along the freeways; the electronic toll systems that collect tolls; as well as the variable message signs which are spaced a few kilometres apart or at the strategic points along freeways. Latest years have seen an increase in the traffic congestion including accidents, and also environmental degradation produced by vehicle traffic and gasoline usage. In both developed and emerging nations, traffic is a major issue that has to be addressed. Accidents involving motor vehicles do significant harm to people and property. The WHO estimates that more than the 100 million people die every year in road accidents throughout the globe, resulting in up to the $500 billion in the economic losses. Urban traffic congestion also reduces transportation efficiency, which has a negative impact on economic development. The existing transportation system's efficiency as well as safety may both need some work. [2].

There are a slew of innovative uses for the VC systems which will make transportation safer, more efficient, as well as the more enjoyable. As a result, procedures for increasing security as well as the privacy must be implemented [3]. It is possible for such driver to customise her driving experience as well as stay informed about vehicle status through a variety of the onboard controls as well as the information sources. The Passive safety mechanisms protect the passengers as well as vehicle against hazardous driving conditions (such as anti-lock braking systems). Using real-time data from the road, traffic, scenery, and vehicle position, they may warn the driver as well as either avoid or at least minimise the consequences of an accident. Fleet management as well as the gathering of traffic data may be accomplished using more complicated systems that depend on diverse technologies (– for example, roadside cameras).

(ITS) that is Intelligent transportation systems are currently taking a huge leap ahead thanks to recent technology advancements in the mobile computing, the wireless communication, and the remote sensing. There are several computers as well as the sensors aboard automobiles, each devoted to a certain component of vehicle's functioning. Additions include new wireless communication as well as computing as well as new sensors. Besides gathering data about their surroundings, cars that are interconnected communicate this data in the real time with the other adjacent (theoretically) vehicles. Radiation-based solutions may work outside radar as well as the vision's line-of-sight restrictions, allowing for cooperative methods. Infrastructure and vehicles work together to detect potentially hazardous conditions across a wide range of spatial and temporal scales. For road safety as well as transit efficiency, the use of appropriate (VC) that is the vehicular communication structures is essential.

In this post, we'll take a look at some of the most recent breakthroughs in virtual reality systems. We keep abreast of the most recent developments in the field, and we glean the most important technical information from a broad variety of ongoing projects. It is our goal, rather than only an architectural one, to compile the most current knowledge from the worlds of business and academics into a single, succinct, and quantifiable report.

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2. LITERATURE REVIEW

[4] Various safety, information, mobility, including environmental applications may be achieved via the use of the vehicular communication. Academic, industry, and governmental interest in the vehicular communication has grown significantly over the last several years due to its unique uses and qualities. A complete review of the vehicular communication is presented in this study, which includes current research and possible future directions. It is a fresh tutorial/survey of such vehicular communication sector, including the most up-to-date information. The architecture, applications, upcoming radio access technologies, standards, and the project activities are presented inside the state of art. We examine ITS protocol stacks inside the United States, Japan, as well as the Europe according to the most recent specifications. In this work, we describe the developing radio access technologies for the connected as well as the autonomous cars, including the visible light communication, the mmWave, the Cellular-V2X, including 5G, and also their accompanying problems. There are also the new study directions in the growing areas of such a domain, including seamless connectivity, fog, edge, software-defined as well asw the named data networks, and security. We think that our effort will assist scholars, developers, as well as government agencies in becoming acquainted with the most recent innovations in the sector.

[5] CVN literature produced between 2010 as well as 2016 is reviewed in this research. Taxonomy depending on 3 key CVN types, namely the (VCC) that is the vehicle cloud computing, (VuC) vehicle utilising cloud, and (HC) hybrid cloud is also described in this paper. System, application, architecture, and service relatedness is the emphasis of the taxonomy. However, whereas VCC has received much attention, the two main types have yet to be thoroughly examined. These factors drive our investigation. In this paper, we compare and contrast cloud computing, virtualized cloud computing, including virtualized virtualized cloud computing (VCC, or VuC, or HC). Lastly, we discuss open topics and difficulties.

[6] VSNs (Vehicular Ad-Hoc Networks) and the (MSNs) mobile social networks are two new communication fields in which key ideas are being taken from one other (MSNs) which is called mobile social networks. Research into data dissemination, content sharing as well as the delivery systems is opening up as a result of this new paradigm. It is possible to harness the interdependencies of the network entities in virtual networks (VSNs) for future applications using (SNA) social network analysis. Virtual social networks (VSNs) bring commuters together who share same aims, hobbies, or modes of transportation in a virtual world of moving cars, passengers, and drivers. In this research, we examine the potential uses of VSNs as well as communication architectures in a vehicular context. In the VSNs, nodes' social as well as mobility behaviours are used for recommendation systems including route planning. VSNs, data distribution, and mobility modelling are discussed in this overview of the latest research. There is also an overview of several recommendation systems including route planning protocols relying on the crowdsourcing as well as cloud computing with the future research goals included.

[7] A scalable as well as dependable mobile communication network is required for vehicular clouds and self-driving cars. Even while both LTE as well as DSRC have indeed been attempting to fulfil this duty, none can meet all of the requirements owing to intrinsic architectural restrictions. Thanks to 5G as well as (MEC) Mobile Edge Cloud or Computing, which aim for the ultra-low packet latency, great dependability and the gigabit-level wireless bandwidth, the next generation of mobile networks is just around the horizon. Rather than merely offloading application service to edge servers on the MEC, the vehicular communication packets are being routed across the MEC network in just such unique vehicular MEC architecture. V2V as well as V2I communication is supported with great scalability and assured low packet latency, which we explain in detail. Our MEC vehicle network architecture and the mobility management problem on edge cloud are also thoroughly discussed. DMM operations allow us to seamlessly and transparently switch between edge cloud IP addresses. NS3 is used to do proof-of- the -concept simulations.

[8] Fog computing in vehicles is an extension of fog computing concept. More cars may be supported, communication efficiency is improved, and constraints in traditional vehicular networks such as the latency, the location awareness, including real-time reaction are addressed thanks to this technology (typically required within the smart traffic control, the driving safety applications, the entertainment services, and the other applications). The importance of these needs is magnified in hostile circumstances (Foe example urban warfare as well as the battlefields within Internet of the Battlefield Things that involving the military vehicles). Vehicle fog computing, on the other hand, does not have a universally acknowledged definition or set of use cases. Here we offer a typical use the case for automotive fog computing in order to codify vehicular fog computing architecture. After that, we'll talk about some of the most pressing security as well as forensic issues and possible remedies.

[9] When it comes to the traffic management, the goal of such intelligent transportation system (ITS) is to deliver cutting-edge applications as well as the services while also making data more easily accessible. Using unused onboard resources in the transportation systems and advances in the Cloud computing resource management have made the notion of the "Vehicular Clouds" more appealing. For more dynamic Vehicular Cloud, one such work compiles and defines the most current ideas and solutions including applications, services as well as traffic models that support Vehicular Cloud. The transportation system as the whole, as well as its managers, drivers, passengers, including pedestrians, benefited greatly from our review of a wide range of potential applications including services. In spite of this, deploying the Vehicular Cloud on constantly changing the physical resources is a huge problem. Constructing a new sort of Cloud is made more difficult by environmental changes that raise basic questions. We discovered which Vehicular Cloud computing is possible in both static and dynamic environments, including a parking lot or even the garage, by examining the traffic models.

[10] There is a lot of promise for the vehicular networking to allow a wide range of traffic safety, the traffic efficiency, including entertainment applications. As part of this survey and instructional article, we present such overview of the applications and related needs, along with the obstacles and their recommended solutions. In additional, we provide the overview of the key ITS initiatives and

the projects in the United States, Japan, and Europe, both present and former. Furthermore, the protocols as well as architectures used in such initiatives and projects in the United States, Japan, and the Europe are examined.

[11] A growing number of researchers in the fields of wireless networking and the automotive sectors are interested in the communication capabilities of vehicular ad hoc networks (VANETs). Vehicular Sensor Networks (VSNs) are now conceivable thanks to recent advancements in the vehicular communications, wherein mobile cars are outfitted with sensors of various kinds that can detect events, analyze observed data, and the route messages to certain other vehicles. VSNs. It is the purpose of VANET research to construct a vehicle-to-vehicle communication system that can quickly and cost-effectively distribute data for such benefit of the passengers. VANETs aren't just for show; they're designed to keep drivers safe by broadcasting vehicle status information like location and speed vectors and alerting them to potentially hazardous conditions in their immediate surroundings. The driver as well as passengers' comfort might be improved by safety as well as convenience applications, as well as by entertainment and leisure apps. When it comes to transmitting real-time information in VSN, our key aim is to use the available bandwidth efficiently and achieve minimum latency. Amongst the most pressing concerns in vehicle networks, data transmission is critical to the success of the network as a whole. Architecture that enables cars to dynamically assess the transmission range as well as use this knowledge for the most efficient propagation of a broadcast message is developed.

[12] Vehicle Ad hoc networks (VANs) are an emerging as well as widely used technology because of its potential for creative uses in the transportation market. The technology has now been confronted with a number of difficulties and is now dependent on a costly architecture. Reduced investment and improved intelligent application performance for the driving safety as well as the traffic efficiency are two benefits of integrating (WSN) Wireless Sensor Networks into vehicular network infrastructures. We provide a wireless sensor-dependent hybrid architecture for automotive Ad hoc network navigation systems in just this study. The design is appropriate for the mountain range highways, where communication between cars is difficult. Using the proposed architecture,the roadside information may be sent and interpreted, which is useful for the navigation as well as for alarm messages.

[13] The absence of substantial advancements in the alternative energy sources has resulted in a rise in both fuel use as well as the gas emissions. In light of this, it is critical that transportation efficiency as well as emissions be improved, since automobiles are a major source of air pollution. As a new eco-friendly the vehicular routing algorithm that takes into account road features including surface conditions and slopes as well as current traffic patterns, EcoTrec is introduced in this work. Data from scattered cars is collected by EcoTrec via the (VANET) Vehicular Ad-hoc NETworks, which is also used to the disseminate information to assist routing algorithm. When the algorithm determines the most fuel-efficient route, it avoids flash congestion by directing the car to the least congested path possible. Using the EcoTrec, the fuel emissions were dramatically decreased compared to current state of the art vehicle routing algorithm.

[14] A brief introduction to cloud computing as well as the fundamental ideas of the vehicular networks is provided in this article. As a result of this, the cloud computing architecture for the multimedia services is offered. Vehicle networks are becoming more capable of providing computing and data collecting for multimedia material because to the increasing use of sophisticated as well as the embedded equipment like sensors.

[15] With its unique characteristics including applications in standardised and effective traffic management, the road safety as well as entertainment, vehicular networking has grown into an important research topic. Communication systems, the on-board computer capabilities, storage, and greater sensor power are projected to be increasingly prevalent in automobiles in the future As a result, a variety of technologies have been used to help preserve and develop (ITS) Intelligent Transportation Systems. There have been some new ideas put out to deal with the problems associated with vehicle networks. (VCC) Vehicle Cloud Computing is one of the possible answers. By using on-board resources including computer, storage, and the internet, the VCC has the potential to have a significant influence on the traffic management as well as safety. This article provides a comprehensive overview of the cloud computing for vehicles. In addition, we provide the taxonomy for the vehicular cloud that takes into account the wide range of applications, the cloud formations, the key management, the inter-cloud communication systems, as well as many elements of privacy including security. We build the architecture for the VCC based on a thorough assessment of the literature and list the characteristics of a vehicular cloud which enable this model. Using a standard (CC) Cloud Computing model, we examine and contrast this new technique. For the converging the intelligent vehicular networks towards the autonomous traffic, the vehicle control, or the perception systems, we discovered which the VCC is being the technologically and the economically viable technology change paradigm.

3. VEHICULAR NETWORK ARCHITECTURE

The system architectural model comprises of four unique domains: in-vehicle, the adhoc, the infrastructure, as well as the service.

3.1. In-vehicle domain

Connected and autonomous vehicles have different in-vehicle components. All three components of vehicle's intravehicle system are referred to as CCU that is Communications Control Unit, OBU that is On-board Unit , as well as HMI that is Human Machine Interface . The CCU conducts communication from the physical layer towards network layer. Transceiver modules with the radio frequency antennas for every communication interface are included in CCU, which allows for the interactions with various wireless access technologies like Bluetooth, WiMAX, the Wi-Fi, DSRC, Wi-Fi Hotspots (IEEE 802.11u) as well as the cellular connectivity (3G/4G/LTE-A), as well as the ability to connect with the Internet. In-vehicle sensors such as GPS, RADAR, Camera as well as the Light Detection or Radar

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(LDR) may be integrated with the system (Li- DAR). The OBU receives data from both internal and external sources through (CAN) Controller Area Network.

All the necessary hardware as well as the software for executing a wide range of programmes are included in OBU's hardware configuration. Aside from these fundamental functions, it is indeed responsible for secure data transfer, IP mobility, as well as other important aspects. ITS applications as well as the services like the hazard-warning, the navigation system, the route information, the traffic information, the voice and the text messaging, etc. may be supported by this computer system. The OBU serves as a conduit between the driver's HMI and the system itself. Drivers may employ the OBU (Hardware and Software) as well as the CCU (Communication and Control Unit) capabilities via the HMI user interface, which provides pertinent information to the driver and other passengers of the vehicle. It enhances the driver-vehicle relationship. Messages are sent to the driver's display screen or even the speaker with in text form, speech, or video inside the event of an emergency. Interaction as well as assistance are enhanced by the use of a display as well as sound system in addition to gesture support, touch screen, and voice recognition in just this interface.
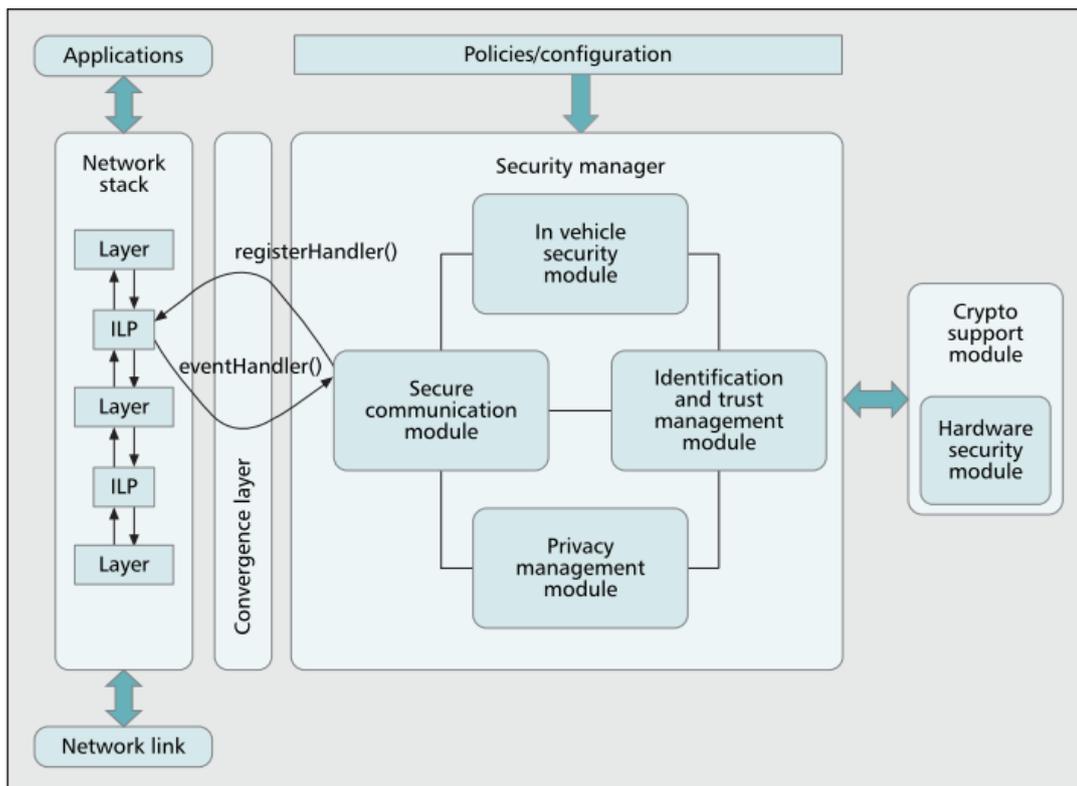
Figure 1 Baseline architecture: deployment view [3]

3.2. Adhoc domain

The adhoc domain is indeed a subset of the (MANET) Mobile Ad-hoc Network, in which the wireless network is built on the fly to facilitate communication between moving vehicles. Vehicle as well as RSU are indeed the two primary parts. Vehicle-to-vehicle communication is ad hoc and might be single hop or even the multi-hop. When RSUs are present, they may assist in extending communication range and helping to pass communications to the other vehicles.

3.3. Infrastructure domain

Roadside wireless infrastructure as well as the cable backbone network with the middleboxes are both included within the infrastructure domain. Base Stations (eNB), the RSUs (DSRC), and the Wi-Fi Hotspots are all examples of the roadside wireless infrastructure. Components of the Virtual Private Network's wired network architecture may include access switches (inside the event of the Software Defined Network), routers (within the event of the Software based Network), fog nodes (in event of the Software Defined Network), as well as gateways (VPN). ITS agencies, telecoms or even the service providers, as well as manufacturers may all make use of such wired including the wireless components. Connectivity between cars as well as service domain is made possible by the combination of wireless infrastructure as well as wired infrastructure.

3.4. Service domain

The top part of architecture is called service domain, and it is responsible for providing services to cars connected to the infrastructure do-main through V2I/I2V. It may be divided into two primary categories:

• In the urban,the rural, as well as highway zones, the road administration agencies offer **traffic-related services**.

• **Generic services** Service types include Internet, the subscription-based as well as the enterprise-based services (phone as well as video conferencing, for example), as well as the cloud-based services like the electricity (from smart grid).

4. VEHICULAR COMMUNICATION SYSTEM

Vehicle-to-vehicle communication encompasses not only the vehicle itself, but also roadside equipment, clouds, grids, fog networks, Internet, and any other communications devices person or a pedestrian may be carrying about with them. When it comes to vehicle communications, the goal is to make driving safer and more comfortable for drivers while also cutting down on fuel usage and carbon emissions. Vehicles as well as other communication units exchange information to accomplish these objectives.

Communication between vehicles and other devices is called Vehicle-to-X (V2X) [2]. Among these connections are V2V,V2N, V2I, and V2P, among others.

Vehicle-to-Vehicle. Vehicle-to-Vehicle. It's impossible to predict how V2V communication will unfold. VANET as well as inter-vehicle communication are widely recognised terms for this kind of communication (IVC) that is Inter Vehicle Communication. If the two vehicles are within range of each other, they may communicate directly; otherwise, data is sent along through the multi-hop communication.

Vehicle-to-Infrastructure/Network. Vehicle-to-Infrastructure or the Network. This style of operation allows for two-way communication in between vehicle as well as roadside network infrastructure. The cellular based stations as well as (RSU) roadside units make up radio access network infrastructure. Switches and routers, among other middleboxes, form the backbone of the network. Fog, Cloud, and the grid networks, as well as server the farms owned by service providers, the manufacturers, and the legal authorities, might form the backbone of the network architecture.
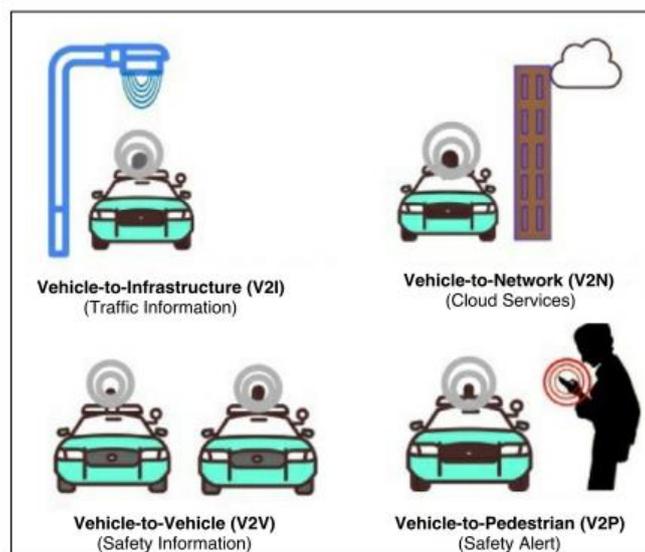
Figure 2 Vehicle-to-everything (V2X) scenario.

Vehicle-to-Pedestrian/Device. Vehicle-to-Pedestrian/Device. Vehicle-to-Person (V2P) is a communication mechanism that may be used by pedestrians, passengers, and cyclists to exchange information with a vehicle. As a result, V2X allows vehicles to interact with each other and their environment. It is demonstrated in Fig. 1 that traffic flow may be improved by using V2N, V2V and V2P to communicate with vehicles in the vicinity of each other, as well as pedestrians, to warn them of potential collisions. The current ITS technologies are just a small portion of the technologies that will be accessible in the future. Some of the most important elements of future ITS will be vehicle connectivity and automation.

Connected Vehicle (CV) technology Using V2X communication, Connected Vehicles (CVs) can converse with one another and the world surrounding them. Such connected vehicle technology aids in the provision of relevant information for the safety as well as the non-safety related services as well as the applications to driver, passengers, the transportation agencies, cloud as well as the objects in its surroundings (pedestrians and cyclists).

The Automated Vehicle (AV) The (NHTSA) National Highway Traffic Safety Administration defines the (AV) Automated Vehicle concept (NHTSA). Six stages of automation have been established by (SAE) Society of Automotive Engineers (Level 0 to Level 5). There really is indeed no automation at Level 0, thus everything must be done by the driver. The first level of automation helps the drivers in their work. There is now just Level 2 automation accessible to the general public, that requires the operator to have their hands on the wheel at all times. Self-driving cars of level 5 are completely autonomous and not need a human driver. The development of automation technologies at the third through fifth levels is still in its infancy. Because it has become commonplace, linked car technology must be included in all vehicles, no matter how advanced they are. Future ITS can be more profitable, effective, and satisfy regulatory and customer demand for the safety, entertainment, and the other services via the use of linked vehicle technologies.

5. VEHICULAR COMMUNICATION APPLICATIONS

User services offered to vehicles are three of the key areas in which VC systems may allow applications. It's the first and second categories that drive a new system development. In several circumstances, it may seamlessly integrate into VC however Its con- tracts and operate as a driving force with in market. The third category makes use of newly coined as well as existing systems, there are a great number of applications that fit through one of the 3 categories stated above:

- As a result, the safety of the motorist is improved.
- For better transportation effectiveness, drivers have access to detailed information on transportation system including current traffic conditions that is often region-specific.
- Services improve comfort and functionality of the passengers and drivers alike when they are on road.
- Every application, we give the following information:
- **Communication** Ad hoc as well as infra-structure-dependent communication, discussed earlier in article, identifies the appropriate wireless data connection.
- **Messaging type**, When it comes to sending messages, there are a number of factors to consider.
- **Message period**, Frequency of messages, which may be used in the periodic messaging apps.
- **Critical latency,** Critical latency, the greatest amount of time the application needs from such underlying protocol stack in order to process and send message in questio.

- **Other requirements**As well as other considerations, such as priority just at (MAC) medium access control layer, precision of location, maximum suggested communication range as well as so forth

6. INTERNET-OF-VEHICLE: EDGE, FOG AND CLOUD COMPUTING

An inevitable combination of IP, the mobile networks as well as the (IoT) Internet of Things is the (IoV) Internet of Vehicles. There are many components to this technology, including smart things (embedded throughout vehicle sensors), the multi-services edges (WiFi, LTE, 802.11p) as well as the fog nodes (dispersed intelligence). The IP/MPLS Core (Safety, QoS, Multicast as well as the Network Services) as well as the Vehicular Cloud (virtualization, IoT analytics, authentication as well as applications) are all part of this (Fig. 25). The introduction of multiple physical things into cyberspace by IoV opens up exciting new study possibilities in the fields of online privacy as well as the security. Research in the Internet of Things (IoT) and its subdomains, like mobile edge, the fog computing, security, privacy, and trust, QoS as well as the large data analysis including processing and machine learning centered intelligence are just a few of the areas where IoV may be used.
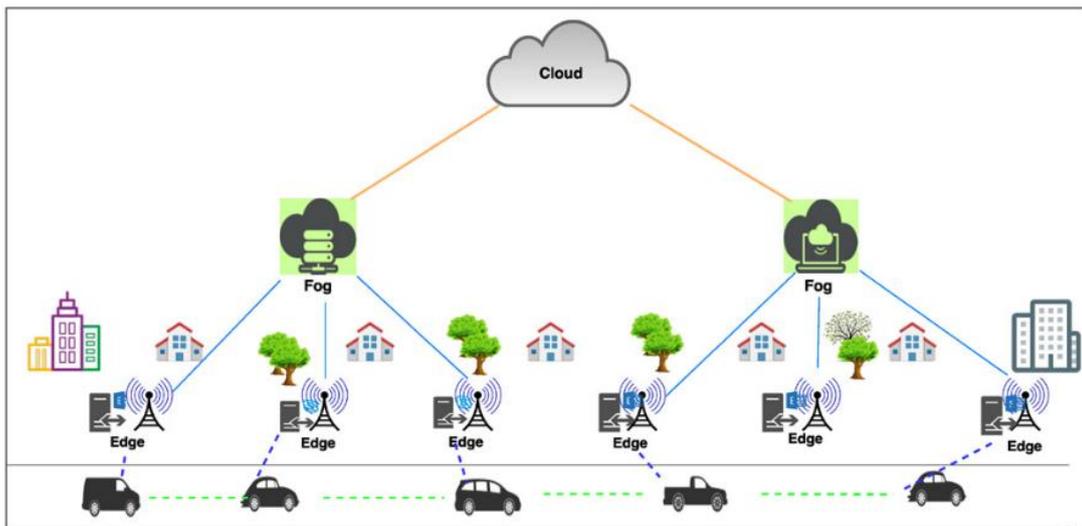
Figure 3 Internet-of-vehicles: Edge, Fog and Vehicular Cloud.

6.1. Vehicular Cloud Computing Architecture

Inside-vehicle, cloud, and communication are the three levels of Vehicular cloud computing architecture shown in Figure 3. Using cloud storage for data aggregation is one of the most significant benefits of VCC, especially for government and commercial entities such as police and the meteorological department. VCC architecture's last layer, cloud, can, nonetheless, quickly process large and sophisticated calculations.
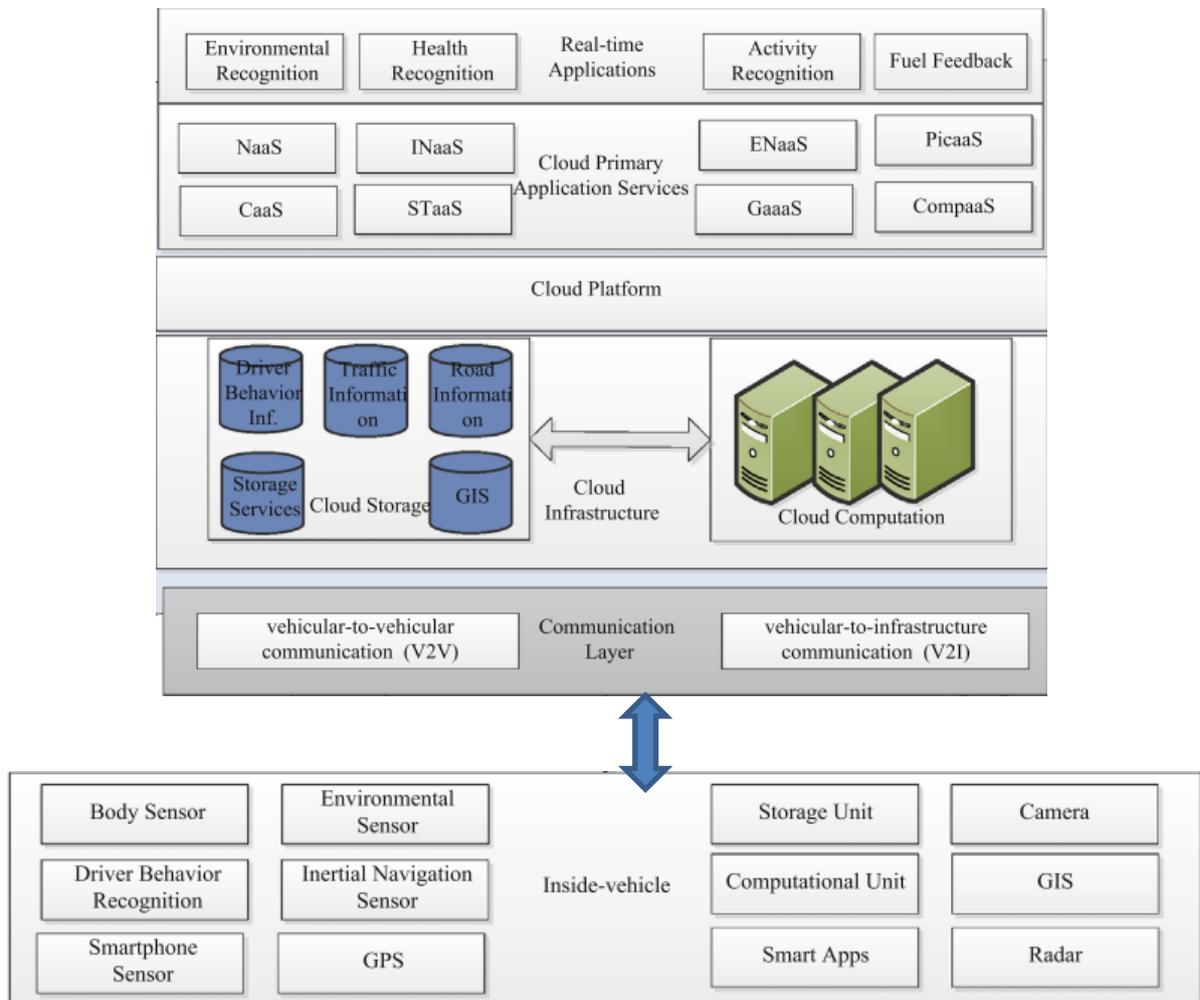
Figure 4 VCC Architecture.

In the cloud, there are three sub-layers: cloud infrastructure, the cloud platform, as well as the application. A variety of applications and also services, including as the fuel feedback, the human activity detection, health recognition, including the environmental recognition, are included in application layer and may be accessed remotely by the drivers. Automatic analysis as well as the interpretation of live events including their video data context are made possible via the application of the human activity recognition. Server 1 continues the discussion of these and other services that are implemented in the core services, like "Storage As A Service," "Network As A Service," "Cooperation As A Service," as well as the "Information As A Service." Input File (F) cloud storage as well as cloud computation make up cloud infrastructure. There are three ways to store data acquired by Server 4 within vehicle layer: the GIS system, the traffic control device, and the storage system called Server 2 Input File (F). Input File (F) computation is being used to speed up computational operations, such as

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sending data from health recognition sensors to the cloud storage database of the Server 3 (Corrupt) driver behaviour.

7. CONCLUSION

Securing vehicle communication systems is indeed a challenging undertaking with many different elements and distinct restrictions. As a result of our systematic examination of the topic, we have identified relevant dangers and adversary models. General security criteria have been examined and translated to particular VC applications. Security architecture for virtual reality (VC) systems has been developed based upon the set of the design principles aimed at creating a viable system which can be easily adopted for deployment. The Identity and the credential management, security for the wide range of the communication protocols, as well as the privacy-enhancing technologies have been the focus of our research. In addition, we carried out experimental assessments of our systems depending on the simulations and prototypes. It is clear from our findings which secure VC systems may be viable and capable of supporting the same kinds of applications as their less secure counterparts. In addition, the security architecture implementation may be easily adapted to just about any platform with just minor alterations. Aside from SeVeCom project coming to a close, we have discovered as well as made progress on new research issues. Our technology can provide a foundation for the implementation of strong, safe, and privacy-preserving VC systems. That's why we think it can.

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A Review on Impact of Image Compression Techniques on Face Recognition Accuracy

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Abstract

Face recognition as well as identification in surveillance including security applications often need a very effective facial image compression technique. However, only heuristic refinement of codec is made as per face verification accuracy parameter when using either regular general image codecs or particular facial image compression techniques. Image as well as video-based face recognition systems are the becoming a hot research area because of the increasing use of face identification in daily life. Face recognition researchers are presently focusing their attention on the effects of factors such as posture, lighting, and expression. Despite the fact that most photos are saved and/or delivered in a compressed format, little research has been done just on impact of the compression on the face recognition. Face-recognition algorithms are compared in a still-to-still setting with the uncompressed training as well as gallery photos, as well as the various compression ratios for the probing images, in such paper's review.

Keywords: Image compression, Lossless and Lossy compression, Face Recognition, Face recognition technique

1. INTRODUCTION

Recent advances in the face verification or even recognition have paved the way for a broad variety of the intelligent applications, including the surveillance video analysis and mobile authentication,

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among others. Face picture compression is widely needed because of the massive quantity of the data that is generated by these regularly used applications, as shown in Fig. 1.
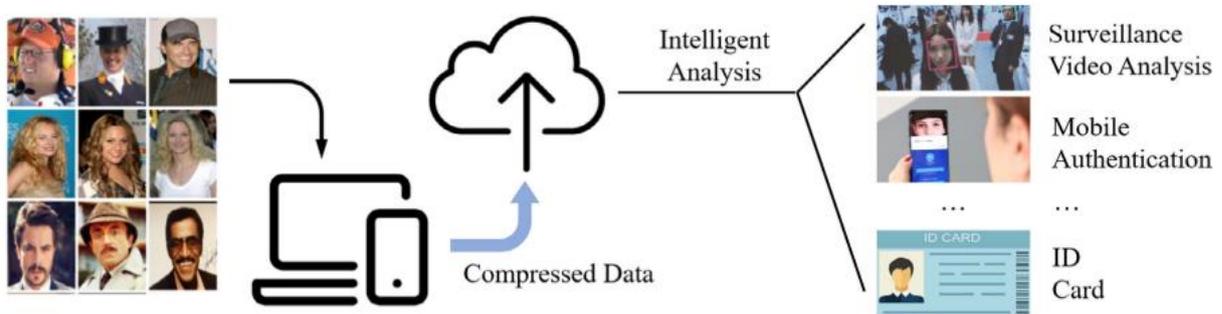
Figure 5 A highly efficient facial image compression is broadly required (located in blue arrow) in a wide range of intelligent applications

Face recognition systems based on the images and videos are becoming an increasingly relevant research issue as the no. of daily applications for face identification rises [1]. Pose, lighting, and expression have been the subjects of the greatest research in the face recognition thus far. In the field of the face recognition, little research has indeed been done over the consequences of compression. Only within uncompressed picture formats are the still-to-still image experimental setups investigated. While still photos are utilised as the gallery as well as compressed video snippets are used as the probes in the still-to-video research, the main focus is on face tracking and recognition. As a result of this misconception, the effects of the compression on the machine vision applications are seldom explored in these articles and thus are rarely investigated in general. As a result, it's common practise to forego compression altogether. Considering that security cameras as well as the other image capture equipment commonly produce compressed images, this study will investigate the impact of compression on established face-recognition algorithms. Another key problem is ability to store the compressed facial pictures on the low-capacity chips as well as smart cards (without reduction of performance whenever exposed to recognition). As a result, biometrics might be implemented into daily life much more quickly (the e-passport serves as an excellent illustration).

1.1. Compression Ratio

Compression ratio, which is measured in bits per pixel, is indeed the primary metric for gauging the degree of compression (bpp). Peak Signal to the Noise Ratio (PSNR) as well as the Mean Squared Error (MSE) are often used to measure picture quality. One such section focuses on a variety of factors. the sum of the squared errors between the compressed and uncompressed images is known as the MSE.

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}(x(i,j) - y(i,j))^2$$

M including N are indeed dimensions of pictures in i(x,y), whereas M and N are indeed dimensions of images in z(x,y). The lower the MSE, higher PSNR, because of such inverse link between both the MSE as well as PSNR.

The PSNR is a measure of the peak error between the actual and the compressed image is measured by:

$$\text{PSNR} = 20\,log\left(\frac{2^n - 1}{\text{RMS}}\right) \text{ [dB]},$$

The peak error in between the compressed picture and the original image usually measured by:

$$\text{RMS} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(I_i - I'_i)^2}$$

where n denotes original image's bit depth and RMS stands for Root Mean Square Error, which is described as.

2. LITERATURE REVIEW

(Calderoni & Magnani, 2022) (Calderoni & Magnani, 2022), When it comes to electronic identification papers, they looked at the influence of the lossy compression on facial photographs. In compliance with existing legislation and their latest modifications, the research is carried out after the registration procedure. Many tests were conducted using the different datasets to represent the various enrollment settings specified by ISO as well as the International Civil Aviation Organization (ICAO). The findings are up for debate. The widely used open-source tool we have adopted indicated a significant deterioration, despite the fact that commercial tool we utilised for our research reported only minor alterations after picture compression. Enrollment process improvements regarding original picture size as well as scanning or even acquisition quality might be lost due to a restriction on image size. Because of this, we recommend that the enrollment standards be updated to emphasise that more space should be provided for the face picture.

(Chen & He, 2019) Facial image compression schemes that are very efficient in surveillance as well as security contexts are often required. However, only the heuristic refinement of such codec is made as per face verification accuracy parameter when using either regular general image codecs or particular facial image compression techniques. It is our goal to develop the image compression framework that is based on the learning and includes a new (RAP) Regionally Adaptive Pooling module for whom the parameters can indeed be automatically optimised using feedback from just the integrated hybrid semantic fidelity metric. We have also explored the possibility of using a (GAN) Generative Adversarial Network, directly in the image compression scheme to achieve better compression rates. Using same

face verification precision distortion criteria, the experiments show that the framework performs better than other codecs by 71.41percent, 48.28percent, and 52.67percent in terms of the Bit Rate Saving, respectively. The newest face image codecs are indeed compared against LFIC's higher performance. This new method of optimising compression using semantic distortion measures, as opposed to the typical heuristic approach used by standard picture compression algorithms, also yields some intriguing visual results.

(Alorf, 2017) For first time, the IPCA method is put to the test on photographs in this study. Using such PCA as well as IPCA algorithms, a novel face detection and identification approach is proposed. There is a comparison between the PCA as well as IPCA algorithms in picture compression as well as face identification and recognition. The results show clearly which approach performs better in every of these areas. The PCA as well as IPCA algorithms' image compression performance may now be assessed using a three-measure approach we developed. For greater efficiency, we've recommended using the other segmentation approach in conjunction with algorithms, which centres and normalises those pixels which occupy faces.

(Mizoguchi, 2017) To reduce the size of fingerprint archives, fingerprint pictures have previously been compressed for forensic biometric systems in (AFIS) Automatic Fingerprint Identification Systems applications. Wavelet Scalar Qantization does indeed have a long history as an effective encoding strategy in such large-scale applications. The Federal Office for the Information Security commissioned Fraunhofer IGD to perform the research BioCompress, which is summarised in this document (BSI). We tested the effect of lossy compression strategies on the biometric recognition performance using fingerprint as well as facial image databases including various biometric algorithms.

(Liu & Kau, 2017) (Liu & Kau, 2017) PCA as well as Entroy Coding have been used to develop a scalable face picture compression technique. We might extract the best representative an eigen-image of the human faces using the PCA and certain training face picture patterns. Encoding of human face will employ just first term of a recovered eigen-images to decrease coding complexity and increase compression ratio; that is, eigen-image with highest energy strength would be used once only during encoding. You can achieve a decent balance between computing the complexity, the compression ratio, and picture quality using the given technique.

(Mofarreh-Bonab, 2016) Many disciplines of research employ PCA that is a statistical method. Recent image processing applications have made advantage of this technology, particularly in the face recognition as well as the database compression. In recent study, this approach has been refined and other methods have been presented, such as 2D-PCA, kernel PCA, and several others. As a rule of thumb, these techniques have been utilised in face identification including processing of groups of photos, like face database processing. A novel approach for compressing a single coloured picture using the PCA methodology is presented in this research.

(Ram et al., 2014) One of the most interesting and useful uses of this technology is in the compression of the frontal face photographs. The performance of JPEG2000 may easily be outperformed by

algorithms specifically designed for this job, as shown in the recent research. Our new advanced redundancy tree-based wavelet transform is being used in the letter to present a unique technique for data reduction. The image adaptive redundant as well as multi-scale decomposition is seen to be extremely successful using such new transform, originally designed for the functions specified on graph as well as cloud of points. Rearranging the picture pixels in such a way that they generate a smooth 1D signal which can be sparsified using a regular wavelet seems to be main idea underlying this approach. Adaptive transforms of aligned frontal face pictures have been used in this study. Utilizing a training set of these photos, transform is intended to achieve best sparsification of an entire set. Transform is used to do sparse coding, and the resulting coefficients are then encoded using the entropy coding. The encoded picture is decoded using an inverse transform as well as further post-processing. We illustrate the suggested scheme's performance and put it up against the work of competitors.

(Hladnik, 2013) Here, we illustrate how two seemingly unrelated technological fields—the digital image processing as well as multivariate statistical analysis—can be effectively merged in the two applications of the great current interest: the lossy compression of the digital pictures and face identification. It is possible to apply (PCA) Principal Component Analysis in such applications. In many scientific and technical fields, (PCA) principal component analysis is among the most often used procedures for the dimensionality reduction or even the data exploration. Fig. 2 illustrates the primary components, which are a smaller no. of the variables that may be connected with each other. It is possible to conduct PCA on the 2D or even 3D data array of the digital picture since it is a two-dimensional (grayscale or color) function of the pixel values. PCA could be performed over the matrix that is m x n.
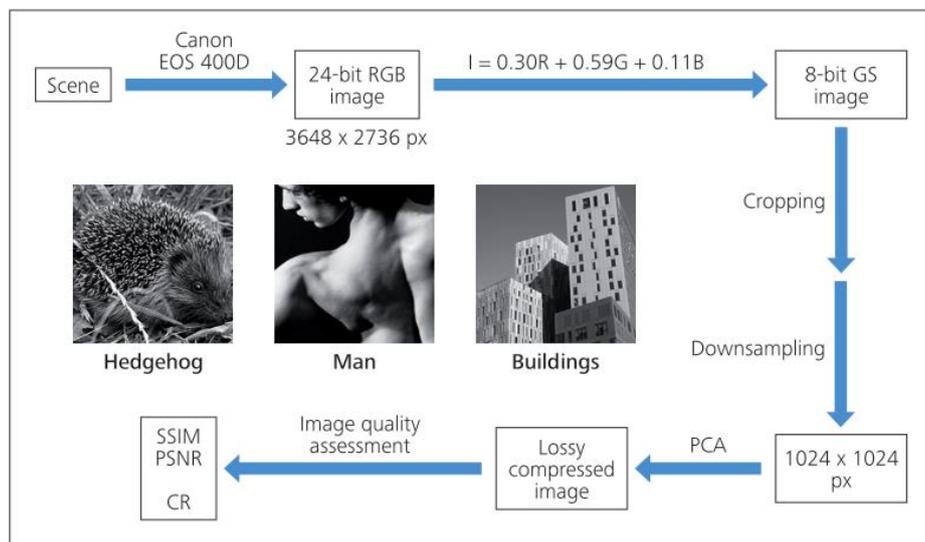

Figure 6 Image compression workflow through PCA

(Yan et al., 2008) (Yan et al., 2008) When developing the wireless face-recognition system, (Yan et al., in the year 2008) recommended using the Contourlet transform to the compress as well as extract

features from images. Wireless transmission for this system incorporates facial recognition methods and picture attributes. There really are two main reasons to use contourlet transform. Face recognition relies on the edge information to extract characteristics, although edges in the face picture are more complex than merely horizontal as well as vertical. Contourlet reconstruction of Stein-thresholder noisy coefficients has a lower mean square error within comparision to   wavelet reconstruction whenever coefficients are sent across the fading channel. Lower band coefficients may be used as the scaled-down version of the face picture for the coarse face recognition the screening whenever network resources are limited. When the coefficients are sent in a prioritised manner, the available wireless channel is fully used. Based on computer modelling, seems that the wireless face recognition system performs just as well as the wired one, but at a lower cost and with more deployment flexibility. If you raise transmission error rate sequentially, recognition performance loss is not the linear, but rather remains constant over a vast range of error rates. This shows even contourlet-based face recognition systems can withstand transmission errors up to the certain threshold. "

(Matschitsch et al., 2007) This study examines how various lossy compression methods effect the fingerprint as well as the face recognition system matching accuracy. This study examines the relationship between rate-distortion performance and matching scores achieved through recognition systems, using PSNR as metric. PSNR properly predicts that JPEG2000 as well as SPIHT will be most suitable compression algorithms for fingerprint as well as face recognition applications. However, PSNR reveals that JPEG delivers lower identification results for the face pictures when using fractal compression, which has been shown to become the least suitable. Face recognition systems use JPEG compression, which despite its poor PSNR performance operates well even at large bitrates.

(Rizk & Koosha, 2006) (Rizk & Koosha, 2006) used (PCA) that is the Principal Component Analysis and the (GHA) Generalized Hebbian Algorithm which is among the PCA approaches using the neural network to accomplish picture reduction and face recognition. The PCA as well as GHA algorithms were tested for the image compression including face recognition, and we observed that PCA provides the better compression ratio in comparision to GHA, while GHA provides a higher recognition rate over the PCA.

(Delac et al., 2005) Analysis of JPEG as well as JPEG2000 compression's influence on the subspace appearance-dependent face recognition systems has been conducted. For the very first time, effects of conventional JPEG2000 compression on the face recognition have been comprehensively studied, and prior tests for the JPEG compression have been extended in this work. More than a dozen different subspace facial recognition algorithms were tested using a variety of the bitrates (compressed ratios). In situations wherein storage space as well as transmission time are crucial, the effects of the picture compression upon recognition performance seem to be of particular relevance. It should be shown whether compression has no negative impact on performance, and in certain circumstances, it may even enhance it. New impacts and directions for future study will be discussed, such as JPEG2000's capability of capturing information necessary to recognise changes produced by photographs shot later in time.

3. DISTORTION METRIC

To put it another way, face image compression is just a specialised application of standard image compression techniques. Image or even video compression algorithms have evolved over time by decreasing the reduced bitrate within the same distortion between reconstructed pixels as well as the original pixels and/or by increasing the rate-distortion performance. The obvious difficulty is how to determine the distortion measure, particularly in the context of face recognition in the surveillance. Perceptual Fidelity, Pixel Fidelity as well as the Semantic Fidelity are the three most often used measures to identify distortion, based on the several levels of the human cognition on images and videos.
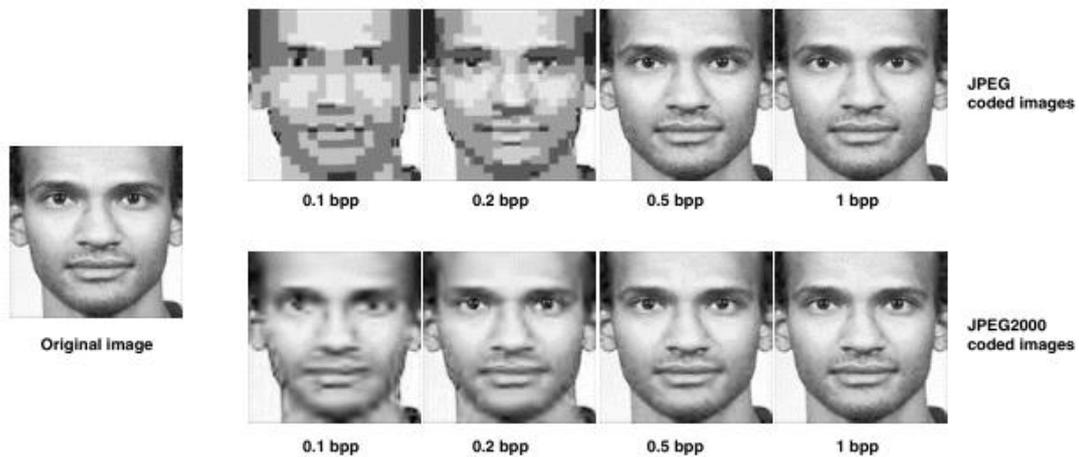
Figure 7 Example of Image degradation when subject to compression

Pixel Fidelity is indeed the most often used statistic, that evaluates pixel level difference in between the original picture as well as the compressed image, for example, MSE that is (Mean Square Error) (For example, MPEG-2, or H.264, or HEVC, etc.). It's a simple in-loop measure for the rate-distortion optimised compression that could be readily included into the image or even video hybrid compression system. Furthermore, it is clear that the pixel fidelity measure cannot adequately represent the human perception of watching. For this reason, numerous academics have established Perceptual Fidelity measurements to study objective metrics evaluating subjective browsing experience of the average person. Image or even video signals would be gathered as well as processed for the semantic analysis as a result of a development of the aforementioned intelligent applications. The semantics difference (– for example, verification accuracy variation) between both the original picture as well as compressed image will indeed be studied by researchers using Semantic Fidelity measure, which will be more required in the future. Few studies have been done in this area, and they tend to be task-focused.
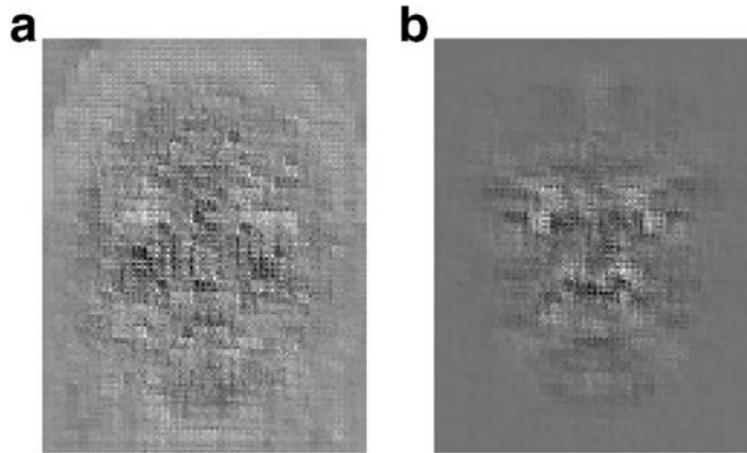
Figure 8 The visualization of gradient feedback from (a) MSE; (b) the integrated face verification metric, which shows that more focus is on the distinguishable regions (e.g., eye, nose) according to such semantic distortion metric

Quality of the reconstructed material may be evaluated using the different distortion measures previously described. Ultimately, however, picture quality evaluation is aimed towards optimising image compression systems, not only measuring quality of the images with varying degrees of distortion. Contrary to popular belief, image compression cannot readily include many of the more complex quality measurements associated with good performance. This may be done by altering image compression settings (– for example, parameters of Quantization) heuristically based on embedded quality measurements, but they're not completely automatic-optimized the end-to-end image encoders with incorporation of sophisticated distortion criteria.

4. THE PCA APPROACH

Predictive modelling as well as exploratory data analysis are common uses of PCA, a multivariate statistical approach. New variables called (PCs) principal components have been constructed that are entirely orthogonal to one another. (SVD) Singular value decomposition or (EVD) eigenvalue decomposition of such data covariance (or even correlation) matrix may be used to do PCA after the mean centering as well as normalisation, although both methods have their advantages and disadvantages.

Face photos are converted into a small collection of distinguishing feature images termed as the eigen faces, that are PCs of training set's face images, in order to use PCA for face identificatioNew images are projected into subspace covered by Eigen Faces (known as "facial space"), where they are compared to locations of known persons to categorise them.

Figure 5 illustrates a picture as well as the curve of the similarity values in between its rows to demonstrate the effectiveness of the procedure stated above. The curve as well as the picture are linked at certain points. The abrupt changes inside the plot of such similarity values are analogous to the big variations inside the image's rows with the most variances rather than its neighbours. There are little red squares in Fig.2 but also blue lines in the Fig . 5 that represent the same spots on the curve.
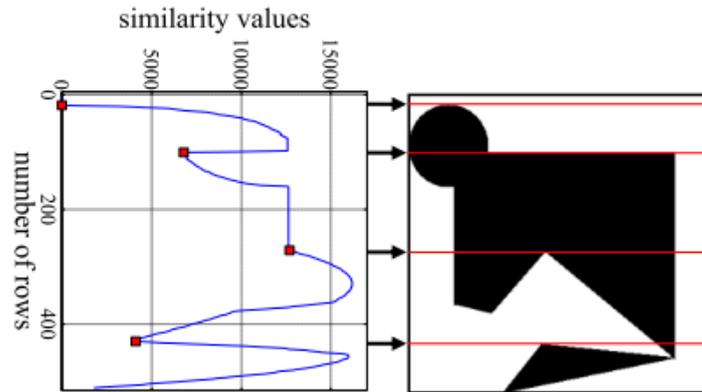
Figure 9 A simple test image and the similarity value curve of the image

We used the previously mentioned method on Lena picture. Figure 6 shows image's similarity measure. A similarity curve appears erratic and has a number of places with strong rises. Just so many points may be found by the algorithm for discovering sharp increases, causing the system to malfunction. Median Filter with the length of 10 was used to cross this similarity curve in removing noise. Fig. 7 shows the filtered curve after it's been processed.
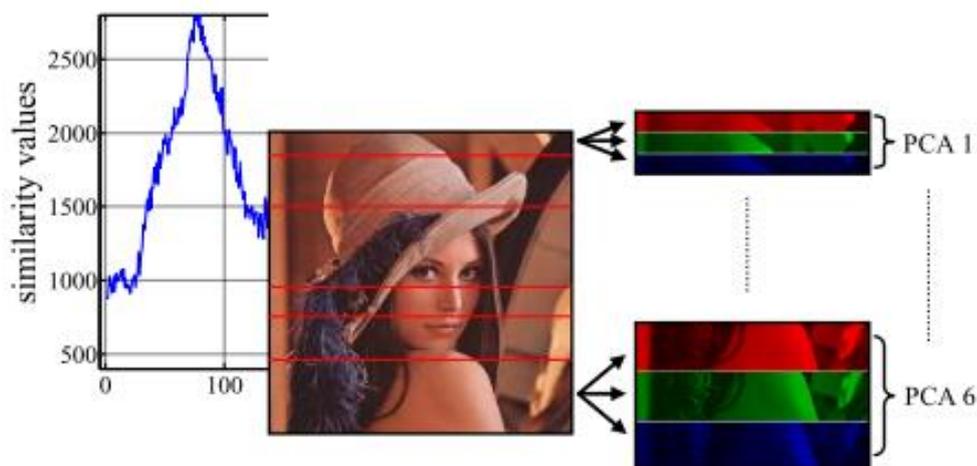
Figure 10 The similarity values for 512by512 image of Lena.
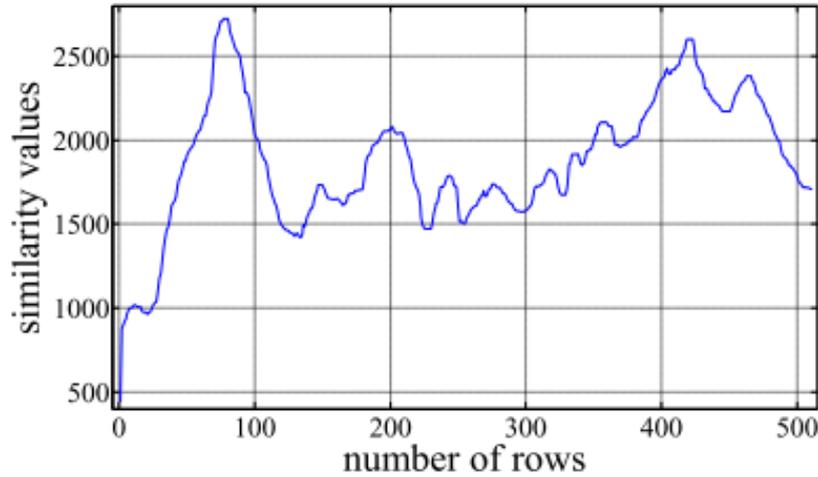
Figure 11 The filtered curve of the similarity values for 512by512 image of Lena

Figure 12 The compressed image of Lena, SSIM =0.7945, PSNR= 28.9760, Memory Ratio=0.0878

As seen in Fig. 8, overall results of the above technique reveal that PCA combined with the aforementioned algorithm is an effective way for compressing coloured photos. Programming in the parallel may help speed up an algorithm's execution time. Because every band of picture's compression process is independent of the others. According to the findings, 2D-PCA is a superior fit for this strategy. It is possible to create a new picture format using the above-mentioned approach. Additionally, compressed pictures may be reconstructed in a fraction of time required by other formats, including such JPEG.

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5. CONCLUSION

Choosing the optimum compression technique is so to be dependent on the particular application. Compression scheme complexity, the existence of artefacts, as well as the quality of compressed picture are among the most essential considerations when deciding on a compression method (block or blur or edge noise). PCA is one method for reducing the size of a picture file without sacrificing image's quality.

Computer vision or pattern recognition applications like face recognition have also been effectively accomplished using PCA. The face recognition system's efficiency may be significantly impacted by image/scene properties such as backdrop pattern or even human face size, as revealed in our research.

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A Survey on The Recent Developments and Modern Hardware Systems for Enhancing the Intelligent Transportation System

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Abstract

High-performance Modern Hardware Devices (MHDs) are becoming more necessary due to the growing complexity of the Intelligent Transportation Systems (ITS), which includes a broad range of applications as well as services. Machine Learning (ML) approaches have made the performance problem more apparent in large-scale contexts. A successful use of machine learning (ML) in the area of intelligent transportation systems (ITS) has provided efficient as well as optimal solutions to issues that were previously solved using conventional analytical and statistical methodologies. It's a difficult challenge to solve in the age of ML to meet the hardware deployment demands of ITS because of the time, space, environment, and cost aspects involved. MHDs were used in this study to examine the most current literature on ML-driven ITS, which focused on performance measures. Survey results may be used as a starting point for building appropriate hardware, enabling the integration of machine learning (ML) into ITS, as well as bridging the gap between academic research and real-world deployments.

Keywords: Intelligent Transportation Systems, Machine Learning, Hardware Devices, Performance

1. INTRODUCTION

The world's population has surpassed the 7-billion mark, but the global economy is also expanding at a rapid rate. People are used to having more freedom of movement, therefore transportation, particularly

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road transit, is the most widely available option. Transportation conflicts (accidents) will inevitably increase in number as the number of people utilising the system grows. As a result, there is a growing need for a transportation system which can securely convey huge numbers of people while also being environmentally benign. First, the US Department of Transportation established a society in 1991 to promote the development of intelligent transportation systems; along with this, multiple prototypes have been developed, but only a handful have been realised. Projects such as vehicle-to-infrastructure communication (V2I), vehicle-to-vehicle communication (V2V), and electronic fee collecting are among the most popular globally. ITS is still in its infancy in underdeveloped nations like India. There is little doubt that when the intelligent technologies are implemented, the world's surface transportation system could become the most efficient and environmentally benign in any industrialised or developing country.
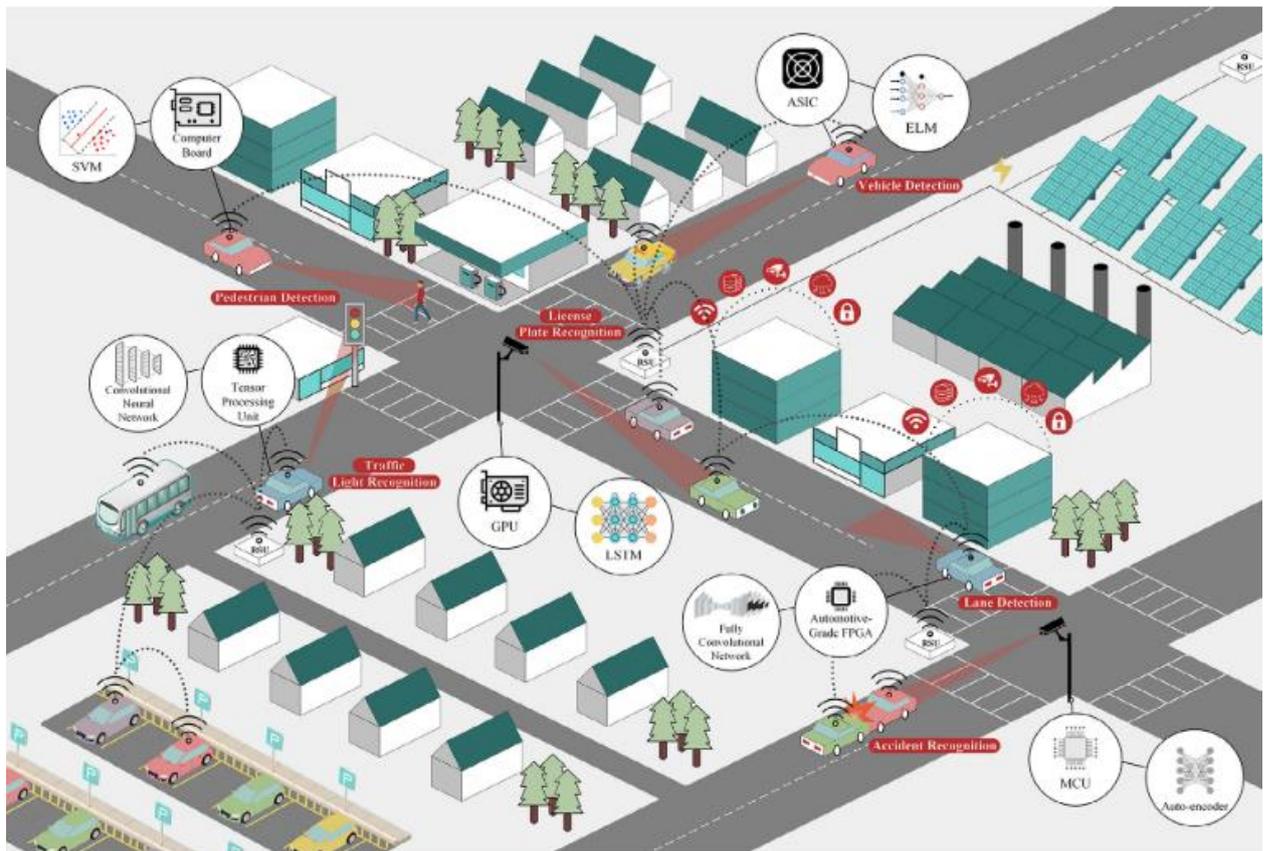
Figure 13 MHDs and ML approaches are used in an array of ITS applications in vehicle control and traffic management

Congestion and the convergence of modern information technology for the simulation in real time with communications networks have sparked interest in an intelligent transportation system. Increasing motorization, urbanisation, population expansion, as well as changes in population density have all contributed to a rise in traffic congestion across the globe. Air pollution, t ravel time, as well as fuel

usage are all impacted by traffic congestion. An rise in the number of road accidents has occurred in recent years as a result of the growth of roads. In order to address this issue with an intelligent transportation system, there is a strong argument to be made.

System built for metropolitan, governmental and private road transport organisations. For the driver console unit, electronic ticking machine passenger information system, the vehicle tracking system, a backend as well as hardware component are needed. GPS, Wi-Fi as well as GPRS are just some of the advanced technologies that may be used to plan as well as monitor buses in an Intelligent Transportation System. The Intelligent Transportation System (ITS) helps to improve public transportation by taking into account factors like bus revenue, public safety, and overall security. In this study, the influence of Intelligent Transportation Systems (ITS) on road transportation is primarily discussed, as are the many ITS application domains. It also discussed the introduction of different transportation technologies which are critical to homeland security, vehicle surveillance as well as technology that make our rides safer and more inexpensive.

2. LITERATURE REVIEW

(Alkinani et al., 2022) Transit logistics have developed to meet the high standards of data-intensive applications as well as the increasing number of interconnected cars to better serve public transportation. The advanced artificial intelligence approach must be implemented to fulfil public transportation demands and evaluate network-edge data effectively in order to support intelligent traffic management, efficient decision making, and intrusion and abuse detection in transportation system. We developed a logistic agent-based model for assessing the public transportation, like autos, buses, and trains, in intelligent transportation system because of the issues outlined above. Swarm-Neural Networks (SNNs) are the basis of the intelligent logistic architecture (SWNN). Sensory input is analysed to identify public transportation just at edge of the network using the suggested SWNN model. Every small-scale logistics delivery is shortened by the suggested SWNN model since it is created to fit in with intelligent logistic transportation architecture. Based on a typical TMD dataset, the proposed SWNN model's performance is tested using data gathered from numerous sensors like accelerometers as well as gyroscopes as well as audio sensors. Using a five-second time period, the sensory data characteristics are extracted. Models like XGBoost, Random Forest, as well as Decision Tree are compared to the suggested SWNN model's performance. According to the findings of the simulations, the suggested approach achieves 78–98% accuracy across the various aspects of a real-time dataset.

(Susanty et al., 2021) It was the goal of this research to find out what's preventing Semarang City from implementing an ITS system. This study outlines 16 obstacles to the execution of an ITS project based on prior research, the validation process, as well as the requests of an expert panel. Interpretative structural modelling (ISM) approach is then used to determine if the obstacles are connected directly or indirectly. Internal organisational impediments in the time of procedure for drafting plans, separated duties, and the correct organisational structure to drive ITS occupied the highest degree of data

processing using the ISM methodology. The lower level has a greater impact on this barrier than the other obstacles. ITS project implementation is hindered by a lack of interoperability of the system at Semarang City Transportation Department, which makes it difficult to integrate ITS-based transportation system; crashes as well as save lives; a lack of involvement of the related institutions to build long-term commitment as well as awareness which the ITS project has the potential to reduce, along with a political problem (the political short-termism or discontinuities because of the political cycles).

(Damaj et al., 2021) When there is a lack of infrastructure resources, there is a rising requirement for a consistent strategy to rational management of automobile traffic with the goal degree of dependability in supplying consignors' demand with the cargo resources. As a result of a hybrid system of cooperative transportation business planning, a freight transportation simulation as well as economic indicators, overcoming issues caused by infrastructure shortage, and preventing it in the future may be achieved. The main goals of this system are the actualization of assessment criteria for car traffic volume management options in to improve the accuracy as well as the promptness of their modification under the operational conditions changes, the establishment of an automatic train admission to port the railway stations, a discovery of conflicts as well as limiting elements based on the cooperative planning. It will be possible to make judgments on the transportation management based on risk as well as economic efficiency, as well as the activities of a company's employees, with this system in place.

(Montoya-Torres et al., 2021) Intelligent transportation systems are becoming more and more important as metropolitan populations continue to rise, since they can handle the transportation demands of both people as well as freight. Analytical approaches must be used in conjunction with automated data collection systems to provide insights that may be used for real policy as well as decision. This piece of writing has a dual purpose. An academic literature analysis on big data analytics for the intelligent transportation systems is presented, followed by a methodology for designing an architecture for dealing with big data analytics in the Intelligent Transportation Systems, which builds on prior research (ITS). An important Colombian city's transportation statistics will be analysed using these findings.

(Zhu et al., 2021) The future of oilfield development will be focused on achieving intelligent management of the heavy oil collection and transportation system. B oundary temperature is defined in this research as the safe inlet temperature and the best oil transit temperature. An oilfield in Western China was monitored in real time using an advanced supervisory control as well as data gathering system. Big data analysis was used to categorise the heavy oil transportation pipeline into nine distinct categories. Flow loop experiments were used to establish the optimal intake temperature under various operating situations. The least square approach was used to rectify the overall heat transfer coefficient, as well as the mathematical model was used to compute the ideal oil transit temperature. The findings showed that the improved total heat transfer coefficient could better forecast the temperature decline along the pipeline. Low-temperature movement of large oil field collection and transportation systems was possible in summer as well as winter. Temperature gradient as well as safe inlet temperature were significantly influenced by water cut, liquid production, as well as the ambient temperature. Lower temperature transportation was made possible by heavy oil with the high liquid output and water cut. An

intelligent control as well as management system for heavy oil production has been presented. With this research's help, oil field collecting as well as transportation systems may be made more efficient & stable, resulting in lower energy consumption as well as cost savings for all parties involved.

(Kaffash et al., 2021) For the Intelligent Transportation System (ITS), there is a need for data-driven techniques due to its volume and accessibility. Big Data methods are being used to improve transportation apps' intelligence. The use of Big Data techniques in ITS is gaining traction in the sectors of academia and industry. Big Data methods in ITS may be used for a variety of purposes, including, but not limited to, object detection, traffic flow prediction, signal identification, travel route planning, trip time planning, as well as vehicle and road safety. As a starting point, this study will compile all relevant literature on the topic, as well as offer an overview of the most often used models using Big Data in the context of ITS. A total of 586 publications have been examined from 1997 to 2019. This research sheds light on how Big Data methods are being used in ITS, exposing new areas of use and bringing together models as well as applications. The study's findings reveal research gaps as well as future directions.

(Mohandu & Kubendiran, 2021) With regards to transportation systems in particular, Big Data has become a potent draw for the world's attention. Since Big Data is generally considered as an unbroken endeavour, transit systems must effectively manage all of the information required by the aforementioned portion in order to offer safe, clean, and dependable means of transportation and to customise the recipient's transport experience. A smart city's citizens are more productive since they have access to centralised services. To turn a city into a digital metropolis, Intelligent Transportation Systems (ITS) are critical to the success of the project. A wide range of intelligent transportation systems (ITS) have been implemented over the past two decades, including city-wide traffic regulation control, the smart parking, general transportation information assistance (rail; compact air; transit vehicle; etc.), measuring of highway speed restrictions, legitimate traffic, etc. As a result of this post, you'll learn more about how to utilise Data Analytics in the transportation and movability business and how it can be used to a wide range of domains as well as use cases in the field. With the big data analytics, this study addresses a number of unresolved issues in ITS.

(Saleemi et al., 2021) There are several ways to increase the efficiency of a transportation network using an Intelligent Transportation System (ITS). This research examines the knowledge of ITS among Lahore's road users including their reactions to the implementation of a safe city project's ITS system in the city's traffic. A sample of 600 people were asked to complete a survey. Many motorists were shown to be aware of the ITS as well as familiar with its many instruments, such as surveillance cameras and electronic challans as well as changeable message signs and radios as a source of the traffic updates, according to the results of the research. Travelers become more reliant on ITS systems as they become more aware of them. Even more importantly, a new survey suggests that passengers are open to the idea of a similar system being used in other parts of the city, that is a positive sign for traffic management efforts.

(Lian et al., 2020) Big Data is here to stay. Big Data has recently been used in several transportation domains, including the traffic safety, in the context of intelligent transportation systems (ITS) as well as

connected/automated vehicles (CAVs). Using Big Data to investigate traffic safety in the context of ITS & CAV has been examined in this work. Accident detection or prediction, the discovery of contributing causes to collisions, driving behaviour analysis, and the identification of crash hotspots are among the subjects covered. According to the research we've looked at, there's a lot of promise in using Big Data analytics to better understand and improve traffic safety. Integrating and processing enormous amounts of multi-source information, Big Data in the traffic safety breaks through the restrictions imposed by conventional statistical analysis. It then finds solutions to issues that cannot be addressed by conventional statistical methods. For the future Big Data safety analyses in the context of ITS as well as CAV, we provide several recommendations.

(Salazar-Cabrera et al., 2020) The most prominent challenges of the transit vehicle service in the Latin American intermediate cities involve: the large number of passengers engaged in the traffic accidents; traffic congestion induced by the transit vehicles, including pollution created by these cars, that worsens in high congestion situations. To improve this scenario, a research has been conducted on the transit vehicle tracking service, that is a basic service for the implemention of the mobility solutions for aforementioned problems, the most relevant of characteristics of the service in the context of the Latin American intermediate cities have been identified, as well as an implementation has been proposed. This paper describes the four steps of the study: a review of the current services or systems related to the vehicle tracking, which includes wireless communications technologies, the usage of the special algorithms for efficiency improvement, the implemented sustainability approaches, as well as the intelligent transportation system (ITS) architecture used as a basis; (a) the process of finding significant qualities of service for a certain environment; (b) proposing an ITS architecture for this service in an intermediate city, its needs as well as the recommended technologies; and (c) creation of the experiments for confirming utilisation of the major indicated technologies. This review allowed the identification of the main service characteristics, with regard to the vehicle positioning technologies, the energy consumption considerations, the recommended wireless communication technology (long range, LoRa), and use of the artificial intelligence (AI) to evaluate the waiting time of users at bus stops. Ultimately, an ITS design for the city of Popayán (Colombian city) considering the aforementioned qualities is presented, as well as the experiments linked to the usage of these technologies are explained in detail.

(Olayode et al., 2020) South Africa's largest city, Johannesburg is located in the Gauteng province. Known for its economic strength and advanced infrastructure, it's a popular destination. Traffic congestion is one of the most frustrating aspects of living in Johannesburg. A growing civilization is hindered by traffic congestion. The South African government has spent millions of rands on cutting-edge traffic signal systems over the last several decades. This article examines the city of Johannesburg, South Africa's traffic congestion issues, an intelligent transportation system, as well as unsignalized road crossings. In both developed and developing nations, traffic congestion is a big problem. Road traffic congestion is a major problem in most nations. Johannesburg highways have become a thing of the past thanks to recent advancements in the intelligent transportation systems as well as new inventive ways of

dealing with traffic congestion. To alleviate traffic congestion at a city unsignalized road junction, this study proposes a smart transportation system solution.

(Motienko, 2020) The construction of a medical network based on contemporary information, communication, and transportation technologies is a current as well as pressing scientific challenge in Russia. Sensing as well as decision support systems which estimate the disease progression as well as distribute patients among prevention as well as treatment facilities, and also intelligent transportation systems which provide emergency response as well as the navigation for ambulance teams in the event of severe aggravation in health of some patients, are highlighted in this article (in case of epidemic threat). In a huge metropolis, transportation issues have been addressed and resolved.

(Vladyko et al., 2020) The development of highly autonomous and driverless cars is accelerating, which necessitates maintaining pedestrian safety in a quieter environment. As a result of the increasing popularity of numerous devices, pedestrians may use them while crossing the street in order to listen to their favourite music. To make it more difficult to warn pedestrians via sound signals, the sophisticated features of current headphones (headsets) include active noise control. The media system of a pedestrian's personal device may be controlled by intelligent transportation systems. Nonetheless, moving the usual sound signal system into the pedestrian's personal area surrounding their headphones is inefficient since the pedestrian can be unable to rapidly and accurately recognise the signals. This need a solution that takes account of the specific circumstances. In this study, we describe the design of an early warning system, present a technique for constructing a sonification thesaurus, plus review our findings.

(Zhankaziev et al., 2020) According to this report, Russia plans to build a testing range that will include basic components and functioning capacities. Cooperative interaction as well as the unmanned traffic will be able to proceed to a whole new level of research as well as implementation with that kind of a testing range for intelligent transportation systems. Systematic testing of prototypes, the development of a regulatory framework and a single certification body are all critical to the success of new technologies, according to the authors of this paper. In addition, the article describes the global experience in creating testing ranges for the advanced communication technologies, the technologies of the cooperative interaction (between vehicles and between vehicles as well as road infrastructure), including the technologies of highly automated as well as the unmanned vehicles including their role in the development of a promising intelligent transportation systems.

(Boukerche et al., 2020) Road safety and efficiency in increasingly linked networks have prompted a lot of attention to the Intelligent Transportation System (ITS) in the recent years. Traffic prediction is a crucial feature of ITS and may assist in a variety of ways, including route routing, traffic congestion management, and more. A better understanding of the function that traffic forecasting plays in ITS systems may be gained by introducing the respective applications and discussing how the traffic forecasting might enhance the performance of these applications. After that, we'll go through some of the fundamental ideas of the traffic flow prediction and the broad framework for putting those notions into practice. Statistical as well as machine learning (ML)-based prediction approaches are the subject

of this study. ITS traffic flow estimates have increasingly relied on these two methods in recent years, and they serve distinct purposes. In general, statistical models are easier to analyse, but their rigid structure restricts their flexibility, while machine learning models are more forgiving. As a result, we'll show you how these two sorts of strategies differ from one another using examples from the cutting edge. Last but not least, a few promising study avenues for the future of this field have been outlined to assist future researchers.

(Putra et al., 2019) Intelligent systems as well as smart city technologies have shown to be very effective in reducing the traffic congestion in the developing cities, particularly in major urban areas. Based on an ACP (system-created-computing-developed) system of parallel management as well as control system for an intelligent transportation system and for a municipality that wants to establish and transform itself into a smart city (PTMS). As part of a new generation of the intelligent transportation systems, PTMS is being expanded to include software as well as hardware which will enable a new architecture in a city which is transitioning from being a developing one to a smart one. Peer-to-peer networks as well as smart cards are used in a lift to regulate congestion in an expanding city through an original town that has a linked system. There are four types of surveillance discussed in this paper: traffic monitoring, vehicle monitoring, passenger monitoring, as well as driver monitoring. The finest ITS (or Smart Transportation Systems) would be created when such surveillances are implemented together (STS).

(Sumalee & Ho, 2018) Big data as well as linked vehicle-infrastructure-pedestrian environments have made it simpler and cheaper to gather, store, analyse, utilise, and distribute data from many sources. Additionally, the networked environment presents new methods for the real-time, flexible control as well as the administration of the transportation networks. Our present intelligent transportation system has to be changed to a connected environment in order to reap the advantages of a connected environment.

(Lin et al., 2017) Transporting people and goods more safely, more efficiently, and with less negative influence on the environment has been the goal of ITS research and implementation for decades. The traditional world of transportation infrastructure is combined with cutting-edge technology and advancements in the information systems, sensors, communication, controllers, and complex mathematical approaches in ITS. The complexity of this scientific topic makes it difficult for newcomers to have a comprehensive understanding of the whole system. First, this study provides an ITS design that is based on the current requirements as well as technology, second, it addresses the bottleneck problem in intelligent transportation research, as well as third, it examines the future prospects of ITS and research emphasis as the new technologies become accessible.

3. OVERVIEW OF ITS

The use of information technology to the surface transportation in order to improve safety as well as mobility while lowering the environmental effect of transportation may be termed as an Intelligent

Transportation System technology. National multi-modal surface transportation system ITS seeks to promote the use of technology to optimise safety, mobility, as well as the environmental performance surrounding vehicles of all kinds, the infrastructure, as well as passenger carry-in devices.

It takes into account all aspects of the transportation system, including the vehicle, the infrastructure, as well as the individual driver. Improved decision-making by transport network controllers as well as other users is the ultimate goal of ITS, which is why the whole transportation system benefits from its usage. Many different methods as well as approaches are included in the concept, including stand-alone technology applications or modifications to existing transportation plans. Some believe that the full effect of ITS can only be realised via integration of its many components. There are several components to ITS system, and they all work together to provide a suitable "Info structure" environment for traffic planning, monitoring, and administration, as well as increasing the system's efficacy.
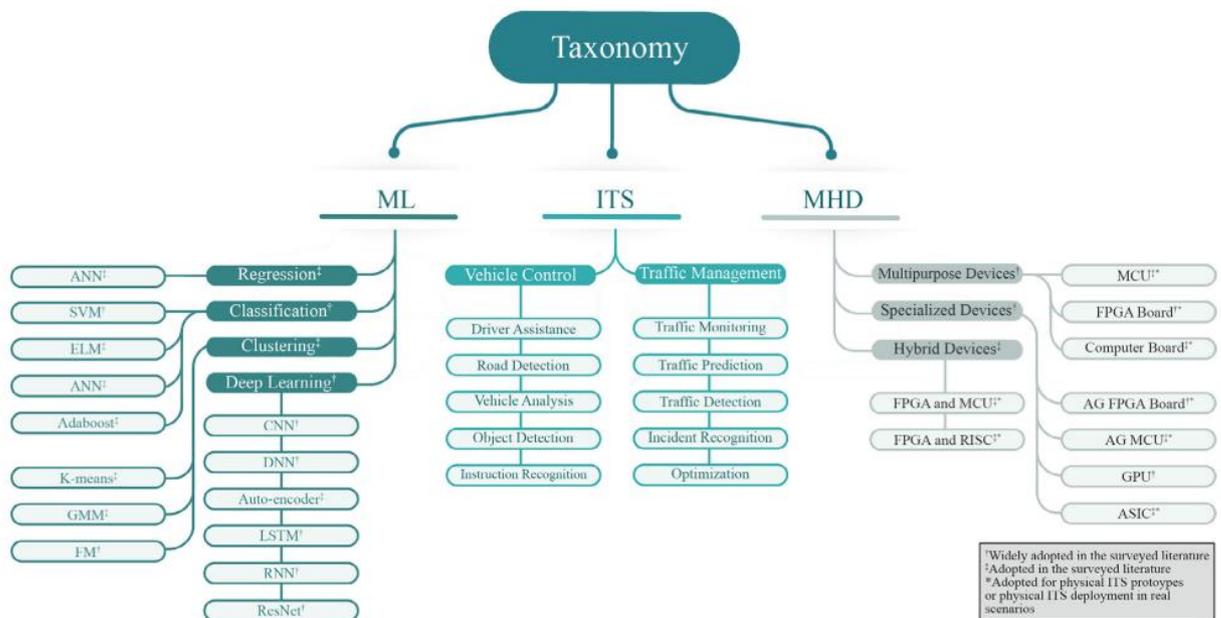
Figure 14 MHDs and ML approaches used in the studied ITS applications are classified into the following taxonomies: ELM (Extreme Learning Machine), DNN (Deep Neural Network), GMM (Gaussian Mixture Model), FM (Fuzzy Minimals), LSTM (Long Short-Term Memory), as well as RNN (Recurrent Neural Network).

Many different technologies and functions are used in ITS such as communications (Microwave, Bluetooth, internet), geographic locations (Geographic Information System), and digital mapping (digital map) ,data collection as well as exchange (camera system and artificial vision), as well as classification (in-vehicle systems), In this study, we'll examine the environmental benefits of these transportation systems, as well as their potential in a variety of other industries.

4. METHODOLOGICAL APPROACH

- **Information Collection**

Accordingly, the study relies heavily on online research, which includes detailed scenarios, research publications, short scenarios, and project goals, that all present novel ideas as well as interesting functionalities of ITS & Ambient Intelligence in the future world, as well as all of that are equally important for the purpose of this paper.

- **Problem Identified**

The three clusters are logically grouped based on the varied publications available: Lack of a Traffic Control System Vehicle and Equipment Operation in the Homeland Security System 3) Vehicle-to-vehicle coordination and new technology deployment.

CLUSTER 1: Lack or Traffic Management System

A traffic management system is designed to handle a large amount of traffic effectively, however the complexity of the management system rises as the number of cars increases, resulting in a loss in mobility, lower fuel economy, longer travel times and pollution.

CLUSTER 2: Homeland Security System and Vehicle

The security and monitoring of the traffic system and vehicles are included in the term "Operation Homeland Security System as well as Vehicle Operation. It helps to maintain track of the car's journey and to identify the vehicle and the driver in real time. The difficulty is that no efficient solution has been devised.

CLUSTER 3: Vehicle to Vehicle Co-ordination and implementation of new technologies

Vehicle-to-vehicle coordination refers to the onboard information about the surrounding vehicle, which would aid in collision control and coordinate them on the basis of the planned excursions by the driver. Technological innovation is uncommon in poor nations. The difficulty here is that there is no such technology applied in the public transit system, despite the fact that the technologies are accessible. The following is the eventual answer to these clusters:

- **Proposed Solution**

An example of a solution to the problem is:

SOLUTION to Cluster 1: This cluster focuses on traffic systems. As a result, the recommended solution to this cluster is the construction of a well planned traffic management system, which includes incorporating GPS, GIS, as well as remote sensing to readily know the congestion on a certain route and therefore to redirect the route. Consolidating traffic management into a centralised digital system would improve mobility while also helping to protect the environment.

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SOLUTION to Cluster 2: An "info structure" environment, which would allow each vehicle to have a distinct digital identity, is presented as a solution to this cluster's problems. Thus, at the blink of an eye, the vehicle record would be on display: this technology would also allow for the identification and knowledge of the vehicle's prior excursions.

SOLUTION to Cluster 3: This cluster is concerned with vehicle-to-vehicle coordination, as well as the solution proposed is the implementation of a wireless communication network between the vehicles using Bluetooth, wifi, different sensors, and so forth: it could enable vehicles to be in contact with one another and thus eliminate collisions.

- **Critical Appraisals**

Reducing traditional cultural issues is made easier by using an intelligent transportation system (ITS). There are both advantages and disadvantages to the use of intelligent transportation systems in the modern world. It is possible to achieve environmental sustainability and decreased travel time by using intelligent transportation systems that integrate vehicles and infrastructure, as well as maximising the use of road and traffic data, as well as improving safety and security on the road. Additionally, this approach has its drawbacks. As a result of the system malfunction, vehicular as well as passenger data security is of paramount importance.

- **Social Acceptance**

Of course, the project's intended users and clients, the city's residents, must approve of it. It is critical that they adopt ITS. In order for the project to succeed, the public has to know what they can anticipate from it as well as what the long-term advantages would be. As a matter of urgency, this must be done. It takes a lot of time to inform the public and dispel rumours.

- **Technologies to be implemented for Environment sustainability**

The following are examples of transportation technology that must be used in order to reduce their impact on the environment:

i.   Electronic Road Tolling

Allows for shorter wait times, more mobility, and less fuel usage.

ii.   Advanced Driver Assistance System

As a result, vehicle mobility will be improved, the driver will be aided at any moment, as well as emergency situations will be dealt with more simply.

iii.   Human machine interface onboard

Human-machine interaction will be much enhanced and deepened as a result of this system's increased human involvement.

iv.   Vehicle to vehicle communication system

Vehicles as well as infrastructure will be able to communicate safely as a result, allowing for more mobility thanks to an awareness of the surrounding infrastructure.

5. CONCLUSION

The introduction of Intelligent Transportation Systems will have a positive impact on our journeys. Passenger happiness is critical to encouraging public transportation usage and reducing the use of private automobiles. A detailed literature review of MHDs used in ML-Driven ITS applications is necessary since ITS has arisen as an area of strong study with a plethora of obstacles. As a result, the environment is protected from high car pollution and traffic congestion is eased. A complete transportation management system based on the differentiated assessments would reduce losses at the point where transportation participants interact if such systems are implemented. Carriers would be able to make better use of their resources while consignors and consignees may streamline their internal technical processes as well as save money. As a result, we've come to the conclusion that I.T.S. is an excellent choice for a comfortable and secure ride.

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Recent Developments and Applications in The Vehicular Embedded System Technologies

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Abstract

In the last two decades, the no. of the computer-based features incorporated in automobiles has increased significantly. Even though vehicle manufacturing is expected to rise modestly in the next years, the embedded electronics, and specifically embedded software, is rising. In addition, hardware components' quality and performance are improving whereas their price is declining. Many novel functionalities that would be prohibitively expensive or impossible to implement using the mechanical as well as hydraulic technology may now be implemented using the software technology, thus addressing the end user's needs in the terms of safety as well as comfort. Customers can now purchase a secure, effective, and customised vehicle owing to such technologies, whereas carmakers seem to be able to the master product differentiation as well as the innovation. Several studies have indeed been undertaken to improve embedded system design and the newest technologies to create smart automobiles, which are reviewed in this article. DSPs, ASICs, FPGAs, as well as other microprocessor-based embedded systems are only a few of the many options out now (field-programmable gate arrays). There has been a lot of recent discussion on the use of AI (artificial intelligence) as well as fuzzy logic controllers in automobiles.

Keywords: In-vehicle embedded electronic architecture, FPGA, real-time assessment

1. INTRODUCTION

It is common for embedded systems to have one or a few specific functions, sometimes with real-time calculation requirements, integrated in them. As a result, it is generally integrated into a larger device

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rather than a stand-alone computer. Embedded systems, such as smart phones, SoCs, and smart sensors, are becoming more commonplace. ASICs that is "Application-specific integrated circuits",and also DSPs "Digital signal processors", FPGAs that is Field-Programmable Gate arrays, as well as other microprocessor-based embedded systems are only a few of the many options out now (field-programmable gate arrays).

In today's market, embedded systems development costs and time-to-market should be kept to a minimum as consumer demand for computing power as well as speed grows ever more. Additionally, embedded system engineers need to pay attention to variables such as simplicity of the development, the power consumption, as well as the intricacy of algorithms. There are two primary families of the digital device technologies that designers may choose from (Monmasson et al., 2011). On a software-only platform, the very first family of devices includes microcontrollers and (DSPs) digital signal processors. The microprocessor core and a number of peripherals are often found in just this family. As illustrated in the image 1, the alternatives family of FPGAs is built on adjustable hardware elementary cells as well as linkages. Hardware architecture is customised by end users in order to fit the unique needs of those customers. Regarding high-speed, high-demanding applications, FPGAs outperform software-based digital devices. Using digital electronics in sectors such as automobile and aviation manufacture presents substantial obstacles. So the publication (Salewski et al., 2008) provides a number of cutting-edge approaches to increase the dependability of FPGA controllers. For the automotive applications, FPGAs that is referred as field programmable gate arrays are a viable alternative to traditional microcontrollers because of their lower cost and ability to be reconfigured.

The comparison of the safety and reliability attributes of the microcontrollers as well as the FPGAs is offered in this research. Hardware including software fault management were both taken into account in just this comparison. As illustrated in figure 2, FPGAs have benefits when it comes towards the encapsulation of the real-time functions, based on empirical assessments. However, in versions produced separately on microcontrollers as well as FPGAs, multiple dependent failures were discovered.

When it comes to the design of portable embedded systems,the power consumption is becoming more important (J. J. Chen et al., 2010). (Choi & Cha, 2010). Several research have been done on the topic of reducing power usage. An in-depth look at the source of the power usage and ways to reduce it is offered in the (Sun et al., 2010). It is proposed that FPGAs may be used to handle the transmission of dispersed applications through Ethernet protocol, (Ferrari et al., 2008; Cotton & Wilamowski, 2011).
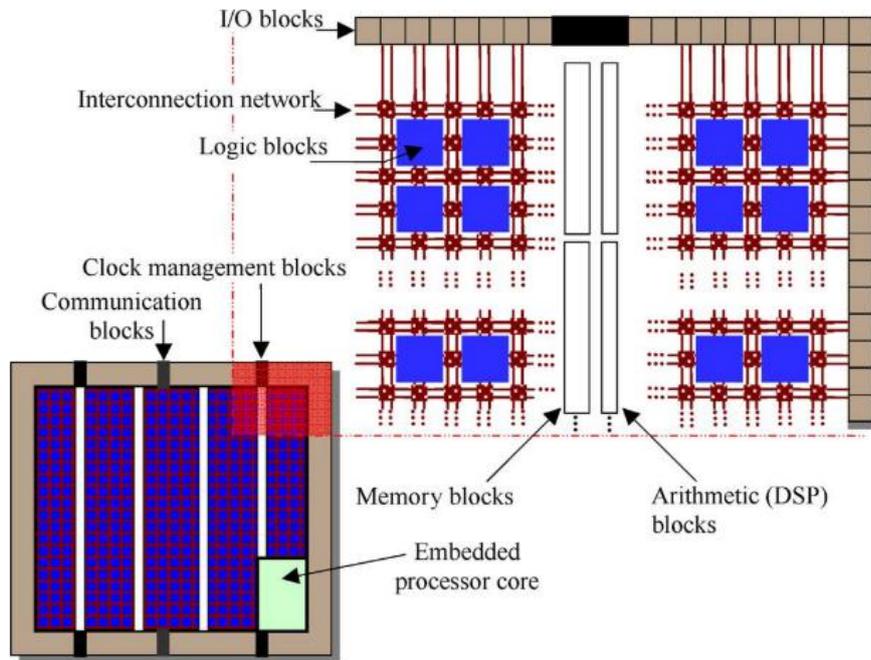
Figure 15 Generic structure of an FPGA (Monmasson et al., 2011)
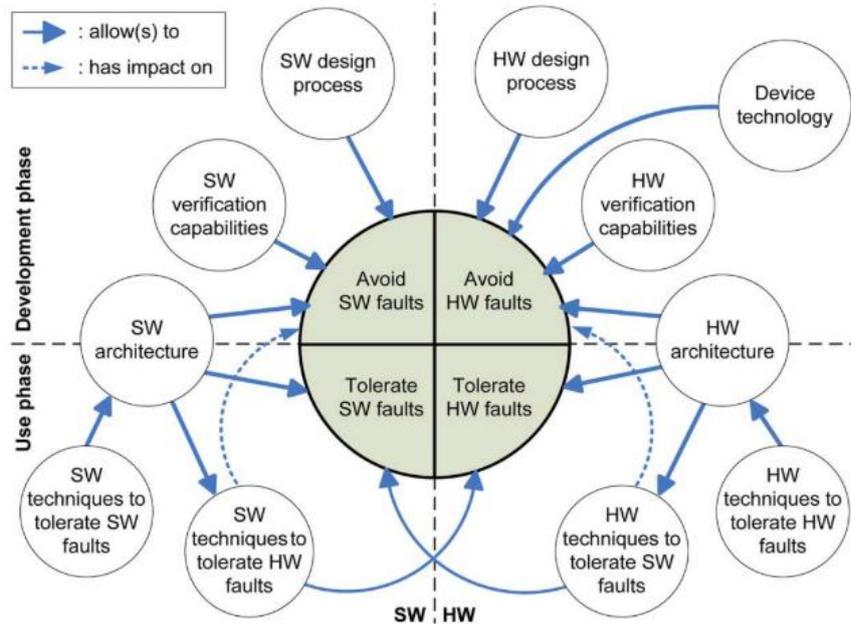
Figure 16 Fault handling in embedded systems: hardware (HW) and software (SW) aspects
(Salewski & Kowalewski, 2008)

The automobile industry has seen a fast increase in the share of the embedded electronic systems, especially software components, during the last two decades. From (Simonot-Lion, 2009), an electronic embedded system accounted for at least 25 percent and more than 35 percent of the overall cost of such a vehicle in 2006, respectively. Today's top-of-the-line automobiles may have up to the100 (Electronic Control Unit) ECUs. The motor vehicle's electrical systems as well as subsystems are all linked together through standard communication buses for easy management. Networks like the FlexRay as well as IDB-1394 are examples of local area networks that may be used as linkages. In light of the increasing complexity of the embedded electronic architecture, the subject of "composability" arises as to how various suppliers' hardware as well as the software can be integrated.

There have been significant advancements in the related technologies, such as temporal isolation of the software components as well as probabilistic approaches to latency computations, which will be discussed in more detail in the next parts of the study.

2. EMBEDDED SYSTEMS IN VEHICLES

Electronic injection systems, automated cruise control, and other innovations in comfort as well as safety are all contributing to a 10 percent yearly rise in integrated electronics in domestic automobiles. There are strict time and fault-tolerant requirements that must be adhered to when employing electronic functions in brakes, active suspension and steering operations, as well Eligible systems are first defined, which means they must meet certain criteria before being designed, and then the best one is produced based on cost considerations. Such integrated technologies need a new level of collaboration between the carmakers as well as OEM suppliers (s). Elloy and Simonot-Lion (2002; cited in Elloy and Simonot-Lion, 2002) There is the French cooperative research as well as the development initiative called "Embedded Electronic Architecture "AEE that aims to define innovative solutions for the development of embedded systems in vehicles (Elloy & Simonot-Lion, 2002). Specification and description of any vehicle electronic architecture are made possible by the (AIL Transport) Architecture Implementation Language. As that of backbone of architectural development, such language supports AEE design procedure but also is utilised by all the designers. Reusable architectural items may thus be defined using this framework.

The Embedded distributed systems provide a major portion of contemporary automobiles' consumer value via computer-controlled functionality. This necessitates the creation of versatile, efficient, as well as the cost-effective software. There are various characteristics that any current component model must meet in order to allow the modelling of the end-to-end resource reservations just upon software architectures of these systems with in study (Mubeen et al., 2016) (Mubeen et al., 2016). They did this as a proof of concept for the (RCM) Rubus Component Model. RCM is utilised by a number of worldwide firms to build control functions in the embedded systems for vehicles. Such systems with the resource reservations have software architectures that may be used to an extract execution models. For demonstration purposes, they built the vehicular distributed embedded system using our method and

added end-to-end resource reservations towards the expanded component model, which allowed them to derive execution model first from such software architecture.

(Bucaioni et al., 2018) (Bucaioni et al., 2018) Model-driven software development for the real-time the distributed the vehicular embedded systems on the single- as well as the multi-core platforms is introduced in this paper. By using an automated approach to uncover suitable design options, the suggested technique reveals the possibility of enhancing the development process's cost-effectiveness. It's important to note that Mubeen et al. (2019) A model- as well as the component-based the software development framework for the distributed embedded systems was proposed by (Mubeen et al., 2019) as the first holistic modelling method for the (TSN) Time-Sensitive Networking communication. Additionally, we provide the embedded TSN-interconnected decentralized network timing model based on such novel models.

(Y. L. Chen et al., 2012) (Y. L. Chen et al., 2012) suggested the intelligent night time driving assistance as well as the surveillance system grounded on a collection of embedded software components as well as the modules, and integrated such modules to create the component-based system framework on such the embedded heterogamous dual-core platform.. Ammoudi et al. (2015) have developed an indoor vision-based vehicle embedded system test bench, which is equivalent to just small-scale simulator for the embedded system labs (Hammoudi et al., 2015). Embedded electronic devices, sensors, including hybrid communication and computing technologies are all used in this simulator. To build the real-time embedded system for boosting the road monitoring services, specifically, following technologies are used. (Sadagopan and colleagues, 2011) Anti-theft car security technology is presented by (Sadagopan et al., 2011) to help keep vehicles safe from being stolen. As soon as the owner inserts their key, its system sends messages to their phone letting them know that the vehicle has been entered, using an implanted chip with the inductive proximity sensor. The technology in the automobile then asks the user to input an unique password. Unauthorized users are also locked inside the automobile, and the only owner whom have access to secret lock system may unlock it. The use of this method enables one to move quickly toward an endeavor at stealing. The design is sturdy and easy to understand.

2.1. FUZZY LOGIC CONTROLLER

In a wide range of the control applications, Fuzzy Logic has shown to be an effective tool. It is necessary to create a mathematical model of system in order to employ a (PID) proportional-plus-integral-plus-derivative control strategy. For the systems that seem to be difficult to describe, fuzzy logic controllers are indeed an alternative to the PID controllers. "If-then" rules may be used to represent control actions in the fuzzy logic controllers. The controller may be implemented in a variety of the ways in order to generate new products. Most often,the general-purpose microprocessor or even the microcontroller is used to construct a fuzzy controller. The controller is required to regulate vehicle's settings in order to maximise its entire performance. The Fuzzy Logic Controller has been used to regulate several parameters in an autonomous vehicle, as shown in Table 1.

Table 1 Employment of Fuzzy Logic Controllers in Vehicles

Parameter Controlled	Study Conducted	Reference
A fuel cell-based energy management system for electric cars (FC)	In this article, the hybrid DC link with such a fuel cell system as well as the supercapacitor (SC) as just an auxiliary power source is modelled and controlled. As per (SoC) SC state-of-charge and the FC's remaining hydrogen amount, a fuzzy estimator may calculate the needed SC current (QH2)	(Mohammedi et al., 2014)
RPM within the AGV which is referred as Automated Guided Vehicle	PID as well as fuzzy logic controllers are used to keep the AGV's RPM consistent. AGVs benefit from these tactics because they enable them to maintain a consistent RPM while reducing the time required to settle, steady state error, as well as overshooting.	(Parikh et al., 2018)
Charging the Electric Vehicles inside a timely manner	Bidirectional real-time the power control from such an (EV) electric vehicle, i.e., V2G as well as G2V, may be achieved by using the zero-order Sugeno fuzzy model in this study (G2V). Not only can the developed FLC handle grid circumstances depending on when it is being used, but it could also handle charging speed needs of user.	(Nag & Lee, 2019)
The motor's speed	The motor speed is used as the reference along with the other parameters in just such closed loop system for estimating the motor speed fluctuation. Fuzzy logic controllers for the electric vehicle speed control may be implemented using FPGAs, according to this article.	(S.Poorani, T.V.S.Urmila Priya, 2005)
In order to change the settings of an FPGA that is field-programmable gate array system.	As a result, the run-time reconfiguration approach is used to change FPGA chip single module at one time. The FLC cann't be implemented on the single FPGA chip owing to small size of its component cells.	(Kim, 2000)
The Electric car charging	An automated charging controller for electric vehicles in distribution networks without communication is proposed in this research. System voltage as well as the battery state of the charge are taken into account in the(SOC) controller's fuzzy logic. The controller was able to exhibit quicker and improved charging performance without exceeding the conventional voltage limitations in any circumstances.	(Faddel et al., 2017)

The vehicle's underwater controller	The Simplified (FLC) fuzzy logic controller design for just an underwater vehicle, such as the (DSRV) that is the Deep submergence rescue vehicle, is presented in this study (DSRV). The (SIFLC) single input fuzzy logic controller is a new approach that replaces the traditional two-input FLC (CFLC) with the single input FLC.	(Ishaque et al., 2011)

3. USE OF ARTIFICIAL INTELLIGENCE IN VEHICLES

EV battery design as well as the management, the charging stations, as well as smart grid have recently seen the industrial and academic uses of (AI) artificial intelligence, that is described as the algorithms supporting models aiming at replicating natural thinking, the perception, as well as the action (Grigorescu et al., 2020). In the purpose of this study, machine learning as well as the computational intelligence-related AI techniques are taken into account. As a result of their capacity to detect odd patterns and their ease of implementation, such artificial intelligence algorithms may outperform traditional rule-based systems (also known as expert systems), that rely on human expertise to design rules for the systems. (1) The EV cost reduction via effective battery-material design as well as the manufacture are some of the appealing features of the AI application (A. Chen et al., 2020) employing AI controls for such auxiliary systems of the EV to reduce energy consumption, and (4) precise range estimate to alleviate EV customer range anxiety (Abu Hanifah et al., 2016) 4. the potential for improved road safety as well as the traffic flow as a result of connected as well as the autonomous vehicle use; (J. Li et al., 2018) an efficient modelling strategy to locate EV charging stations (EVCSs) in the most appropriate locations and allocate resources, and to schedule EVs' interactions with the smart grid (Fig. 3) (Rigas and colleagues, 2015).

(ML) that is refered as the Machine learning and computational intelligence (CI) are indeed the two primary AI approaches employed in electric vehicles and associated infrastructures, as seen in Figure 4. It's important to note that ML models are excellent at identifying patterns in data that have been seen before, hence they need to be trained using data from a prior dataset. The supervised, the unsupervised, as well as reinforcement learning are the three broad categories into which machine learning in electric vehicles and associated infrastructures may be grouped (RL). Large datasets, like those used in estimating the battery condition and discovering novel materials for the EV batteries, make supervised as well as the unsupervised learning methods well-suited for EV but instead infrastructure applications (C. Chen et al., 2020). As shown in Figures 4A–4C, the DL model employs neural network designs with more than single hidden layer, while RL model attempts to learn optimum course of the action on its own via trial as well as error, and as a result, the agent gets rewarded in accordance including its actions.
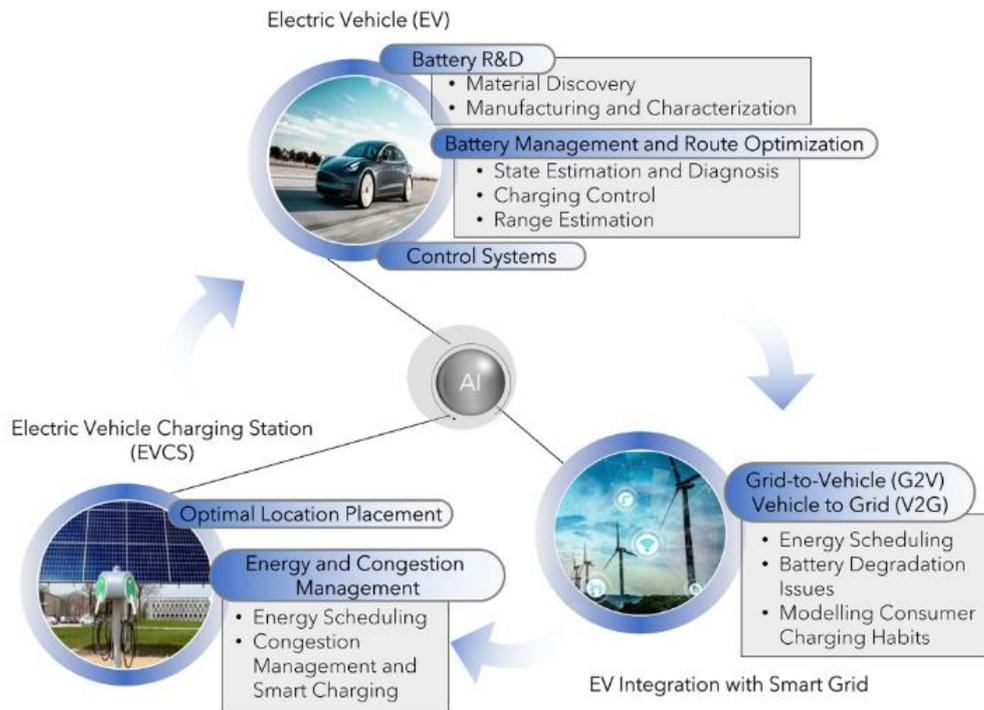
Figure 17 Overview of the use of AI in EV, EVCS, and EV integration with smart grid (Ahmed et al., 2021)

There are many additional complicated issues that can be solved using CI techniques than those that can be solved with machine learning (ML) (Slowik & Kwasnicka, 2020). Control system optimization, appropriate EVCS location, as well as the integration of EV infrastructure including smart grid are all examples of complicated, dynamic optimization issues that may be solved using CI algorithms (Soares et al., 2013). A growing number of research papers, patent filings, and manufacturing scales have been devoted to artificial intelligence in the EV sector, notwithstanding this. Research and development and large industrial use and commercialization of AI in the EVs as well as their infrastructure requires a comprehensive look at its function in these systems.
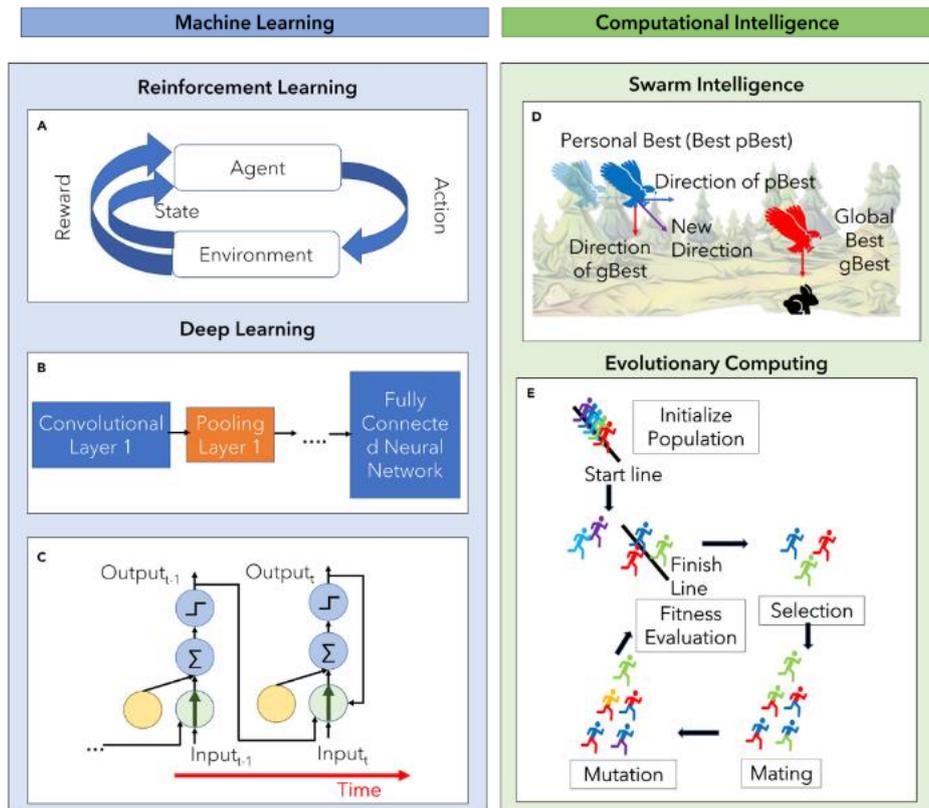
Figure 18 AI techniques (ML and CI) used in EV and mass adoption (Ahmed et al., 2021)

Artificial Intelligence-based embedded controllers are getting more and more common, and research in this area has grown significantly. Many sensors as well as the devices have nonlinearities that need to be corrected, hence (Cotton & Wilamowski, 2011) provided a lightweight technique to apply the neuron-by-neuron procedure (Wilamowski & Yu, 2010) on the embedded systems.

It's a common one to use fuzzy logic to operate the AIC controller, and it's also known as the (FLC) Fuzzy logic controller. When numerical input signals are fuzzified and then defuzzified using rule-dependent inference (as seen in Figure 5D), the linguistic output is identified as wellas transformed into the numerical output (X. Li et al., 2019). When used in the HVAC systems, FLCs outperform traditional controllers since of their ability to improve comfort during using less power (Institute of Electrical and Electronics Engineers., 2012). Whenever SOC and vehicle speed are utilised as the FLC inputs, this decrease in the energy usage results in a greater EV driving range. Reconfigurable FPGA systems (S.Poorani, T.V.S.Urmila Priya, 2005) as well as (Kim, 2000) provide approaches for implementing the Fuzzy Logic Controller. Particle swarm optimization and the Gauss-Newton approach are both used by (Guo et al., 2011) to the estimate sensor-node physical location.
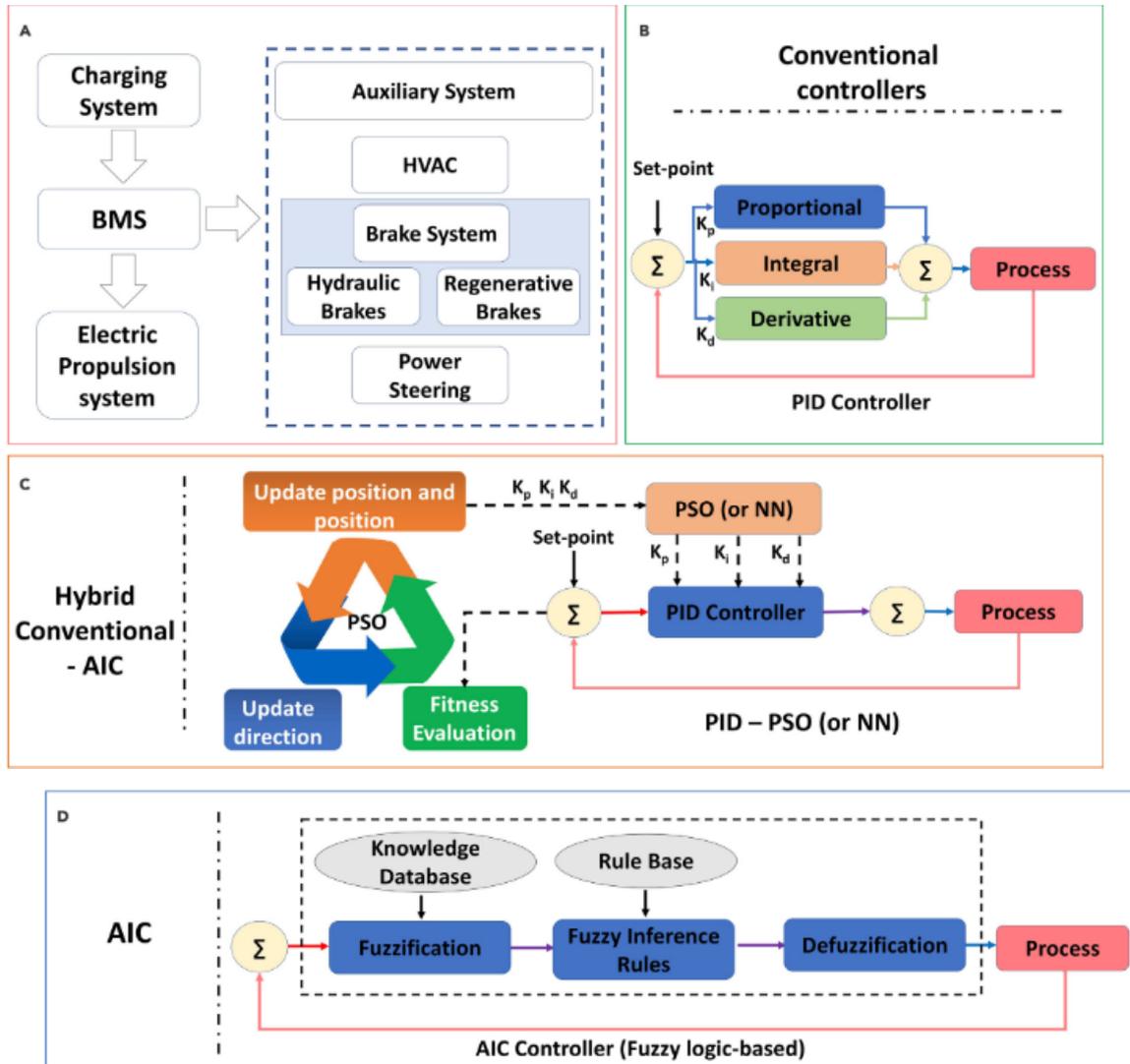
Figure 19 EV control architecture and process flowcharts of some related controllers (A)
(Ahmed et al., 2021)

(A) EV control architecture. (B) Conventional (PID) controller. (C) PID-artificial intelligent controls (AIC) (particle swarm optimization [PSO] based) controller. (D) AIC (fuzzy-logic based) controller.

New technology, customer demand, social concerns, as well as the government laws all have an impact on the need for vehicle thermal management advances. For example, (Marshall et al There have been a number of recent advancements in car thermal management technologies and modelling, with a particular emphasis on the interior, electronics, especially external components of the vehicles. The   Thermal loads, the HVAC systems, including window glazing or even the tinting as well as

the vehicle surface treatments are all included in this section. Active or even passive cooling technologies that use jet impingement, heat pipes, the heat sinks, the forced convection, as well as the phase-change materials are reviewed in this article.

4. CONCLUSION

Embedded systems, particularly those found in automobiles, are an integral part of our daily lives. Development of the embedded systems has a profound effect on people's daily lives as well as society as a whole. But even as the embedded systems technology continues to evolve, there are still significant problems in methodology, and these obstacles will only increase as the market demands ever-increasing speed and dependability. The performance of (FLC) fuzzy logic controller is heavily reliant on the rules it uses to make inferences. For the most part, adding additional rules to the FLC increases its precision. The more rules you have, the longer it takes to process them. In order to implement FLC, the high-performance CPU is needed.

It also looks at how AI has been used in adjacent fields including electric vehicles, electric vehicle control systems, and how electric vehicles engage with smart grid, all of thst have been emphasised and summarised for the sake of highlighting commercial appeal. Battery design as well as discovery, as well as battery management including accurate renewable energy (RE), are examples of AI algorithms being utilised in the EV battery design, as well as smart control of the EV hardware as well as auxiliary systems to preserve battery energy. With regard to EV user comfortability, AI is examined in the next section with regard to the appropriate position and energy consumption of EVCS. Please keep up the good work in this field.

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A State of Review on Biomedical Image Processing Techniques with A Focus on Deep Learning

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Abstract

In recent years, the area of medical images processing has been developed into the established one. In clinical research, the accurate segmentation of medical pictures is essential for monitoring, diagnosis and planning therapy. Segmenting medical photos by hand takes a long time and is tiresome. As a result, high-accuracy segmentation algorithms for such automated data collection are highly sought after. An algorithm's efficiency may be influenced by a variety of things. For instance, the scope of a segmentation technique's applicability, the method's repeatability, the precision of its findings, and so on. With an emphasis on the Deep Learning Techniques, this paper will provide readers an overview of the current picture segmentation techniques. The review focuses on picture segmentation using deep learning with in medical imaging field.

Keywords: Machine learning, Deep learning, Medical imaging, MRI

1. INTRODUCTION

The discipline of natural science that deals with the processing of biological as well as medical data is ever-changing. Designers of bioelectrical as well as biomechanical systems drew inspiration from biological signals while creating their creations. Diagnostic techniques for medical problems were developed by doctors and human services specialists. Experts in biological signals have focused o

the both diagnosis along with interpretation of the health status details for individuals. Engineers working in the biomedical applications will find the current signal processing tool or even programmes easier to use than those working in other fields.

Biomedical signals may be divided into action potentials and event-related potentials based on their importance. EMG, ENG, ECG,EEG as well as ECG are all existent action potentials that may be used to monitor a patient's health. EPs (electrogastrogram), carotid pulse, phonocardiogram, signals from the catheter-tip sensors, the speech signal, the vibromyogram and the oto-acoustic emission signal, are all included in the event-related potentials list. Imaging modalities such as (fMRI) that is functional magnetic resonance imaging, (CT) which is computed tomography, ultrasound, including positron emission tomography represented as (PET) are frequently employed inside the biomedical area (PET). To investigate the workings of healthy and sick brains, under varied task situations and at the rest, fMRI data has been widely employed to create high-spatial resolutions functional data as well as low temporal resolution.

2. LITERATURE REVIEW

(Bas et al., 2021)A real-time technique was presented for finding spatio-temporal correspondence in between target point's locations in pre-treatment 3DCT picture and throughout the operation. Target registration error within third-tier registration circuits is minimised as a key component of the design. To generate an abdominal deformation field, we employed Particle Swarm Optimization as well as Differential Evaluation to discover the ideal values of the Elastic Body Spline parameters. Rigid, Thin Plate Spline, affine, and Elastic Body Spline are among the transformation classes that have been put to the test. Differential Evolution (D.E.) was found to have lowest TRE for rigid as well as affine versions: 3.47 as well as 3.73 mm, correspondingly.

(Rahman et al., 2021)Anatomy of (RBCs) that is red blood cells is critical to diagnosis of the number of disorders, including cancer. It is possible to save time for both the pathologists as well as patients by using an automated image-based technology to examine morphology of the blood cells in real time and with high accuracy. A new approach for segmenting and identifying various RBCs in the blood smear pictures is presented in this research. After colour processing as well as double thresholding of the blood smear pictures, the suggested approach uses the central pallor as well as entire cell information. For the detection of abnormalities in the peripheral blood smear pictures, the shape as well as size variations of the cells are computed. Cross-validation precision weighted probabilistic ensembles was employed in this study (CAWPE). When compared to a broad variety of possible parent classifiers, this heterogeneous ensembling strategy of roughly comparable classifiers yielded much superior classifiers (in terms of errors but also probability estimations). This approach is put to the test on three different sets of photographs before it is finalised. Pathologists at the government hospital within the area worked together to create the photos. Photographic circumstances are different for each collection of images. There is a high degree of accuracy and precision in terms of findings using this procedure. The suggested

approach has an average accuracy of the 97 percent when segmenting single cells as well as 96 percent when segmenting cells that have overlapped. Accuracy has a variance (2) of 3.5 and just a deviation () of around 1.87, respectively.

(Geist & Neufeld, 2021)To analyse dynamic PET data, we use continuity equation for such tracer density as well as the linear response theory approaches. A tracer particle's path through an organ may be predicted probabilistically, and extensive information about the underlying physiological functions can be gleaned from this technique. We demonstrate our method by using renal data from a PET/MRI scanner that used the sugar analogue radiotracer as just a radioactive source.

(Yang et al., 2020)A global epidemic of tuberculosis is caused by the most frequent mycobacterial illness. Mycobacteria identification is critical for identifying infected persons, initiating and monitoring therapy, and limiting or preventing transmission. An acid-fast Mycobacterium (AFB) may be identified in tissue slices using Ziehl-Neelsen stained slides, which show a brilliant red stain over blue background. Developing the machine learning pipeline to categorise digitised ZN-stained slides either positive or even negative for AFB was a time-consuming and laborious process for our team. the CNN models are used to identify AFB-containing tiles, and (LR) that is the logistic regression model is used to categorise slides using AFB-probability maps generated from CNN tiles classification result. Six AFB-positive and eight AFB-negative slides were used to train the first CNN, whereas 19 AFB-negative slides from the active learning framework were used to train second CNN utilising extra tiles from first set. To categorise tiles on a different set of the 134 slides, the two CNNs produced F1 scores of 99.3 percent and 98.75 percent when tested on a second set of tiles "46 AFB-positive (+) as well as 88 AFB-negative (-)". AFB-probability maps for every CNN were generated as a result of the categorization. Cross-validation on 10 times the number of the feature vectors recovered from AFB-probability maps created by every CNN was used to test the LR model's robustness. The positive tile rate as well as seven AFB-probability map histogram features formed feature vector (PTR) that is positive tile rate. The AFB-probability map generated by the CNN trained with in an active learning framework had a sensitivity of 87.13 percent, specificity of around 87.62 percent, as well as an F1 of around 80.18 percent, compared to such baseline performance of the PTR-based slide detachment which yielded F1 scores of around 73.13 percent as well as 66.67 percent, respectively.

(Thakur & Juneja, 2020)Glaucoma, the most prevalent cause of irreversible blindness worldwide, and its prevalence is expected to climb even higher in near future, make early detection of any retinal abnormalities, like glaucoma, of critical importance. Digital fundus cameras are often used to get fundus pictures for the purpose of making a diagnosis. However, the pictures taken are susceptible to several disturbances that might influence the accuracy of such diagnosis. Valves and low-contrast pictures inside the retina are among the noises associated with glaucoma, as as uneven lighting conditions that degrade cup as well as disc segmentation. As a result, removing outliers from retinal pictures before processing is critical for diagnosis. To remove outliers from the retinal pictures, a hybrid approach is presented in this work. In order to enhance diagnostic tools, the proposed method may be implemented in digital cameras.

(Krasoń et al., 2019)A critical step in computer-assisted diagnosis and treatment is the segmentation of the anatomical entities in (CT) computed tomography images. To deal with the variety of anatomical variations and pathological alterations that might be seen in the computed tomography images, the segmentation is still considered a difficult challenge. Depending on the generalised , segmentation, statistical shape model approach in this study is described in detail. Tests were carried out on 40 instances of computed tomography (CT) with the contrast, 20 of which were used as training sets and 20 for testing. The kidney, liver, spleen, pancreas, as well as duodenum were outlined by experts in each instance. DICE coefficient was found to be 0.96, 0.88, 093, 0.86, and 0.81 on average. The established approach may be considered a step toward the universal method of the segmentation in normalised scaled pictures since method doesn't need the selection of the new parameter values whenever used to segmentation of the varied set of the parenchymal anatomical organs.

(V, 2019)There is a lot of activity in field of semantic segmentation when it comes to looking at medical pictures. Traditional segmentation approaches failed to keep complete picture resolution across the network, leading to research that created strategies to safeguard image resolution. As part of proposed method, the semantic segmentation model for such biomedical images is used to down the sample spatial resolutions of input data as well as develop a lower resolution feature that the mapping which is very effective at differentiating the classes, including then perform up samples to have the full-resolution segmentation map of such biomedical images, which reduces diagnostic time. Cascaded convolutional neural networks are used to perform image segmentation in the proposed framework. Radiologist-performed analysis of biological images employing semantic segmentation reveals an increase in efficiency due to reduced test times as well as increased scope of analysis.

(Tchagna Kouanou et al., 2018)The Big data analytics on biological imaging is discussed in this work, along with examples from the literature, novel processing techniques, and some findings. We believe that Hadoop as well as Spark frameworks should be used to adapt and enhance relevant work approaches in the area of the big data software. This is the best and most effective way to analyse biological images. As a result, big data analytics for biomedical imaging detection is given a wide review in this study. All of the best approaches and algorithms for each phase of a process are presented here.

(Arulmurugan & Anandakumar, 2018)The identification as well as segmentation of the salient regions in the biological pictures is often a vital step in the image's comprehension. Initial contour selection throughout segmentation is the competent operation, but incorrect discrimination between the foreground as well as background colours compromises this process." The region-based the cell detection approach termed Histogram Color Contrast Seed Point Selection is used in such research to enhance cell identification.. (HCC-SPS). By grouping similar colours together within every pixel, HCC model addresses colour contrast in the visual signals, which results in precise desired edge locations. The region-dependent seed point fine adjusts salient value as well as makes it simpler to distinguish between a prominent point and a background point. Thirdly, the segmentation of biological pictures is accurate because of such salient mapping function with the pixel representation. Based on the factors

like segmentation time, accuracy, as well as the mapping functions, results are being compared to those of the present system.

(Rajeswari & Jagannath, 2017)In recent years, medical image processing has become a well-established subject. Clinical investigations for the diagnosis, monitoring, including therapy planning all depend on precise picture segmentation. It takes a long time to manually segment medical photos. Because of this, high-accuracy segmentation algorithms seem to be of importance. A segmentation algorithm's success is heavily influenced by a number of important elements. How the approach is used, how it is reproduced, how accurate its outcomes are all examples. An overview of the current picture segmentation techniques is what this paper is all about. They are compared in terms of their efficiency, benefits, and challenges. Several commonly used benchmarks for segmentation outcomes are listed here.

(Shaikh et al., 2016)A new and complex topic in the biomedical image processing has emerged in the recent years. Medical imaging software generates massive amounts of identical pictures. Due to the enormous volume of data, manual picture interpretation as well as analysis becomes a difficult process. MRF c1assification is the well-established approach in the medical image processing for c1assifying a picture based on the statistical inference. Our focus in this study has been on Markov Random Fields (MRFs) and several prerequisites relevant to medical picture processing.

(Navab et al., 2015)There is widespread agreement that thousands of the annotated training samples are required for effective deep net workplace training. With the help of the data augmentation, we show how to make better use of annotated examples that are already accessible in this publication. An expanding route as well as a contracting path are used in design to record context and provide exact localisation. When used to segment neural structures in the electron microscopic stacks, we demonstrate that the network like this can be the trained end-to-end from a small number of pictures and exceeds the previous best approach (the sliding-window convolutional network). We topped ISBI cell tracking challenge of the year 2015 by such a wide margin in each of such categories using same network trained on the transmitted the light microscopy images (a phase contrast as well as DIC). There is also a high-speed network. Segmenting a 512x512 picture on a modern GPU requires less for a second.

3. TYPES OF BIOMEDICAL IMAGES

Biomedical pictures come in a variety of forms depending on the technology used to capture them. Below is a list of some of the most often used the biomedical imaging methods. New imaging methods are constantly being developed to help doctors make more accurate and quick diagnoses.

- **Clinical images**

Digital photographs of such patient's body are called "clinical images," and they are frequently used to show the extent of an injury, burn, or other skin condition. Using computer vision to analyse these photos, and it might be possible to monitor the treatment's effectiveness over time. Such pictures are

often used in dermatological as well as cosmetic procedures to monitor the skin or the anatomical structure before and afterward the treatment. The diagnosis of melanoma, a kind of the skin cancer, is the most common clinical imaging use.

- **X-ray imaging**

Fractures and dislocations of the bones are most often detected by X-ray imaging that is most extensively used imaging technology. The two-dimensional picture is created. NIH has made 100,000 chest x-ray pictures, together with the related data as well as diagnoses, freely available in order to improve imaging analysis tools. Additionally, the (MIT) Massachusetts Institute of Technology released a dataset of over 350,000 chest x-rays for such development of the machine learning algorithms that can identify 14 common ailments including pneumonia or even punctured lungs automatically [27].

- **Computed Tomography (CT)**

As the name suggests, CT is a computerised imaging process that uses x-rays to generate cross-sectional pictures of an internal organs, bones, even the soft tissues and blood arteries with in body. The long axis of such body lies perpendicular to axial or even transverse planes in which the pictures are normally taken. To make a 3-dimensional picture from two-dimensional photos, such images, also referred as slices, may be divided into various planes. It is one of most commonly explored biomedical imaging challenges and therefore is widely utilised to diagnose cancer by localising the existence of tumours and their size. There are 32,000 CT pictures with related data as well as diagnoses that have been made openly available by the (NIH) National Institutes of Health.

- **Magnetic Resonance Imaging (MRI)**

The strong magnetic fields are utilised in the MRI imaging to create pictures of inside bodily organs, processes, including tissues. The non-bony or the soft tissues of such body may be seen with MRI. Ionizing radiation is not used in this procedure, unlike CT scans. MRI scans provide a clearer picture of knee as well as shoulder problems than x-rays or CT scans. Aneurysms and tumours may be detected using MRI scans of the brain that can discriminate between grey as well as white matter. The (OASIS) Open Access Series of the Imaging Studies initiative has amassed more than 2000 MRI datasets for the biological imaging researchers.

- **Ultrasound Imaging (US)**

The internal organs, the tissues, aswell as blood flow may be seen using the high-frequency sound waves, a technology used in the United States. Monitor the foetus throughout pregnancy with this method. If you're having a scan of your abdomen, you're more likely to have a scan of your arteries, veins, and thyroid. The advantage of utilising the United States is that it is quick as well as radiation-free.

- **Optical Coherence Tomography (OCT)**

A technology called OCT utilises low-coherence light to produce micrometer-resolution, the two- and the three-dimensional pictures of biological tissues. Because it gives doctors a cross-sectional picture of such retina, they can clearly identify the different layers of such retina while doing OCT eye exams. Layer mapping but also thickness measurements may be used for diagnostic purposes as a result of this.

- **Microscopic Images**

Microscopical medical pictures are utilised to examine the tissue's microscopic structure. Sections of tissues are stained and coloured with the staining components to expose cellular features after being acquired by biopsy. The photos' colour, contrast, and visibility are all improved by the employment of counterstains. For the identification of cancer, these pictures are commonly employed. The cell's form and size, as well as its nucleus, are two of the most common aspects that are examined.

4. IMAGE PROCESSING and SEGMENTATION

Non-invasive diagnostic treatments rely on medical imaging, which is a critical component of today's healthcare system. In order to conduct clinical research, it is necessary to create models of human body as well as its organs, both visually and functionally. the Molecular imaging, (MRI) which is defined as magnetic resonance imaging, and ultrasonic imaging are a few of the numerous forms. X-ray-based modalities, like traditional X-rays, (CT) computed tomography, as well as the mammography, are also included. As well as using such medical imaging tools, clinical photographs are becoming more important in diagnosing a wide range of illnesses, particularly those that affect the skin.

Image creation and reconstruction and image processing as well as analysis are two separate aspects of the medical imaging [2]. In image creation, procedures are used to create 2-dimensional (2D) representations of 3-dimensional (3D) objects, whereas in an image reconstruction, algorithms are used to create 2D as well as 3D representations of such projection data. As an example, noise may be removed from a picture using an algorithm, whereas image analysis uses quantitative information or the collection of characteristics extracted from the image to identify or classify objects in image

There are a variety of the image processing techniques, including enrichment, separation, identification of the area of interest, pre-filtering, thresholding, as well as morphological procedures. Using segmentation, photos with several complicated techniques may be simplified. The traditional picture segmentation is based on the texture, the shape, the contours, and other features. Within a picture, edge detection may be used to determine where one item ends and another begins. An image's edge is characterised as a quick change in its appearance. An edge is a sharp shift in brightness inside a picture. Sobel, Prewitt, canny Robinson, including Laplacian are some of the different first as well as second derivative edge detectors. Space-domain or even frequency-domain image enhancement methods are used to bring back the original picture. Using point processing or mask processing inside space domain.

Three types of image segmentation methods may be found in all of them:

- **Manual segmentation (MS)**

In order to appropriately annotate each picture pixel, MS approaches need subject specialists to first establish region of interest also represented as (ROI) and the then draw exact borders around the ROI. For such development of the semi-automatic as well as the fully-automatic segmentation systems, MS provides ground truth tagged pictures. MS is a time-consuming process that can only be applied to a limited number of images. High-resolution pictures may lose their sharp border (poor contrast) as a consequence of the increased resolution, which may lead to huge errors in the ROI boundary selection. It's another problem with the manual segmentation because the technique relies on an expert's knowledge as well as experience, which leads to high inter including intra expert variability.

- **Semi-automatic segmentation**

Automated algorithms and a little amount of human intervention are required for semi-automatic segmentation to obtain reliable results. The user might well be asked to pick an initial ROI, that is then utilized to segment the whole picture. Region boundaries might well be manually checked and modified to minimize segmentation errors. Seeded region growth (SRG) is an example of the semi-automatic segmentation approach that repeatedly combines neighboring pixels of comparable intensity using an initial seed point specified by the user. This model uses implicit level of the function to repeatedly update initial boundary forms indicated by the contours, and has the benefit that it doesn't need previous shape information or beginning placements of ROI or even contours. An active contour approach that uses tiny local areas to define both foreground as well as background of an image utilizing region parameters seems to have the added benefit of being able to handle a wide range of textures.

- **Fully automatic segmentation techniques**

There is no need for the user to engage with the totally automated segmentation algorithms. Atlas-based segmentation algorithms, Shape models, the random forests, and the deep neural networks are all examples of supervised learning the techniques which need training data. Manual segmentation is required to produce labelled pictures both for training data as well as validation data when using unsupervised learning algorithms. In addition, there are significant differences in form, size, texture, as well as colour of ROIs across patients, as well as low contrast between areas in automated segmentation of the medical pictures.

5. DEEP LEARNING TECHNIQUES

If source data is not consistent or noisy, the resulting source picture data may be inconsistent, which is commonly the case in real-world applications. There are several current methodologies, such as the watershed algorithms as well as (ML) machine learning based approaches which have the fundamental issue of not being universally applicable, limiting their utility to a certain set of applications.

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It's also time-consuming as well as doesn't handle the natural data in its raw form, that's why it's commonly used in the machine learning techniques depending on the support vector machines (SVMs) or the neural networks (NNs). Natural data may be processed without the requirement for manufactured characteristics using deep learning algorithms.... Semantic segmentation on photos of nature and biological image segmentation have both benefited from these techniques. (CPUs) Faster central processing units and graphics processing units (GPUs) have greatly decreased training as well as execution times, made massive datasets more readily available, and advanced learning algorithms have all contributed to a rise in the popularity of deep learning techniques.

- **Machine Learning**

Classification of ROI, for example, as a sick or even healthy zone, is a common use of the machine learning-based picture segmentation. Pre-processing is first step in creating like the app, and it might entail using a filter to reduce noise or to boost contrast in image. A segmentation method such as the thresholding, clustering-based approach, or the edge-based segmentation is used to separate the picture after pre-processing step. Depending on ROI's colour information, the texture, the contrast as well as the size, characteristics are retrieved. (PCA) Principal component analysis and statistical analysis are indeed then used to identify the most important aspects in a data set.
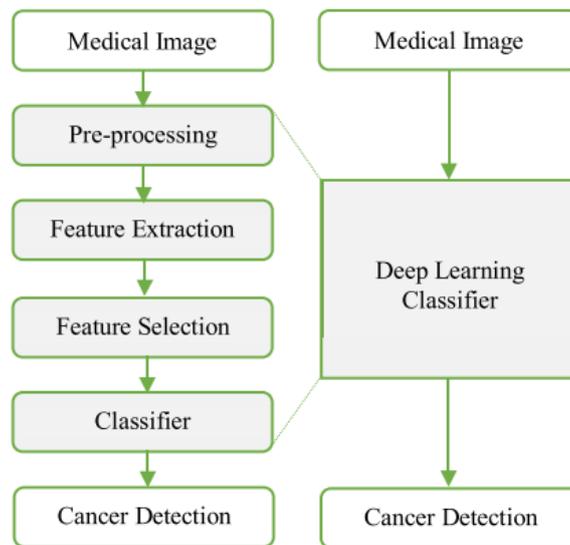
Figure 20 Change in classifier approach using typical machine learning algorithm and deep learning.

- **Deep Learning-based Classifier (DLC)**

DLC is capable of processing raw images directly, therefore pre-processing, segmentation, but also the feature extraction are not necessary. Because the limited number of input variables, picture scaling is a need for most deep learning algorithms. However, data augmentation methods (described below) is

used during training to minimise the need for procedures like intensity normalisation and the contrast enhancement. The greater classification accuracy of DLC, the better, as it can prevent mistakes connected with incorrect feature vectors or inaccurate segmentation. Figure 1 depicts a side-by-by-side comparison of ML vs. DLC methods. To get the best possible results, researchers have shifted their attention away from standard image processing methods and toward designing network architectures. There are even more hidden layers within DLC networks than in ML-based techniques, hence the models need more computing power to run due to their higher computational requirements.

- **Deep Learning Architecture – Convolutional Neural Network (CNN)**

Due to its similarity to a normal neural network (NN), CNN has become the most popular deep learning architecture. An image is sent into a CNN's 3-dimensional arrangement of the neurons instead of complete previous layer as seen in Figure. 2(b) beneath, as being opposed to the standard neural network (NN) as seen in Figure. 2(a). Convolutional, the non-linear activation, the pooling, or even the fully linked layers are all part of CNN's three levels of the non-linear activation. When a filter is used to the extract features from an image, convolutional layer is applied to picture to create feature over the maps containing those features. For increased non-linearity and faster training, function fx is applied to input values in the ReLU, the non-linear activation layers. As the calculation is based on surrounding pixels, pooling layer is the translation invariant because it down-samples understanding input values to lower spatial dimensionality of picture. All neurons in just such layer are being connected to neurons in previous layer in same way as hidden layers of conventional neural networks are connected.

The last layer of the CNN is often a fully connected layer, which is similar to hidden layers of classical NN in which all neurons in such the layer are coupled to neurons within previous layer. As previously stated, CNN is often used to solve classification issues. For the semantic segmentation, a convolutional neural network (CNN) divides the input picture into equal-sized patches. The CNN uses the patch's central pixel to classify it. The patch is again slid forward to next centre pixel to be classified. As features travel into final fully linked network layers, they lose spatial information due to the inefficiency of this technique, which does not reuse an overlapping features of sliding patches. Figure. 2(c) shows a proposed solution to such problem: the (FCN) fully convolutional network that uses up-sampling over the low-resolution feature maps to the recover original spatial dimensions whereas performing the semantic segmentation. The ultimate fully connected layers of CNN have been changed to the transposed convolutional layers in order to accomplish this.

The back propagation technique and an optimization approach such as gradient descent are often used to train the deep neural networks. Loss function gradients are utilised by optimization method to update network weights throughout order to minimise loss function's value.
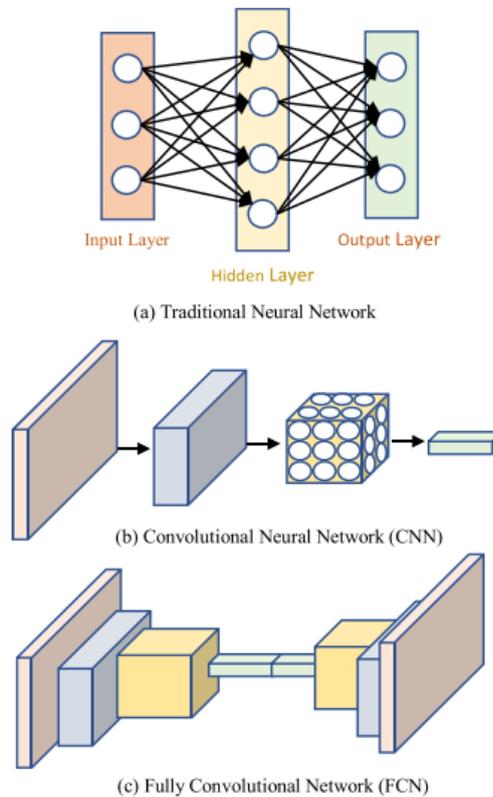
Figure 21 (a) A 2-layer Neural Network (one hidden layer of 4 neurons and one output layer with 3 neurons), and three inputs, (b). Convolutional Neural Network (CNN) and (c) Fully Convolutional Network (FCN)

6. CONCLUSION

There are a wide range of topics in the biomedical engineering education as well as research that focus on the image processing. Many novel treatment procedures currently make advantage of this principle as a result of advances in physiological understanding. In addition, sophisticated signal as well as image processing techniques are often studied using time-frequency representations strategies in the fields of neurology, functional imaging, as well as cardiovascular system. Certain imaging techniques are now widely available inside the advanced world that could deal with the disease presentations and offer diagnostic data.

A wide range of biological applications have benefitted from groundbreaking advances in the deep learning, including automated processing of CT images and the segmentation of the skin lesions. Furthermore, if more tagged photographs are made the public, the lot more may be accomplished. In

order to generate the ground truths, the experts must manually label the visual data. In the lack of hard facts, it is necessary to devote more time and effort to investigating unsupervised learning methods.

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A Review on Wireless Sensor Network Based Approaches for Temperature Sensing Applications

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Abstract

In this paper, the most current breakthroughs as well as research investigations on the cold thermal energy storage are summarized in detail (CTES). Water may be chilled or frozen to the store cooling capacity (or even the other materials as the glycol and the eutectic salts). A number of practical as well as the the thermodynamic factors, along with the availability, the relative harmlessness, and the compatibility with a broad range of the equipment for storage as well as handling, make water the storage medium of choice. Decisions including that equipment must be utilized, whether the eutectic salts are needed to boost the freezing temperatures etc. might be difficult to make. Often these decisions are not easy. There are a plethora of possibilities, yet there are no easy solutions. CTES methods should be tailored to the unique demands and limits of facility in that they are implemented.

Keywords: WSN, decision, monitor, CTES

1. INTRODUCTION

The energy as well as cold supply chains throughout the globe are expected to confront enormous challenges in the next decades as a result of climate change as well as an increasing global population. There will be 9.7 billion people in the globe by the year 2050, according to the United Nations' projections. On the other hand, and over 820 million people throughout the globe are hungry, in part because of food spoilage owing to a broken cold chain (Yang et al., 2021). The refrigeration sector will see a significant rise in energy consumption as a result of these developments. There will be a 33-fold

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increase in refrigeration, the air-conditioning, and the heat pump equipment use by 2100 compared to 2015's consumption levels. Meanwhile, several sources of the cold energy have not yet been properly exploited to their full potential. (LNG) Liquefied natural gas consumption, for example, is expected to treble by 2040, to over 700 MTPA (Selvnes et al., 2021). It is important to note that during the LNG regasification, around 830 kJ/kg at 162 °C is typically squandered into ocean or ambient air. As a result of the global rise of the intermittent renewable energy sources, the efficient and the cost-effective power storage solutions are also necessary. For this reason, research has been conducted to create (CTES) cold thermal energy storage systems to store cold, materials to store cold, including smart ways to distribute cold to meet the rising worldwide need for the refrigeration energy consumption.

CTES is a novel approach to store nighttime off-peak energy for usage throughout the day. Summer is a high season for electricity use in many places. During the hottest part of the day, whenever energy is most costly, air conditioning accounts for much of the half of demand. During the "off-peak" period, which occurs at night, the cost of producing power is much lower than during the day. In essence, power generated at night may be used to cool a room during day. CTES has emerged as a key tool for resolving the problem of the electrical power shortages during the day as well as surpluses at night. Off-peak cooling loads may be shifted using CTES systems provided the systems are correctly built, operated and maintained. This ensures that energy demand is equally distributed and avoids power shortages that occur during peak times (Selvnes et al., 2021).

It has been decades since CTES have been invented, notably for food including the medical commodities to be preserved and transported over a broad range of the temperatures. Technology and materials for use in this industry have been reviewed by a large number of writers. Research has been done to categorise diverse cold storage systems and applications (Ma and colleagues, 2016). Cold storage and (PCMs) phase change materials ranging in temperature from 7 to 14 °C have also been developed (Mandal et al., 2020). The Thermal energy storage at the low temperatures was also examined in the review. Analysis and characterisation of PCMs accounted for the majority of investigations, according to findings (Arshad et al., 2020). Only a small percentage of them were used in cold storage. However, despite their best efforts, they acknowledged that the study described in their publication was in its infancy and needed to be further developed.

Khyad et al. (2016) published a survey of CTES materials that included up to the 88 PCMs with the melting temperatures ranging from -86°C to 20°C. Corrosion, the phase segregation, the stability during prolonged thermal cycling, as well as subcooling are all examples of long-term stability for the analyses of materials. This article (EanestJebasingh, 2016) (Sar et al., 2018) also examined several PCM encapsulation technologies and PCM applications in various cooling systems. Aside from that, almost all of applications in our evaluation were at or below zero degrees Fahrenheit. While several references to the materials and techniques for the storing cold energy at the low temperatures may be found, we discovered that a thorough updated work that synthesises the knowledge available on the materials,the technologies and the applications in the area for very low temperatures was needed. A

complete evaluation of sub-zero cold energy storage (CTES) has been lacking in the literature, and this work intends to address that need by providing a systematic summary of CTES technology.

2. WORKING PRINCIPLE

Because of the potential for significant savings in running costs, CTES systems may be the most cost-effective in scenarios like these (Yang et al., 2021).

- When a facility's maximum cooling demand is much higher than the average cooling load;

- At times of peak demand, an utility rate structure imposes higher demand charges

- There will be an addition to an existing cooling system.

- A tank already exists;

- Only a little amount of electricity is accessible on-site at this time.

- Hence, a backup cooling system is a good idea;

- It is desirable or useful to have cold air distributed.

If any of the above conditions is met, a more thorough evaluation may be warranted. It's indeed difficult to generalise about whenever cool storage solutions will be the cost-effective. Throughout non-peak hours, many CTES systems produce ice and store this for usage during the day.

2.1. OPERATIONAL LOADING OF CTES

Various charging and discharging options are available to satisfy peak cooling needs. In terms of strategy, complete and partial storage are the two basic options (Selvnes et al., 2021).

In a full-storage approach, all of the peak cooling demand is shifted to the off-peak hours (Fig. 3.20a). Nonpeak hours are often reserved for charging the storage, and system is the typically built to run at maximum capacity during these hours. Whenever peak demand costs are large or the peak time is short, this technique is ideal.

Fully decoupling the functioning of heating and cooling generation equipment again from peak heating and cooling loads are the full-storage systems. During periods of inactivity, the storage may be used to meet peak heating or even the cooling demand, i.e., discharging. Only if one or even more of the foregoing applies will a full-storage system be cost-effective:

- Peak load curve spikes are short-lived;

- Time of use pricing are dependent on the peak times that last for a short length of time.

- Short periods of overlap exist between times of peak demand and periods of the peak energy.

- TES users are eligible for substantial financial rewards.

- Charges are imposed during times of high demand.
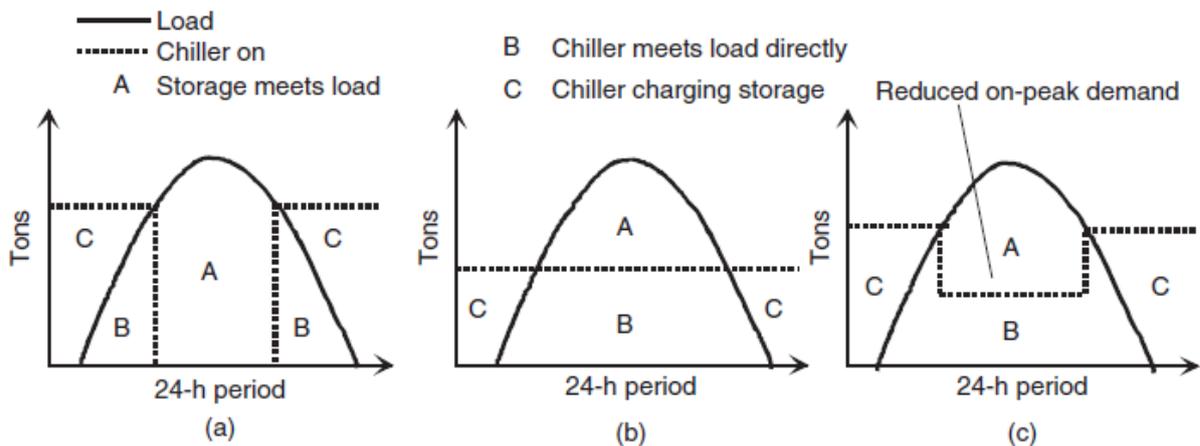
All of the facility's peak cooling demands are met by the storage unit when adopting the full-storage technique, which shifts every one of the electrical demand associated with cooling to the off-peak hours. You can figure out how big a storage tank you'll need by the calculating the peak cooling demand (in tonnes per hour) and multiplying it by such tank's efficiency factor. In most cases, the initial expenditures are projected to be rather substantial.

Only a portion of the building's cooling demand is met by load-leveling partial-storage technique during the peak hours. The cooling requirement of a structure may be even off by this strategy on the design day. This strategy is more cost-effective since it reduces the amount of the storage as well as the refrigeration equipment required to the cool a building. Moreover, such approach doesn't really result in as significant a reduction in operational costs as the others.

2.2. COLD THERMAL ENERGY STORAGE MATERIALS

The earliest steps of the CTES system design begin with selection of storage material that has a significant impact on system's storage space as well as, ultimately, its final design. Material requirements for the CTES materials are usually believed to be as follows: [9–11]:

A temperature range that is suitable for the task at hand.

- High density

- High thermal conductivity

- High energy density

- Low degree of the subcooling (or the supercooling)

- Low cost and available in large quantities

- Not poisonous, toxic, flammable, or explosive

- Chemical and physical stability

- Small vapor pressure and volume change

- Corrosion resistance

There isn't a perfect CTES material; every material seems to have its own advantages and disadvantages [7,12]. As a result, deciding on a material is frequently a trade-off between many factors aimed at finding the best material for a certain application.

3. APPLICATIONS

CTES type Temperature range mentioned in the literature (∘C)	Storage material type	Temperature range mentioned in the literature (∘C)	Suitable applications	References
Packed bed and thermocline CTES	Sensible material (mostly solid), PCM with macro encapsulation	-170 to 0	Waste cold recovery, big-scale active refrigeration as well as large scale power storage are some of the small-scale active including the passive refrigeration systems that may be used.	(Sharma et al., 2016)
Shell-and-tube CTES	Sensible material (mostly liquid), PCM	-210 to 0	Combined small as well as the large-scale active including the passive refrigeration systems; the large-scale waste cold recovery; the small-scale electricity storage; as well as the large-scale electricity storage.	(Babapoor & Karimi, 2015)

Plate-shaped CTES	**PCM**	-45 to 0	Activated refrigeration as well as the waste cold recovery across small including large scales	(Kaviarasu & Prakash, 2016)
Slurry	PCM (in phase change slurry form)	-78.5 to 0	Activated refrigeration as well as the waste cold recovery across small and large scales	(Kaviarasu & Prakash, 2016)

4. CONCLUSION

Materials appropriate for the cold thermal energy storage, along with their thermal characteristics and improvement techniques, are identified and studied for the cold thermal energy storage technology. Phase shift materials are far more abundant than sensible (solid as well as liquid) materials, and they are still under the development. Energy density drops dramatically when melting temperature lowers with lower temperature applications of phase change materials (PCM). Although research on the numerical calculations and experimental investigations of the cold thermal energy storage at the sub-zero temperatures is scarce, the pace of publication of these works is quickening.

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A State of Review on Biomedical Image Processing Techniques with A Focus on Deep Learning

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Abstract

There is a lot of activity in the subject of medical image processing, and it has developed into an established specialty. In clinical investigations, accurate segmentation of medical pictures is essential for diagnosis, monitoring, and planning therapy. Segmenting medical photos by hand takes a long time and is tiresome. Therefore, high-accuracy automated segmentation methods are of relevance. The performance of a segmentation algorithm is influenced by a number of things. How the approach is used, how it is reproduced, how accurate its outcomes are all examples. With an emphasis on Deep Learning Techniques, this paper will offer an overview of current picture segmentation techniques. The review focuses on the automated segmentation of medical pictures using deep learning algorithms.

Keywords: Image Segmentation, Deep Learning, Convolutional Neural Network, Biomedical Image

1. INTRODUCTION

The discipline of natural science that deals with the processing of biological and medical data is ever-changing. The architects employed biological signals to develop bioelectrical and biomechanical systems. Diagnostic techniques for medical problems were developed by doctors and human services specialists. Both diagnostic and health status information have been addressed by these specialists in biological signals, which have been handled comprehensively. Engineers working in biomedical

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applications may more readily make use of the current signal processing tools and algorithms because of the roles they play.

Action potential and event-related potential are two of the most significant biological signals. EMG, ECG, ENG, EEG and ECG are all existent action potentials that may be used to monitor a patient's health. EEG (electrogastrogram), phonocardiogram, carotid pulse, signals from catheter-tip sensors, speech signal, vibromyogram and vibroarthrogram, oto-acoustic emission signal, are all included in the event-related potentials category. Biomedical imaging modalities include functional magnetic resonance imaging (fMRI), computed tomography (CT), ultrasonography, and positron emission tomography (PET) (PET). Studies of brain activity in health and illness, under various task situations and at rest, have relied on fMRI data because of its great spatial resolution and poor temporal resolution.

2. LITERATURE REVIEW

(Bas et al., 2021) Spatio-temporal correspondence between pre-treatment 3DCT images of the target point and throughout the operation has been suggested using a real-time approach Target registration error in third-tier registration circuits is minimised as a key component of the design. Abdominal deformation fields were generated by using Particle Swarm Optimization and Differential Evaluation to obtain the best Elastic Body Spline parameters. The following transformation classes have been examined: rigid, thin plate spline, affine, and elastic body spline. It was found that swarm optimization technique had the lowest TRE - differential evolution for stiff and affine version: 3.47 and 3.73 mm, respectively.

(Rahman et al., 2021) Anatomy of red blood cells (RBCs) is critical to the diagnosis of a number of disorders, including cancer. Using an automated image-based approach for the study of blood cell morphology may save pathologists' and patients' time, as well as reduce the risk of errors. A new approach for segmenting and identifying various RBCs in blood smear pictures is presented in this research. Color processing and double thresholding of blood smear pictures are employed in the proposed approach to extract the core pallor and entire cell information. For the detection of abnormalities in peripheral blood smear pictures, figure and size variations of cells are computed. A probabilistic ensemble with cross-validation accuracy weighting was utilised (CAWPE). When compared to a broad variety of possible parent classifiers, this heterogeneous ensembling strategy of roughly comparable classifiers yielded much superior classifiers (in terms of errors and probability estimations). Three sets of photographs are used to test the new approach. Expert pathologists at a government hospital in the area created the picture sets. Photographic circumstances are different for each collection of images. The approach was shown to be more accurate in terms of outcomes than other methods, and hence closer to the real world. The suggested technique has an average accuracy of 97 percent for single cells and 96% for cells that overlap. Variance ($\sigma2$) of accuracy is 3.5 and deviation (σ) is 1.87.

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(Geist & Neufeld, 2021) For dynamic PET data analysis, we use the linear response theory and continuity equation regarding tracer density to create effective mathematical tools. A tracer particle's path through an organ may be predicted probabilistically, and extensive information about the underlying physiological processes can be gleaned from this technique. We demonstrate our method by using renal data from a combination PET/MRI scanner with a sugar analogue radio tracer to show how it works.

(Yang et al., 2020) The most prevalent human mycobacterial illness, tuberculosis affects people all over the globe. In order to identify infected persons, commence and monitor therapy, and reduce or prevent transmission, rapid and accurate mycobacteria diagnosis is essential. An acid-fast Mycobacterium (AFB) may be identified in tissue sections using Ziehl-Neelsen stained slides, which show a brilliant red colour on a blue background when seen under a microscope. Our team created a machine learning pipeline to categorise digitised ZN-stained slides as AFB-positive or AFB-negative due to the lengthy and rigorous screening required for ZN-stained slides by an expert pathologist. CNN models are used to identify AFB-containing tiles, and a logistic regression (LR) model is used to categorise slides using AFB-probability maps generated from the CNN tile classification results. The pipeline comprises both models. There were six AFB-positive slides and eight AFB-negative slides used to train the first CNN, while the second CNN was trained using the original tile set enlarged with extra tiles from 19 AFB-negative slides picked using an active learning framework. To categorise tiles on a different set of 134 slides, the two CNNs produced F1 scores of 99.3 percent and 98.75 percent when tested on a second set of tiles (46 AFB-positive and 88 AFB-negative). AFB-probability maps for each CNN were generated as a result of the categorization. In order to test the LR model, the AFB-probability maps were cross-validated ten times using the average of feature vectors recovered from each CNN. The positive tile rate and seven AFB-probability map histogram features formed the feature vector (PTR). An AFB-probability map generated by the CNN trained in the active learning framework had a sensitivity of 87.13 percent, specificity of 87.62 percent, and an F1 of 80.18 percent, which was higher than the baseline performance of PTR-based slide separation, which had a sensitivity of 73.13 percent and a specificity of 66.67 percent.

(Thakur & Juneja, 2020) As the number of cases of glaucoma, the leading cause of blindness, is likely to rise sharply in the near future, it is vital that retinal abnormalities be detected early. Fundus photos from digital fundus cameras are often used to diagnose it. Images are prone to sounds, which may influence the results of diagnosis by reducing their accuracy. Valves and low-contrast pictures in the retina are among the noises associated with glaucoma, as as uneven lighting conditions that degrade cup and disc segmentation. Pre-processing retinal pictures by removing outliers is critical for diagnoses. Outliers may be removed from retinal pictures using a hybrid method presented in this paper. In order to enhance diagnostic tools, the proposed method may be implemented in digital cameras.

(Krasoń et al., 2019) Computing tomography (CT) image segmentation of anatomical features is still a crucial step in computer-aided diagnosis and treatment today. Complex anatomical features in abdominal cavity, presence of anatomical variations and pathological alterations of organs in computed tomography images, segmentation remains an ongoing research challenge. The generalized statistical

shape model is used to segment the data in this article. To evaluate the segmentation approach on 40 instances of computed tomography with contrast, 20 cases were included in the training set and 20 were included in testing set. The spleen, kidney, liver, pancreas, and duodenum were outlined by experts in each instance. The DICE coefficient averaged 0.96, 0.093, 0.88, 0.86, and 0.81, respectively. The established approach may be considered a step toward a universal method of segmentation in normalised scaled pictures since the method does not need the selection of new parameter values when used to the segmentation of a varied set of parenchymal anatomical organs.

(V, 2019) In the study of medical pictures, semantic segmentation is a particularly active topic of research. As a result of typical segmentation algorithms' inability to keep the pictures' full resolution throughout the network, researchers began looking for ways to safeguard that resolution. As part of the encoder/decoder structure, a lower spatial resolution feature mapping is developed that is extremely successful at distinguishing between the classes, and then up samples are conducted in order to create a full-resolution division map of biological pictures that reduces diagnostic time. A pixel-to-pixel fully trained cascaded convolutional neural network is used for image segmentation in the proposed framework. Biomedical image analysis utilising semantic segmentation demonstrates an improvement in performance due to reduced testing time and an increase in radiologists' ability to analyse images.

(Tchagna Kouanou et al., 2018) Big data analytics for biological imaging is discussed in this work, along with examples from the literature, novel processing techniques, and some findings. Big data technologies, such as Hadoop and Spark, may benefit from adaptation and extension of associated work processes. These are the best and most efficient architecture for image analysis in biomedical applications. As a result, big data analytics for biomedical imaging detection is given a wide review in this study. A process that uses the best approaches and algorithms for each phase is presented.

(Arulmurugan & Anandakumar, 2018) The identification and segmentation of salient regions in biological pictures is often a vital step in the image's comprehension. Foreground and background colours are incorrectly differentiated at the first contour selection during segmentation. The Histogram Colour Contrast Seed Point Selection technique, which uses region-based cell finding and separation approach, is described in this study as a way to enhance cell detection (HCC-SPS). Color contrast in visual signals is addressed by the HCC model's ability to group comparable colour values in each pixel, resulting in precise intended edge points. A region-based seed point fine adjusts salient worth and makes it simpler to distinguish between a salient object and its backdrop. Because of a pixel-based mapping function, the segmentation of biological pictures is done correctly. Analogies are drawn between them and the current system based on metrics like accuracy, segmentation time, and mapping functions.

(Rajeswari & Jagannath, 2017) There is a lot of activity in the subject of medical image processing, and it has developed into an established specialty. In clinical investigations, accurate segmentation of medical pictures is essential for diagnosis, monitoring, and planning therapy. Segmenting medical photos by hand takes a long time and is tiresome. Therefore, high-accuracy automated segmentation methods are of relevance. The performance of a segmentation algorithm is influenced by a number of things. How the approach is used, how it is reproduced, how accurate its outcomes are all examples. This article's

goal is to offer an overview of the current picture segmentation techniques available in the marketplace. Discussed are their efficiency, benefits, and challenges. Several commonly used benchmarks for segmentation outcomes are listed here.

(Shaikh et al., 2016) A new and complex topic in biomedical image processing has emerged in recent years. Medical imaging applications generate large numbers of pictures that are almost identical. Due to the enormous volume of data, doing manual picture interpretation and analysis becomes tedious and time consuming. MRF c1assification is a well-established approach for c1assifying a picture based on statistical inference in medical image processing. Markov Random Fields (MRFs) and a few prerequisites relevant to medical image processing are described in this work.

(Navab et al., 2015) Deep network training needs thousands of annotated training examples to be effective. Data augmentation is heavily used in this article to make better use of the annotated examples that are already accessible. A contracting route and a symmetric extending path make up the design, which allows for exact localisation. In the ISBI challenge for the segmentation of neuronal structures in electron microscopic stacks, we demonstrate that a neural network can be trained end-to-end from just a few photos and beats previous finest solution (a sliding-window convolutional network). With same network trained on DIC and phase contrast pictures from transmitted light microscopy, we were able to take first place in the ISBI cell tracking challenge 2015. And the network is lightning-fast. 512x512 picture segmentation on a modern GPU is completed in less than one second.

2.1. TYPES OF BIOMEDICAL IMAGES

Biomedical pictures come in a variety of forms depending on the technology used to capture them. Below is a list of some of the most often used biomedical imaging methods. The following is not a complete list, since new imaging methods are always being developed to help doctors make faster and more accurate diagnoses.

- **Clinical images**

When it comes to biomedical imaging, there are a variety of options. Biomedical imaging methods that are often utilised are listed below. New imaging methods are always being developed to improve diagnostic accuracy and speed. The following list does not include all of the available options.

- **X-ray imaging**

Fractures and dislocations of the bone are most often detected via X-ray imaging. The two-dimensional image is being formed. The National Institutes of Health (NIH) has provided free access to 100,000 chest x-ray images and accompanying data and diagnoses in an effort to enhance imaging analysis methodologies. More than 350,000 chest x-rays from the Massachusetts Institute of Technology (MIT) have been made available for use in developing machine learning models that can detect 14 common illnesses, such as pneumonia or a punctured lung, without any human intervention.

- **Computed Tomography (CT)**

The cross-sectional pictures of interior organs of the body (X-Rays), bones, soft tissue, and blood arteries are produced by using a computerised imaging process known as CT. The long axis of the body is perpendicular to the axial or transverse planes in which the pictures are normally taken. It is possible to create a three-dimensional picture by reformatting the images, also identified as slices, into different planes. It is one of the most commonly explored biomedical imaging challenges and is widely utilised to diagnose cancer by localising tumour's existence and their size. Improve lesion detection accuracy by providing open access to 32,000 CT scans and accompanying data and diagnostics from the National Institute of Health (NIH).

- **Magnetic Resonance Imaging (MRI)**

Strong magnetic fields are utilised in MRI imaging to create pictures of inside bodily processes, organs, and tissues. The soft tissues or the non-bony tissues of the body may be seen with MRI. While CT scans do not involve ionising radiation, x-rays are used in this procedure. MRI scans are superior than x-ray and CT scans when it comes to detecting knee and shoulder ailments. Aneurysms and tumours may be detected using MRI scans of the brain, which can discriminate between grey and white matter. The Open Access Series of Imaging Studies (OASIS) initiative have accumulated more than 2000 MRI sessions for use by biomedical imaging researchers.

- **Ultrasound Imaging (US)**

US imaging employs high-frequency sound waves for generating pictures of inside organs, tissues, and blood flow. Monitor the foetus throughout pregnancy with this method. Abdominal, vascular, and thyroid scans are the most common applications, although it is seldom used to image bones or tissues that contain air, such as the lungs. Fast and radiation-free are the main advantages of utilising the United States.

- **Optical Coherence Tomography (OCT)**

To get pictures with a resolution of a few micrometres in two and three dimensions, optical coherence tomography (OCT) makes use of low coherence light. Because it gives doctors a cross-sectional picture of the retina, they can clearly identify the different layers of the retina while doing OCT eye exams. Layer mapping and thickness measurements may be used for diagnostic purposes as a result of this.

- **Microscopic Images**

Microscopical medical pictures are utilised to examine tissue's cellular structure at the molecular level. Sections of the tissue are then stained with staining components in order to expose cellular level characteristics of the tissue. Color, contrast, and visibility are all provided by counterstains. These pictures are often used in the search for signs of malignancy. The nucleus and the location of cells in the tissue are two of the most often examined aspects.

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3. IMAGE PROCESSING and SEGMENTATION

In today's healthcare system, procedures of executing non-invasive diagnostic would be impossible without the use of medical imaging. Functional and Visual representations are created of human body and its organs for clinical study. Medical imaging may be divided into two broad categories: those that use radioactive x-rays and those that use non-x-ray technologies like computed tomography or mammography. Additionally, clinical photographs are increasingly being utilised to identify a wide range of disorders, particularly those relating to the skin.

Two components of medical imaging are: 1) image formationand reconstruction and 2) image processing and examination [2]. In image creation, procedures are used to create two-dimensional (2D) representations of three-dimensional (3D) objects, whereas in image rebuilding, algorithms are used to create both 2D and 3D representations of the object using projection data. In contrast, processing of image employs algorithms to improve picture qualities like noise reduction, while image analysis pulls quantitative data or a collection of features from the image for object identification or classification. Image processing.

Images may be enhanced, segmented, detected, pre-filtered, thresholded, and morphologically processed using a variety of different ways. Using segmentation, photos with several complicated techniques may be simplified. Classic picture segmentation uses information from texture, shape and contours. Detecting the edges of objects in a picture is accomplished via the use of the edge detection method. Image discontinuities are specified as edges. The word "edge" refers to a sharp break in the brightness of a picture. Sobel, Prewitt, canny Robinson, and Laplacian are all first and second derivative edge detectors. In either the frequency or spatial domain, image enhancement methods are utilised to recover the original picture. Point processing and mask processing are two methods used in the space domain.

All of these image segmentation methods may be divided and assembled into three classes:

- **Manual segmentation (MS)**

In order to appropriately annotate each picture pixel using MS approaches, subject experts must first establish the area of interest (ROI) and then draw exact borders enclosing ROI. MS offers ground truth tagged images for the development of semi-automatic and full-automatic segmentation algorithms. Using MS requires a lot of time and can only be done with tiny picture collections. High-resolution pictures may lose their sharp border (poor contrast) as a consequence of the increased resolution, and even little changes in the selection of pixels for the ROI boundary might lead to significant errors. It is also problematic because manual segmentation has a high degree of subjectivity since it is reliant on the expertise and knowledge of the individual segmentation experts.

- **Semi-automatic segmentation**

Automated algorithms and a little amount of human intervention are required for semi-automatic segmentation to obtain reliable results. The user may pick an approximate starting ROI that will be used to segment the whole picture in the following steps. To minimise segmentation errors, it may be necessary to do manual checks and edits on region borders. Iteratively merging neighbouring pixels of the same intensity, using a seeded region-growing (SRG) method, is one semi-automatic segmentation approach. Iterative shrinkage or expansion of initial boundary forms represented by contours based on implicit level of a function, with benefit which previous shape information and the starting positions of ROI are not required. Another method is level-set based active contour model. the use of tiny local areas to characterise the foreground and background of an image with the aid of region parameters, allowing for the management of images with varied textures in the foreground and background.

- **Fully automatic segmentation techniques**

Automated segmentation methods do not need any human input. In general, supervised learning techniques, such as shape models, atlas-based segmentation algorithms, random forests, and deep neural networks, are used in most of these methods. Manual segmentation is required to produce labelled pictures for both the training data and the validation data when using unsupervised learning algorithms. In addition, there are significant differences in the form, size, texture, and colour of ROIs across individuals, as well as poor contrast between areas in medical pictures.

4. DEEP LEARNING TECHNIQUES

In real-world applications, noise or inconsistent data capture may lead to substantial variances in the source picture data. The lack of universal applicability of most modern systems based on clustering methods, watershed algorithms, and machine learning (ML) approaches hinders their use throughout the globe.. It takes a long time and doesn't function with natural data in its raw form, which is why it's typically utilised in machine learning approaches based on support vector machines (SVMs) or neural networks (NNs). Natural data may be processed without the requirement for manufactured characteristics using deep learning algorithms.... Sophisticated techniques to semantic picture segmentation, such as those employed in nature photography, as well as biological image segmentation, have proven useful. Rapid developments in central processing units (CPUs) and graphics processing units (GPUs), as well as easier access to big data sets and improved learning algorithms, have all contributed to a rise in the popularity of deep learning methodologies.

- **Machine Learning**

Classification of ROI, for example, as a sick or healthy zone, is a common use of machine learning-based picture segmentation. The pre-processing stage may include usage of a filter for eliminating any noise or to boost contrast, depending on the needs of the application. A segmentation method like

thresholding, clustering-based approach, or edge-based segmentation is used to separate the picture after the pre-processing step. The ROI's colour, texture, contrast, and size information is used to extract features after segmentation. Then, using feature selection methods like principal component analysis (PCA) or statistical analysis, the most prominent characteristics are identified.
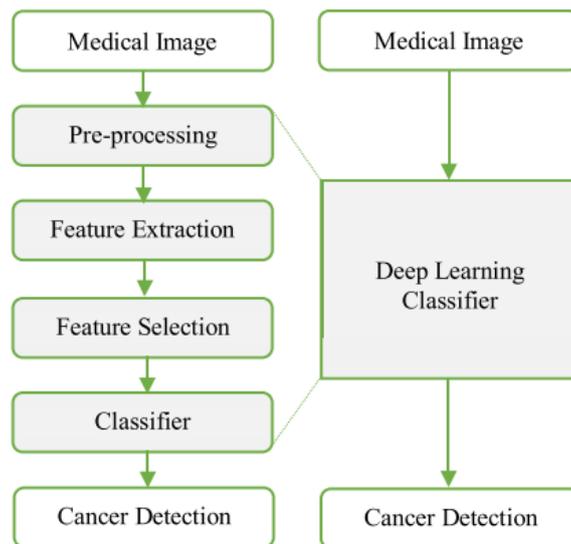
Figure 22 Change in classifier approach using typical machine learning algorithm and deep learning.

- **Deep Learning-based Classifier (DLC)**

No pre-processing, segmentation, or feature extraction is required since DLC can handle raw images immediately. Due to the limited number of input data, most deep learning algorithms include picture scaling. If the data augmentation approaches outlined below are used during training, certain techniques may not need to be normalised and contrast enhanced. By eliminating feature vector and segmentation mistakes, DLC achieves improved classification accuracy. Fig. 1 illustrates how two techniques to machine learning might be compared (ML and DLC). Traditional image processing methods for feature engineering have been replaced by network architecture design as the primary focus of DLC-based research. As a consequence of DLC networks' use of numerous hidden layers, the models are more computationally costly than those based on machine learning.

- **Deep Learning Architecture – Convolutional Neural Network (CNN)**

The most extensively used deep learning architecture is CNN, which is quite similar to a normal neural network. An image is sent into the CNN as input and the neurons are organised in three dimensions with connections to a tiny part of the previous layer rather than the complete layer as seen in Figure 2(b) below. This differs from a normal NN (Fig. 2(a)). Convolutional, non-linear activation, pooling, or fully linked layers are all part of the CNN's three levels of non-linear activation. Layers of convolution are

used to extract feature maps from an image using a filter's feature maps as a starting point. ReLU, that applies the function fðxÞ ¼ maxð0, is a non-linear activation layer; xÞ to input values for increasing non- linearity and improve the speed of training. This technique, which relies on surrounding pixels to do calculations, is translation invariant since it downsamples input values to lower image's spatial dimensionality and hence minimise computational costs. If you're using convolutional neural network (CNN), last layer is called a fully connected layer, and it's similar to the hidden layers of classic neural networks.

(a) Traditional Neural Network

(b) Convolutional Neural Network (CNN)

(c) Fully Convolutional Network (FCN)
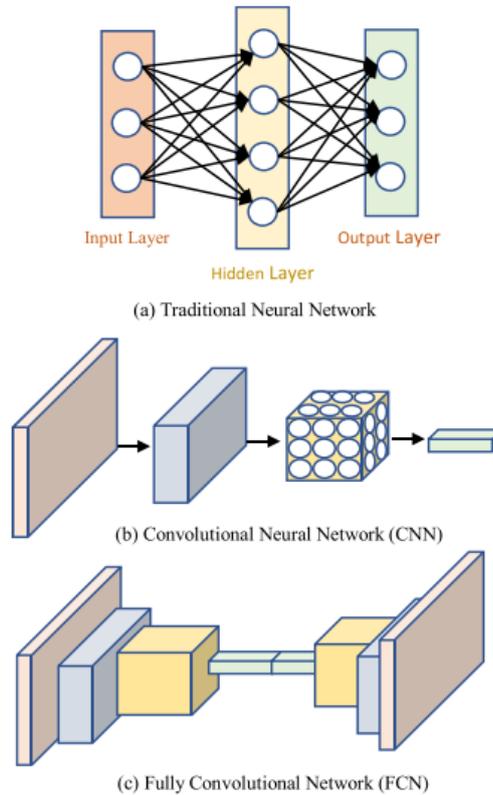
Figure 23 (a) A 2-layer Neural Network (one hidden layer of 4 neurons and one output layer with 3 neurons), and three inputs, (b). Convolutional Neural Network (CNN) and (c) Fully Convolutional Network (FCN)

If you're using a convolutional neural network (CNN), the last layer is called a fully connected layer, and it's similar to the hidden layers of classic neural networks. It was already established that CNNs are often employed to classify data. The input picture is separated into equal-sized patches before CNN can be used for semantic segmentation. The patch's central pixel is classified by the CNN. The patch is then slid forward to the next centre pixel to be classified. A sliding-patches-based technique is inefficient because overlapping characteristics of the sliding patches are not reused in the final fully linked network layers, resulting in a loss of spatial information. Figure 2(c) shows the suggested solution to this problem:

the usage of a fully convolutional network (FCN) that uses transposed convolutional layers (TCL) to up-sample low-resolution feature maps to restore original spatial dimensions during concurrently conducting semantic segmentation.

An optimization approach like gradient descent is often used in conjunction with backpropagation to train deep neural networks. Loss function gradients are employed by the optimization method to update the network weights in order to minimise loss function's values.

5. CONCLUSION

In the subject of biomedical engineering, there are several areas of study and research that focus on biomedical image processing. It is now possible to apply this principle to a broad range of medical applications thanks to a better understanding of the human body's functions. Furthermore, in fields of neurology, functional imaging, and cardiovascular system imaging, sophisticated methods in signal and image processing are often carried out using time-frequency representation methodologies. Some imaging techniques are now widely available in the advanced world, which can deal with disease presentations and offer diagnostic data.

Biomedical applications ranging from CT scan automatic processing to skin lesion segmentation have shown exceptional performance improvements because to deep learning approaches. However, if more tagged photographs are made public, a lot more may be accomplished. In order to generate the ground truths, the experts must continue to manually identify the visual data. A greater emphasis should be placed on testing out non-supervised learning methods in the absence of established facts.

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A Systematic Review of Routing Protocols for Vehicular AD Hoc Networks and Recent Developments

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Abstract

The development of Vehicular Ad Hoc Networks (VANETs), new strong technology that aims to keep passengers secure, has developed. Cars may be linked to the Internet using IEEE 802.11p, which is a technology that can be used with or without existing infrastructure. To solve these issues and get packets to their ultimate destinations on VANETs, there are several current and proposed technologies that may be used. Following the preceding, this study presents a full explanation of several current routing strategies in literature, so that a specific approach may be selected based on its suitability for a given application. Many routing strategies are categorised in the article, with critical examination of each categorization's merits, weaknesses, limits, and uses.

Keywords: Routing Protocols, Intelligent Transportation Systems, Vehicle Routing

1. INTRODUCTION

Ad hoc NETworks for vehicles, often termed VANETs, are kind of mobile NETworks (MANETs). They serve as the backbone of an Intelligent Transportation System (ITS), which aims to enhance road safety by streamlining vehicle operation. Due to the widespread availability and low cost of wireless technology, they have the primary benefit of not requiring a costly infrastructure. Cargo-side or vehicle-side devices mounted in cars or on the roadside provide early warning of possible risks and circumstances

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for drivers. Drivers benefit from real-time traffic and weather information (including ice) and Internet access as well as enhanced road safety as a result of this technology.
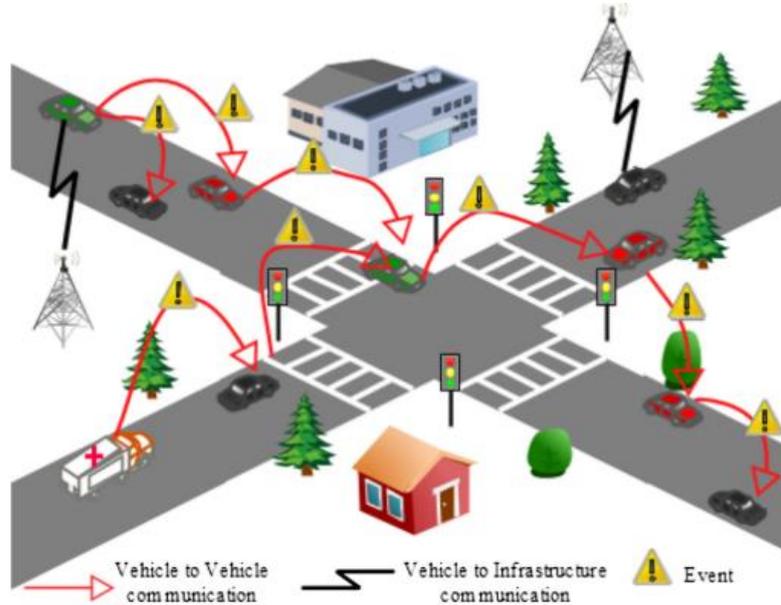
Figure 24 VANET-scenario.

The frequent topology changes and high vehicle speeds that distinguish a VANET. Because of this, it is difficult to route and forward packets in VANETs. Topology-based routing (such as AODV and DSR) and position-based routing techniques have been compared in urban and highway traffic situations and reveal that typical ad-hoc protocols have trouble coping with high mobility peculiar to vehicle ad-hoc networks. They have somewhat different needs than other sorts of mobile ad hoc network systems. There is no limit to how much memory and energy can be stored in today's automobiles, and every vehicle may obtain its own physical location since current vehicles can be fitted with a positioning system (GPS). When compared to traditional ad hoc networks, this one is much more dynamic due to the great mobility of the automobiles, which do not move at random but rather follow a defined pattern of movement.

2. LITERATURE REVIEW

(Elaryh Makki Dafalla et al., 2022) Voice over Internet Protocol (VoIP) makes use of the VANET infrastructure to provide high-quality services to mobile users. In order to maintain an adequate level of Quality of Service (QoS) for voice conversations, these networks must overcome several obstacles. VoIP applications on the VANET network are tested using the Optimized Link State Routing Protocol. Quality of Service (QoS) characteristics such as end-to-end latency, delay variation (jitter), and chance of packet loss between two moving hops across multi-hop Ad-hoc networks were assessed before and after

executing the OLSR algorithm. End-to-end latency, jitter and packet loss probability were reduced by 18.72 percent, 20.42 percent and 128.6 percent, respectively, when the technique was applied to two nodes. When additional hops were added, the latency increased to about 400 ms, which is not allowed by ITU-T standards. The OLSR initially performed well for four hops. Instead of utilising a simulation, we developed a testbed to get the findings we wanted.

(Ye et al., 2021) Advanced Intelligent Transportation Systems (ITS) now rely on V2X communication in the form of the vehicular ad hoc network (VANET) to send and receive data. The development and implementation of innovative network routing protocols that provide V2X communication with reliable end-to-end connection and efficient packet transfer is a critical research topic in VANET. VANET's packet delivery accuracy and reliability are threatened by the dynamic nature of road traffic vehicles. In VANET, position-based routing protocols are the technique of choice because of their ability to deal with the frequent changes in vehicle movements. (I) inaccuracy in high-dynamic network topologies, (II) improper link-state estimation, and (III) poor movement prediction in diverse route layouts are some of the disadvantages of current routing protocols. A novel target-driven and mobility prediction (TDMP) based routing protocol for high-speed mobility, dynamic topology of vehicles, fluctuating traffic flow, and diverse road layouts in VANETs is suggested in this paper. For inter-vehicle connection status estimation, The Received Signal Strength Indicator (RSSI) and a driver's destination target are the foundations on which TDMP builds an effective routing system. TDMP's dynamic position prediction and evaluation of inter-vehicle connection status, as well as global road layout, may help enhance packet transmission over current geographic routing protocols, according to the authors. When compared to other common position-based routing protocols, such as GPSR, GyTAR, and PGRP, simulations on operational road environments show better performance in terms of getting better packet delivery ratio by 21-57 %, reducing end-to-end delay by 13 % -47 %, and average hops count by 17 % -48 %.

(Hu et al., 2021) A range of new uses in civilian wireless communications (such as 5G and 6G) and the military sector might be enabled by the flying ad hoc network (FANET), specific sort of mobile ad hoc network (MANET). In FANET, routing protocol is critical. Aerial nodes are supposed to move at random while constructing routing protocols for FANET. A mission-oriented FANET (MO-FANET), where aerial nodes normally travel toward specified form of destination provided parting points, maybe with fairly deterministic flight route during retaining an established formation, is plainly incompatible with this approach. An new cyber-physical routing protocol is presented in this study that takes full use of mission-determined trajectory dynamics to construct a temporal sequence of joining and splitting, as well as an adjacency matrix for each node. According to thorough simulations in a MO-FANET based on realistic setups, our protocol has a superior packet-delivery ratio (PDR) than the current representative routing methods used in FANETs at expense of even lower overhead and lower average end-to-end latency.

(Jaiswal, 2020) In position-based routing systems, the Location ID is derived from the GPS location of a vehicle. Vehicle ad hoc networks (VANETs) are concerned about the GPS accuracy since it is impacted by environmental and technological variables. Because of this, the GPS position of a car may

deviate from its real location by margin error of 5–100 m. This research evaluated position-based routing protocol utilising Kalman filter (KF) and extended Kalman filter (EKF) to minimise the impact of the margin of error on routing (EKF). As a prediction module, each of these was used in order to reduce location error and improve the average latency, packet delivery ratio, and throughput. C++ programming and the Eigen library were used to create KF and EKF prediction modules, which were then integrated into an NS-3.23 simulator. When it came to PDR, AD, and throughput, the proposed routing protocol was pitted against the CLWPR (cross-layer, weighted, and position-based) standard.

(Saleh, 2019) Providing drivers with secure and reliable warning messages necessitates securing data transmission in VANETs. A secure routing mechanism for VANETs has been presented in this work. It combines a security unit that uses a modified Diffie-Helhman key agreement protocol with an efficient location-aided routing protocol (LAR) which uses a tilted rectangular shape (TRS) request zone. Communication between cars on VANETs is protected against a man in the middle attack by the Secure Tilted Rectangular-Shaped Request Zone Locating-Aided Routing Protocol (STRS-RZLAR) (MITMA). The suggested routing protocol surpasses the unsecure TRS-L AR and the conventional L AR in terms of safe data delivery by performing extensive simulation results utilising 2 primary network parameters: vehicular node density and the number of malicious nodes.

(Bhoi et al., 2018) Media sharing, internet access, file transfer, and gaming are just a few of the many non-safety applications available on the UVANET. Routing is critical to UVANET's ability to provide better service to its customers. For non-safety applications, a new routing protocol for UVANET is presented in this work. Drivers and passengers in separate parking lots may play multi-player games with each other in a non-safety application. As a result, it's important that the game's data reaches its final destination quickly. The simulation results demonstrate that the suggested protocol fulfils the end-to-end delay tolerance of 100 ms when the city area's vehicle density is large. Final tests of proposed routing protocol are carried out by running a simple puzzle game on a UVANET prototype suited for indoor and outdoor use.

(Boussoufa-Lahlah et al., 2018) There have been several routing protocols developed for Vehicular Ad hoc NETworks (VANETs) throughout the last decade. Because of the constant changes in the environment and the great mobility of the vehicles, the geographic routing protocols (GR) and position-based routing protocols (PBR), which are based on the locations of the vehicles, have shown to be the most suitable for VANETs. Routing protocols based on location rather than IP addresses, as in the case of Mobile Ah hoc NETworks (MANETs), are used to pick the optimal route for forwarding data. In addition, unlike MANET routing protocols, they do not share link status information or preserve previously defined routes. As a result, the protocols are more resistant to topology changes and vehicle movement. A state-of-the-art on routing techniques based on vehicle location is presented in this work. It is important to understand the objectives for designing these protocols, as well as the prospective future research areas, in order to make an informed decision about whether or not these protocols are appropriate for your application.

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(Tyagi & Dembla, 2017) Mobile nodes based on mobile ad-hoc networks (MANET), as well as vehicular nodes based on ad-hoc networks for vehicles, have become more common in next-generation communication networks (VANET). The goal of VANET is to keep drivers safe by allowing them to communicate with other cars autonomously. The ad hoc network's vehicles operate as intelligent mobile nodes, capable of forming dynamic networks and moving around rapidly. Due to the constant movement of the vehicles, the ad-hoc networks demand a high level of efficiency and security in their communication. Warm-hole attacks, denial-of-service attacks, and Black-hole attacks are all more likely on these networks. For the first time, an unique approach is used to analyse the security aspects of routing protocols in VANET and the applicability of the AODV (Ad hoc On Demand) protocol to identify and counter a specific kind of network attack known as the Black Hole Attacks. As part of a new technique to improve AODV's security mechanisms, the source node saves all route answers in a look-up table, which may be used to identify and avoid Black Hole Attacks. The PUSH and POP operations used to sort all route responses are stored in this table, which keeps the sequences in ascending order. It is assumed that the RREP has a very high destination sequence number, thus the priority is determined based on that. ITS security is improved, as is VANET security as a consequence of using the suggested technique to identify and prevent a Black Hole Attack on ITS nodes. To carry out this study, researchers turned to NCTUNs simulator.

(Dua et al., 2014) For Vehicular Ad-hoc Networks, this study presents a Reliable Routing Protocol (R2P) that breaks up the network into zones that overlap. The Master Node (MN) is designated for each zone and is responsible for keeping the zone's routing boards up to current for inter- and intra-zone communication. The Internal Routing Board (IRB) and the External Routing Board (ERB) are the two kinds of boards that R2P relies on (ERB). Each network node maintains its own IRB, which is called a Zone Routing Board (ZRB) or a Private Routing Board (PRB). Zone node routes are registered by both ZRB and PRB, whereas ERB is maintained by MN and records gateways to adjacent zones. Finding the best path to the destination is done by R2P using a particular route-discovery method. Routing protocols from the recent VANET have been compared to this new system. R2P has been found to outperform the competition in tests.

(Boussoufa-Lahlah et al., 2015) An intelligent transportation system (ITS) may benefit from the use of Vehicular Ad Hoc Networks (VANETs), a kind of Mobile Ad Hoc Networks (MANETs) (ITS). Routing data is the most difficult part of VANET systems. This is because of the frequent topological changes caused by the vehicles' great mobility. VANET routing protocols have proven that position-based routing is ideally suited for dynamic situations, such as inter-vehicle communication on highways. It's challenging for position-based routing to handle two-dimensional situations containing barriers (buildings, trees, etc.), such as in metropolitan areas, where radio broadcasts are often obstructed by these obstructions. To cope with obstructions and voids in a metropolitan context, this study proposes a position-based routing technique for Vehicular Ad Hoc Networks.

(Bitam et al., 2013) Over the last decade, there has been a dramatic rise in interest in Vehicular Ad hoc NETworks (VANETs), which are networks of vehicles that provide real-time and accurate

information to drivers and authorities. Routing protocols for VANETs have recently been suggested to ensure timely transmission of messages. Hybrid Bee Swarm Routing (HyBR), a protocol for VANETs, is presented here for the first time. To account for the dynamic environmental changes that occur in real-time in VANETs, HyBR utilises the continuous learning paradigm. Topology routing and spatial routing are combined in the protocol. Road safety services are guaranteed by transmitting packets with minimal delays and high packet delivery via the use of HyBR, a unicast and multipath routing protocol. The end-to-end latency, the packet delivery ratio, and the normalised overhead load were all used in our performance test to show how well HyBR works. While standard routing algorithms such as Ad hoc On-Demand Distance Vector (AODV) and Greedy Perimeter Stateless Routing (GPSR) performed well, HyBR outperformed them in terms of performance.

(Wang & Lin, 2013) In the transportation industry, vehicle-to-vehicle communications might benefit from the use of vehicle ad hoc networks (VANETs). Because vehicle velocity fluctuates over time, VANET data transmission is complicated by the network's frequent topological changes. As a result, it is critical to devise a routing system that is both efficient and trustworthy. Clustering is an effective method for routing in a mobile context, according to previous research. It has been shown that the PC clustering (PC) method is more efficient than conventional clustering methods. Since vehicle behaviour and connection quality aren't taken into consideration in the PC process, it may be inappropriate for use in VANET cluster structure construction. For the one-way multi-lane highway situation, we provide PassCAR, a passive clustering assisted route planning technique. PassCAR's major goal during route discovery is to find persons capable of forming an effective cluster structure. Multi-metric voting entails nodes competing for a participant based on metrics such as node degree, expected transmission count, and connection duration. Results from a series of simulations demonstrate that PassCAR not only improves route discovery but picks more appropriate nodes as well to join new cluster structure. Because of its preference for dependable, robust, and long-lasting routing pathways, this well-designed cluster structure enhances packet delivery ratios and boosts network performance.

(Bernsen & Manivannan, 2012) Emerging technologies such as Vehicle Ad Hoc Networking (VANETs) enable cars to build self-organizing networks on the road without the help of fixed infrastructure. The construction of an effective route and the adaptation of the routing protocol to the quickly changing topology of moving vehicles are prerequisites for communication in VANETs, however. VANET routing protocols are designed to achieve this purpose. In this research, we describe the Reliable Inter-VEhicular Routing (RIVER) protocol, an efficient routing system for VANETs. Streets are represented in River by an undirected graph with vertices at places where they meet and edges at sites where they don't. The edges indicate street segments between these points. For the first time, RIVER employs real-time, active traffic monitoring and assigns a dependability grade to each street edge using this and other data collected passively. The protocol then selects the most reliable route based on these dependability ratings. Using control messages, a node's neighbours may be identified, and the dependability of street edges can be determined. This information can be shared with other nodes.

(Bhaumik et al., 2012) High mobility wireless ad hoc networks, such as the Vehicular Ad hoc Network (VAN), allow moving cars to exchange data without the need of infrastructure. Vehicles may travel at a variety of speeds, and the network topology is constantly changing, making the development of multi-hop communication in VANE T a challenge. Communication between cars might be disrupted at any moment if network nodes fail to communicate with each other. Having a solid routing protocol is essential for ensuring reliable communication between automobiles. Affinity-based clustering routing protocols for VANETs have been given in this research, which divides the overall network into a number of different clusters depending on infrastructure type, traffic, and node speed and affinity propagation. Routing overhead and time it takes to discover a suitable route are the primary goals of this new suggested routing system.

(Van Minh et al., 2012) When a node travels at high speed, it creates temporary communication connections that impair the performance of protocols that have been created. As a result, previously established paths are often rendered invalid, causing delays and extra expense to be incurred. When it comes to route discovery time, this research focuses on measuring end-to-end latency in VANETs and applying these data to develop route metrics. It is our goal to decrease routing overhead, speed up convergence, and improve the quality of the routing table in each node by using a hybrid routing protocol (mixed proactive/reactive routing protocol). Our suggested paradigm is well shown by the simulation results.

(Bernsen & Manivannan, 2009) VANETs enable cars to build a self-organizing network without the need for a permanent infrastructure, such as the Internet. Establishing an effective route between network nodes and having it adapt to frequently changing topology of moving vehicles is a precondition for communication. The goal of VANET routing protocols is to do this. Unicast routing protocols for VANETs are discussed in this study, with a chronology of the evolution of current unicast routes provided. In addition, we categorise and describe the current VANET unicast routing protocols and compare their quality. Existing procedures in this field may now be clearly classified and characterised, revealing their strengths and limitations as well as any unresolved concerns.

3. APPLICATIONS OF ROUTING

There are three primary areas of routing applications: safety, transportation efficiency, and entertainment [6]. Safety applications, such as rapid message distribution and collision prevention, fall within this category. Dynamic route planning and real-time traffic monitoring are two of the most important applications in transportation efficiency. Infotainment applications include, but are not limited to, those that provide convenience, such as finding the local gas station, restaurant seating availability, or movie showtimes. Routing in VANET has many more essential applications such as:

I.   **Alert generations**

- Information about vehicles approaching a junction is gathered, processed, and analysed by RSU. RSU will generate an alarm and tell oncoming cars if there is a risk of collision or accident, and they will take proactive actions to prevent such a circumstance.

- Everyone on the road is alerted in case of an emergency, allowing emergency vehicles to pass safely.

- Even in the event of an accident, cars approaching the area are alerted so that they may use other routes.

- Alerts to slow down and refrain from using horns are sent out by RSUs in certain places such as hospitals, schools, and animal crossing zones.

II.   **Vehicle maintenance**

- It is common for RSU to be put in places where people are confined to their homes or where animals are moving through to inform drivers that they must slow down or refrain from honking while approaching the area.

III. **Community services**

- It is feasible to distribute a huge file to others by letting them to download individual chunks at a time. The car choose which peer to download from based on what it thinks is the best. This cooperative file assembly is highly suggested due to the limited quantity and capacity of accessible access points. For this collaborative downloading, BitTorrent or CarTorrent may be employed.

IV.   **Security services**

- On any roadway or in any city, dangerous events like heavy traffic, inclement weather, man-made or natural disasters, or hostile attacks might occur. Multimedia material like video may be sent from one or more automobiles to the vehicles trailing behind so that they are visually alerted about the situation. Rather of just receiving an alert text message, these cars have the ability to make a more educated choice.

4. CONSTRAINTS AND CHALLENGES

In VANETs, routing might face a variety of issues and limits when it comes to managing Quality of Service (QoS) for diverse services:

- Because of the great mobility of nodes, topology is always changing. In certain locations, vehicle density is low.

- Poor network connection and performance degradation due to varying vehicle density and speed on the road.

- Based on preset criteria, efficient clustering and the selection of the Cluster Head (CH).

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- Security and intrusion detection

Numerous VANET-related research suggestions have been published in the literature in response to the above-described limits and obstacles.

5. TAXONOMY OFROUTING IN VANETs

Routing protocols for dependable, high-quality service, like minimal End-to-End Delay and low collision and interference are available in a variety of ways to achieve these goals. These are analysed in terms of both their successes and their shortcomings. Topology, geography, hybridity, clustering, opportunistic and data fusion are some of the categories used to categorise routing systems, as illustrated in Figure 2.

- **Topology Based Routing**

Topology-based routing is concerned with how information is sent from source to destination, and how it is picked. It is thus possible to classify it as routing protocols that are proactive and reactive in nature.
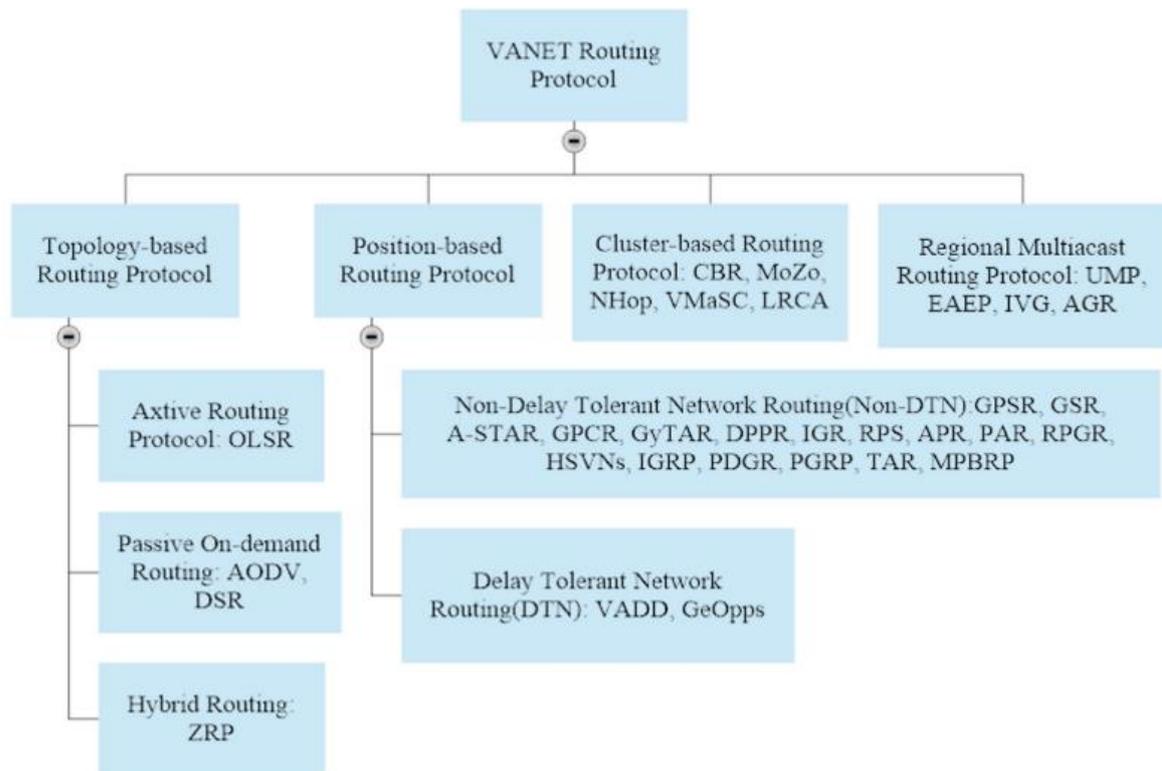

Figure 25 Taxonomy of VANET routing protocols.

Routing tables are frequently sent across the network in order to keep the list of destinations and their routes up to date. Reactive schemes protocol uses a flood of Route Request packets to discover a route on demand. There is a solution to the issue of large bandwidth use, but it's slower than proactive routing when connection is accessible immediately. When it comes to restructuring and failures, these protocols have a slower response time.

- **Geographic routing**

These protocols use location data obtained either from a GPS system or via periodic beacon messages to help in route planning. The messages may be routed directly without having to know the network topology or previous route discovery if they know their own location and the target location.

It is better at PDR and latency than DSR, but the loss of connection in the route picked by the algorithm causes GSR to fail. Packet delivery may be 40 percent faster if A-STAR, with its traffic awareness, chose routes with better connection. Bypassing lost nodes using recovery techniques minimises packet loss in GSR, whereas DSR, which is more aggressive, relies on the node that has made the most progress and causes more packet losses. DSR accomplishes just 86% of packet delivery with GPSR, which is why GPSR has a better data packet delivery rate of 97%. In the absence of planarization, GPSR has good results on connection graphs. Because it eliminates all of the cross-links seen during planarization, CLDP is more efficient than GPSR, but it has a greater stretch cost.

- **Hybrid routing**

In order to combine the best aspects of both Topology-based and Geographic-based systems, these protocols have been developed. IntrAzone Routing Protocol (IARP), a proactive routing component, keeps zone's routing database current. An interzone routing protocol (IERP) is used to find routes outside of the zone. In fact, IARP and IERP are members of a larger proactive family and reactive routing protocols known as IARP/IERP. It is necessary to employ Bordercast Routing Protocol (BRP) for global route finding. Zone boundaries may be accessed directly by BRP nodes. New nodes and broken links are detected by ZRP using the MAC Layer's Neighbour Discovery Protocol (NDP). The NDP uses beacon signals to keep track of its neighbours. A node gets deleted from the database after a certain amount of time if it has not sent a beacon message. The protocol's performance may be improved by altering the transmission power of nodes to regulate the number of nodes in a zone.

- **Clustering based routing**

Among the numerous cars in a cluster, a single node is designated as the CH, in charge of overseeing the other nodes, collectively referred to as "cluster members." A border node is node that is within communication range of two or more clusters. They vary in how the CH is picked and how the routing is handled.

Due to Roadside Router failures, the LocVSDP performance is adversely degraded. This is due to the fact that service requests were interrupted during the propagation phase of a location-based request. During the reply propagation phase, service messages are interrupted. FTLocVSDP, on the other hand,

has a success rate of 70% up to 100 nodes, which is 50% greater than LocVSDP's. As a result, both the amount of data sent and the time it takes to respond have increased. In low-density scenarios, alternative routing methods suffer from significant collisions, resulting in a poor PDR. The VWCA protocol has been devised to enhance network security.

6. OTHER TYPES OF ROUTINGS

Greedy Perimeter Stateless Routing: As an ad-hoc network protocol, (GPSR) uses the greedy algorithm as its core mechanism to ensure that messages reach their final destinations as quickly as feasible in congested networks. It is possible that GPSR packets may be sent along highways with low vehicular density or significant network disconnections, resulting in a high rate of packet loss and transmission delay, since GPSR only sends packets greedily based on a vehicle's location.

Greedy Perimeter Coordinator Routing: In VANET, the (GPCR) technique enhances the GPSR's dependability. However, unlike the GPSR, the GPCR selects a relay node based on road data rather than GPS coordinates. Instead of picking only one, GPCR takes junction-based routing into account along with the location of the router. When using GPCR, traffic density on the nearby node and connection to the destination are taken into account when forwarding packets. Latency and trans-mission delay may grow if traffic density is low and connection between nodes is clear to be poor. GPCR assigns a specific vehicle, known as the coordinator, to relay packets and address obstacle difficulties at intersections. And packets in GPCR are transported straight between intersections without need of road maps, which can be fail to determine the optimum way.

Greedy Traffic-Aware Routing: The geographic routing protocol (GyTAR) may be used in urban areas since it is based on intersections. With GyTAR's consideration of the specific qualities such as high dynamic vehicular traffic, high road traffic density, and road topolgy, both car-to-car and value added infrastructure-based ITS services may benefit. The inter-section is used to transport the data packets to their final destinations. It also depends on curved distance to target node and traffic density between present junction and potential intersection for dynamic selection of intersection. Global information would cause incorrect intersection selection, increasing the transmission latency and packet loss, which would be a problem because of the absence of global information in this case..

Predictive Directional Greedy Routing: A directional greedy mechanism is used to pick the next-hop neighbour in (PDGR) based on each neighbor's location, direction, and velocity. The weight computation for each next-hop node in PDGR is shown as a weight calculation based on their location and direction information. PDGR has been tested and evaluated using the NS2 simulator. To put the PDGR to the test, certain parameters like as packet delivery ratio, end-to-end latency, average hops, send rates, and node count were chosen. It is, however, a simulation of an open environment, not one that takes into account the metropolitan region.

Predictive Geographic Routing: Precisely because it takes into account vehicle mobility issues and predictability, (PGRP) is a newer routing protocol that emphasises vehicle connection. Tests of the PGRP have been carried out using the MOVE plat-form, which incorporates Sumosuda and Ns-2. PGRP may be employed in grid-based and highway-based environments. PGRP, on the other hand, does not take into account the accelerating speed of each vehicle and the aim of the driver in order to make a better judgement in genuine urban environment.

On addition, several researchers have recently proposed the FoG-oriented framework for PBR in VANET. Urban connectivity-aware PBR systems make use of a variety of modelling techniques, including genetic algorithms and regression-based models. Road intersections and parked automobiles near junctions are used for route selection and packet transmission in their research. In order to improve packet delivery ratio, end-to-end latency, transmission time, and cost, this sort of structure should be implemented.

7. CONCLUSION

VANETs have evolved in recent decades as a powerful new technology that may be utilised in broad range of applications, including search-and-rescue, surveillance, and entertainment. All of these scenarios need effective routing methods that can cope with the vehicles' rapid mobility and frequent topological changes. Various current routing systems and their respective benefits and drawbacks are discussed in this study. Each kind of routing is examined in depth in the book. As a conclusion, a comparison of several routing strategies with regard to various criteria is also included. One of the above-described schemes would be implemented in the future and compared to other schemes in its category to see how well it performed.

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A Survey on Computer Graphics Technology with A Focus on Its Applications in Bio Medical Imaging

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Abstract

Humans are able to process visual information more quickly than any other kind of information. Recognition, monitoring, as well as surveillance are all made possible by image sensors. There are a wide range of applications where networks of sight sensors are the best answer. Designers of image sensor nodes face architectural problems, like processing power, energy consumption, communication routes, as well as sensing capabilities. In this article, we'll go through the features and specifications of an image sensor node. A wireless sensor network image sensor node is developed and built. CMOS sensor, RF module, image acquisition unit, and power unit are all included in the system. Imaging sensors may benefit from more energy-efficient hardware management solutions. In this article, the issue of picture compression in sensor nodes is thoroughly examined.

Keywords: Graphics Processing Unit (GPU), Image Segmentation, Image Registration, Image Visualization

1. INTRODUCTION

Sensor nodes in a wireless sensor network (WSN) are able to execute data processing as well as computations on the data they receive from other sensor nodes over a wireless communication channel. Habitat research, item tracking, environmental monitoring, satellite imaging, video surveillance, and military applications are all possible uses for WSNs.

There has recently been an increase in interest in developing a dependable as well as efficient wireless multimedia sensor network research and development study (WMSN). In a hardware restricted context, the development of a WMSN is problematic due to the substantial processing required for multimedia data like photos and video frames acquired from camera nodes. An efficient and versatile WMSN has several obstacles and limits, including high power consumption, restricted bandwidth, as well as memory limitations.

Since the development of MEMS (micro electro mechanical systems), sensor plus battery technology in recent years, it is now feasible to produce small sensor nodes that can perform several functions for a fraction of the cost and power normally required. Using wireless communication, a sensor network is formed by a large number of small sensor nodes. Traditional sensors have been significantly outperformed by sensor networks. An investigation of wireless sensor networks has been a major focus of industry and academic research. It's common for sensor nodes to include the following components: sensor(s), computer(s), radio(s), and power supply(s). In various types of situations, from disaster zones to battle zones to industrial plants and buildings, the sensor nodes are installed to detect important physical phenomena like temperature and humidity or to monitor interesting activities like moving objects, human movement, etc. Sensor nodes of various functionalities capture different types of data; for example, acoustic as well as image sensors may collect data on sound and sight. Networked sensors process and send acquired information to the base station.

2. LITERATURE REVIEW

(Yang & Chen, 2022) An investigation of the water resources system's complicated uncertainty is the focus of this paper. Water resources carrying capacity is separated into three subsystems: bearing pressure, bearing support capacity, and bearer control. This study introduces multi-dimensional conditional cloud algorithms and wireless sensor networks as analytical approaches to evaluate the carrying capacity of water resources such as correlation analysis and grey correlation analysis. Combine it with subtraction set opposition, the partial bias connection number, as well as the risk matrix. Three kinds of water resource carrying capacity assessment and trend analysis models were built, and they are all shown in the following tables. Carrying capacity estimates are consistent with actual process and show a steady upward trend in the overall development. Using the assessment model of the water resource carrying capacity, application results have been gathered. Using the extraction model's picture texture feature, we were able to get comparable results to what we saw before the modification. Change is becoming increasingly apparent. Water resource carrying capacity may be described as a whole, but it also characterises dependability of calculation findings and bearing risk due to uncertainty in water resource carrying systems. The water resources carrying capacity assessment as well as trend analysis of the calculation findings are realistic and attainable. Decision-making frameworks based on this study may be used to analyse and suggest adaptive risk prevention as well as control methods for the ability to carry out water resources-related activities in a systematic manner.

(Rodrigues et al., 2021) CG courses in a confined setting provide unique issues, methodology, and approaches, all of which we explore in this paper. We also evaluate our own experience and offer suggestions for future research. Our approach combines the complexity of CG subjects with the creation of relevant and engaging material for a CG course while addressing communication, support, and evaluation concerns. This is critical in the setting of a pandemic, because online courses may have a negative impact on students' involvement and contact with their teachers. Using an in-house WebGL-based instructional library called WebCGF, we were able to simplify onboarding while maintaining linkages to the underlying ideas and technologies using the methodology we've been using for the last several years. That paradigm has to be supplemented with collaboration tools and mentorship tactics because of the confinement restrictions. On top of remote lessons and video presentations, we also used tools for organised community involvement as well as Git-based code management systems particularly tailored for classroom usage. This enabled us to track the progress of each student's development process in more detail. Students' interest and performance were found to be on par with previous years, leading us to develop a set of criteria to keep in mind in similar situations.

(Fahad A. Rida, 2021) It was difficult to communicate with medical staff or patients because of bandwidth limits when medical technology, communication as well as computers were invented and used in the treatment as well as the follow-up of distant health care patients. Power consumption as well as sending large amounts of data between medical professionals and patients are strictly prohibited. Patients and physicians may exchange huge data, such as video and audio files, at any time and from any location thanks to CDMA-based wireless sensors, which employ a direct spread spectrum based on CDMA. The wireless sensor network uses binary transmission as well as multipath to reduce the power consumption of transmitter as well as receiver sensors. The measurement's precision is dependent on the device's bandwidth when estimating arrival time (TOA). TOA predictions are sent to the receiver simultaneously because of the MPC delay as well as reduced number of initial signal replication. Adding to the TOA's positive bias is the diffusion delay produced by the signal passing across obstacles.

(Morra et al., 2020) The development of powerful sports analytics as well as broadcasting software will benefit greatly from the development of the automatic event detection from photos or wearable sensors. Large-scale sport datasets are difficult to acquire and annotate because of technological challenges, data collecting costs, and economic interests. To generate synthetic data, we propose the Soccer Event Recognition (SoccER) data generator in this study, that is built on top of an already-existing, high quality open-source game engine. Spatio-temporal data and fine-grained, autonomously created event ground truth are generated by the programme. It also features an event detection system that was created as well as tested on a synthetic dataset that included 500 minutes of play and over 1 million events. As a last section, we propose potential directions for future work in the sports event identification, now that synthetic data has been introduced.

(Zamri & Sunar, 2020) One of the most important components of the natural phenomena visualisation system is the modelling of atmospheric clouds. In the past, a variety of ways have been presented to address the complex difficulties related with visual realism as well as performance. However, the scarcity

of new review articles on computer graphics approaches for atmospheric cloud modelling makes it difficult for academics and practitioners to comprehend and choose the best options for constructing an atmospheric cloud visualisation system. A full study of the available atmospheric cloud modelling systems was thus done. The research trends on this issue were examined using 113 research papers from well-known data sources. By classifying the cloud modelling approaches according to their common properties, we created a taxonomy and summarised each method. Finally, we highlighted a number of research questions and possible avenues for further study. For both scholars and practitioners, this paper provides an overview as well as general picture of the atmospheric cloud modelling approaches.

(Martinez et al., 2019) In structural biology, one of the most frequent jobs is to visualise molecular structures using tools like Chimera, PyMOL, COOT or VMD. Computer graphics as well as data visualisation have had a significant impact on our knowledge of biomolecular function, and so this Perspective piece summarises current discoveries which promise to revolutionise structural biology. There has been a lack of contact between the computer scientists and structural as well as computational biologists who may benefit from these advancements in molecular graphics. We want to promote communication across these groups by referring to classic articles and describing the technological advancements underpinning new graphical breakthroughs in simple words. This, in turn, will help define the future of molecular graphics. Martinez et al. describe how computer graphics as well as data visualisation have helped to enhance our knowledge of biomolecular function, including review current breakthroughs in computer graphics which promise to revolutionise the structural biology.

(Hänel et al., 2019) With the use of hyperspectral imaging, geo-information may be collected in a variety of ways. Hyperspectral cameras on aircraft and satellites are now the primary competitors in large-scale imaging efforts. Aside from the fact that satellites and aircraft only fly over certain locations sporadically, long-term, continuous surveillance of certain regions is difficult to do with these methods. WSN-based ground monitoring is a prospective innovation that can be permanently installed and provides data more continually. Most wireless sensor networks (WSNs) don't employ hyperspectral sensors since they're too pricey and power-hungry. For a lower cost, we propose combining multispectral sensors, which may provide spectral resolution comparable to that of hyperspectral sensors while maintaining the WSN's inherent sensitivity to small changes in temperature and light. Using in situ and distant sensing datasets, we test our strategy by comparing several data processing techniques.

(Shaheen et al., 2019) Different areas, including as medicine, the military, the online personal albums, private communications, including video conferencing, all need the ability to store and send photos in a way that maintains their confidentiality. It is possible to encrypt images using a variety of methods. More data, more redundancy, plus the correlation between picture pixels distinguish digital images from text data. Wireless sensor networks (WSN) are being developed with a wide variety of encryption methods in mind. Because sensor nodes have limited memory, energy, and computing power, any new methods must take this into account. Traditional cryptosystems can't be used on WSNs since they don't work with digital pictures because of their structure and size. Discrete cosine transform (DCT) and discrete wavelet transform (DWT) are utilised in this work to offer digital pictures encryption methods for WSNs.

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(Kin et al., 2017) Advances in the computer technology are allowing surgeons to plan and perform surgeries using a virtual reality model. A literature search was done to identify trends in virtual surgical simulations for brain tumours. MEDLINE yielded 1,298 results for the search term "neurosurgery AND (simulation OR virtual reality)". 28 papers on clinical application remained after excluding research for educational or training reasons. Clinical simulation needs to solve a few challenges, as seen by the overwhelming number of studies focused on teaching and training rather than actual surgery. There were also ten articles from Japanese organisations in the total of 28. Virtual surgical simulation has been shown to improve patient outcomes in 28 studies. Simulating intricate spatial relationships of anatomical landmarks as well as evaluating surgical techniques proved extremely helpful. A surgical navigation system or an augmented reality system, which displays virtual reality pictures onto the operating field, were employed in several investigations. It was found that the simulation systems were lacking the capacity to react to tissue deformation as a result of surgical operations, as well as the ability to reflect properties of tissue (such as hardness and adhesiveness). More information on image processing is needed, as seen by the paucity of details, which suggests that more work must be done before the technology can be used clinically to its fullest potential.

(Jarabo et al., 2017) When it comes to computer graphics as well as computer vision, transient imaging has lately had a massive influence New approaches for recording, recreating, or simulating light transport have been suggested to display movies of light in motion, identify objects in highly-scattering surfaces, or infer material qualities from a distance, among other things. At the nanosecond or picosecond level, we may take use of a variety of information that is often lost during capture-time temporal integration. From a graphics as well as vision standpoint, this article highlights current improvements in transient imaging, covering capture methodologies, analysis, applications, as well as modelling of the results.

(Nisha & Megala, 2015) Sensors that communicate wirelessly Automated irrigation system for agricultural usage based on a network. Soil moisture as well as temperature sensors are embedded in a wireless sensor network to create the system. Irrigation system microcontrollers employ an algorithm based on sensor threshold values to manage water amount utilising the Zigbee protocol to handle sensor data. For data examination, the device is powered by solar panels and a cellular-internet interface. An image processing technology is used to keep track of the disease area by mounting a wireless camera in a crop field. Useful in locations where water is scarce and geographical isolation is a problem, the technology is low-cost and energy-independent.

(Hasan et al., 2014) In visual sensor networks, sensors with several dimensions, such as those used in digital cameras, are common. When compared to the scalar sensors in wireless sensor networks, VSNs produce enormous amounts of data. WSNs The limited processing as well as bandwidth requirements of low power sensor nodes make it difficult to process and send this kind of data in a hardware constrained environment. Vision data acquired by sensor nodes may be reduced in size before being sent to its final destination by using source coding. By reducing unnecessary data from the collected picture raw data, image compression provides a more efficient processing and transmission mechanism. JPEG and JPEG2000 are only a few examples of the many kinds of conventional, state-of-the-art image

compression standards discussed in this study. A literature assessment of the benefits and drawbacks of using these algorithms in the VSN hardware environment is provided here. Compression methods for VSNs are also described, along with their key influences. Some hardware-oriented qualities of the chosen compression technique include simplicity in coding, low memory requirements, low computational burden, and a high compression rate." The severe hardware limits in WSNs are addressed head-on in this survey work, which calls for a hardware-based image compression method that consumes less energy.

(Lloret et al., 2011) Observing the stems, the grapes, and/or the leaves of a vineyard is first step in identifying any deficiencies, pests, or diseases that may be present. It's clearly not cost- or deployment-effective to put a sensor in each vine in each vineyard. We need to explore for innovative ways to accurately and affordably identify these signs. Sensor nodes in this network collect photographs of the field as well as analyse the images internally to identify any abnormalities in the leaves, as shown in this study. In addition to a deficit or pest, this condition might be caused by illness or another damaging substance. When an issue is discovered, a message is sent from the sensor node to sink node over the wireless sensor network, alerting the farmer. The IEEE 802.11 a/b/g/n standard is used by the wireless sensor, allowing communications over long distances in open air. Wireless sensor network architecture, wireless sensor placement, node image processing, as well as sensor network traffic from a flat vineyard in Spain are described in this study. For example, a symptoms database as well as an integrated neural system might be included for a more accurate issue diagnosis despite the system's inability to discriminate between deficiency, pest, illness, or other hazardous substances.

(Pingping et al., 2009) An unmanaged and potentially hostile environment is the setting for the transmission of digital picture data in a wireless sensor network (WSN). In order to safeguard the wireless sensing data creators' interests, copyright protection has received a great deal of attention. As a result of the additional overhead, traditional security measures are computationally inefficient. Watermark systems are often low in weight as well as do not need a large amount of computation or power resources. In this way, wireless sensor applications may find them to be enticing alternatives. This study provides a real-time, resilient watermark technique based on the DCT coefficients, which are derived by experimentation. As a result, the watermark has been embedded within the DCT's low-frequency coefficients to increase its robustness. The results of the experiments reveal that this technique is real-time, undetectable, as well as robust enough to meet wireless network transmission criteria.

(Li et al., 2008) Humans are able to process visual information more quickly than any other kind of information. Recognization, monitoring, as well as surveillance are all made possible by image sensors. There are a wide range of applications where networks of sight sensors are the best answer. Designers of image sensor nodes face architectural problems, like processing power, energy sources, energy consumption, communication routes, as well as sensing capabilities. In this article, we'll go through the features and specifications of an image sensor node. A wireless sensor network image sensor node is developed and built. CMOS sensor, RF module, image acquisition unit, and power unit are all included in the system. Imaging sensors may benefit from more energy-efficient hardware management solutions. In this article, the issue of picture compression in sensor nodes is thoroughly examined.

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(Bilotta et al., 2006) In order to share our findings with others working in the field of computer graphics, we've written this article to share some of the challenges we've encountered while trying to visualise patterns from Chua's circuit. Furthermore, the study discusses cutting-edge computer graphics approaches for portraying chaotic as well as hyperchaotic systems while yet maintaining control of complexity. Since the output might be formed of diverse pieces such as cubes, cylinders, and so on, we've had issues with the nature of such configurations, their forms and dimensions, as well as the granularity of these things. There are still many unanswered questions about how we see 3D shapes and recognise them.

3. APPLICATIONS

Sensor networks may be used in a variety of industries, including military, healthcare and the home. Humans are able to process visual information more quickly than any other kind of information. Recognization, monitoring, and surveillance are all made possible by image sensors. There are a wide range of applications where networks of sight sensors are the best answer.

- **Surveillance:**

Mechanisms for detecting as well as tracking intruders across broad regions are required for the protection of major installations (airports, factories, stadiums). Visual processing may be used to identify and evaluate events, and visual information of interest can be relayed to the base station using miniature image sensors.

- **Environmental monitoring:**

Many scenarios need for long-term visual monitoring of large, inaccessible regions in order to discover anomalies or collect environmental data. Traffic management on motorways as well as in natural habitats like woods and deserts are examples of hazardous places. NASA's Jet Propulsion Laboratory (JPL) created Sensor Webs a few years ago to detect the Martian surface.

- **Military reconnaissance:**

Image sensors collect high-quality pictures in order to enhance the command state's perceptibility, properly estimate the threat, and follow it. For the purpose of improving army combat and command capabilities, several nations have conducted military scientific research on image sensor networks. A medical assistant who assists with medical procedures Doctors can keep an eye on their patients' health thanks to built-in image sensor nodes. Surgeons may benefit from the use of image sensors during an operation. For instance, image sensors let surgeons do thoracic mirror surgery using a television as a mirror. In addition, several image sensor nodes are used to monitor the operation's progress, which is then evaluated by medical professionals.

Wireless sensor networks' most essential design aim is to extend the network's lifespan because of the restricted power supply. For image sensor nodes, greater processing power, more energy, as well as a larger bandwidth are required. The image sensor node presents a number of architectural issues for designers, including processing power, energy consumption, energy sources, communication routes, and sensors. At same time, the base station receives a vast amount of data created by the device. To tackle the issue of limited energy as well as bandwidth, the energy-efficient picture transmission as well as network protocols are needed.

4. CHARACTERISTICS AND REQUIREMENTS

Our focus here is on image sensor node features and needs.

1. Higher processing power and more memory

Due to the large amount of information in a picture, image capture and processing are computationally as well as memory-intensive operations.. Bayer pattern images with 8-bit pixels use 300KB of RAM for a 640x480 resolution picture. After interpolation, an RGB mode picture uses 900KB of memory. The green component of a colour image's histogram calculation necessitates an arithmetic comparison of 300KX256. Image compression is required to lower the amount of memory used. Image compression, on the other hand, is a more computationally demanding process.

2. Real-time and high communication bandwidth

For an image sensor network, real-time is a need. The image sensor node, for instance, must capture an image as soon as an intruder enters the monitoring area, analyse it quickly, and communicate it. Consequently, high-speed picture capture and processing are necessary. High bandwidth is required because of the massive volume of picture data. However, the transmission bandwidth of the image sensor node is restricted. Image compression as well as partial image processing must be implemented at the node in order to avoid the demand for high connection bandwidth. The base station only receives data that is absolutely essential, thanks to basic picture analysis.

3. Energy-efficient

Because every image sensor node is powered by a single battery, low power design should be addressed.. It is more energy-intensive to transmit images than it is to compute. There must be an energy-efficient method of transmitting images. Multi-hop Wireless Sensor Network (WSN) makes it difficult to send data from sensor node to the base station directly. Using an energy-efficient network routing strategy may extend the life of the network by preventing the depletion of the nodes on a particular route.

4. Robust transmission and quality of service (QoS)

Wireless channels are susceptible to noise, which may cause transmission failures. To remedy the issue, robust transmission methods are required. With FEC and ARQ, the most common resilient

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techniques, errors may be coded and retransmitted automatically. Take a look at this scenario: Identifying a target in a combat situation is critical. Imaging sensors should be used to locate a potential prey item. These sensors may be activated to identify and track the target after it has been located and detected. For this to work, sensors and controllers need to transmit data in real time. To handle real-time multimedia data, you need a particular amount of bandwidth and the smallest amount of delay and jitter that you can get away with. QoS traffic has to be reliably delivered through a service differentiation mechanism.

5. Distributed processing and collaboration

Images are captured by each individual sensor node. Image sensor nodes may have overlapping fields of vision as a result of fault consideration or dense deployment. To cut down on the needless, collaborative processing is required. Neighbor image sensor nodes communicate with each other to perform object tracking tasks. It is also possible for image sensor nodes to work with other types of nodes in order to perform a job more effectively. Low cost and compact size are other important considerations for image sensor nodes in addition to the previously mentioned traits and criteria.
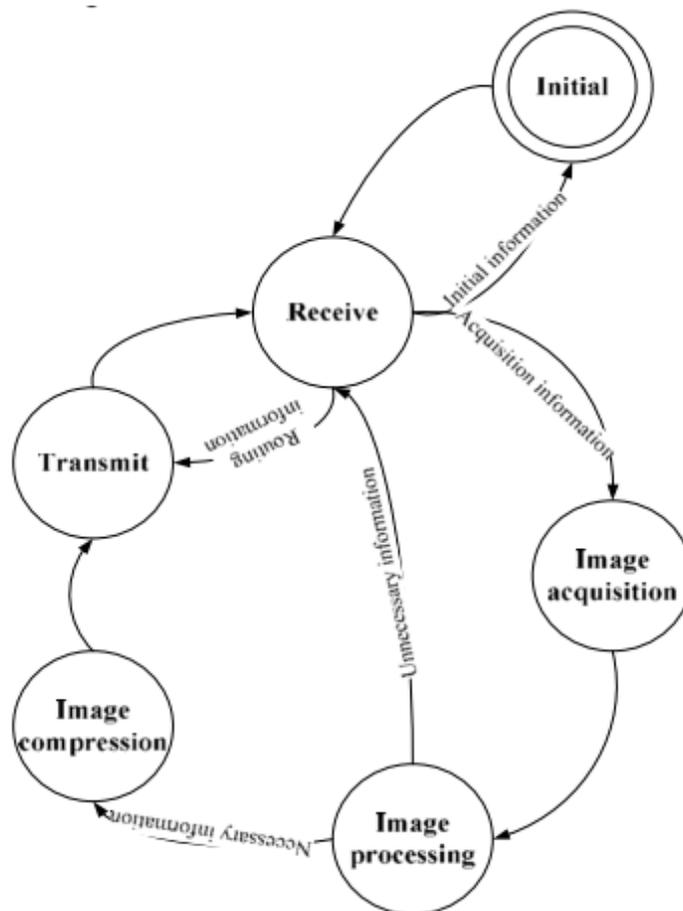

Figure 26 State transition state graph of image sensor node

5. GRAPHICS IMAGE COMPRESSION

The image sensor nodes have an important role to play in compressing images. Hardware or software may be used to compress images. Low-power hardware implementation requires a lengthy design cycle. The embedded processor provides significant levels of freedom for software implementation. Real-time as well as low power requirements, on the other hand, remain unmet. For image sensor nodes, hardware implementation is the best option in the long run.

An image compression technique known as DWT (Discrete Wavelet Transform) has been employed in a wide range of applications. Its computing strength, however, seems to be the major constraint. It has been shown that the calculation of DWT may be lowered by a factor of two. The combined advantages of the Integer Wavelet Transform (IWT) and the use of filters with integer lifting coefficients may be used to produce still further improvement. In instance, the LeGall filter, that is used by default in JPEG2000 for lossless compression, has excellent de-correlation performance despite its simplicity. Although its performance is somewhat lower than CDF's, it is an excellent option for low-energy systems because of its reduced processing needs. In order to test a wireless sensor network with reconfigurable IWT IP, a CPLD-implemented version was developed. According to the data, current CPLDs are capable of achieving very impressive low-energy performance. Additionally, we use the lift strategy based LeGall wavelet transform in the image sensor nodes as well as implement it in the FPGA. A huge quantity of redundant background information is acquired due to the static nature of the image sensor nodes. Shape-Adaptive Discrete Wavelet Transforms (SADWT) may be utilised to further minimise the amount of data sent. When there are no objects in the field of view, image sensor nodes may capture a backdrop picture. To get an input mask picture in the Image Processing Module, you compare the background image to the collected image. In terms of data reduction, this approach beats ROI coding. The wavelet area compression technique may be used to further process wavelet coefficients.

The various benefits of wavelet transform-based embedded image coding, such as resolution scaling, quality scalability, and rapid codec speed, have led to its widespread use. Coded embedded images are used for two purposes: 1) taking use of the highest picture quality possible at a given bit rate, 2) In other words, all images encoded at lower bit rates are placed at the beginning of bit stream for the desired bit rate, rather than being tacked on at the end.

Two issues need to be addressed by the embedded coding method: First, how to classify as well as code the wavelet coefficients according to their relative significance, and then how to include the code stream's positional information about the most significant coefficients. The bit planes coding approach may be used to address problem number two. Options for resolving the issue Structure-based as well as context-based coding are the two primary catalogues. There are a variety of structures-based coding techniques, the most common of which being embedded zerotree wavelets, set partitioning in hierarchical trees, and set partitioning embedded blocks, amongst others. EBCOT, pixel classification and sorting (PCAS), morphological representation of wavelet data (MRWD) are examples of context-based coding techniques.

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With regard to classification of wavelet coefficients as well as arithmetic coding, context-based approaches are more efficient than the structure-based methods. For image sensor nodes, the complicated algorithms can't be tailored to the low power needs. Table 1 contains a comparison of performance metrics for your perusal.

Table 2 Comparison of lossy coding methods for three common test images

Coding method	PSNR(dB)		
	0.25bpp	0.5bpp	1.0bpp
Lena image ($512 \times 512 \times 8bpp$)			
EZW	33.17	36.28	39.55
SPIHT	34.11	37.21	40.44
SPECK	34.03	37.10	40.25
Barbara image ($512 \times 512 \times 8bpp$)			
EZW	26.77	30.53	35.14
SPIHT	27.58	31.40	36.41
SPECK	27.76	31.54	36.49
Goldhill image ($512 \times 512 \times 8bpp$)			
EZW	30.31	32.87	36.20
SPIHT	30.56	33.13	36.55
SPECK	30.50	33.03	36.36

SPIHT as well as SPECK outperform EZW, as can be shown in Table 1. It's less effective than SPIHT for Lena & Goldhill, but more effective than SPIHT for Barbara. Wavelet pyramid decomposition sub-band correlation is used by SPIHT, whereas sub-band energy convergence is used by SPECK. This means that the SPIHT has to deal with a lot of memory access issues while sorting coefficients in a spatial orient tree. This means that SPIHT is not resolution scalable as well as has a lower resilience to Bit Error Rate than other coding techniques (BER).

SPECK's key benefits are as follows.

1) Progressive transmission: The information content of the source samples is coded in decreasing order.

2) Low computational complexity: There are no sophisticated computations required in the method, which consists mostly of comparisons.

3) Low dynamic memory requirements: Only one linked area (e.g., a 32 x 32 block sitting entirely inside a sub-band) is handled at a time throughout the coding process.

4) Fast encoding/decoding: Due to its simplicity and the fact that it can operate with data that fits entirely in the CPU's quick cache memory, this technique uses less data from slower storage. If you're looking for low-power image compression methods for the image sensor nodes, SPECK is your best bet.

6. CONCLUSION

A brief introduction to wireless network based digital image processing as well as its IOT applications in many domains, with an emphasis on image compression methods, is provided as part of our article in order to be self-sufficient Using lifting wavelet transform-based image compression, this work presents a low-memory as well as low-complexity version of SPIHT that does not need entropy coding. By making modest tweaks to SPIHT software, this technique greatly decreases memory needs while maintaining all the benefits of embedded programming attained with strip-based, listless coder as well as line-based SPIHT.

Performance in a hardware environment isn't much harmed because of the smaller memory as well as circuitry. This energy-efficient picture compression technique is thus closer to implementation in highly restricted hardware contexts, like VSNs, due to the decrease in DWT coding complexity and the huge reduction in memory required. An image-integrated FPGA and ASIC circuits may be used to test the performance of the hardware-based image compression technique. This would result in considerable energy savings as well as processing time reductions.

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A Review on The Realistic Mobility Models for Vehicular AD-Hoc Networks

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Abstract

There has been an imperative rise in interest in Vehicular Ad-hoc Networks (VANETs) in both the academic and commercial arenas. In the research of VANETs, one of the problems is to define a model of vehicle mobility that provides an accurate and realistic description of vehicle movement at macro and micro levels. The ability to dynamically adjust vehicle mobility as a result of vehicular communication protocols is another problem. The community has come up with a variety of solutions to these two problems. For this reason, as well as the fact that there are so many models on the market claiming to be suitable for vehicle traffic, it is difficult to discern their genuine qualities, level of realism in relation to vehicular mobility, and actual capabilities.

Keywords: VANETs; Mobility models; VANETs' Mobility

1. INTRODUCTION

In latest years, vehicular ad-hoc network (VANET) communication become a hot research issue in both the wireless networking and automotive sectors. To improve passenger safety and convenience, VANET researchers are working to create a vehicle-to-vehicle communication network.

VANETs (Vehicular Ad Hoc Networks) are a fast growing and challenging subset of Mobile Ad Hoc Networks (MANETs) (MANETs). VANETs are self-organizing, dispersed communication networks made out of moving vehicles; as a result, their nodes move at very high speeds and with a restricted amount of flexibility. In VANETs, these qualities may render ordinary networking protocols ineffective

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or impossible to use. Vehicle-to-vehicle communication (V2V) protocols are now focused on using the messages sent between vehicles to improve traffic flow in order to prevent congestion. There is a close connection between network protocol and vehicle mobility in both circumstances. Mobility affects data traffic in a conventional way. Mobility can be affected by data traffic in VANETs. As a result, in VANETs, mobility and wireless communication are intimately linked. This increased focus on developing vehicle-specific communication protocols and mobility models makes sense when considering the enormous effect VANET technology implementation may have on the automotive business.

The mobility of nodes is a critical consideration when modelling ad hoc networks. In order to accurately represent the real-world performance of a VANET in simulation, it is critical to adopt a realistic mobility model. For a realistic mobility model, you'll need a topological map that shows varied densities of roads and different types of streets, each with a separate speed limit. The impediments are yet another crucial element that should be modelled. Vehicle nodes in the actual world are often limited to roads that are divided by buildings, trees, or other things. Compared to an open field, impediments like these might increase the average distance among the nodes. In addition, each vehicle must choose its own path at crossing (e.g. turn left, turn right or go straight). Using a turning model like this might have an impact on traffic congestion and vehicle clustering. For this reason, a model that accounts for gradual deceleration and acceleration should be considered. For reliable network simulation results, several past research have proven that a realistic mobility model with adequate detail is required.

2. LITERATURE REVIEW

(John Justin Thangaraj et al., 2021) The topological structure of vehicular ad hoc networks (VANET) is constantly changing since the cars are continually on the go. Security is a critical problem for network resources in vehicular ad hoc networks because of this. The Vehicular ad hoc networks protocol architecture has the purpose of detecting traffic jams and determining the safest routes around them. An effective data communication model for mobile ad hoc networks using cloud computing is the goal of this article. Vehicle Processing Units are equipped with a configurable Cloud server interface mechanism for inter-vehicle communication. This paradigm guarantees low-cost, rapid computation, and expanded storage for the nodes without the need for extra network infrastructure. ' Data aggrega- tion, resource management, and privacy are all included in the service offerings. The results of the simulation are compiled and compared to the current model of mobility. Reduced packet loss is readily seen in this graph when compared to the previous method. As a result, the model for Cloud-based Ad-hoc Vehicular Networks outperforms the Mobility model in terms of performance.

(Ye et al., 2021) It has evolved as a critical element of the sophisticated Intelligent Transportation System (ITS) for information transfer and vehicular communication in the form of vehicle-to-everything (V2X) communication. The development and application of innovative network routing protocols that provide V2X communication with reliable end-to-end connection and effectual packet transfer is a

critical research topic in VANET. VANET's packet delivery accuracy and reliability are threatened by the dynamic nature of road traffic vehicles. Position-based routing protocols are the most used in VANETs because they are able to handle fast vehicle movement changes. There are various drawbacks to current routing protocols such as inaccuracy in high dynamic network topology, faulty link-state estimation, and poor movement prediction in diverse road layouts that need to be overcome. Therefore, in this research, a novel target-driven and mobility prediction (TDMP) oriented routing protocol is presented for high-speed mobility and dynamic topology of automobiles, fluctuant traffic flow, and diverse road layouts in VANETs. TDMP relies heavily on a driver's destination goal for mobility prediction and the Received Signal Strength Indicator (RSSI) for inter-vehicle link-status assessment to construct an effective routing protocol. As opposed to existing geographic routing protocols, the proposed TDMP is able to improve packet transmission by taking into account the assessment of inter-vehicular connection status and the forecast of vehicle locations dynamically in fluctuating mobility and global road layouts. Experimental findings demonstrate higher performance in terms of enhancing packet delivery ratio by 21-57 percent ; lowering end-to end latency by 13-47 percent ; and average hops count by 17 to 48 percent when compared to many standard position-based routing protocols such as GPSR, GyTAR, and PGRP.

(Sethi et al., 2020)Models for optimising HANETS based on quality of service are examined, observed and evaluated in this research. An intelligent communication heuristic may be used in smart cities to alleviate emergency services, traffic congestion, and safety concerns, among other things. In real-time deployment, self-organization and optimization in ICN make it difficult and expensive to achieve congestion, dynamic topology, high mobility, scalability, and optimization. Various routing algorithms and network performance characteristics have been observed in literature by various authors using different simulation tools in different settings and circumstances. Routing protocols are affected by a variety of factors, including vehicle speed, road conditions, driver behaviour, and barriers. Longevity of a network is greatly impacted by the volume and mobility of data. Speed impacts VANET performance measures including throughput and packet delivery ratio at various BSMs in different conditions were studied in this work.. The simulated vehicle ad hoc network's throughput, goodput, and packet delivery ratio all improved with increased mobility and link awareness.

(Duarte et al., 2019) MobiVNDN, a distributed framework that is used for Vehicular Named-Data Networking (VNDN) communications, is proposed in this study. ' In VNDN, mobility and wireless communications degrade communication performance. MobiVNDN attempts to mitigate this deterioration. Multiple issues, including broadcast storms, redundant messages, network partitions, and content source mobility are all addressed concurrently by MobiVNDN. When it comes to scalability and performance, MobiVNDN is a clear winner, according to simulation data. MobiVNDN also functions effectively when numerous apps are using the same wireless communication channel.

(Sun et al., 2018) With the advent of 5G, vehicular networks will play an increasingly important role in the development of intelligent transportation systems (ITS) and smart cities (SC). The assessment of routing policies and the control of traffic flow rely heavily on mobility models. With the rapid

advancement of big data technologies, academics are more interested in vehicle mobility analysis and design. As a result of the vehicular network's inherent dynamism and complicated network theory, these properties are also shown. This section introduces a large GPS dataset in Beijing and its difficult feature verification. On the basis of the GPS dataset, new vehicle and location-based cooperative mobility solutions are developed. Complex parameters including duration distribution, interval time distribution, and temporal and geographical characteristics are used to assess their performance. This study discusses the design and analysis of automotive networks in terms of mobility.

(Abdelgadir et al., 2017)VANETs (Vehicular Ad-hoc Networks) are one of the most current and hard study fields for automobile businesses and ITS designers. As a result of these networks, a broad variety of uses for transportation systems may be realised, including safety applications, mobility, and connection for both drivers and passengers alike. The most appropriate routing protocol must be chosen for use in safety-critical applications. DSR, AODV, and DSDV are the three most prevalent routing protocols in VANET. A VANET simulation programme may be used to conduct testing and evaluation of various routing protocols before implementing them in the real world. Based on this study, three routing protocols for the VANET system in Khartoum have been compared and evaluated. PDR, average throughput, latency, and total energy are all metrics used to assess and compare the system's performance. It is our goal to evaluate the performance of a city routing model. In Khartoum, Sudan, the primary purpose is to establish the best routing protocol for a dense traffic location. DSR, AODV, and DSDV are the three routing protocols we've examined. The findings show that the DSDV protocol, a sort of proactive routing system, is of low quality. At its utmost, the AODV protocol can provide throughput of 330.07 kilobits per second on average. The DSR technique resulted in a maximum delay of 15.81 ms.

(Campolo et al., 2015) When large-scale solutions are implemented, the expense and complexity of the experimental evaluation of vehicular ad hoc networks (VANETs) rises. Prior to implementing VANETs, performance assessment is required, and simulation is the de facto norm for network protocols and topologies to be analysed. For network simulation, automotive settings are especially hard because they need accurate modelling of not just the network stack, but also traffic dynamics and radio-frequency signal propagation in highly mobile surroundings. In this chapter, we'll go over how VANET simulations reflect mobility, the first of these two aspects. To be more specific, we'll go through the criteria for a reliable simulation and introduce models for road infrastructure, driver behaviour, and traffic dynamics in general. In addition, we'll talk about the progress of the simulation tools that implement these models and provide a practical example of trustworthy VANET simulation vehicular mobility modelling.

(Silva et al., 2015) To evaluate large-scale vehicle networks, researchers encounter a significant hurdle. Because large-scale testbeds aren't possible, simulation is the most often utilised assessment approach, which necessitates a realistic mobility model in order to deliver correct outcomes. But constructing large-scale realistic vehicle mobility models is a tough endeavour and many crucial aspects, especially macroscopic ones, have been overlooked. As part of this study, we describe a real-world vehicle motion trace and infer macroscopic properties. In this study, we propose and test a more realistic

model of the vehicular network assessment process based on this characterisation. By presenting a more realistic macroscopic model that complements a number of vehicle mobility generators in the literature, the acquired findings add to the research community.

(Rahman & Nasiruddin, 2014) VSAs are specifically designed for VANETs. Inter-vehicle communication may be used to separate them. It is essential for a vehicle to be able to drive at high speeds while maintaining its reliability and safety. IDM-IM and IDM-LC mobility models were explored in this study to see how they affected AODV, AOMDV, DSDV, and OLSR routing protocols in a specific urban situation in Dhaka city. In the event of an emergency or collision avoidance, messages are sent between cars using the periodic broadcast (PBC) agent. Prior to designing a strong safety application for VANETs, the simulation findings propose that various issues, including reduced packet loss rate, latency, jitter, route cost, and mean-hop, be taken into consideration.

(Ros et al., 2014) Smart transportation systems that use communication-capable cars to deliver important safety, traffic management, and informational services may be designed and evaluated using simulation. When real-world models are included in the simulation toolchain, simulation results become meaningful. It's true that many studies in this area are based on too simplified models that don't account for the particularities of vehicular communication networks. For simulation findings to be accurate, it is important to understand the assumptions made by the models used in the simulation. Wireless signal propagation, short-range communication technologies, and vehicle mobility models are all examined in depth in this article. A variety of simulation tools and techniques are described, also procedures which must be done to fine-tune model parameters for getting the realistic results. In addition, we provide helpful tips and resources to assist you choose best tools and models. It is our aim that this paper will serve as a guide for future ITS researchers and encourage the use of best practises in simulation in order to get accurate findings.

(Kumar and Dave,2014) There has been a steady flow of research on vehicular networks coming from academic institutions as well as commercial research firms. For the vehicular network, defining a general mobility model that describes mobility accurately and realistically is a major issue. But since there are so many mobility models, it's difficult to actualize incomparable characteristics, genuine capabilities, and the true level of realism with regard to vehicle mobility. In vehicular networks, all the cars share a limited network capacity, therefore data aggregation and dissemination (distributing the data to other vehicles or roadside devices) conserve the network bandwidth and, thus, enable more vehicular applications to co-exist on the same network. Numerous studies in the literature deal with mobility models and data aggregation or offer new models for aggregating and disseminating the information they contain. As mobility models evolve, so does the performance of data gathering and dissemination systems. As a result, examining the impact of mobility models on data aggregation and dissemination is critical in studies of vehicular network performance. In this study, we begin by describing the various degrees of mobility and numerous elements that influence mobility. On to the performance measures for evaluating different vehicular network algorithms. Following that, we describe the various types of mobility models in detail. Finally, we provide an overview and taxonomy of several vehicular network

mobility models that may be simulated. Mobility models have a significant influence on data collection and distribution, and this guideline will help readers make an informed decision about which model is ideal for a certain application.

(Kumar Singh & Lego, 2011) Many initiatives and research groups are working on the implementation of VANET (Vehicular AdhocNETwork), which has sparked attention throughout the globe. The primary goal of these initiatives and studies is to create protocols and technologies which will allow automobiles to communicate wirelessly. In order to create new VANET protocols and algorithms, actual cars cannot be used in a large-scale scenario since it is impractical. VANET simulators need a representation of the wireless channel's unsteadiness and lossiness. It is crucial to consider radio propagation and mobility models for VANETs in order to choose a viable protocol for vehicle-to-vehicle (V2V) communication.

(Lan & Chou, 2008) Using automobiles as movable nodes in a network, the Vehicular Ad-Hoc Network (VANET) is becoming more popular. Most VANET research depends on simulations for assessment since real-world deployment and implementation of such a system would be too expensive. VANET simulations need a realistic vehicle mobility model to guarantee that the insights derived from simulation tests are applicable to real-world deployments. First, we offer a tool called MOVE that can be used to quickly construct realistic mobility models for VANET simulations. SUMO, an open source micro-traffic simulator, serves as the foundation for MOVE. As a result of MOVE, network simulators such as ns-2 and qualnet may instantly employ a realistic mobility model. It is crucial to pick suitable levels of simulation details for VANET protocol design when evaluating the implications of mobility model parameters in three case studies of VANET simulations (particularly the presence of traffic signals, driver route choice, and overtaking behaviour).

(Karnadi et al., 2007) There is a new ad-hoc network called the Vehicular Ad-hoc Network (VANET), which is made up of automobiles. Research in VANET is heavily dependent on simulations because of the prohibitive costs of building and operating a system in the real world. A realistic vehicle mobility model is essential for VANET simulations because it assures that the findings derived from simulation trials are applicable to real-world deployments. For VANET simulations, we've developed a new tool called MOVE, which makes it easy for anybody to quickly create realistic mobility models. SUMO, an open source micro-traffic simulator, serves as the foundation for MOVE. As a result of MOVE, network simulators such as ns-2 and qualnet may instantly employ a realistic mobility model. MOVE's ad-hoc routing performance is evaluated and compared to that of the random waypoint model for vehicular nodes. A realistic mobility model produces dramatically different simulation outcomes than the typically used random waypoint model, as we demonstrate.

(Filali & Bonnet, 2006) We begin by introducing a framework for developing vehicle mobility models that might serve as a guide. There are a variety of ways in which vehicle mobility models and network simulators are developed by the community. For automotive ad hoc networks, we provide an overview and taxonomy of the several mobility models accessible. The goal is to help readers comprehend and objectively evaluate the various models, so that they may finally pick the one that best meets their requirements.

3. A FRAMEWORK FOR REALISTIC VEHICULAR MOBILITY MODELS

The following components should be included in mobility models in order to produce realistic patterns of vehicle motion:

- **Accurate and realistic topological maps:**

There must be a variety of junction densities, numerous lanes, and various types of streets and their related speed limits in streettopolo- gies to handle.

- **Obstacles:**

When used broadly, the term "obstacles" includes both physical restrictions on vehicle movement and technological challenges in wireless communication.

- **Attraction/repulsion points:**

We don't choose our starting and ending points at random when we go on a road trip. Many cars go to or from the same ultimate destinations, known as "attraction points," or "repulsion points," which may lead to bottlenecks and jams on the roadways.

- **Vehicles characteristics:**

a collection of traffic parameters is affected by the characteristics of each vehicle type. Macroscopically speaking, trucks are prohibited from using certain metropolitan streets and roads during certain times of the day. Cars and trucks have varied acceleration, deceleration, and speed capabilities when seen from a microscopical perspective. When simulating genuine vehicle movements, traffic generation engines must take into account certain features.

- **Trip motion:**

When seen from a macro perspective, a journey consists of a collection of urban origin and destination places. It's possible that different drivers have different preferences when it comes to where they want to go.

- **Path motion:**

Macro-scopically, a route is defined as the collection of road segments an automobile uses to go from one location to another. In reality, vehicles don't just randomly select the next lane at a crossroads, as is the case in most vehicular networking traffic simulations. There are several factors to consider, such as time of day, traffic congestion, distance, and the habits of the drivers themselves.

- **Smooth deceleration and acceleration:**

There is no sudden acceleration or deceleration in the driving of a car. Consequently, slow down and speeding up models should be investigated.

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- **Human driving patterns:**

Static and dynamic impediments, such as other automobiles and pedestrians, are all factors that drivers consider while interacting with their surroundings. Overtaking and traffic jams are examples of reciprocal interactions between vehicles that should be controlled by a model of mobility.

- **Intersection Management:**

Static obstacles (stop signs), conditional obstacles (yield signs), or time-dependent obstacles (traffic lights) are all examples of this procedure (traffic lights). But the Traffic Generator block does not notice the modification between stop sign and a huge quantity of traffic. These are seen as the restriction on movement.

- **Time patterns:**

During the day, the volume of traffic is not the same. At top periods, such as rush hour or during special events, there is always a wide range of traffic density. Motion Constraints and Traffic Generator blocks can be affected through this block's trip or path calculation and attraction/repulsion points.

- **External Influence:**

Vehicle mobility models can't control various types of movement since they're impacted by factors beyond their control. This category represents the effect on the mobility restrictions and the traffic generating blocks of accidents, temporary road works, or real-time traffic status information. Communication systems are major source of information on external influences.

4. CLASSIFICATION OF VEHICULAR MOBILITY MODELS

There are four broad categories in which the advancement of automobile mobility models may be placed on a global scale: Survey-based Models, Trace-based Models and Traffic Simulators-based Models are all examples of synthetic models that include all models based on a mathematical model and are used to generate mobility patterns using actual mobility traces. Figure 1 depicts a possible categorization system.
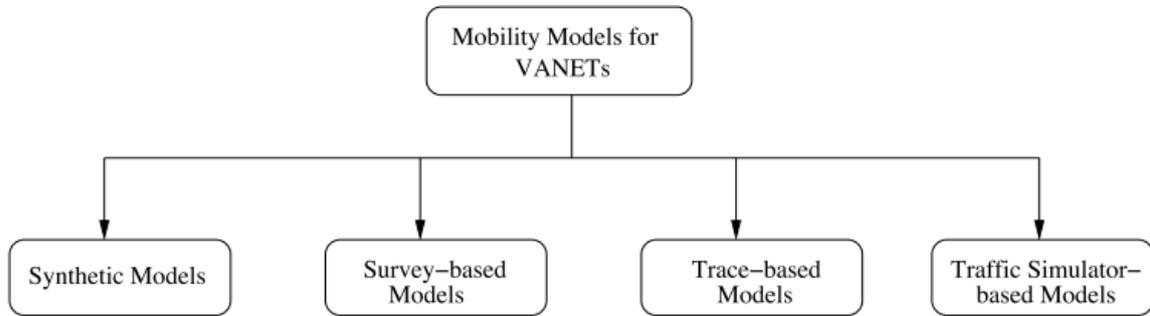
Figure 27 Classification of Vehicular Mobility Models

- **Synthetic Models**

Synthetic models make up the first and most well-known category. In order to build mathematical models that accurately represent the physical impact, much research has been conducted. Fiore [4] compiled a comprehensive list of all the models that fit this description. The categorization he came up with may be summarised in a few sentences. We recommend [4] for those seeking a more in-depth explanation. Stochastic models, traffic stream models, Car Following Models, QueueModels, and Behavioral Models are the five classes of synthetic models according to Fiore's classification, and each model is classified into one of these five categories. Fiore's categorisation is seen in Fig. 3. Mathematical models must be validated before they can be used to predict real-world traffic patterns. Large-scale measurement campaigns may be used to obtain mobility traces, which can then be used to compare these patterns to those generated by a synthetic model.
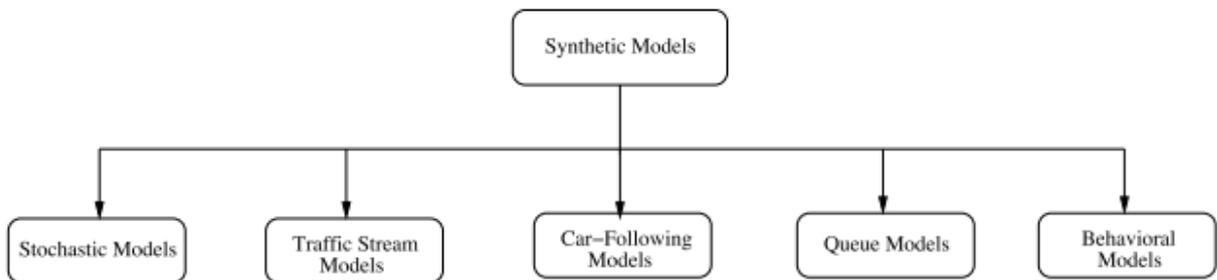
Figure 28 Classification of Synthetic Mobility Models (Fiore)

The difficulty of modelling complicated human behaviour is a fundamental drawback of most synthetic models. Drivers aren't robots, and they can't be made to do what we want them to do all of the time. A local disturbance or stimulus may have an impact on traffic modelling at the global level. Behavior theory should be taken into account while creating a realistic mobility model, so.

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Synthetic mobility models have a three-pronged approach: first, they attempt to analyse a movement, then they construct a mathematical model, and lastly, they attempt to duplicate it. It's conceivable that certain motions are so intricate or intertwined that a mathematical model is hard to build. Based on these observations or surveys, the following methodologies seek to recreate an approximation of the movement.

- **Survey-based Models**

Macroscopic mobility data may be gleaned via surveys, which are common in the business world. It is the US Department of Labor that conducts the most comprehensive large-scale surveys, compiling considerable data on the habits of US employees in areas such as commute times, lunch breaks, travel distances, and lunch preferences. One may construct a generic mobility model capable of reproducing the pseudo-random or deterministic behaviour seen in actual urban traffic by integrating such data in a mobility model.

- **Trace-based Models**

Complex synthetic models can only get close to genuine motion patterns because of the difficulty of portraying vehicle movement. It's possible that we'll choose a different route. Directly extracting general mobility patterns from movement traces might save important time instead of constructing sophisticated models and then calibrating them using mobility traces or surveys. In recent years, such an approach has been more common as numerous measurement initiatives established by projects such as CrawDaD, UMASS Diesel-Net, MIT Reality Mining, USC MobiLib, or Cabspotting have begun to collect mobility traces. Using this method, the most challenging component is extrapolating patterns that can't be seen in the traces themselves. It is feasible to anticipate some of the movement patterns that are not recorded in the traces using complicated mathematical models. The measuring campaign's class is also a common source of the constraint. Using an extrapolated model for personal car traffic is not possible if motion traces have been collected for bus networks.

Trace-based vehicular mobility models are hindered by a lack of available vehicle traces. However, the results may not be known to the general public for some time, if they are indeed made available at all.

To better represent actual pedestrian movement patterns, researchers have been able to derive mobility models that include traces. As a result of trace-based mobility modelling, the speed and pause time distributions are not uniform but rather follow a log-normal distribution, and inter-contact time should be modelled by an exponentialdistribution rather than a power law. This contradicts the hypothesis used by synthetic models. In order to be as realistic as possible, synthetic models should be further developed to include more details that reflect their real-world counterparts. Real-world data may help us understand the distribution of speed, halt durations, and inter-contact periods in vehicle motion, and we can then utilise this information to design the synthetic models appropriately.

- **Traffic Simulator-based Models**

Some firms or research groups have developed realistic traffic simulators by enhancing synthetic models and through an extensive validation procedure which is based on actual traces or behaviour surveys. It is possible to replicate microscopic traffic in urban areas using fine grain simulators like PARAMICS, SUMO and CORSIM for urban traffic engineering purposes. However, since no interface has been built and the traces are mutually incompatible, these simulators cann't immediately be utilised for network simulators. There may also be a licencing fee associated with the use of these traffic simulators. In light of these problems, we decided to create new, commercially available vehicle mobility models, which we will discuss in this article. However, by establishing a parser between traffic and network simulators' input files, end-user might acquire access to verified traffic patterns and so receive a degree of detail which is not attained by any genuine vehicular mobility model. This method's primary flaw is its high level of setup complexity, since calibrating these traffic simulators often requires adjusting a significant number of parameters. Another consideration is that compared to traffic analysis, simulating global patterns of vehicle mobility rather than identifying specific vehicle behaviours may not need the same degree of granularity. Some university programmes may even eliminate the need to obtain commercial licences for the usage of commercial traffic simulators (VISSIM, for example), allowing students to use them for free.

5. CONCLUSION

In this part, we discussed the various methods for creating mobility models. Developing a mathematical model and then simulating it with great accuracy may be an option if the motion patterns aren't too complicated. Observed movement patterns may be used to estimate the motions if that is not possible. This method relies on global mobility patterns rather than exact motions, which has its drawbacks. In addition, the created model is unable to duplicate a pattern that was not detected in traces or surveys. Another benefit is that it can show intricate motion that is impossible to describe mathematically.

However, the decision between the two ways is heavily dependent on the needs of the application, therefore they are not mutually exclusive. The mobility model, for example, must be developed by a synthetic model if the application is a vehicle safety protocol that requires a high degree of accuracy in representing actual motion. The gross motion patterns are adequate for evaluating a data distribution technique in comparison, and thus a trace or survey-based model may be imagined. As we'll see in the next section, the traffic simulator technique is also becoming more popular since it provides a degree of accuracy that can't yet be achieved by any synthetic model.

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Security Attacks in Vehicular Networks and Survey on Recent Developments in Detection and Protection Against Threats

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Abstract

In today's automobiles, security is a primary issue. Among the numerous advantages provided by contemporary vehicle systems are reduced traffic congestion, improved safety, and decreased use of gasoline and diesel fuel. Personal information may be leaked and human lives put in jeopardy by security holes in automobile systems. Vehicle networks are vulnerable to a wide range of security risks, and this article aims to examine them all in relation to the network's cyber security. To help prevent these hazards, the study also provides a literature review of current practises in this area.

Keywords: Vehicular Ad hoc Networks, Routing protocols, Security threats, Trust management

1. INTRODUCTION

The complexity of today's automobiles has skyrocketed. Modern automobiles are quickly becoming more technologically advanced as a result of the constant addition of new technologies. Each contemporary vehicle is equipped with a number of electronic control units (ECUs) that communicate with each other through a network of buses. In the short term, this may be convenient for the driver, but it also presents a greater risk of security breaches. Attackers have the potential to abuse the system in ways that are hazardous to the vehicle and its occupants. The safety of the massive amount of data sent between a vehicle and the outside world is the second source of worry (e.g., through internet, Wi-Fi, or

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Bluetooth). The infotainment systems, for example, provide a convenient entry point for a variety of cyber assaults.

There's a growing gap between current security threats and current safety measures, which necessitates study into security for vehicle systems. Personal information may be leaked and human lives put in jeopardy by security holes in automobile systems. Every sector of life that relies on the sharing of information is affected by cyber dangers. Internet of Things (IoT) dangers are expected to rise by 100% between 2019 and 2020, as the IoT's fast adoption raises the danger to catastrophic levels. To put it simply, a cyber-attack may have a direct impact on the physical world, potentially putting human life at risk and inflicting material damage. This is because cyber-physical systems are becoming more prevalent. In the rapidly emerging area of Connected Autonomous Vehicles, such a hazard presents a serious concern (CAV). It is possible to suffer serious or even fatal consequences if a vehicle's computerised steering systems fail. In autonomous vehicle initiatives centred on V2X communications, where the vehicle may connect with anything, such as vehicles (V2V), infrastructure (V2I), networks (V2N), clouds (V2C), devices (V2D), and pedestrians (V2P), a great emphasis is placed on cyber-security (V2P).

2. LITERATURE REVIEW

(Hidalgo et al., 2021) Increased protection of autonomous vehicle drivers from dangerous cyberattacks would significantly reduce the number of fatalities and injuries throughout the world. Consequently, when a cyber-attack targets high-risk systems like driverless cars, the European Commission has concentrated on communication security. SerIoT, an open and reference framework for real-time monitoring of traffic transmitted over heterogeneous IoT systems, emerges as a feasible option. Using this method, anomalous patterns may be detected, analysed, and, if warranted, countermeasures taken. A case study of the SerIoT project's rerouting testing in vehicular communication is presented in this article. The SerIoT's system capabilities are used to identify and mitigate potential network threats in order to provide safe and dependable communication among C-ITS components (vehicles, infrastructures, etc.). Consequently, fleet management and smart junction scenarios were selected, in which on-board units (OBU) and roadside units (RSU) communicate with each other and the traffic flow to achieve an ideal flow of traffic. Using SerIoT technologies, these devices are able to protect themselves from cyberattacks such as Denial of Service (DoS). The tests have been shown to work in a variety of dangerous circumstances. Taking the necessary steps to guarantee a smooth and safe flow of traffic is a testament to the SerIoT system's high performance.

(Kumar et al., 2021) Because they ensure the safety and security of drivers and passengers, vehicular ad hoc networks (VANETs) have drawn considerable interest in the field of intelligent transportation systems (ITS). Because of their unique properties and system design, VANETs vary significantly from mobile ad hoc networks (MANETs). Vehicle-to-vehicle and vehicle-to-infrastructure communication in a VANET are both affected by security concerns. Detecting and preventing security breaches is critical

in VANET because of malicious attacks. It's possible for a node connected to the network to inject faked routing tables into other nodes, which would have an impact on the overall network performance in a VANET network. A secure AODV routing protocol for detecting black hole attacks has been devised in this research to tackle this problem. Routing protocol enhancements have been made to AODV's RREQ and RREP protocols in the proposed technique. An additional layer of protection is provided by encrypting and decrypting data using a cryptographic function. Different network metrics, such as lose packets, end-to-end latency, packet delivery ratio (PDR), and routing request overhead, are used to show the proposed technique on an NS-2.33 simulator. Proposed routing approach outperforms AODV under black hole attack and enhances network performance, according to results.

(Sultana et al., 2021) One of the fundamental enablers of 5G technology is the development of VANETs based on Software Defined Networking (SDN). VANETs allow for a wide range of services to be provided by cars and roadside equipment by allowing them to communicate. Intelligent Transportation System (ITS) developed this new technology in order to increase traffic efficiency while providing passengers with more comfort, safety, and entertainment. Because of its rigid and inherent rules, the traditional VANET is unable to manage big, dynamic networks with complicated design. An organisation called Open Network Foundation (ONF) is encouraging the use of SDN via open standards' development in order to facilitate management of the whole network from a single point. SDN allows VANET to adapt to new services and features as they become available. The overall network functions and data packet routing are controlled by a centralised controller in the control plane. VANET's efficiency and security are both improved by SDN. With the addition of new technology and architectural components to the network, there are new security concerns to contend with. VANET, SDN, and SDN-based VANETs are thoroughly examined in this article in terms of their architecture and implementation aspects. As a follow-up, it describes how SDN affects the security of VANET when it is used with standard VANET. SDN-based VANET security solutions are reviewed in this study, which also identifies future research areas for SDN-based VANETs. As far as we know, this is the first full assessment of the security aspects of SDN-based VANETs considering architecture and security services on various tiers of the network.

(Eftekhari et al., 2021) An entirely new concept has been established by the incorporation of fog-based computing paradigm into traditional vehicle networks. The goal of this integration is to provide a more fun and safe driving experience. Clearly, one of the most difficult aspects of achieving this aim is how to safeguard these massive communications. If developed and utilised correctly, shared secret key agreement protocols are an accepted solution for this purpose. There have been a large number of these strategies developed so far, but they have mostly failed to meet all of the needed security criteria outside a suitable performance. After the cryptanalysis of a state-of-the-art and distinguished protocol, we propose a security-enhanced three-party pairwise shared key agreement protocol for fog-based vehicular communications with a 23.65% computational cost reduction. Using a well-known "ProVerif" programme, in addition to informal reasons, the proposed protocol is formally validated as well.

Comparisons are made between security metrics and performance to show that the suggested protocol is superior when both security and efficiency are taken into account simultaneously.

(Nandy et al., 2021) Due to their small weight and lack of security, a large range of authentication methods are created to protect vehicular ad-hoc network (VANET) transmission from possible assaults. Trusted authorities and signatures are often used to authenticate communication in automotive networks; however this is not always sufficient. In these approaches, achieving speedy validation and correspondence is a challenge, and the execution demands from coming about overhead make it much more challenging. As a result, we've created ELSAP, a more secure and lightweight V2V authentication protocol for VANETs. A self-authentication method before communication, which increases network feasibilities, which in turn requires less message transmission during authentication and communication, indicating light characteristics. In addition, Burrow–Abadi–Needham (BAN) reasoning proves that two or more vehicles may safely undertake mutual authentication. According to Automated Validation of Internet Security Protocols and Applications (AVISA), the proposed protocol's ability to withstand current threats is shown by security analysis and comparison tools such as these (AVISPA). With the proposed protocol's security characteristics, the performance study demonstrates that communication and computation costs are lower than those of the previous authentication techniques.

(Sun et al., 2021) Due to their unique wireless characteristics, such as highly dynamic vehicles and unstable channels, vehicular ad hoc networks (VANETs) have high QoS and security requirements. QoS and security are difficult to maximise together since they are competing priorities for scarce network resources. Because of this, a trade-off is necessary. Each vehicle in the research competes for resources internally and externally in a two-period game that simulates each of these aspects. To optimise throughput in the initial external decision-making phase, each vehicle builds a cross-layer utility between the MAC and PHY layers. Aside from that, the optimum strategy for the vehicle's external decision-making is gained as an input for the following period, serving as an input for the optimal transmission power. An individual vehicle's QoS and security are regarded as two abstract actors competing for the vehicle's limited resources in the second stage of internal decision-making. The 'communication player,' which controls the quantity of data blocks, is modelled like a game, while the 'security player,' which controls the hash length, is modelled after a game. Two players' optimum strategy composition is calculated and shown to equal the theoretical value of the Nash equilibrium of the internal game. Simulated findings show that a vehicle may achieve sufficient QoS and security levels by dynamically adapting its optimum tactics to the network and traffic conditions in which it is positioned.

(Amin et al., 2020) Vehicular Ad-Hoc Network (VANET) is a term used to describe the connectivity of automobiles for the purpose of sharing relevant information. Driving safety and comfort may be assessed using the information sent. It is also utilised in traffic analysis, road safety measures, vehicle performance statistics, and multimedia data sharing between cars through continuous Internet access. After obtaining critical information, adversaries might cause multiple system outages. As a result, establishing reliable communication requires a strong security protocol. The protocol developed by Bidi et al. is examined in this article and shown to have a number of serious security weaknesses. Once we've

established a high degree of security, we present a comprehensive protocol that defends against any and all connected threats. Using Scyther, we were able to verify that the creation of a shared key does not compromise the privacy of any data. In addition, the protocol's overall performance is better to that of competing methods.

(Al-Turjman & Lemayian, 2020) The future Intelligent Transportation Systems (ITS) must handle the essential issue of VSN security (ITS). Assailants have access to the personal information that users voluntarily provide. Malwares and Spams, Black Holes, Wormholes, and Physical/Electronic Outages are among the most common assaults. As a result of these VSN assaults, people may be killed in car accidents or have their privacy violated. VSNs in a smart city paradigm based on vehicle IoT are discussed in this study, emphasising on security aspects. VSN's resilience and dependability are also discussed in this section. We also address the security issues associated with various communication systems. This article focuses on the most pressing challenges in literature research and offers advice on how to overcome them. To create effective ITS, VSNs must play a vital part in this study's conclusion However, to provide a dependable and secure transportation system, present VSN security requirements must be upgraded.

(Malhi et al., 2020) Intelligent Transportation Systems (ITS) are concentrating their attention on cars that have extensive processing, communication, and sensor capabilities (often known as "smart" vehicles) (ITS). When it comes to vehicular ad hoc networks, the primary goal is to make driving more secure and efficient by giving real-time traffic information to drivers and any other parties that may be engaged. This article focuses on the security issues of VANETs and analyses some of the most popular safety solutions. VANET threats and security methods (a), a comparison of cryptography-based security schemes (b), and trust management strategies based on discrete features and intrusion detection systems (c) are the four main components of this study. (d) unresolved concerns that will need to be addressed in the future. On the basis of previous computer security research, we explore how this study represents the evolution of security assaults and its future predictions.

(Pu et al., 2020) Using edge stations or cloud service providers, vehicular social networks (VSNs) may deliver traffic or location services to cars. Furthermore, the exchange of information between cars may help prevent traffic accidents and ensure safe driving. When communicating between a car and an edge station, a cloud service provider or another vehicle over a VSN, it's simple for the privacy of the vehicle to be compromised. Some wicked users, on the other hand, may dishonestly provide information in order to deceive others for their own gain. Because of this, we provide a blockchain-based solution for VSNs that is fast, secure, and private. Using pseudonyms, we're able to protect the identities of individuals by obscuring the cars they're travelling in. An incentive-punishment scheme is also developed to encourage cars to submit reliable information. The message's dependability may be assessed using a combination of many variables and a single factor weighted assessment method. In addition, PBFT and blockchain are used to establish consensus and store data, respectively, to prevent malevolent actors from altering vehicle reward and credit ratings. As a last step, we examine the suggested scheme's security from several perspectives: external assaults, internal attacks, collusion

attacks, etc. According to the findings of the relevant experiments, our plan is both practicable and efficient.

(Ghaleb et al., 2019) Cooperativeness among network members is essential to the majority of VANET and FANET applications, protocols, and services. In order to enhance network performance and to offer safety, traffic efficiency, and entertainment, vehicles, including unmanned aerial vehicles (drones), communicate sensor data. VANET performance relies heavily on this data's precision and dependability. A vehicle's cooperativeness characteristic may be used by misbehaving (or defective) automobiles to pass on false information, resulting in the death or destruction of persons or property. Existing detection methods are unable to stop such assaults, which is a shame. Furthermore, they depend on predetermined and static security boundaries to distinguish between false and true information, which is a major oversight. Detection accuracy and false alarm rates may both be improved by using context-aware detection, as shown in this study. As a starting point, elements that accurately reflect the automobile setting have been culled out. An online unsupervised learning approach called the hierarchical clustering algorithm is utilised to identify the incoming messages as authentic or bogus. Finally, the classification's validity was confirmed using Bayesian-based hypothesis testing. The results demonstrate that the proposed detection method is promising in detecting false information attacks and enhancing application performance.

(Awais Javed et al., 2018) Transportation in smart cities will be safer and more dependable because to the potential of VSNs, or vehicular sensor networks. Various intelligent transportation applications may be accomplished by developing widespread communication between automobiles and road infrastructure. To successfully integrate VSNs, effective network security becomes a top priority. Strong security measures, on the other hand, come at a considerable cost in terms of security overhead and processing time, reducing QoS dramatically in heavy-traffic environments. The QoS of safety applications in VSNs may be improved by using a security adaption mechanism based on trust. Connectivity duration, security level, and centrality indicators of neighbouring cars are used to compute trust levels. Using simulation findings acquired from our proposed study, we have shown a 25–65% increase in safety awareness and a 33–53 improvement in packet inter-arrival time for safety applications in VSNs.

(Tyagi & Dembla, 2017) There are two types of ad-hoc networks in use today: those based on mobile nodes and those based on vehicle nodes. These two types of networks are known as MANETs and VANs, respectively (VANET). The goal of VANET is to keep drivers safe by allowing them to communicate with other cars autonomously. The ad hoc network's vehicles operate as intelligent mobile nodes, capable of forming dynamic networks and moving around rapidly. Due to the constant movement of the vehicles, the ad-hoc networks demand a high level of efficiency and security in their communication. Assaults such as denial of service and Black Hole attacks are more likely to occur on these networks. For the first time, this study attempts to explore and investigate the security characteristics of VANET's routing protocols and the applicability of the AODV (Ad-hoc On-Demand) protocol in order to identify and combat a specific kind of network assaults known as Black Hole Attacks. As part of a novel method

suggested to improve the security of the AODV protocol and to add a mechanism to identify and avoid Black Hole Attacks, a look-up table of all route answers is maintained by the source node and is used to keep track of the network's path. PUSH and POP operations are used to organise the reply sequences in ascending order in this table. Sequence number is used to determine priority, and RREPs with a very high destination sequence number are discarded. ITS security is improved, as is VANET security as a consequence of using the suggested technique to identify and prevent a Black Hole Attack on ITS nodes. In this study, NCTUNs simulator is used.

(Cherkaoui et al., 2017) Vehicular Ad-hoc Networks (VANs) are a new form of wireless ad-hoc network that may be used between automobiles. The creation of such a communication network is aimed at streamlining traffic and promoting driver safety by providing relevant information to its users. Prior to building up an actual network, we must protect the communication by forecasting certain security concerns and preparing for them. The Black Hole Attack is only one of the many crises that plague humanity. The black hole assault may be detected using a quality control chart proposed in this research. Real-time network activity monitoring utilising visual representations is used to identify any abnormalities that may occur during the course of communication using this technique in this manner. Conference Program Chairs responsible for peer review.

(Pan et al., 2017) It has emerged in recent years as a wireless ad-hoc network connecting automobiles, which is known as a Vehicular Ad-hoc Network (VAN). The creation of such a communication network is intended to help with traffic flow and to promote safe driving behaviour by providing users with relevant information. Consequently, we must foresee a number of security threats before implementing this network in the actual world. There are a number of difficulties that need to be addressed. Using a quality control chart, we offer a new approach for detecting black hole attacks. This approach monitors network traffic in real-time using graphical representations to identify any anomalous behaviour during communication. The Conference Program Chairs are in charge of peer review.

(Mokhtar & Azab, 2015) Unlike other ad hoc networks, vehicular Ad hoc Networks (VANs) are characterised by a lack of infrastructure as well as the fact that the communication entities move at varying speeds. As a result, dependable end-to-end connection and efficient data transmission are hindered. These network and security problems and difficulties influence the trust between mobile networking entities, which in turn affects the capacity of VANETs to provide ubiquitous connection, secure communications, and reputation management systems. To better understand the security aspects of VANETs, we conducted a study to categorise the assaults on VANETs based on the various network levels.

3. TYPES OF ATTACKS

Passive attacks and active assaults are the most typical types of attacks against ad-hoc routing methods:

Passive attack: In contrast to a Direct Attack, a Passive Attack aims to get valuable information through intercepting the protocol's communication. Sniffing the network is a key component of passive attacks. Defending against these types of assaults is tough since they are difficult to detect. If it is not feasible to pinpoint the precise position of a node, one may still be able to learn about the network's architecture by using this kind of attack.

Active attack: As the name implies, an Active Attack attempts to disrupt the protocol's normal functioning by injecting random packets in an attempt to restrict access, get authentication, or snoop on traffic heading to other nodes. Attraction of all packets for analysis or denial of service is the primary objective. Detection and identification of the nodes involved in such assaults is possible. Some of the threats to the routing layer and some of the routing protocols are outlined below.

- **Routing table overflow attack**

Proactive routing algorithms, which update route information on a regular basis, defend against this assault. Using this method, the attacker attempts to build routes from nonexistent nodes to the network's established and trusted nodes. The attacker may easily overwhelm the target system's routing database by sending out aggressive route announcements. Routing protocol implementation should be hindered or impossible because of the sheer volume of routes already in existence.

- **Routing cache poisoning attack**

The promiscuous way of updating the routing table is exploited in a routing cache poisoning attack. If the data in routing tables is updated, tampered with, or injected with incorrect information, this might happen. M, a malevolent node, is trying to poison the routes between X and Y. As a result, nearby nodes who overhear the packet and see the faked source route to X may add the route to their caches.

- **Attacks on particular routing protocols**

This survey's primary goal is to categorise VANET assaults by layer, hence we must include attacks that specifically target routing protocols. The fundamental issue with these proto-cols is that they don't pay enough attention to security. This issue is prevalent in most contemporary studies. Following that, we'll look at various typical routing protocols and the security risks, benefits, and drawbacks associated with each.

- **AODV**

AODV is a reactive technique for routing data over wire-less mesh networks using the Ad-hoc On-Demand Distance Vector (AODV) algorithm. Because it is simple, takes minimal memory, and doesn't produce more traffic for communication over existing networks, AODV is a good choice for routing. A malicious node may advertise a route that has a lower distance metric than the original distance or announce a routing update with a big sequence number that invalidates all other nodes' route updates. In order to improve the security of AODV's multihop authentication and integrity (using hash chains and signatures), a new version of the protocol known as "Secure AODV" was suggested.

- **DSR**

If you're looking for something similar to AODV, the Dynamic Source Routing (DSR) protocol could be a good fit for you. Source routing instead of depending on each intermediary node's routing table distinguishes them. In addition, a packet may be sent hop-by-hop using this feature. If an attacker wishes to change the source route mentioned in the RREQ or RREP packets, they may do so in DSR. It is possible to delete a node from the list, change the order, or add a new node to the list in DSR.

- **ARAN**

Malicious activity may be detected and prevented using the Authenticated Routing for Ad hoc Networks (ARAN) protocol, which is an on-demand routing system. To provide basic security, this protocol introduces authentication, integrity, and non-repudiation. When it comes to ad-hoc security measures, ARAN is meant to be resistant to the rushed assault detailed later.

- **ARIADNE**

Ariadne is an efficient and on-demand routing technology based on DSR that employs extremely effective symmetric cryptography. A message authentication code (MAC) and a common key between the two communicating parties are used to enable point-to-point authentication of a routing message. Cache poisoning and flood of RREQ packets aren't enough to keep ARIADNE safe from these attacks.

- **SEAD**

SEAD is based on the DSDV-SQ protocol, which is a subset of the DSDV standard. One-way hash chains instead of costly asymmetric cryptography operations are used to cope with attackers who modify routing information and replay attacks. To thwart the attackers, the system makes use of two separate methods for authenticating messages. SEAD, on the other hand, cannot handle wormhole assaults.

4. OTHER ADVANCED ATTACKS

VANET has recently been targeted by increasingly sophisticated and covert assaults. To counter the assaults, new routing protocols are being suggested and certain protocols have been improved. Even so, it's something that security personnel are interested in. Black holes (or sinkholes), Byzantine, wormholes, and rushing assaults are just a few of the most common instances.

- **Rushing attacks**

This is a new attack that results in denial of service when employed against all prior on demand ad hoc network routing prototypes. Routes longer than two hops cannot be discovered using DSR, AODV, or secure protocols based on these technologies, such as Ariadne and ARAN. An attacker who is able to fast send route requests might raise the likelihood that routes that involve the attacker will be identified

rather than other legal routes. A weakness of this assault is that it may be carried out by a very inexperienced attacker. Named Rushing Assault Prevention, it is an attempt to prevent this attack (RAP).

- **Wormhole attack**

The term "wormhole attack" refers to an attack in which two or more nodes work together to encrypt and tunnel data between them. This vulnerability allows a node or nodes to interrupt the regular flow of data, producing a virtual vertex cut in the network controlled by the two collaborating attackers.

- **Black hole attack**

There are two stages to the black hole assault. There are many ways that a malicious node might use the mobile ad-hoc routing protocol (such as AODV) in order to trick other nodes into believing that it has a legitimate route to the target node. No further action will be taken from this point forth. If the attacker is skilled, he or she may modify or silence packets emanating from certain nodes while leaving the rest of the data untouched. In this manner, the attacker tampered with the nearby nodes that keep track of the current packets.

- **Byzantine attack**

A single malicious node or a group of nodes working together may launch a byzantine assault. Compromises may be carried out either by a single compromised intermediate node or by a group of compromised intermediate nodes working together. Nodes that have been hacked may cause routing loops, send packets along a lengthy path rather than the best one, or even discard packets altogether. Routing services are disrupted and performance is degraded as a result of this attack.

An assault on the system's resources The MANET relies heavily on energy. In order to save battery power, battery-powered devices communicate with each other only when required. The goal of a resource consumption attack is to deplete the battery life of the victim node by sending requests for excessive route discovery or superfluous packets. As a result, the MANET's regular operation may be disrupted by an attacker or a compromised node. In VANETs, this assault has little impact since there are no significant restrictions on energy supplies.

- **Location disclosure attack**

Disclosed location attacks are part of an information disclosure assault. The rogue node discloses information about the network's location or structure, which it then utilises to further attack the system. It collects node location data, such as a route map, and determines which nodes are located along the intended path of travel. Detecting traffic patterns is one of the VANET security threats that has yet to be addressed.

5. CONCLUSION

There are several research possibilities in this area to stay up with technology advancements and the changing nature and demands of our society. As an example, balancing security, privacy, and function in certain vehicle circumstances may be a difficult task. Cyber-security in autonomous vehicle projects is heavily centred on V2X communications, which include vehicle-to-vehicle communication (V2V), as well as communication with infrastructure, network and cloud. V2D and V2P communications are also heavily emphasised in the paper, as is vehicle-to-pedestrian communication (V2P) (V2P).

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A Review on Recent Developments in The GPS Based Localization and Wireless Sensor Networks

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Abstract

The advancement of the location as well as navigation technologies and procedures has made it easier to locate individuals in difficult and complicated situations. Researchers have been focusing on Wireless Sensor Network (WSN) localization over the last decade or more. A number of recent advances in the GPS location technology are discussed in this article, including applications of such technology in a variety of industries.

Keywords: WSN, Noise, Multipath, GPS location technology

1. INTRODUCTION

The "pluralistic era" of navigation as well as positioning has arrived. On just one hand, GPS receiver prices are falling, receiver sizes are shrinking, as well as GPS accuracy is rising significantly once Selective Availability is removed due to widespread use of the GPS technology. When it comes to outdoor placement, wherein there is the clear view of sky, GPS is thus almost uncontested! Contrast such condition with more difficult positioning situations including high-dynamic navigation, interior positioning, including positioning in the urban surroundings. Other locating technologies are still required in order to address GPS's major drawbacks. For example, multiple sensor systems, the pseudo-satellite technology as well as helped GPS methods have indeed been proposed or even developed, as well as wireless signals, TV signals and IP addresses as well as (DNS) that is domain name system and various mobile phone-dependent positioning techniques like the (E-OTD) enhanced observed time difference and (TOA) which is time of arrival .

Due to the difficulties of wireless signals penetrating below, the most wireless communication is almost impossible. In order to overcome this obstacle, the subsurface sensors must operate together in the network. There are several applications for wireless sensor networks, from the home to the workplace. The use of wireless sensors in the industrial monitoring as well as control has been highly successful, but recent terrorist attacks on the underground locations have revealed the vulnerability of these locations, as seen in Fig. 1. Following the year 2005 London Underground explosion, WSNs have been introduced and are currently the subject of ongoing study. Localizing and routing information via underground wireless nodes is a must. As a result, the necessity for subterranean monitoring has grown significantly.
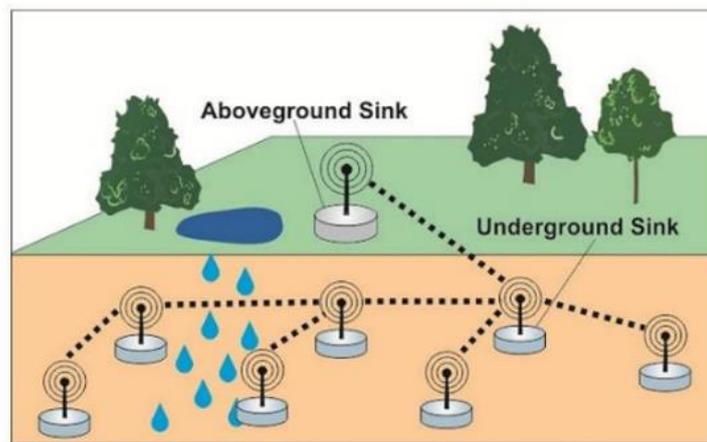

Figure 29 Usage of wireless underground sensor networks for agricultural monitoring

Within literature, there are a variety of approaches for locating and detecting target nodes. However, it is necessary to look into strategies that may give better precision in the localization of wireless nodes during communication is being carried out. Using beacon-dependent communication, nodes within network may be accurately located and communicated with. Within literature, there are methods for the localization that are greater than 50% accurate. When it comes to sending data more efficiently, localisation is a crucial aspect of this new method. An effective method for localising and facilitating communication in subterranean wireless sensor networks has been suggested, simulated, and confirmed in this study Related papers, the description of such suggested approach, and a simulation analysis are included in the following sections.

2. LITERATURE REVIEW

(O'Mahony et al., 2021) A unique intelligent interference diagnostic system is developed in this study to enhance the security of the wireless edge devices. Received in-phase (I) as well as quadrature-phase (Q) samples being only used to identify sophisticated, subtle, and conventional crude jamming assaults

on communications networks and systems. Decentralized decision-making is enabled by this I/Q sample use, in which the low-order characteristics were recovered in a prior work focusing on the 2.4–2.5 GHz wireless signals. The article's work is based on the optimum intelligent models that are related with this research. Monte Carlo simulations first study the ideal situation, which has no hardware limits, defines data type of the signal interactions as well as stimulates the research of a hardware implementation. SDRs broadcast matching ZigBee signals including continuous-wave interference within ZigBee wireless testbeds that have been constructed using (SDRs) software-defined radios. Low-order features are used primarily in the development of low-complexity supervised machine learning models, which have an average accuracy of over 98percent. SDR as well as commercial (XBee) sources of the artificial jamming as well as SDR jamming of the ZigBee signals are examined for the ZigBee over-the-air data inside the suggested technique. For the wireless edge device interference diagnostic tools, such method provides a genuine node categorization mechanism as well as an overall algorithm. Support Vector Machine, XGBoost, including (DNN) Deep Neural Network models are being developed as part of the inquiry, with XGBoost being the most effective. Using worldwide positioning system signals to modify the optimised models shows the methodology's transferability. Upon that Raspberry Pi, the methods were put into practise Embedded device investigates a deployment that is very resource restricted. It is the actual experimentally confirmed interference diagnosis paradigm that allows independent device operation, since no channel assumptions, the network-level information, or even spectral pictures are needed. When using I/Q data low-order features, models are able to achieve excellent accuracy and generalisation to previously unknown data sets.

(Cheng et al., 2021) Even time intervals of the video recorders may be calibrated utilizing an LED panel termed as "SEXTA," that uses GPS signals as a time reference. Direct frame-by-frame measurements of recording's frame intervals are made using video recorders with the CCD or even the CMOS sensors in the global shutter or even rolling shutter modes, with a temporal resolution of the 2 ms or more. Utilizing a DSLR camera as well as a previously examined dashboard camera, the system has been shown to be accurate. Sexta's frame-by-frame analysis may disclose sensor information such as kind of the sensor (CMOS versus CCD), exposure duration, direction as well as speed of the rolling shutter for the CMOS sensors, and usual features of the dashboard cameras like frame skipping.

(Nassar et al., 2020) We have made two datasets available to the general public in this study. RP fingerprints were created by four users in the Bush Court, a busy part of the Murdoch University, and also the dataset includes 16,032 of the most accurate as well as consistently labelled RP WiFi fingerprints. More than 2.4 million Wifi signal strength records are included in second dataset, which is made up of records produced by a total of 1000 devices, along with four users. As a solution to Bush Court's WiFi coverage issue, we mounted our previously built (WSNs) Wireless Sensor Nodes to existing rubbish bins, allowing them to offer real-time environmental monitoring as well as operate as soft APs which detect MAC addresses as well as Wifi signals from nearby devices.

(Simões et al., 2020) The advancement of the location as well as the navigation technologies and procedures has made it easier to locate individuals in difficult and complicated situations. As a result of

these advancements, scientific community is increasingly interested in employing (IPSs) indoor positioning systems with a better degree of accuracy and faster delivery time in order to help groups of individuals like visually impaired. To provide a more comprehensive understanding of IPSs, much study synthesises a variety of works which deal with their physical as well as logical methods. Such surveys, though, have to be examined on a regular basis in order to keep the literature up-to-date. One such paper provides readers as well as researchers with the more recent version of what's been done as well as advantages including disadvantages of every approach to guide reviews as well as discussions on such topics, expanding the range of the technologies as well as the methodologies for helping visually impaired in earlier works. For the visually impaired, we examine a number of issues and future developments in the building of the indoor navigation and the locating systems.

(Adegoke et al., 2019) (CAVs) Connected autonomous vehicles must be able to assess their location to the closest centimetre in order to implement the intelligent vehicular transport networks as well as self-driving automobiles. If you're utilizing a CAV, you may get traditional positioning simply attaching the (INSs) inertial navigation system to one of the satellites navigation systems, like the (GPS) Global Positioning System . Enterprise or even carrier-grade Wi-Fi networks could be used opportunistically for the localization or even "fused" with the GNSS to enhance localization accuracy as well as the precision throughout urban environments in which Wi-Fi coverage has been ubiquitous as well as GNSS signals experience signal blockages, even multipath or the non-line-of-sight (NLOS) propagation. With in literature, there exist GNSS-free systems, but a review of vehicle location from the standpoint of the Wi-Fi anchor or even an infrastructure is few. Since recent advancements in positioning approaches between being an ego vehicle as well as the vehicular network infrastructure will be examined in this analysis, The correctness, complexity, and relevance of the studied literature with regard to an intelligent transportation system needs for CAVs are also addressed in this research. Pervasive localization services for the CAVs in urban canyons, thick greenery, or even the multi-story parking garages are anticipated using hybrid vehicular localization systems.

(Mardonova & Choi, 2018) This article presents an overview of such mining industry's existing and future use of the wearable devices, as well as technology's current as well as future developments. Among the topics covered in this overview are the many types of the wearable devices and sensor functions that may be found in them, as well as instances of how they have been put to use in various industries. The mining industry's current use of wearable gadget technologies is examined. Other conceivable uses include a mining safety management system that may be worn by miners. The outcomes of this study suggest that the safety of the mining operations may be improved by incorporating wearable device technology. Because of this, wearable gadgets should be employed more often in the mining sector.

(Kapoor et al., 2017) In light of the current developments in the (UAS) Unmanned Aircraft system-Traffic Management research framework, it is critical to fulfil rigorous the separation assurance as well as the navigation performance criteria for the Unmanned Aircraft Systems (UAS). The (GNSS) Global Navigation Satellite System is susceptible to data deterioration or full signal loss owing to the multipath

effects, the interference, or the antenna obscuration in the dense metropolitan areas with towering buildings as well as the complex man-made structures. With the low-cost civilian GNSS receivers susceptible to the spoof attack, there has to be a danger of the jamming or even spoofing of the GNSS signals. To enhance the effectiveness of the UAS navigation within urban canyons, a variety of (SoOP) Signals of Opportunity strategies are being tested. The system performance characteristics are modelled using electromagnetic signals present in metropolitan contexts, such as analogue or even the digital radio, the analogue or even digital television, GSM, Wi-Fi, as well as the Code Division Multiple Access (CDMA)-based signals.Time of Arrival (TOA), (AOA) that is the Angle of Arrival, Received Signal Strength (RSS) as well as the TDOA are some of the implementation approaches for the exploiting SoOP. Additionally, new low-cost (NGS) Navigation and Guidance Systems may make use of SoOP approaches. No one source of the SoOP for the navigation works in all situations, thus a SoOP source must be chosen depending on the unique needs of urban area in which the SoOP is to be employed. In addition to hardware and software expenses, the (UAV) Unmanned Aerial Vehicle's power and weight restrictions are also taken into account while choosing acceptable SoOP signal sources. As a result, the low-cost as well as the low-volume integrated NGS solution supporting the trusted autonomous aerial operations has a significant potential to save infrastructure as well as energy expenses.

(Nellore & Hancke, 2016) Even while vehicle traffic has skyrocketed, infrastructure like roads and transit networks hasn't kept pace, making it difficult to effectively handle the influx of automobiles. This has resulted in a rise in traffic jams and traffic-related pollution, which has a negative impact on a variety of economies throughout the globe. Static control systems may cause traffic backups that prevent emergency vehicles from getting through. It has becoming more popular to use (WSNs) that is Wireless Sensor Networks to monitor traffic as well as prevent congestion. As a result of its fast data transmission, low-maintenance, small design, and lower cost, WSNs have become a popular choice among businesses and consumers alike. The use of Wireless Sensor Networks (WSNs) in traffic management systems has indeed been extensively studied for its ability to reduce average waiting times at junctions while also reducing traffic congestion. Real-time traffic monitoring is now possible because to RFIDs, WSNs, ZigBees, VANETs, infrared signals, cameras, and Bluetooth. Priority-based signalling as well as minimising vehicle AWT congestion are among the goals of this work. According to this study, the primary goal is to identify various traffic management strategies that may be employed to reduce congestion. For the purpose of avoiding congestion and prioritising emergency vehicles, the existing urban traffic control techniques are examined.

(Gandhi & Rama, 2015) The Subterranean Wireless Sensor Networks are intended to detect anomalous subsurface conditions and report them to base station based upon the application area. Multi-hop communication may be defined by distance between the nodes within the network. In several power optimization methods, the position of nodes as well as the distance in between the nodes is critical. However, the question of how to go from one place to another, no matter how far apart they are, still remains. We're looking for a way to locate and send data in underground locations that's as efficient as

possible. Nodes are first installed in the subterranean regions, all of which link to sink which is then connected towards the Base Station. Using GPS, Base Station can find all of the nodes and utilise them as the reference inside the event of a failure. To avoid having to go via intermediary nodes, sink node has what's known as an NTA that is a region where nodes may be identified directly by the sink node. The computational approach to achieving performance is supported by our research findings.

(Garg & Jhamb, 2013) A wireless sensor network (WSN) is a network made up of sensor nodes that are small wireless devices. As technology advances, so does the field of the wireless sensor networks (WSN). The remote environmental monitoring, the target tracking, and other uses for Wireless Sensor Networks are all possible. A variety of techniques have been developed in two dimensional for the location tracking, however in the actual world, we need all 3 planes for accurate estimate and more precision in localization WSN positioning on tough terrain necessitates 3D positioning algorithms that give improved accuracy and reduce estimate errors while also providing a real-world picture. In this survey, we'll go through the many ways that node may pinpoint its exact location.

(Egea-Lopez et al., 2005) Sharing information effectively is the current foundation of knowledge management. Multimedia information collecting as well as the system integration are major issues in current industrial operations, which need huge expenditures and the use of new technology. Wireless networks including GSM or even IEEE 802.11 are increasingly the focus of the industrial attention since they provide various advantages, like cheap cost, quick implementation, and the possibility to build new applications at the low cost. When it comes to wireless networks, although, they must meet industrial requirements such as scalability as well as flexibility; the high availability; immunity to the interference; security; as well as many more. All of these needs are thoroughly examined in this study, as are current wireless solutions as well as the possibilities for industry and indeed the existing wireless standard to fit.

3. GLOBAL POSITIONING SYSTEM (GPS)

(GPS) The global positioning system may be used to determine the location of sensors having pre-existing location data, which are referred to as anchors. The placement of sensor network will be determined by such anchors. It is possible to determine the exact location of the GPS satellite anywhere at given point in time. The difference between when GPS signal is obtained just at receiver and when the GPS signal is sent through the GPS satellite is used to calculate the distance between a GPS receiver on the ground and a GPS satellite. According to Capkun, the GPS downsides include high costs, inability to utilise it inside, and confusion due to tall buildings or the other environmental impediments. Power-constrained sensor nodes have a challenge when using GPS receivers because of the large power they use.

WSN the location identification or even the localization refers to creating a WSN map through finding every node's precise geographical coordinates. Manual localization or even GPS localization are also

viable options. While GPS Localization uses satellites, the Manual Localization relies on human input and computation. GPS has a limitation in which it can't be used in areas with extensive vegetation, mountains, or the other obstructions in the path of GPS satellites' view. For the localization, the reference node is used in the same way as the neighbour node as well as the anchor node (whose positions were previously known thanks to GPS) are. The x and y plane, where the x as well as y coordinates are same as true location of surface and the height is fixed, is where the majority of localization algorithms function. The 2D localization mechanism is less complicated and consumes less energy as well as time than 3D localization. It's indeed difficult to the estimate in hard terrains but delivers high accuracy in the flat terrains. Whenever the no. of nodes increases as well as anchor nodes remain present, it delivers an exact distance. In order to get the best results in 3D, an additional plane known as the z plane is needed. It has a high degree of accuracy and may be utilised in difficult terrain. It is possible to make a mistake in mapping of such predicted locations to the actual world since it includes all three planes. With the help of a 3D localization technology, this issue has been fully removed.

4. LOCALIZATION METHOD

Anchor nodes are used to identify the position of the node in 2D and 3D, respectively. Nodes may be classified in the followed ways:

- **Anchor nodes:** An Anchor or even Beacon node is a kind of node in a wireless sensor network (WSN).

- **Base Station**: Network information is sent to a PC using this particular anchor node. The remainder of AmI devices get data from such a PC, which is then sent out across the network. Above 50 different methods have been developed for the WSN localization to far. In order to avoid wasting time, we'll first categorise these algorithms into a few broad groups. Such algorithms may be categorised based on a variety of factors, such as.

1) Centralized versus distributed

2) Anchor based versus. Anchor less

3) Range based versus. Range free

1. Centralized Localization:

One single base station does all of the computations in centralised localization. Overhead and rising costs are the main drawbacks. Localization of the unknown nodes utilizing MDS-MAP is done by estimating the distances to each other using shortest route algorithm, although in minimal (LS) least square approximation approach, the distances to each other are estimated using RSSI data.

2. Distributed Localization:

In the Distributed Localization, every node calculates its own location inside the network by communicating with the nodes around it. It was possible to reduce error by employing mobile nodes as well as the acoustic energy for the distance estimate in the distributed method. The authors employed a Kalman filter-depends on distributed localization approach to identify the position of the WSN nodes.

3. Anchor Based:

To begin an algorithm, an anchor-based algorithms use the positions of an anchor nodes as well as resulting global coordinates to provide a beginning point for process. An average localization error seems inversely related to density of the anchor nodes in methods based on anchors. There are more precise reference points more and more anchor nodes there are. When more resources are added to these nodes, the price of system grows. So far, the methods used to determine distance have indeed been inaccurate. The use of the anchor-based localization is lately gained attention since global coordinates are more common than local coordinates throughout most applications.

4. Anchor Less:

This distance in between nodes is being used to create the local map of nodes with in anchorless schemes. Maps may be translated, rotated, or flipped so that they can be stitched into any coordinate system. The MDS-MAP technique can produce a local map of such nodes within WSN without anchors, but now at least 3 anchors are needed to construct the global map avoiding flip ambiguity problems. a global map.

5. Range-based:

Ultrasound sensors, for example, are used in this method to determine the distances between all of the nodes. It is possible to determine the exact location of the nodes that are not attached to anchors using triangulation methods. These methods provide a greater degree of precision, but they need more hardware, increasing both size and expense. Received Signal Strength Indicator (RSSI), (TOA) Time of Arrival, (AOA) Angle of Arrival, (TDOA) Time Difference of Arrival, Lateration as well as Angulation technique are the most often utilised.

6. Range-free

Using messages exchanged between anchor nodes and so-called "beacons," this method determines the location of the non-anchor nodes depending on the implicit information supplied by anchor nodes. In most cases, this data is made up of many components, such as the no. of devices that are connected in a hop or the radio coverage that a device has. They include Hop Count, APIT (for Centroid), as well as DV-Hop (for DV-Hop).

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5. CONCLUSION

In the wireless sensor networks, location is a critical consideration. Many scholars have put in a lot of time and effort, and a new algorithm has also been developed. It is of particular significance to real-world applications of the WSNs whenever the disparity between localizations in the 2-D place as well as the 3-D space is large. Compared to the 2D localization, 3D computation as well as the communication is far more powerful.

Wifi-based localization systems have gotten a lot of attention lately since GPS signals are hard to get by inside and in the certain open regions. Several datasets have indeed been developed in the last decade to allow academics to evaluate various methods of localization. It has been difficult to cover wide regions like parks wherein GPS remains unavailable as well as Wifi connectivity points are few because of the existing datasets. Existing datasets also concentrate only on obtaining user-provided Wifi fingerprint data. In our experience, no dataset contains RSS values gathered by the wireless (APs) access points.

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A Review on Recent Developments in Image Compression Techniques

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Abstract

In recent times, the digital image compression has indeed been the subject of a great deal of study. As a consequence, new and improved image compression technologies are always being developed. Using digital pictures efficiently requires the use of specialized strategies to limit the number of bits necessary for their display. In the field of the Digital Image Processing, it really has led to an immediate increase. We don't only focus on lowering the size of a picture, but we also focus on doing thus without sacrificing the quality or content of the image. Images may be compressed using lossy or lossless approaches. The study highlights the merits and downsides of both types of compression. A better understanding of the advantages and disadvantages of different compression methods may be gained through this investigation. Here, an overview of several picture compression algorithms is provided so that researchers may gain an idea of the efficient methods to be applied.

Keywords: Image Compression, Lossyand Lossless Compression

1. INTRODUCTION

As information technology advances, our everyday lives are increasingly filled with multimodal information like text, pictures, and audio, which presents significant storage as well as communication issues. So the data compression is extensively employed with in transmission, storage, as well as transfer

of digital information [1]. The number of photographs created is much more than the no. of other sorts of data. It's fortunate that photos include a lot of the redundant information, like geographical temporal redundancy, redundancy and the visual redundancy, among others. Furthermore, the human eye isn't affected by differences in picture quality or color contrast. There has been an increase in interest in picture compression as a result of such developments.

It is the process of compressing digital photographs by using data compression. Image data must be reduced in redundancy so that it may be stored or transmitted more efficiently. The storage as well as the transmission bandwidth needed to store and transmit the uncompressed multimedia data (graphics, music, as well as video) is enormous [2][3]. No matter how quickly storage density, the processor speed as well as the digital communication system performance improve, demand for the data storage space as well as the bandwidth continues to exceed the capabilities of currently available technology. Since the recent proliferation of the data-intensive multimedia-based online applications, compression of the signals and pictures has become an essential part of both storage and transmission technologies.

2. LITERATURE REVIEW

An image compression as well as the classification system employing multi-task learning has been presented for the visual Internet of Things (IoT) applications [4]. Generative Adversarial Networks (GANs) are discussed in detail, including the encoder, the generator, the discriminator, quantizer, and classifier to do picture compression as well as the classification at same time. Compression as well as classification is made possible by quantized latent representation, which is at the heart of the proposed architecture. With the perceptual quality, GANs are able to accomplish the low-bitrate compression as well as minimize data.

Also, several sequences forecast model was tested for lossless compression of 3D medical pictures (16-bit depth) using various input configurations including sampling strategies [5]. Authors want to figure out how to get the suggested Long Short-Term Memory model (LSTM) for achieving the high compression ratio as well as quick encoding-decoding speeds. Datasets obtained from several hospitals, representing various body segments as well as the scanning modalities, were used for experimental assessment (CT including MRI). When compared to earlier approaches, the new ology enables for simple parallelization, resulting in a decoder speedup of up to 37 per second. The trained models surpass well-known lossless approaches by between 17% and 12% when it comes to compressing 3D medical pictures without losing quality. For the lossless compression of the volumetric medical imaging, this will be the first work which focuses on the voxel-wise predictions.

The Entropy Minimization Histogram Mergence (EMHM) has been developed as a method to minimize the amount of the Gray Scales with Nonzero Pixel Populations (GSNPP) without sacrificing picture quality [6]. Paper demonstrated theoretically that now the entropy of such a picture is lowered following histogram merging, and that this reduction is maximized using EMHM. Since the Shannon's

first theorem states that the minimal the average code word length per source symbol is equal to entropy of source signal, the reduction in picture entropy is beneficial for an entropy encoding. Experimental evidence shows shown EMHM is capable of a 20% reduction in overall code length whereas still maintaining excellent picture quality when used with entropy coding methods like Shannon, Huffman, and the arithmetic coding. Another benefit of utilizing EMHM to preprocess photos is that it may increase performance of several traditional lossy image compression algorithms, including such Joint Photographic Expert Group 200 (JPEG2000), Better Portable Graphics (BPG), as well as other members of such Joint Photographic Expert Group (JPEG).

A new hybrid picture compression and encryption approach is presented in this paper, allowing compression within the encryption domain [7]. Permutation as well as the substitution is used to encrypt the data, which is grounded on Chaos theory. The shuffled picture is first compressed losslessly, and afterwards compressed bit stream is reassembled into 8-bit parts for the replacement step. Medical picture compression as well as encryption may benefit from the suggested method's lossless nature. Proposed methods have been tested and indicate that they are able to meet security requirements while maintaining compression efficiency of the lossless algorithms. Entropy encoder performance may be improved by using the data-to-symbol mapping approach using no. theory to the represent contiguous pixels as a single block of values. For Uncompressed Color Image Database (UCID) dataset, compression savings increased from 5.76% to 15.45 % when using this approach.

Compressed pictures are often used in computer vision applications. JPEG2000 and other well-known the image compression standards are commonly utilized [8]. The problem, though, is that they don't take into consideration the exact end-goal. Author presented unified network topologies for both picture compression as well as the 3D reconstruction grounded on previous work on the Recurrent Neural Network (RNN) based image compression. The picture compression provided by such the joint models is specifically designed for the job of 3D reconstruction. As comparison to the JPEG2000 compression, suggested models result in better 3D reconstruction performance. A wider variety of the compression rates may now be used to rebuild 3D models. The results also demonstrate that this could be done very rapidly and nearly at no extra cost in order to gain compression on the top of computation currently necessary to do 3D reconstruction work.

When using compression approach based on the Singular Value Decomposition (SVD), it is recommended that more than the half of smaller singular values as well as accompanying singular vectors be omitted SVD [9]. Despite the fact that such deleted regions include some noise as well as the fuzzy elements, they also provide valuable information for picture reconstruction. Singular Vector Sparse Reconstruction (SVSR) is a revolutionary lossy image compression approach that retains sparse representation data of the additional singular vectors to improve the compression ratio as well as the reconstruction quality of the SVD-based image compression. The singular vector is treated as a signal as well as expressed sparsely using sparse sampling depending on the examination of singular vector's features. As a result, the suggested approach has the compression ratio that really is around 70% more than the typical SVD method. Proposed SVSR technique outperforms other image compression

algorithms in terms of compression ratio as well as the reconstruction quality when tested on a variety of picture datasets.

Generative Adversarial Block Truncation Coding (GABTC) is the compression models with many variances have been presented [10]. Multi-layered Deep Neural Networks (DNNs) using Generative Adversarial (GA) neural models are used to build GABTC. The use of both the GA models as well as the Block Truncation Coding (BTC) concepts dramatically improves block building and restoration. Varieties of E-Learning pictures (Color and Grey Scale) as well as the compression quality assessments are used in this study to evaluate overall the model complexity as well as the efficiency.

Here, Author developed a novel approach of compressing Remote Sensing Images (RSIs) that is influenced by standard compression methods and uses the Symmetrical Lattice Generating Adversarial Network (SLGAN) [11]. Numerous symmetrical encoder-decoder lattices are being used to develop a generator that first generates deep representative codes of pictures as well as then decodes them, as shown in the figure. Discriminators are built for every encoded as well as the decoded lattice pair to undertake adversarial learning. The cooperative learning approach is suggested to provide training jointly pairs of the symmetric lattices within generator whenever the multiple discriminators are employed for all lattices. An Enhanced Laplacian of Gaussian (ELoG) loss is used to train SLGAN to improve edges, the contours, and the textures within decomposed RSIs. SLGAN outperforms other current state-of-the-art algorithms in experiments using panchromatic pictures from GF2 satellite.

The Sparse Flow Adversarial Model (SFAM) is a new way for compressing data that has been presented [12]. For robust compression, it leverages an advanced the generative framework that learns an efficient and reversible mapping across picture distributions. The sparse adversarial map is also incorporated into SFAM to limit the SFAM to create more sparse features for optimal compression purposes. In order to demonstrate the method's efficacy and resilience, several tests are carried out on various datasets. SFAM, on the other hand, requires just a single training set and performs well on three separate datasets, demonstrating the resilience of the algorithm as described.

3. TYPES OF IMAGES

Images may take up a lot of space in Random Access Memory (RAM) as well as storage when they're in their raw form. Streaming a picture across the network may use a lot of bandwidth if indeed the image isn't compressed properly. The followed are the most common types of images:

1. **JPG:** JPG is best suited for the continuous tone pictures that include a large number of colors, such as photos [6]. JPG reduces the amount of data stored in photographs by removing the types of details that the human eye is unlikely to detect. It saves data in the form of 24-bit color images. JPG has a configurable compression level. Even at great magnification, the human eye is unable

to perceive any difference between the original and the compressed picture. More than about 20 compression factors are generally acceptable.

2. **Tagged Image File Format** (**TIFF**)**:** The picture file format which can be used for both lossless and lossy compression is TIFF. For the 24-bit as well as 48-bit totals, it typically stores 8 or even16 bits per color (red, green, blue). The file also contains information about the methodology used to save the images. A lossless picture storage format, TIFF is the almost solely employed for this purpose. There are no online images that employ TIFF files. TIFF files are large and, more crucially, are not visible in the majority of web browsers.

3. **JPEG:** A good approach to save the 24-bit photographic pictures, which are often used in the imaging as well as the multimedia applications, is to utilize the JPEG. A 24-bit JPEG picture on the Video Graphics Array (VGA) display looks better than an 8-bit (256 color) JPEG image on the same device and is at its best whenever shown on 24-bit display hardware (that is now the quite inexpensive). Color or even the gray-scale continuous-tone pictures of real-world objects, such as photos, video stills, or any sophisticated graphics resembling natural scenes, may be compressed using JPEG. It is unreasonable to think that JPEG would effectively compress animations, the ray tracing, line drawing, and other types of vector graphics such as black-and-white texts. Furthermore, while JPEG is already being used to the compress motion video, the standard does not provide any specific provisions for this use.

4. **Graphics Interchange Format (GIF):** Useful for the pictures with fewer than 28 colors, gray scale graphics, including black as well as white text is the GIF. GIFs may only be used on pictures with the 8-bits per pixel or even less, that implies 256 or even less colors are supported. Most color pictures have a pixel count of 24 bits. The picture must first be converted from the 24 bits to the 8 bits before it can be stored in GIF format. GIF seems to be the lossless file format for images. As a result, only pictures with 256 colors or less may be considered "lossless" in the context of GIF. GIF might lose 99.998% of the colors in a beautiful, true-color picture. Since each picture may only have 256 colors, it is not suited for photographing photos.

5. **(Portable Network Graphics) PNG:** Images may be compressed without sacrificing quality by using the PNG file format. PNG files may often compress images by 10% points – 30% points more than GIF files. When the picture gets compressed, it enables for trade-off between the file size as well as image quality. More colors and lower files are also advantages of this method. Partial transparency is also supported in PNG. For example, fades as well as the antialiasing for such text might benefit from the partial transparency.

6. **BMP:** Windows' Bitmap also represented as (BMP) file type is used to store graphical files. BMP files are often huge since they are uncompressed, but their simplicity, widespread usage, and compatibility with Windows programs make them a worthwhile trade-off.

7. **RAW:** When it comes to the digital cameras, RAW consists of a variety of raw picture formats (output). For the full-size processed photos from same cameras, this format often uses lossless or almost lossless compression, resulting in substantially reduced file sizes than TIFF. Unlike TIFF files, raw images do not follow any standards and are four times larger. The drawback is that every other manufacturer's RAW format is distinct, necessitating the use of such proprietary software in order to examine the photographs.

4. PRINCIPLE OF IMAGE COMPRESSION

The nearby pixels throughout most photographs are correlated, which means that now the information they carry is redundant. The first step is to identify a less connected visual representation. Redundancy and relevance reduction constitute two of the most important aspects of compression. In order to reduce redundancy, signal source (image or even video) must be cleaned up. Reducing the signal's irrelevance eliminates sections of signal that would not be detected by signal receiver, such as the Human Visual System (HVS). There are three main forms of redundancy:

A. Coding Redundancy: An information or sequence of events may be represented by a set of the symbols (texts, numerals, bits, etc.) known as a code. Using a series of code symbols, known as the code word, every item of the information or event is encoded. Every code word's length is determined by the no. of the symbols it contains. Most of the 2-D intensity arrays utilize 8-bit codes, which include more bits than the necessary to express the intensities in such arrays' data.

B. Spatial Redundancy and Temporal Redundancy: Most of the 2-D intensity arrays include spatially linked pixels; therefore, information is redundantly represented in correlated pixels' representations. Temporally connected pixels in the video sequence also share information.

C. Psycho-visual Redundancy: It is indeed a redundancy comparable to the different sensitivity of individual eyes to everyone picture inputs. As a result, it may be sufficient to exclude some less important information from our visual processing.

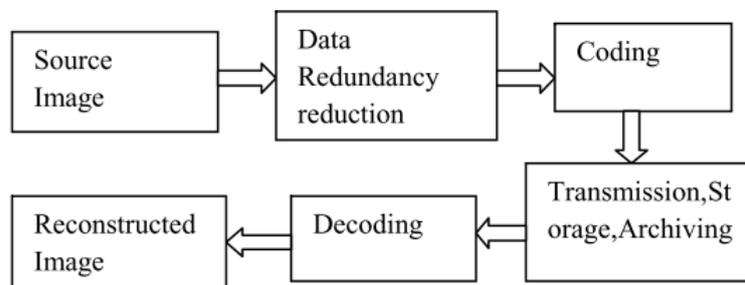Compressing a picture typically involves the following steps:

Figure 30 Steps of Image Compression [13]

- To get a desired result, it is necessary to provide the target image's Rate (number of bits available) as well as Distortion (permissible mistake).

- Classifying the picture data according to its significance

- As little distortion as possible is achieved by dividing all available bit budget throughout such classes.

- Use bit allocation data generated in step3 to quantize every class independently.

- Use the entropy coder to encode every class independently and save the results to a file. Reconstruct the picture from compressed data is generally a quicker process than compressing it. It's a lengthy process.

- An entropy decoder may be used to read inside quantized data from file into memory. (Step 5 is reversed).

- Reduce the data's precision by de-quantizing it. (Step 4 is reversed).

- Create a new picture. (Step 2 is reversed)

5. IMAGE COMPRESSION TECHNIQUES

Various compression techniques have indeed been developed during last 2 decades in order to meet the primary issues of digital image. It's possible to divide such compression techniques into two basic categories: the Lossy Compression as well as the Lossless Compression [13] [14].

1. **Lossy Compression methods**

Most lossy compressors (Fig 2) comprise 3-step algorithms, all based on the three forms of redundancy described above. The first step is a transformation that removes the redundant information between pixels in order to effectively group data. It is then quantized to remove any the psycho-visual redundancy so that the information may be represented with as little bits as possible. Quantized bits are therefore the resourcefully encoded in order to benefit from either coding redundancy or reduce the file size further.
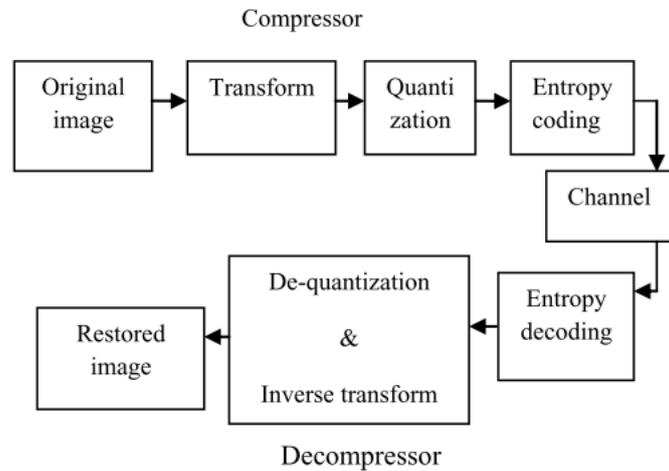
Compressor

```
Original      Transform      Quanti       Entropy
image                        zation       coding
```

Channel

```
De-quantization              Entropy
Restored         &           decoding
image
Inverse transform
```

Decompressor

Figure 31 Lossy image compression [15]

It is the mapping from a collection of the values to a single value which is called quantization. Quantization may be divided into two basic categories: scalar as well as vector. On every value, Scalar Quantization (SQ) applies a different to one mapping. Utilizing a few proximity dimensions, Vector Quantization (VQ) substitutes each input pixel block with index of the vector inside the codebook. When a decoder gets an index, it goes to codebook to find the corresponding vector.

Photos and other natural pictures may benefit from lossy compression algorithms since they can be used to reduce the bit rate while still maintaining a high level of fidelity.

Transform coding: Lossy picture compression is often achieved via the use of transform coding. This technique uses a reversible as well as linear transformation to turn the original picture into a collection of transform coefficients. After that, coefficients being quantized as well as sequentially coded inside the domain of transformation. In a variety of contexts, transforms are employed. Distinct Karhunen-Loeve Transform (KLT) depending just on Hoteling transform is perhaps the most beneficial for its own information-packing capabilities but is typically not practical because it is difficult to figure out. Additionally, the Distributed Fourier Transform (DFT) and the Discrete Cosine Transform (DCT) are quite accurate in their estimation of KLT's energy-packing efficiencies. Since DFT coefficients require almost twice as much storage space as DCT coefficients, DCT is the most common practical transform system being used today.

DCT: For picture and audio compression, the DCT is a popular choice of algorithm. Consider JPEG images. Digital Signal Processing (DSP) is used to transform data into the sequence of the cosine waves with varying frequencies. While Fourier Transforms employ complex numbers as well as sine including cosine functions, DCT use just real coefficients as well as Cosine functions. Because fewer functions are required to the approximate a signal using Cosine functions, they are far more effective for the signal compression. In both the Fourier as well as the DCT, data is transformed from a spatial to the frequency domain and then back again.

Discrete Wavelet Transform (DWT) In the DWT, each picture is represented as the sum of a number of wavelet functions, each with a distinct location as well as the scale, referred as the wavelets. The hierarchical filter structure is often used to construct discrete wavelet transform. The pre-processor generates picture blocks to which this filter is applied. The approximations at level j+1 as well as the details in 3 dimensions are decomposed into four components using two-dimensional DWT (horizontal or vertical or even diagonal).

The Fractal Compression (FC) It is based on the notion that some sections of a picture resemble the other parts of the very same image inside the FC process. Its geometric forms that are transformed into "fractal codes" using fractal algorithms that are then utilized to decode the encoded picture. When a picture is transformed into the fractal code, it loses its connection to a certain resolution; it is now resolution-agnostic. Pixel-based compression introduces artifacts and reduces sharpness when resizing a picture to fit a smaller screen.

2. Lossless Compression Methods

Figure 3 shows a typical lossless compressor method. The first step is to convert the original picture to a format that reduces the amount of duplication between pixels. Using an entropy encoder, we remove coding redundancy inside the second phase. When a lossless compressor is used, lossless decompressor performs an exact opposite function.
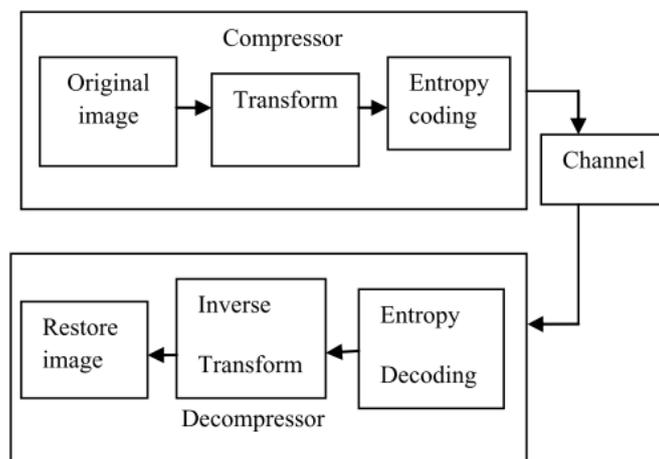

Figure 32 Lossless image compression [15]

When data is replaced by the (length, value) pairs, "value" is indeed the repeating value as well as "length" is indeed the repetition count. Since a lengthy run of such a value inside a gray-scale picture is rare, this strategy works exceptionally well when compressing bi-level images. The gray-scale picture may be broken down into the bit planes as well as compressed one bit plane at a time. One type of the run length coding includes effective run-length coding.

Lossless predictive coding: Every pixel's value may be predicted using the values of the neighboring pixels, which is called lossless predictive coding. A prediction error rather than the actual pixel value is stored in each pixel. Less storage space is needed to retain minor mistakes since they're so little in comparison to real value.

Differential Pulse Code Modulation (DPCM): It is possible to compress lossless images using DPCM that uses predictive coding. The Lossless JPEG compression is built on top of it. The adaptive prediction is indeed a modification just on lossless predictive coding which separates the picture into the blocks as well as calculates equal prediction coefficients for each block individually to achieve excellent prediction performance. It may also be used in conjunction with another scheme to create a more efficient coding method.

Hierarchical INTerpolation (HINT): It is a subsampling-based coding technique that allows for many resolutions to be encoded simultaneously. With a low-resolution picture, it starts by interpolating pixel values to produce higher resolutions. The initial low-resolution picture and the errors between the interpolation values as well as the true values are saved. The low-resolution picture as well as error values may both be recorded with fewer bits than that of the real image, therefore compression is possible.

Laplacian Pyramid: One of the picture compression methods created by Burt as well as Adelson is the Laplacian Pyramid. In order to achieve a two-fold reduction in pixel count at each scale, it down samples the original picture and creates successively lower quality versions of the original. A complete picture reconstruction is possible by storing and using the changes between successive resolution versions, as well as the lowest resolution image. However, since the quantity of the data values is indeed improved just 4/3 of the real picture size, it cannot achieve a higher compression ratio.

6. RECENT DEVELOPMENTS IN IMAGE COMPRESSION TECHNIQUES

Arithmetic Encoding: The lossless encoding method known as "Arithmetic Encoding" compresses data by representing it as discrete intervals on a number line ranging from 0 to 1. Essentially, it separates the 0-1 range into the smaller intervals, each corresponding to a different probability for each of the message's symbols to appear. The first symbol then picks an interval that is subdivided into the smaller intervals by a second symbol in the chain. Such intervals may be selected using a next input symbol. With each symbol, the specified range narrows, allowing any no. in the final range to constitute a message. Increasing the accuracy of the input code by one bit increases output code precision by one bit. In terms of symbol coding, AC is by far most efficient way. IBM created the Q-Coder, a variant on the arithmetic coding, in the late year 1980s.

Entropy: The smallest dataset required to transmit a given quantity of information is called entropy of dataset. Entropy coding methods include Huffman coding, Lempel-Ziv (LZ) coding, as well as the arithmetic coding. Entropy Coding employs a technique known as the redundancy to reduce file size. Repetitive characters are written down, and rather than reusing them at every pixel, the locations of such

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pixels are noted as well as they are all marked as having the same sign. So-called the non-lossy coding prevents data loss.

Lempel–Ziv–Welch (LZW) Coding: Repetitive substrings are replaced in the input data by references to previous occurrences of strings using LZW Coding LZ77 as well as LZ78 are two methods of dictionary-based compression. With a sliding window, LZ77 finds previously encountered substrings as well as uses the (position or even length) pair to refer back to the original. Substrings are replaced using index within dictionary that is dynamically constructed from the input file. Grounded on such concepts, LZW is indeed a technique for compressing data.

Huffman coding: The Huffman coding is indeed a data compression technique that uses entropy encoding. For example, Huffman Coding uses a variable length code, wherein the short code words are given to more often occurring values as well as the longer code words being assigned to the less commonly occurring values. If you compare the Huffman algorithm to others, it produces the fewest redundant codes. Compression systems including, MPEG2, JPEG, H.263 or H.264 have all employed Huffman coding to great success.

Quarter-tree decomposition: It is possible to decompose a picture using Quarter-tree decomposition technique, although the compression ratio isn't really particularly high. However, extracting the interactive function that is so crucial towards the quality of such reconstruction is challenging, and large calculations are also required. Fractal coding as well as the Quarter-tree decomposition both use image decomposition as their foundation.

It's easy and quick to figure out how to use the Quarter-tree decomposition picture compression technique. In addition, it works with images that are based on the data in the picture. Rectangle Segmentation and Sparse Matrix Storage (RSSMS) compression technique, that considers neighboring pixel spots meeting the consistency criteria to be one picture block, this problem may be remedied in one step. As an added benefit, the picture block may be rectangular rather than square, which is constrained by 2n. This allows for a smaller file size while maintaining a higher compression ratio. Combining the storage technique of the sparse matrix with image compression may increase the compression ratio even more. Images that have been compressed using another means may still benefit from correlating them. However, the compression ratio is limited, particularly for intricate photos.

7. EVALUATION OF COMPRESSED IMAGE

The quality of a picture may be assessed using a variety of metrics, including Peak Signal to Noise Ratio (PSNR) as well as Mean Squared Error (MSE). This section focuses on a variety of factors. The MSE measures the sum of the squared differences between the original and compressed images.

$$MSE = \frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} (x(i,j) - y(i,j))^2$$

The image's maximum error as compared to its compressed counterpart is used to calculate the PSNR:

$$PSNR(dB) = 10log_{10}\left(\frac{255^2}{MSE}\right)$$

In this case, i(x, y) represents the real picture, z(x, y) represents the estimated version (that is really a decompressed image), whereas M, N represent images' dimensions. To put it simply, a lower MSE indicates a lower level of error, which in turn results in a higher PSNR number.

8. LOSSY vs. LOSSLESS COMPRESSION

Using lossy techniques may reduce the size of the compressed file while still matching the application's requirements, which makes them preferable to lossless ones in certain situations.

Compression of sound, pictures, and videos is often done using lossy techniques. When it comes to compressing files, lossy video codecs are virtually always superior to their audio as well as still-image counterparts in almost every case. At 10:1 audio compression, the quality is unaffected; at 300:1 video compression, the quality is noticeably reduced. Similar to compressed music, lossy-compressed still photos may be reduced to a tenth of their original size while maintaining the same image quality.

User acquisition of lossy compressed files (e.g. to save download time) may result in a file that is substantially different from the true at a bit level, but that is unrecognizable to a person's senses for most practical uses. For instance, the fact that perhaps the human eye could only see certain light frequencies is taken into account in several ways. To understand how sound may be drastically compressed without affecting its perceived quality; psycho-acoustic model is used to explain how this occurs. Compression artifacts are defects that may be seen or heard as a result of lossy compression.

Statistical redundancy is often used in the lossless compression methods to replicate sender's data more succinctly but still perfectly. Because almost all the real-world data contains statistical redundancy, the lossless compression is possible. Because the letter 'z' is less prevalent than the letter 'e' in English literature, it is less likely to follow letter 'q' than just the letter e.

It's possible to compress data using the lossy data compression if you're okay with some quality being sacrificed. It's possible that, for instance, a viewer of an image or a television show would not realize if some of the most important aspects of the scene are missing. Likewise, a listener may mistakenly believe that two audio recordings are the same despite the fact that one lacks information that the other has. It is possible to reduce the size of a photo, video or audio file using the lossy data compression methods.

When it comes to data compression, lossless techniques preserve the original data, whereas lossy methods sacrifice some data to achieve a greater level of compression. A few files will never be able to be compressed using the lossless data compression techniques, and this is true for all algorithms that attempt to compress data that has no identifiable pattern. When trying to the compress data which has

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previously been compressed or data which has been encrypted, even an expansion is almost always the consequence.

It's also possible that the lossy data compression would get to the point wherein compressing again doesn't work, but some really lossy technique, such as one that constantly eliminates the final byte of each and every file, would always compress file until it's empty.

9. CONCLUSION

Compression of images has been an increasingly popular and important area of study in recent years. In the last several years, a number of academics have come up with a variety of methods for compressing images. Here, the most common compression methods and quality assessment factors are discussed. As a result, we can say that compression may be achieved via the employment of two distinct sorts of methods. It is possible to get a high compression ratio using lossless techniques, but the quality might not be as good as with lossy methods. If you use lossy compression methods, you may get a higher compression ratio although at the expense of picture quality.

The image compression is indeed a trade-off between the compression ratio as well as the peak signal to the noise ratio, however better and more efficient compression-decompression algorithms are still needed in the industry. Research in this field has been significant, but new ways as well as the more efficient algorithms may be developed to meet ever-increasing demand for the low-bit rate compression methods. According to the analysis, this area will continue to pique the attention of scientists for some time to come.

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A-State-Of-Art Review on The Advances and Applications of Artificial Neural Networks

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Abstract

In field of Artificial Intelligence (AI), Artificial Neural Networks (ANNs) have been widely accepted as a cutting-edge computing technology. There is a lot to learn about AI and ANN in this study, which focuses on modern applications of these technologies. Using a combination of Neural Networks (NNs) and fuzzy logic, it hopes to improve the data's capacity to be interpreted. The past two decades, ANNs have been intensively explored and deployed as a major soft-computing technique. Pattern recognition, data analysis, control, and grouping are most common uses of NNs in problem solving. There are several advantages to ANNs, including rapid processing rates and the capacity to learn from examples. Research in this article focuses on the newest applications of NNs and offers an overview of the sector in which NNs are utilized. It explores how NNs play a key role in several fields, such as AI.

Keywords: Artificial Neural Networks; Artificial Intelligence; Neural Networks, Newest Applications

1. INTRODUCTION

As a branch of computer science, AI aims to build intelligent machines that can think and act like people. By copying the structure and behavior of the real brain, an ANN mimics its ability to learn.

AI research has given rise to the phrase "neural network," which refers to models developed to better comprehend and simulate the functioning of the human brain. In computer science, AI is a branch that focuses on the construction of intelligent machines, systems that can think and act like people. The ANN has shown itself to be a superior option for handling complicated issues in several fields in the last few years. The ANN has three layers: input, hidden and output. Various inputs are processed by hidden layers for creating desired output from them. NN efficiency is dependent on the learning method used for pattern recognition. An answer is provided for every input in every case of supervision learning, while in unsupervised learning, the correct answer is derived from prior assumptions and inferences; but it is unknown to the system in hybrid learning, which combines the best features of both supervised and unsupervised learning [1] [2].

1.1. ANNs

As extensions of mathematical models of organic nerve systems, ANNs have been established. After McCulloch and Pitts (1943) introduced simpler neurons known as connectionist models, there was a first wave of interest in neural networks. The ANN is collection of extremely basic processors (referred to as "Neurons"), each of which may have a (little) local memory. Local data and inputs received through unidirectional connections are all that the units have access to. There is a method for computing the output signal that is transmitted to other network units, as well as a rule for summing the signals that are flowing into the unit [3]. Calculation rules, according to Callen, are referred to as the activation function.
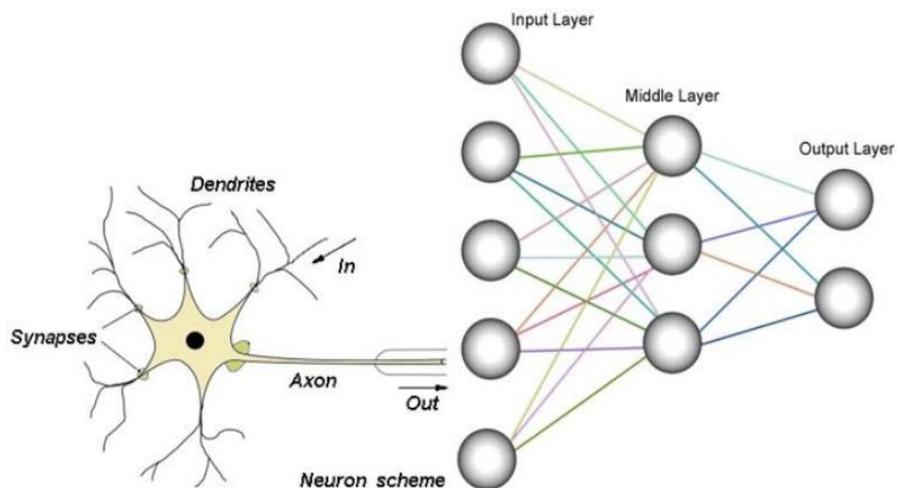

Figure 33 Biological vs. ANNs

Figure 1 depicts the three layers of a neural network. There are three layers: an input layer, a hidden unit that does computations based on functions supplied, and an output layer from which we get our

results. The synaptic weights between neurons in NNs are how knowledge is stored. Until the output data is created, input data is sent through each layer of network. For example, if the output of a multilayer perceptron network is different than desired, an error is computed and transmitted through the network in reverse. As the mistake spreads, so do the synaptic weights. As of Late a silicon-based electrical network that is modeled on the human brain's workings and shape is seen in Figure 1. ANNs are so strong because they are able to generalize. When it comes to the human brain, it is able to recognize and retain patterns. In the same way, the NNs created can retain and learn patterns.

1.2. NN ARCHITECTURE

There are many different designs regarding the neural networks. Different aspects like the number of layers, learning methods and activation functions are all unique to each. NNs may be built in two basic ways:

- **Feed Forward NNs**

This kind of network allows just one path of signal flow, from input nodes to output nodes via hidden nodes. In feed forward neural networks, there is no feedback or looping. In these networks, perceptrons are structured into layers, much as in any other neural network. If you don't link hidden layer with either input or output layer, it won't work. It's dubbed a "feed forward NNs " since information is sent from one layer to other.
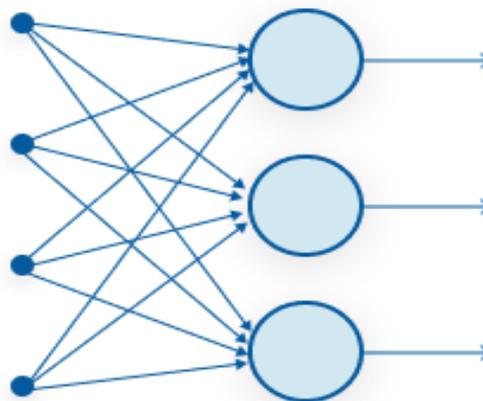

Figure 34 Feed forward NN

- **Feedback NNs**

When loops are included into feedback NN, signals may flow in both ways. Feedback signals are travelling from one layer to the next in computer architecture. As their name implies, feedback or recurrent networks are constantly changing their state until a sufficient answer is received.
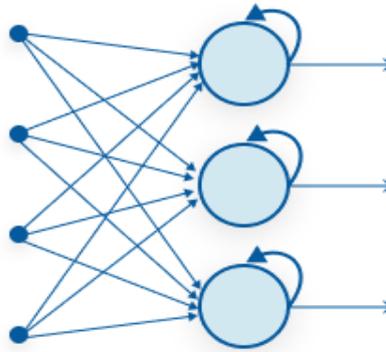
Copyright Content

Figure 35 Recurrent/Feedback NN.

- **Feed Forward Back Propagation NN**

Basically, it's combination of two different kinds of NN. Back propagation refers to process by which networks learn to identify patterns, while feed forward refers to the technique by which the networks learn to recognize patterns. Essentially, "feed forward" defines how NNs learn and remember patterns.
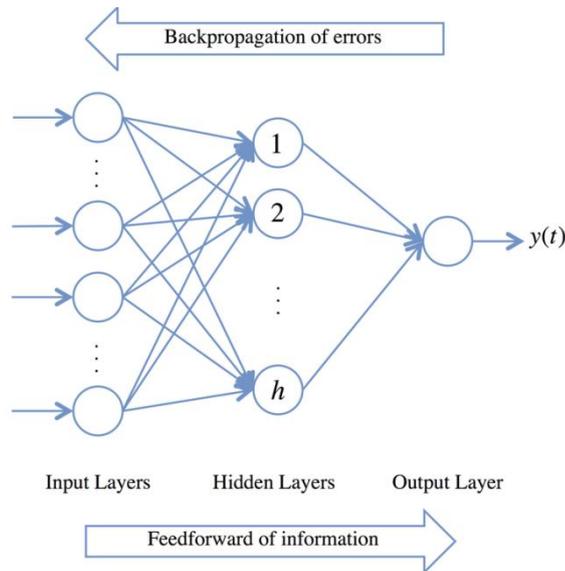

Figure 36 Feed forward back propagation NN

In order for back propagation to operate, network must be given input and the intended output. Errors are calculated by comparing expected results to actual results. Back propagation is a technique in which the NN's weights and input threshold are adjusted to reduce the computed error.

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1.3. Activation Functions

The NN's behavior is strongly influenced by the activation function. Weighted inputs are combined with activation function to generate output response. The rate at which a cell fires, is abstracted by the activation function. Most NNs use activation functions to transfer the output of layers. The output of a NN is scaled by activation functions to the suitable range. For neurons in similar layer, same activation functions are employed for their activation.
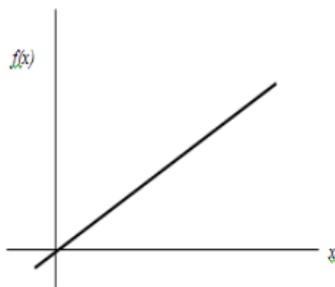
Activation functions that are often used include:
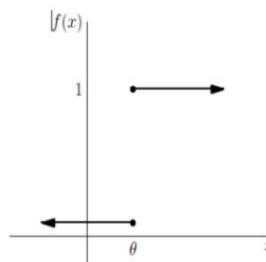
- **Linear Activation Function:**

In single-layer networks, these functions are the most prevalent. In order to get the identity function, we use Equation

F(x) = x for all x

As can be seen in Figure 5(a), the output has a constantly changing value.

| (a) | (b) |

Figure 37 (a) Identity activation function (b) Binary Step Activation Function

- **Binary Step Activation Function:**

Equation depicts the binary step activation function mathematically.

F(x) = 1 if x ≥ θ = 0 if x < θ.

Where, θ indicates threshold value. Figure 5(b) shows its variation of output of function with input values.

- **Log Sigmoid Transfer Function:**

0 to 1 are the possible values returned by this function. Using Equation, we can determine the final output.

$$\text{Logs }(n) = \frac{1}{1 + \exp(-n)}$$

- **Hyperbolic Tangent Sigmoid Activation Function:**

Scaled between -1 and 1, this transfer function returns a result. The derivative of the hyperbolic tangent function makes it suitable for gradient descent-based training. Equation is used to determine the final result.

Networks with just one layer are the most usual place to find these functionalities. Equation represents the identity function.

$$n = \frac{2}{(1 + \exp(-2*n))} - 1$$

2. APPLICATIONS OF ANNs

ANNs may be used in variety of fields, including medicine, business, agriculture, and more. For example, the outcomes are more accurate and quantifiable and error-free when employing ANNs. There are a slew of issues to contend with, including ANN training, implementation, NN interpretation, and the gathering of pertinent data. Table 1 provides a literature review of the numerous sectors in which ANNs have been used.

Table 3 Applications of ANNs

Area	Study	Results	References
Automotive	Prediction of engine performance, combustion and emission characteristics.	ANN models are designed to reduce error based on the Empirical Risk Minimization Approach (ERM).	[4]
Chemical industry	Production of bio-based chemicals or a bio refinery using ANNs	Biochemical processes, such as fermentation and anaerobic digestion, may benefit greatly from real-time, dynamical use of bio-chemical methods for quick parameter observing and management.	[5]
Pavement Engineering	Monitoring and maintenance. And pavement design, construction, inspection	Many of obstacles associated with using ANNs in pavement design and cost analysis are due to a lack of adequate data collecting and	[6]

		parameter optimization, as well as difficulties in model transferability and low-cost data annotations.	
Low-energy buildings	ANN -based smart aerogel	The design and operation of aerogel glazing systems may enhance multi-criteria performance (such as thermal, acoustic, and visual performance), raise economic competitiveness with optimum geometrical design parameters, and give realistic guidance for dependable system operations.	[7]
Plastic Waste	Plastic pretreatment, plastic type, mixing circumstances, percentage of addition, and bitumen characteristics were analyzed in this study.	Plastic waste in bitumens that may be used in both mild and hot regions. There should be no more than 5% added, so that the bitumen's workability does not suffer.	[8]
Photovoltaic cells	photovoltaic fault detection and diagnosis	The claimed success rate for categorization is more than 90%. Furthermore, comparisons of the suggested model's performance with those of other machine learning algorithms have shown its superiority in several circumstances.	[9]
Wastewater Treatment	ANN modeling of wastewater treatment and distillation make use of membrane methods	The employment of ANN approach instead of more traditional methods based on transport-based models has shown to be very effective. The ANN models that have been built may be utilized to simulate, control,	[10]

		and optimize membrane process activities.	
Composite Materials	In the context of composite materials constitutive modeling ANN prototypes provide a number of advantages and drawbacks.	It seems that modern endeavours in the modeling of composite materials have shifted in the direction of the use of ANN prototypes in combination with physical tests and data science, creating an innovative new hybrid system that takes use of all the potentials of each component.	[11]
Solid Waste	ANN framework, algorithm, data set partition, input parameters, hidden layer, and performance evaluation	ANNs have been discovered to be extensively used in waste generation and technical parameter prediction and shown useful in tackling meso-microscale and micro scale concerns, involving waste conversion, emissions and microbiological and dynamical methods. Most studies used a sample size of 101–150 due to the difficulties in collecting data on numerous solid waste-related concerns. Data should be divided into three sets: Training, Validation, and Testing (TVT), with the training set accounting for around 70% of total data.	[12]
Micro grids	Distributed generation, scheduling, power sharing, supervisory control and optimization of micro grid distributed generating sources.	The non-linearity and parallel processing capabilities of (NNs), as well as other positive properties, make them well-suited to help MGs overcome the needs and obstacles they meet in the traditional power grid.	[13]

Audio signals	Classification of audio signals	For vast data sources, automated categorization method utilizing AI is more feasible than the manual categorization. Several kinds of AI estimations have been anticipated in writing like K-Nearest Neighbors (KNN) Principal Component Analysis (PCA), Gaussian Mixture Model (GMM), and Hidden Markov Model (HMM) etc.	[3] [14]
Surface Coatings	ANN modeling and optimization of surface coating process parameters	An ANN capable of performing complex nonlinear processes is the ideal choice for future studies on surface coating approaches.	[15]
Accuracy measurement	Extraction of Interpretability-accuracy balanced Rules from ANNs.	Approaches include Decomposition Approach, Pedagogical Approach, and Eclectics Approach, all of which examine the relationship between input and output, such as by calculating a gradient.	[16]
Solar Energy	Instrumentation for measuring solar irradiance and estimating solar power production based on this data	The appropriate control and correction of the solar irradiance equipment may increase predicting accuracy to some extent. This suggests that minimizing apparatus faults that determine the weather parameter might enhance solar forecasting accuracy.	[17]
Solar Energy Systems	prediction of different SE appliances working, like solar collectors, solar stills, solar supported heat pumps,	It is possible to forecast and improve the performance of solar energy equipment using ANNs.	[18]

	solar dryers, solar air and water heaters, solar cookers, and PhotoVoltaic/Thermal (PV/T) systems.		
Health Care	health care organizational decision-making	In setting of complicated, unstructured, or restricted information, ANN-based solutions applied on the mesa- and macro-level of decision-making reveal the potential of its usage. Ethical, social, and economic considerations may need to be better understood before ANN can be successfully implemented and adopted in health care organizations. PLOSONE	[19]
Modularization	ANN modularization methods	Modular Neural Networks (MNNs) are NNs that represent the perceptions and principles of modularity	[20]
Environment	Management of odors in the environment using an ANN—measuring and describing, controlling and treating—as well as continuously monitoring.	The robustness of ANN outcomes is shown in terms of strong correlation (R2), decreased residuals (RMSE) and excellent classification scores when compared to conventional statistical approaches. ANN was also able to adapt to the data set, particularly when it came to developing a well-defined pattern despite the presence of background disturbances.	[21]
Forecasting	Time series forecasting	Despite the fact that several research has examined the use of	[22]

		NN models for forecasting, only a few have developed novel models that take into account theoretic support and a systematic approach while building the model.	
Chemical engineering	Application of ANNs for Catalysis	The study illustrates how ANNs may be used well for catalysis estimate, the design of novel catalysts, and the sense of catalytic structures.	[23]
Medical	Lung Cancer Detection	Detecting lung cancer early is crucial because treating lung cancer becomes progressively difficult as the disease progresses and because the endurance rate of lung cancer patients in later phases is quite poor. The ANN model is especially beneficial in this scenario.	[24]
Food	analytical chemistry and specifically of food control.	Their adaptability and capacity to deal with extremely non-linear patterns in the data allowed for considerably excellent outcomes in many situations for which the employment of classic chemo metric approaches failed.	[25]
Commercial Hardware	training and implementing the ANN within a computer	It represents model and monitor the temperature inside of a kiln for the ceramic industry and evaluation of ANNs and neuro-fuzzy methods utilized for developing and operating a real system.	[26]
Medical	ANNs are being used in the fields of cancer, critical care,	NNs have a place in clinical verdict support, but their	[27]

	and cardiovascular medicine to improve clinical diagnostics, prognosis, and survival analysis outcomes.	attainment depends on a number of factors, which include improved combination with clinical protocols, an understanding of the requirement of combining various patterns to produce the easiest and most universal overall perceptive structure, and a willingness and ability to estimate this in a real clinical environment.	
Composite Materials	Fiber-reinforced polymeric composite material mechanical behavior simulation modeling.	Further study is needed to improve the prediction capacities of NNs, such as finding the right design, number of hidden layers, and number of neurons in each hidden layer, among other things.	[28]

3. CONCLUSION

As a general solution for many different issues, including control and pattern recognition, ANNs have gained popularity. Approaches based on NNs have a lot to offer the computer industry. As a result, they are very adaptable and strong. The inherent processes of a job do not need the creation of an algorithm in order to carry out that task. Parallel design makes them ideal for real-time applications because of their rapid reaction and calculation speeds. Computers that can think like humans are the ultimate objective of AI. The AI issue over the past decade has academics attempting to bridge the gap between human and AI.

In the future, AI will strive to create machines and computers that are much more advanced than they are now. It is predicted that robots with basic common sense, comparable to human humans, would be produced in the future, but only in specified sectors. Furthermore, it is anticipated that future intelligent robots would execute human-like mental activities such as learning by doing, learning by rehearsing, cognition, and perception.

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A Comprehensive Review on Recent Developments in Pattern Matching Techniques

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Abstract

Several different design methodologies have been used to build pattern matching procedures for network security. Global Positioning Systems (GPPs), application-specific integrated circuits, and configurable hardware designs such as field-programmable gate-arrays are often utilized in these techniques/methods. GPPs provide scalability and flexibility, but at a cost of lower performance and efficiency. However, the capacity to scale is not considered while designing Application-Specific Integrated Circuit (ASIC). However, Field-Programmable Gate Array (FPGA)-based hardware solutions provide a wide range of performance and scalability design options. Considering this, scalable hardware designs for pattern matching procedures are gaining in popularity. In addition, the implementation of pattern matching is hampered by the complexity of these systems' architectural layouts. Because of this, it is necessary to conduct a comprehensive investigation to identify and define current scalable hardware designs.

Keywords: Artificial Neural Networks, Application To Pattern Recognition, Field-Programmable Gate Array

1. INTRODUCTION

Using novel and enhanced standards, infrastructures, and technologies, data may be sent through networks. Data breaches, internal and external security breaches, and other risks have plagued these networks. In order to protect these networks, a variety of techniques have been implemented. Monitor

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and identify harmful traffic by examining data packet headers is one of the most often used firewall components. Unseen files in the payload of a packet might nevertheless include malicious material, like viruses, spam, malware, and intrusions, which may cause network attacks. In order to ensure the security of corporate networks, such as the Supervisory Control and the Data Acquisition (SCADA) and other processing subnets, the defense-in-depth strategy is often implemented [1]. A number of levels of firewalls between the Internet-encrypted systems are crucial. There are a number of components to the defensive systems, including Network Intrusion Detection and Prevention Systems (NIDPS), firewalls and content cleaning technologies. Depending on the configuration, the NIDPS may be installed at a single or several sites across the network. As the last line of protection in the entire network architecture, these systems are scanning the network for any harmful or undesired activity. System-generated packet alerts are sent out in detection mode as a warning or alert message [2]. These systems assessed the packet's identity using patterns or preset signatures in order to detect any possible assault. NIDPS are further subdivided into signature and anomaly-based systems, respectively.

Precisely what it is, pattern matching is the skill of comparing an input stream of characters to stored patterns. The String Matching (SM) and the regular Expression Matching (RegEx) are two most common methods of pattern matching. Coordinating a set of strings against a stream of characters is done with the help of SM. In order to match character combinations in strings, programmers include RegEx standard dialects. When it comes to network security, automata comparison, computational biology, and artificial intelligence, the choice of a certain pattern matching method or approach is dependent on the needs of the target application.

2. LITERATURE REVIEW

A Siamese convolutional model is used to produce a new huge artificial dataset of characteristic sets, both similar and also distinct [3], so that we can describe and match discovered features. The full matching process is now complete. A vast number of picture characteristics and their related parameters make manual labelling of them laborious, therefore new deep learning models rely on the results of handmade approaches for training. Because of our dataset, we do not have to worry about a model being trained incorrectly due to erroneous detections of feature patches extracted by other techniques or inaccurate labelling. We may also modify the content (corners, edges, etc.) of synthetic patches as well as their geometric and photometric properties, and thus we can control the model's invariance. It is possible to train different matching modules without depending on existing methodologies by using fresh datasets. To the best of our information, these are first feature datasets for image matching produced using synthetic patches.

There are two main goals of this research [4]. After developing set of criteria also using logic-based pattern matching methods, we identified premature exits from an online text-based counselling service. Second, we examined the link between early parting and user satisfaction to confirm its significance. Preliminary exits were more prevalent among users who viewed the session as less beneficial. An online

text-based counselling platform's sample of 575 human-annotated sessions served as the basis for our classification model development and testing. We utilized 80% of the dataset to train and create the model, and 20% of the dataset to test effectiveness of model. Following this step, we used our model to analyse all the data (34,821 sessions). A post-session survey was used to assess user satisfaction between those who left early and those who stayed for the whole session. In the training and test sets, the model's F1 score for identifying premature departure instances was 97% and 92%, indicating that it is highly compatible with human coders' judgement. The model correctly categorized 15,150 (43.5%) of the sessions as premature departures and the remaining 19,671 (56.5%) as finished sessions when applied to the whole dataset. The post-chat survey was more likely to be filled out by cases that had been completed than those that had been abandoned (4.0%). Lower levels of perceived helpfulness and efficacy in alleviating distress were connected with premature departure. In an online text-based therapy, this is the first model to identify premature departure systematically and reliably. Risk reduction and service enhancement may be easily adapted and extended to new situations using this method.

Agricultural planning must take crop selection into consideration since it is a critical component of food security and economic growth for a nation [5]. Weather, soil properties, and government laws all play a role in this process. To assist farmers, pick the best crop for the season and location of planting, a method has been proposed. The farmers will benefit as a result since their net profit will rise as a result. The system produces a model or approach that may recommend a list of crops that is primarily beneficial to farmers in their decision-making by analyzing various datasets in relation to five criteria like rain, climate, slope, humidity, and soil moistness of horticulture information.

NIDPS uses deep learning to find patterns that match known attacks and protect the network from intrusions by identifying new, malicious activity [6]. NIDPS uses deep learning to find patterns that match known attacks. Networks are being disrupted by hostile activity and security breaches. Due to the various characteristics and pattern kinds of the new assaults, it is tough to keep track of them. There are a variety of techniques for extracting and matching patterns. When it comes to solving optimization problems in a layer-by-layer fashion, learning deeply is one of the subfields of Machine Learning. Pattern matching, on the other hand, is an important approach for intrusion detection because of the wide range of applications it may be used in. Pattern matching approaches, on the other hand, take up over 70% of the overall operating time. A pattern matching engine in intrusion detection may be improved using two approaches proposed in this paper: Deep Learning-based Feature Extraction (DLFE) and Optimization of Pattern Matching (OPM). Snort ruleset is used for pattern matching in the studies, and the results are acquired. Proposed techniques perform better in terms of time, quantity, and memory use in experiment results.

Standard matching and insertion for compacted tree patterns with regular constraints are studied in this study [7]. Unranked tree patterns may be appropriately generalized if context variables with regular restrictions are used. Certain queries on Xml streams with references need regular insertion on unranked tree patterns. There is a polynomial time reduction to equivalent issue without regular constraints for standard matching and insertion with standard restrictions.

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Understanding the current and future changes in organisations, social environments, and technological growth may be greatly enhanced by qualitative research [8]. In this approach, qualitative methodologies have a crucial influence on the enhancement of theoretical frameworks. However, the relationship between observational and theoretical domains is sometimes ambiguous. Recent breakthroughs have made it possible to continually iterate between theories and empirical evidence from qualitative data, enabling for the generation of innovative ideas at the same time. Flexibility and strength in unravelling societal and technical shifts are highlighted in this paper's argument. The Gioia technique is integrated into a seven-step roadmap that we use to improve the flexible pattern matching methodology. In addition, we explain the scientific procedure.

A network intrusion detection system makes heavy use of algorithms and methods for pattern matching [9]. Systematic examination of the literature is necessary since there are a wide variety of scalable pattern matching hardware designs. This article does a comprehensive literature analysis to classify the most current research projects on scalable hardware implementations of pattern matching procedures and approaches. Consequently, 49 studies are chosen for further investigation. They are then broken down into string and regular expression algorithms, as well as single character and multi-character pattern matching, for further study. As a result, a comparative study of different algorithmic methodologies, methods, and architectures is offered in light of key design factors (like throughput and area). Some latest trends and design difficulties have been identified via a comparative investigation.

Extraction, use, and disposal of natural resources in the building sector are all part of a linear system that does not address the need to lessen environmental effect [10]. In order to complete the material loop and progress towards a Circular Economy (CE), different governments have devised strategies to encourage the construction industry to do so. In a BIM setting, this research examines the socio-economic and environmental obstacles to CE adoption. Using semi-structured interviews, we spoke with variety of asset lifecycle investors, including those with expertise in BIM or sustainable approaches, to better comprehend what is preventing a holistic view of asset lifecycle in CE context. The results regarding these interviews can be found in papers. Descriptive interpretive analysis was performed to find common themes and sub-themes in the transcripts of interviews. We employed a pattern-matching tool to compare and contrast the viewpoints of the twenty stakeholders with those found in the scholarly articles. According to the interviews, the investigation uncovered thirty-four additional hurdles that were not previously documented in the scientific literature. Accelerating asset lifetime reconsideration and CE adoption are suggested.

Finding each substring in the given text that matches a particular pattern's Cartesian tree is known as Cartesian Tree Matching (CTM) [11]. In this article, we provide novel representations and encodings for CTM to speed up process. We offer a framework for a binary filtering approach and an efficient identification mechanism for single pattern CTM. CTM may be filtered using any precise string-matching technique. Both the parent-distance and binary encoding approaches are shown for CTM with multiple patterns. An efficient fingerprinting approach is combined with a traditional multiple string-

matching algorithms to tackle multiple pattern CTM quickly. For both, single and multiple pattern CTM, we demonstrate that our matching algorithms work well.

By minimizing residual mismatches in RANSAC's matching results, this research aims to improve image matching accuracy [12]. This study proposes a matching optimization technique called pixel shift clustering RANSAC, or PSC-RANSAC for short, based on RANSAC and pixel shift clustering algorithms. Pixel shift models for space points from two views are built using parallax and camera projection models. Then, using the Density Peaks Clustering (DPC) technique and the established pixel shift model, the mismatches are weeded out to improve accuracy of picture matching. Graph-cut RANSAC, regular RANSAC, progressive sample consensus, and PSC-RANSAC have all been compared, and PSC-RANSAC has been shown to be more successful and resilient in eliminating early matching mismatches. Image matching may be improved with the use of this technology.

K-CPM problem: Any length M substring of T and any cyclic rotation of P are examined in this research to determine the lowest Hamming distance [13], if any, if this distance is not more than the distance between any two cyclic rotations of P and T. In this case, the k-mismatch issue is a variant on a well-known theme. K-CPM has been studied extensively, although so far only upper boundaries have been established. The first non-trivial worst-case upper limits for this issue are presented in this study. There is a [Formula presented]-time algorithm and an O (nk)-time algorithm. For the k-mismatch issue, an approach that was created very recently is enhanced in this algorithm.

For regex patterns with complicated signatures, a unified memory controller and a single core SRAM memory have been suggested [14]. Many current NIDS systems use token streams with specialized hardware units to allow byte-oriented matching with modest network throughput rates, which is a limitation of current systems. With more data stored, NIDS's overall performance metrics are affected. An integrated payload monitoring approach may be met by any memory-based digital NIDS system. Parallel processing and network assertion payload validity checks may be achieved by using a bit-based pattern matching approach with (Finite State Machine) FSM state transition during the tokenization process. The FSM state controller is used to reduce overall matching time when the regex patterns are divided into sub patterns and the concurrent matches are ended concurrently in segments with multiple non-trivial tokens. At long last, distinct SRAM controllers powered by completely down-converted sub-groups solve the synchronization problem during hierarchical state transition and vector matching across several pages. The categorization rate shows the efficiency of proposed NIDS system in mild intrusion database processes. By contrast with currently used methods we can see that the NIDS system we propose uses fewer memory resources.

The deformation tensor may be retrieved from electron backscatter diffraction patterns using a novel simulation-based pattern matching approach [15]. The distortion tensor may be deduced with average absolute error of 10 8 under ideal circumstances by minimizing least squares difference among the target pattern and simulated distorted patterns. Compared to cross-correlation based technique, the novel approach is more resistant to considerable pattern rotation. For noise-free patterns, pattern centre may be adjusted concurrently with average absolute distortion tensor error of ~ 10 - 4.

For classical pattern matching problems, this study affects the use of quantum computers since they can enable parallel computations intrinsically [16]. Several algorithms are qualified and used as criteria for others according to classical machines, and it is vital to note that Knuth Morris Pratt and Boyer Moore are two such algorithms that solve this issue in O (M + N) time. The high-speed approach underpins quantum identical pattern matching algorithms. Searching an unstructured database of "N" entries in O (N) time using Grover's quantum search approach, Ramesh and Vinay suggested a typical quantum method that may achieve processing speed and offer a solution in O (M + N) time. Using a combination of two existing quantum based exact and approximate pattern matching algorithms, a novel exact pattern matching method is developed that overcomes the algorithmic limits and considerably demonstrates to be equivalently superior to current classical and quantum benchmarks. There are many quantum pattern matching algorithms discussed in this page, as well as flowcharts and examples to illustrate their operation, as well as a mathematical explanation for their use. Finally, we talk about prospective application areas and possible variants on the presented work.

An extra functionality is added to pattern matching when using a wildcard character [17]. Here, we address two issues of secure pattern matching with wildcards, namely: I SPM-RW and (ii) SPM with compound wildcards (SPM-CW). The first SPM issue with wildcards makes use of the "*" kind of wildcard characters to indicate pattern gaps. For the pattern matching problem, wildcard character called "*" is sometimes utilized to substitute with zero or more letters in text. Yasuda et al. (ACISP 2014), the semi-honest model of symmetric Somewhat homomorphic encryption (She) for safe wildcards pattern matching has an existing data packing approach to secure wildcards pattern matching utilizing symmetric Somewhat Homomorphic Encryption (SwHE). To further extend their work, we develop SPM-RW protocols employing the symmetric and public-key SwHE methods in the semi-honest model to replace the wildcard with any order of letters in the text. To tackle SPM-RW issue, we suggest improved packing approach that increases the number of homomorphic multiplications by the number of sub-patterns by factor of k over naïve use of Yasuda et al's method. When it comes to private database queries, we will take a look at the SPM-CW issue, which permits a few different sorts of wildcards (''$", ''*", and ''!") to be used in the pattern. A semi-honest SPM-CW protocol based on a double-query approach with public key SwHE encryption is proposed to address this issue. New SPM-RW and SPM-CW techniques that surpass current best performs have been shown in our studies.

One of the most promising modern technologies in research is Wireless Sensor Networks (WSN) [18]. In NIST's words, "a network that comprises of the vast number of sensors termed wireless sensors distributed in geographical region and the environment" is a description of WSN. A sensor network includes certain computational components as well as actuators and sensors. The sensors nodes in the WSN are responsible for sensing the physical quantities in the surrounding environment. In recent years, wireless sensor networks have gained prominence for both military and civilian applications. WSN security is one of the most difficult problems to solve since it is unsecured in an open environment. When it comes to securing a sensor network from outside threats, the use of cryptography is not much better.

In order to find a specific item in a very wide picture, pattern matching is a critical challenge in computer vision [19]. It may be used to manage a wide range of vision issues, from the simple identification of objects by humans to the detection of damaged components in manufacturing machinery. This study describes a rapid pattern matching method based on the Image Integral model that takes use of cumulative subtraction and division operations. A tiny rectangle of the visual scene and input pattern to be searched for will be evaluated using both cumulative subtraction and division operations, respectively. Sliding window pattern matching may be achieved by transforming picture values to Haar Projection Values (HPVs) using Haar transforms. Seven mathematical operations, including two additions and five subtractions, are required for HPV computation, which are identical to those required for the Image Integral method. As a result, the suggested pattern matching approach has been shown to be computationally efficient in terms of both time and memory.

A pattern (or a series of patterns) in a compressed text file may be found using a process known as Compressed Pattern Matching (CPM) [20]. Patterns may or may not be compressed in this form of matching. Managing massive amounts of data, particularly across the network, is a breeze using CPM. For example, it may be used in computational biology to identify patterns in DNA sequences, network intrusion detection, and big data analytics. Researchers have come up with a variety of ways to match a pattern directly to the uncompressed text. Such a system needs a large amount of storage space and a significant amount of time to process enormous amounts of data. Several academics have offered efficient techniques for compression; however, pattern matching over compressed text has very few if any researchers' proposals to back it up. Because of the increasing rise in the number of data, CPM has emerged as a desired activity. CPM approaches are examined critically in this work. Covered methods include Wavelet Tree Based Indexing; Huffman Codes Based on Words. All of the methods described above have been compared, and the benefits and drawbacks of each have been discussed.

Clock routing eventually takes over chip performance, as measured by delay, cost, and power consumption, as IC manufacturing methods progress into the nanoscale age [21]. In order to address the foregoing issues, X-architecture may be used to route metal wires in diagonal and rectilinear directions. Here, we describe creation of a zero-skew clock tree using a clock routing technique called PMXF, which has a minimal latency. To make the DME approach's merging process easier, an X-pattern library has been created, an X-Flip method has been provided to shorten the distance between paired points, and a wire sizing strategy has been used to achieve zero skew. Experimental findings on benchmarks show that the proposed PMXF method can reduce clock latency, wirelength, power consumption, and via count more than earlier X-architecture clock routing techniques.

3. PATTERN MATCHING ALGORITHMS

Text remains the primary means of exchanging information, despite the fact that material may be remembered in a variety of ways. This is most apparent in the study of literature or linguistics, where large corpora and dictionaries are used to gather data. A vast quantity of data may be stored in linear

files in computer science as well [22]. Since biological molecules may frequently can represented as sequences of nucleotides or amino acids, this is also case in molecular biology. In addition, the amount of data in these categories tends to double every 18 months. Therefore algorithms need to remain effective even as computer speeds improve. The difficulty of finding a certain pattern in unstructured data is known as pattern matching. It is common for a pattern to be composed of a collection of strings that are specified in a formal linguistic manner. Single string patterns and estimated string patterns are shown.
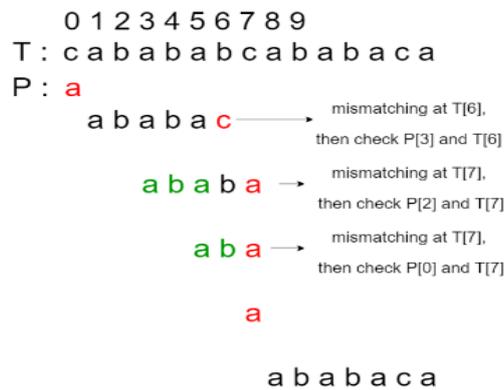
Figure 38 A simple illustration of pattern matching algorithm

- **String-Matching Algorithms**

String matching is process of locating single or more examples of a certain pattern in each piece of text. A finite alphabet is used to build both the pattern and the text (finite set of symbols). Algorithms in this section return a list of all text instances in which a given pattern appears. The pattern is represented by $x = x[0 \ldots m - 1]$; its length is denoted by m. The text is indicated by $y = y[0 \ldots n - 1]$; its length is equal to n. The alphabet is denoted by Σ and its size is equal to σ. Pattern and text alignment is the initial step of string-matching algorithms in this section. Then, letters in the text aligned with patterns are compared — An attempt is the name given to this particular piece of effort. If there is a complete match, the pattern will shift in the right direction. It is repeated until the right end of the pattern reaches beyond the text.

We align each attempt with place in text when the pattern is aligned with $y[i \ldots i + m - 1]$. Brute force approach checks for every value between 0 and n - m in the text, Whether or whether the pattern is first seen there. The pattern is then shifted precisely one place to the right after each try. The brute-force algorithm is provided. Graph 1 O (mn) is worst-case time complexity of brute force technique, however in reality; it often behaves linearly on particular data.

```
void BF(char *y, char *x, int n, int m)
{
 int i;

 /* Searching */
 i=0;
 while (i <= n-m) {
     j=0;
     while (j < m && y[i+j] == x[j]) j++;
     if (j >= m) OUTPUT(i);
     i++;                    /* shift one position to the right */
 }
}
```
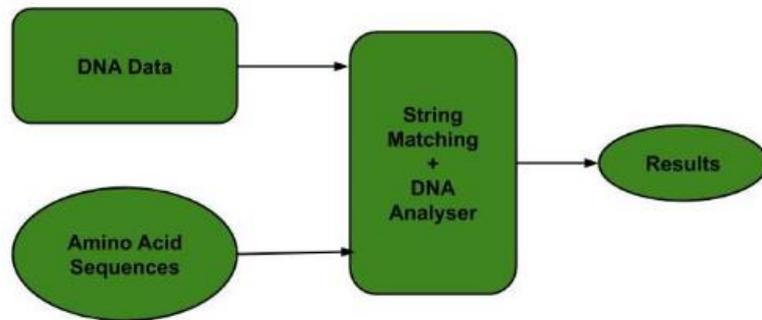
Figure 39 The brute force string-matching algorithm

Figure 40 A block diagram of the String matching algorithm for DNA Sequencing

i.   Karp-Rabin Algorithm

It is possible to prevent quadratic symbol comparisons by using hashing in most realistic cases. A more effective method to determine whether or not pattern is present in text is to just examine the piece of text that is aligned with it. A hashing method is employed to verify the similarity between these sections.

```
#define REHASH(a, b, h) (((h-a*d)<<1)+b)

void KR(char *y, char *x, int n, int m)
{
 int hy, hx, d, i;

 /* Preprocessing */
 d=1;
 for (i=1; i < m; i++) d=(d<<1);
 hy=hx=0;
 for (i=0; i < m; i++) {
    hx=((hx<<1)+x[i]);
    hy=((hy<<1)+y[i]);
 }

 /* Searching */
 i=m;
 while (i < n) {
    if (hy == hx && strncmp(y+i-m, x, m) == 0) OUTPUT(i-m);
    hy=REHASH(y[i-m], y[i], hy);
    i++;
 }
}
```
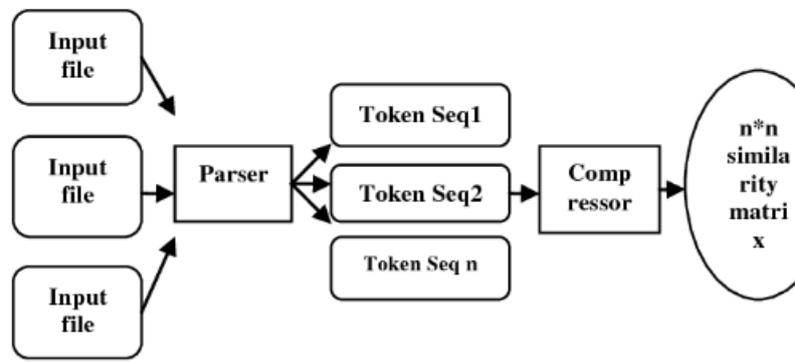
Figure 41 The Karp-Rabin string-matching algorithm.

Figure 42 Plagiarism detection by Karp-Rabin string matching algorithm

ii.   Knuth-Morris-Pratt Algorithm

Hashing is a straightforward way to prevent quadratic symbol comparisons in most realistic cases. An easier way to determine whether the pattern is there is to observe if the text aligned with the pattern "looks like" the pattern rather than analyzing each individual location of the text. Using a hashing technique, we can see how similar these pieces are.

```
void KMP(char *y, char *x, int n, int m)
{
 int i, j, next[XSIZE];

 /* Preprocessing */
 PRE_KMP(x, m, next);

 /* Searching */
 i=j=0;
 while (i < n) {
     while (j > -1 && x[j] != y[i]) j=next[j];
     i++; j++;
     if (j >= m) { OUTPUT(i-j); j=next[m]; }
 }
}
```

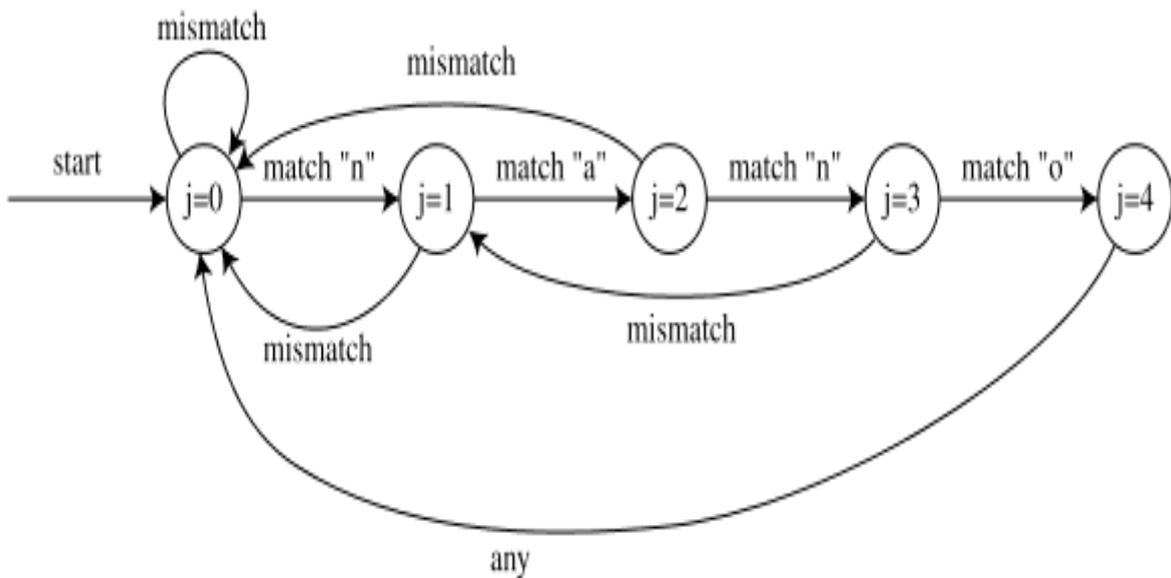**Figure 43 The Knuth-Morris-Pratt string-matching algorithm**

Figure 44 Knurth Morris Pratt Algorithm block diagram

iii.   Boyer-Moore Algorithm

As far as string-matching algorithms go, Boyer-Moore one is the most efficient. In text editors, the "search" and "substitute" functions commonly use a reduced version of the method or the complete algorithm. It begins with the rightmost symbol in the pattern and scans it from right to left. Two pre-calculated routines shift the pattern right if the pattern is mismatched (or if it is a full match). As you can see, these two shifting functions are known as "bad character" and "good suffix".

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```
void BM(char *y, char *x, int n, int m)
{
 int i, j, gs[XSIZE], bc[ASIZE];

 /* Preprocessing */
 PRE_GS(x, m, gs);
 PRE_BC(x, m, bc);

 /* Searching */
 i=0;
 while (i <= n-m) {
    j=m-1;
    while (j >= 0 && x[j] == y[i+j]) j--;
    if (j < 0) OUTPUT(i);
    i+=MAX(gs[j+1], bc[y[i+j]]-m+j+1);          /* shift */
 }
}
```

Figure 8 The Boyer-Moore string-matching algorithm

```
void PRE_BC(char *x, int m, int bc[])
{
 int j;

 for (j=0; j < ASIZE; j++) bc[j]=m;
 for (j=0; j < m-1; j++) bc[x[j]]=m-j-1;
}
```

Figure 9 Computation of bad-character shift

iv.   Quick Search Algorithm

This approach uses Boyer-Moore algorithm, which uses bad-character move when the alphabet is tiny. However, if the alphabet is vast, such as in ASCII tables and text editor searches, the shift is quite beneficial. In practice, relying only on it yields a highly effective algorithm.

```
void QS(char *y, char *x, int n, int m)
{
 int i, j, bc[ASIZE];

 /* Preprocessing */
 for (j=0; j < ASIZE; j++) bc[j]=m;
 for (j=0; j < m; j++) bc[x[j]]=m-j-1;

 /* Searching */
 i=0;
 while (i <= n-m) {
    j=0;
    while (j < m && x[j] == y[i+j]) j++;
    if (j >= m) OUTPUT(i);
    i+=bc[y[i+m]]+1;                          /* shift */
 }
}
```

Figure 45 The Quick Search string-matching algorithm

```
void PRE_GS(char *x, int m, int gs[])
{
 int i, j, p, f[XSIZE];

 for (i=0; i <= m; i++) gs[i]=0;
 f[m]=j=m+1;
 for (i=m; i > 0; i--) {
    while (j <= m && x[i-1] != x[j-1]) {
       if (!gs[j]) gs[j]=j-i;
       j=f[j];
    }
    f[i-1]=--j;
 }
 p=f[0];
 for (j=0; j <= m; j++) {
    if (!gs[j]) gs[j]=p;
    if (j == p) p=f[p];
 }
}
```

Figure 46 Computation of the good-suffix shift

v.   Aho-Corasick Algorithm

Standard text (or file) capabilities are provided by the UNIX operating system. Patterns may be found in files by using the grep command. This section explains the UNIX command fgrep's algorithm. For example, it may produce lines having at least one of strings it searches for in a series of files. An initial method is to perform few string-matching algorithms for each pattern in order to find all instances of all patterns picked from a limited collection of patterns. If set have k patterns, this search runs in time $O(kn)$. Aho and Corasick designed an, $O(n \log \sigma)$ algorithm to solve it. Number of patterns has no effect on the

execution time. The method is based on the Knuth-Morris-Pratt algorithm, which is a straight extension of it.

```
int AC(char *y, char X[KSIZE][XSIZE], int n, int k)
{
 NODE r, s;
 int i;

 /* Preprocessing */
 r=PRE_AC(X, k);

 /* Searching */
 for (i=0; i < n; ++i) {
    while ((s=GET_NODE(r, y[i])) == UNDEFINED) r=GET_FAIL(r);
    r=s;
    OUTPUT(r, i);
 }
}
```
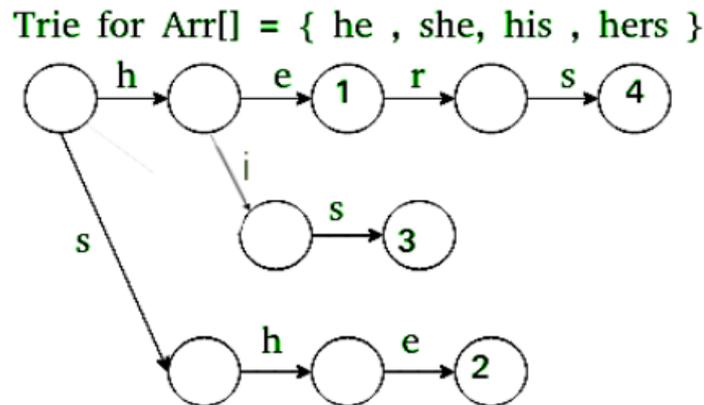
Figure 47 The Aho-Corasick algorithm

Figure 48 Aho-Corasick algorithm block diagram for pattern matching

- **Two-dimensional pattern matching algorithms**

Only two-dimensional arrays are discussed in this section. Images are represented using bitmap images in which each cell in the picture includes a codeword that corresponds to one or more pixels. In two dimensions, an analogous version of the string-matching issue may be found (and even in any number of dimensions).

The challenge now is to locate every use of a 2D pattern $x = x[0 \ldots m_1 - 1, 0 \ldots m_2 - 1]$ of size $m_1 \times m_2$ inside a 2Dimensional text $y = [0 \ldots n_1 - 1, 0 \ldots n_2 - 1]$ of size $n_1 \times n_2$. Figure 3.1 shows the result of using a brute force approach to solving this issue. It consists in checking at all the positions of

$y[0 \ldots n_1 - m_1, 0 \ldots n_2 - m_2]$ if pattern occurs. The brute force algorithm has worst-case time complexity in $O(m_1 m_2 n_1 n_2)$ with respect to the size of the problem. In the next sections, we'll show you two additional effective algorithms. The Karp-Rabin algorithm is extended in the first one. The second solution employs both the Aho-Corasick and Knut10h-Morris algorithms to solve the issue in linear time on a fixed alphabet.

```
typedef char BIG_IMAGE[YSIZE][YSIZE];
typedef char SMALL_IMAGE[XSIZE][XSIZE];

void BF_2D(BIG_IMAGE y, SMALL_IMAGE x, int n1, int n2, int m1, int m2)
{
 int i, j, k;

 /* Searching */
 for (i=0; i <= n1-m1; i++)
    for (j=0; j <= n2-m2; j++) {
        k=0;
        while (k < m1 && strncmp(&y[i+k][j], x[k], m2) == 0) k++;
        if (k >= m1) OUTPUT(i,j);
    }
}
```

Figure 49 The brute force two-dimensional pattern matching algorithm

i. Zhu-Takaoka Algorithm

The Zhu-Takaoka algorithm is a String matching in one-dimensional mode is only achievable if the "aligned" text "resembles" the pattern in terms of appearance. Vertically using Karp and Rabin's hash function approach is the goal.

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```
#define REHASH(a,b,h) (((h-a*d)<<1)+b)

void ZT(BIG_IMAGE Y, SMALL_IMAGE X, int n1, int n2, int m1, int m2)
{
 int YB[YSIZE], XB[XSIZE], next[XSIZE], j, i, row, d;

 /* Preprocessing */
 /* Computes first value y' */
 for (j=0; j < n2; j++) {
     YB[j]=0;
     for (i=0; i < m1; i++) YB[j]=(YB[j]<<1)+Y[i][j];
 }

 /* Computes x' */
 for (j=0; j < m2; j++) {
     XB[j]=0;
     for (i=0; i < m1; i++) XB[j]=(XB[j]<<1)+X[i][j];
 }

 row=m1-1;
 d=1;
 for (j=1; j < m1; j++) d<<=1;

 PRE_KMP(XB, m2, next);

 /* Searching */
 while (row < n1) {
     KMP_IN_LINE(Y, X, YB, XB, n1, n2, m1, m2, next, row);
     if (row < n1-1)
       for (j=0; j < n2; j++)
          YB[j]=REHASH(Y[row-m1+1][j], Y[row+1][j], YB[j]);
     row++;
 }
}
```

Figure 50 The Zhu-Takaoka two-dimensional pattern matching algorithm.

ii.   Bird/Baker Algorithm

Bird and Baker developed a 2Dimensional pattern matching method that incorporates both Aho-Corasick algorithm and Knuth-Morris-Pratt algorithm independently of each other. Pre-processing is done in Aho-Corasic k method, where the rows are sorted into a trie.

```
void B(BIG_IMAGE Y, SMALL_IMAGE X, int n1, int n2, int m1, int m2)
{
 int next[XSIZE], a[TSIZE], row, column, k;
 NODE root, r, s;
 char *x;

 /* Preprocessing */
 memset(a, 0, n2*sizeof(int));
 root=PRE_AC(X, m1, m2);
 PRE_KMP(X, m1, m2, f);

 /* Searching */
 for (row=0; row < n1; row++) {
    r=root;
    for (column=0; column < n2; column++) {
        while ((s=GET_NODE(r, Y[row][column])) == UNDEFINED) r=GET_FAIL(r);
        r=s;
        if ((x=GET_OUTPUT(r)) != UNDEFINED) {
            k=a[column];
            while (k>0 && strncmp(X[k], x, m2) != 0) k=f[k];
            a[column]=k+1;
            if (k >= m1-1) OUTPUT(row-m1+1, column-m2+1);
        }
        else a[column]=0;
    }
 }
}
```

Figure 51 The Bird/Baker two-dimensional pattern matching algorithm.

4. CONCLUSION

The aim of this work is to offer a complete analysis of the most modern approaches for pattern matching, as well as the applications of the technique in a variety of sectors. Pattern recognition methods that have been used in the past are also discussed. Extensions of string-matching algorithms are presented for matching patterns in photos. Texts in certain programmes must be organized before they can be searched. Even in the absence of further information on their syntactic structure, a searchable database may be created.

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