Fusion-based Diversified Model for Internet of Vehicles: Leveraging Artificial Intelligence in Cloud Computing

Hayder Sabah Salih[1,*], **Fatema Akbar Mohamed**[2]

Department of Private Education in the Iraqi Ministry of Higher education and Scientific Research, Baghdad, 10024, Iraq

[2] Teaching Excellence and Technology Center, Gulf University, Sanad 26489, Bahrain

Emails: haydersabah2@gmail.com; fatema.akbar@gulfuniversity.edu.bh

Abstract

The Internet of Vehicles (IoV) is a distributed system that enables data connectivity between vehicles and vehicular ad hoc networks, ensuring efficient and secure information exchange with infrastructures. Challenges in IoV include security clustering related to packet loss during data exchange, real-time analysis of public communication, and the need for autonomous-vehicle technology development using machine learning (ML). ML-assisted IoV has made significant progress in communication with public networks and interaction with the immediate surroundings. This study presents an experimental foundation for the advancement of the IoV system. While support vector machine (SVM) offers a robust and accurate approach for clustering velocity and solving classification challenges related to security, it is primarily a binary classifier and faces limitations in handling multi-class classification. To address this, an artificial neural network (ANN) is proposed for effective packet loss management in the autonomous system, improving the physical layer's secure network and offering better packet loss experience using the Global Positioning System. The fusion-based diversified model not only enables IoV systems to compete with rivals but also provides key advantages to ensure consistent profitability in cloud-enabled IoV. This paradigm integrates cloud computing (CC) with in-vehicle networks and the Internet of Things, offering safety and infotainment applications for road users. Data collection and experiments are conducted using Network Simulator 2 to automate AI configuration in the IoV fusion system.

Keywords: Internet of vehicle; Fusion system; SVM; ANN; Cloud computing.

1. Concepts on the Internet of the Vehicle through AI and cloud computing:

Edge computing and content caching in wireless networks have made it possible for the Intelligent Transportation System (ITS) to provide high-quality services to cars. It is difficult for ITS to distribute resources effectively because of the range of vehicle applications and time-varying network state [1]. With the ultra-low latency requirements for many developing Internet of Vehicles applications, vehicular edge computing (VEC) is considered a viable solution [2]. Vehicle-to-Vehicle (V2V) communication is extended to include the Internet of Vehicles. With the use of vehicle Artificial Intelligence (AI) knowledge of other cars and IoV helps enhance driving aids [3]. Because of the rise in traffic accidents and developments in information sharing, vehicle-to-vehicle communication has grown in importance during the last several years [4]. The Internet of Vehicles is a critical component of smart cities' intelligent transportation systems since an industrial application of the Internet of Things [5]. Electric cars are progressively becoming more popular for people, and they have become a more conscious need to reduce carbon emissions and protect the environment [6]. Despite its widespread use in various traffic settings, GPS for vehicles has a poor degree of precision that prevents from providing lane-level location [7]. Security under severe latency is one of the most essential and crucial criteria for the Internet of Vehicles. Authentication systems for automobile ad hoc networks often need regular self-authentication checks [8]. Automakers and researchers have recently embraced the concept of

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

vehicles with intelligence, dubbed the Internet of Vehicles, providing various benefits, such as increased passenger and driver safety, improved entertainment options, and reduced traffic congestion and pollution [9]. The notion of smart cities has grown important in contemporary metropolises to the advent of embedded and linked smart devices, systems, and technologies [10]. The Internet of Vehicles has recently received a lot of interest due to the rapid advancement of wireless communication, sensor, and computing technology [11]. As the linked cars on the road grow, traditional network data transmission suffers from several restrictions, including high latency, missed packets, and network congestion [12]. Smart devices and vehicular communications are integrated into IoV, a growing vehicular networking architecture incorporating IoV technology. Green computing and communication in a disruptive vehicular environment is a difficult job for IoV to enable [13]. Cloud computing and the Internet of Things are now part of the Internet of Vehicles, cover vehicle-to-vehicle and vehicle-to-infrastructure (V2I) connections [14]. Intelligence in transportation systems is critical to increasing urban road safety, fostering behavioural interaction between users and networks, improving service quality, and reducing network costs in light of the rapidly developing Internet of Vehicles [15]. The Internet of Vehicles, automobiles, infrastructure on the highway, wireless networks, and cloud computing platforms are linked together in a decentralised network. Wireless suggestions play a key role on the Internet of Vehicles, such as advising optimal routes, driving methods, and information [16]. The Internet of Vehicles has struggled to manage computationally expensive and time-sensitive computing activities due to the proliferation of mobile devices and sophisticated application services [17]. The Internet of Vehicles results from recent breakthroughs in the Internet of Things and the implementation of vehicular networks. However, the IoV's wireless nature presents major cybersecurity, and the volume of vehicular data will solar as more cars join the IoV network [18]. Data from sensors installed in car infrastructure is highly relevant in the emergence of Intelligent Transportation Systems [19]. As smart cities and smart transportation systems evolve, the Internet of Vehicles will play an increasingly important role. the edge network and the service data centre are part of the IoV technology [20]. The current task offloading technique does not perform well enough. The onboard terminal cannot conduct efficient computing because of the rapid expansion of automobiles, the exponential growth of data, and the growing limitation of spectrum resources [21]. Due to the absence of security, the future generation of IoT devices is an easy target for hackers because of their fast growth. Distributed denial of service attacks against IoT devices can be readily hacked to build botnets [22]. Connected and Automated Vehicles (CAVs) are essential infrastructure advances for the smart world because of their ability to seamlessly and real-time transmit data [23]. An essential part of IoT is the Internet of Vehicles. Communication between vehicles is especially difficult in mobile IoV networks due to their operational surroundings' wide range of variables and complexity [24]. Detection models for assaults on in-vehicle networks have gained interest from the automotive industry and researchers due to a rise in attacks on in-vehicle networks [25].

The main contribution of the paper:

- Self-driving automobiles are conceivable because of machine learning algorithms using cameras and other sensors; a vehicle may gather information about its surroundings.
- The SVM method is used for automated object recognition by clustering and characterisation, takes these data points, and produces the hyperplane is security.
- The traffic congestion networks are classified by ANN as packet loss if there is a lot of public communication traffic in road lights. Other routes are automatically rerouted to alleviate the physical congestion layer.
- The diversified model that supports cloud computing through ML assists IoV technology for a vehicle in security improvement in performance ratio can be improved in implementation with accuracy.

The rest of the paper is as follows: section 2 denotes a literature survey of the existing method, section 3 proposes a method mention ML assist IoV to be discussed, section 4 indicates experimental analysis, and section 5 delivers the conclusion of the article.

2. Related work on the Internet of Vehicle:

Dutta, A. K et al. (2020) proposed that Vehicle ad hoc networks (VANETs) be taken to the level with the help of the Internet of Vehicles. Due to the severe resource constraints on VANETs [26]. Clustering is described in this research to use available resources better and, as a result, lengthen the lifespan of a network. A roadside unit gateway is assumed in the plan for connecting automobiles to the internet. The experimental results proved the outperformed and distributed multi-hop clustering utilising a neighbourhood following an algorithm.

Lu Y et al. (2020) explained the asynchronous federated learning system that uses deep reinforcement learning (DRL) for node selection to increase effectiveness [27]. Data providers cannot participate in data exchange problems with

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

bandwidth, security, and privacy concerns. Further improvements in data sharing efficiency and reliability are required for the sporadic and unstable communications in the IoV environment. To alleviate the burden of transmission and solve privacy concerns, propose a novel architecture based on federated learning. Improve the safety and trustworthiness of the model parameters. Numerical findings demonstrate that data sharing may improve learning accuracy and convergence speed.

Lv, Z et al. (2020) introduced JDE-VCO (Joint Delay and Energy-Vehicle Computation Task Offloading) optimisation under the software-defined vehicular networks architecture, allowing intelligent edge computing task offloading and migration [28]. The loss ratio and latency identify packet loss and transmission delay. The JDE-VCO method outperforms the RTO (Random Tasks Offloading) and UTO (Uniform Tasks Offloading) algorithms in task unloading per unit time and average task completion time. The IoV system's experiments are based on JDE-VCO.

Ghafoor, K. Z et al. (2020) said the significant volumes of data created by different connected vehicle settings could not be handled by short-range wireless access, such as dedicated short-range communication (DSRC) in 4G cellular connectivity [29], even though this data utilised to inform and aid decision making. Adaptations to link blocking, handover algorithms, sensor-aware protocols, and beam width size adaptations are the primary focus of work at the physical layer. Finalise the conversation by highlighting different features of smart transportation applications and outlining potential future study areas and their associated challenges.

Sutrala, A. K et al. (2020) detailed elliptic curve cryptography (ECC) to build a novel batch verification-based authentication method in the IoV environment that preserves conditional privacy [30]. Data exchange among cars in the Internet of Things is essential in public communication to improve driving safety and enhance vehicular services in the IoV. As a result, several possible threats to public communication between cars include replay, a man in the middle, and impersonation attacks. Use a thorough comparison of the proposed system with the relevant schemes, improved security and functionality qualities, and similar storage, communication, and computation overheads.

Zhou H et al. (2020) [31] discussed the rising needs of upcoming sophisticated vehicle applications, such as intelligent transportation systems and autonomous cars; conventional vehicle-to-everything (V2X) technologies are transitioning to the Internet of Vehicles. The Internet of Things (IoT) has advanced significantly in recent years. Begin by looking back at the early days of dedicated short-range communications and comparing communications with both advantages and disadvantages. The arrival of big data and cloud-edge regimes emphasises the most important technological problems and prospects for IoVs powered by big data and IoVs built on top of the cloud. For both academics and the IoV business, a thorough analysis of the progress of V2X technologies toward IoV will give useful insights and inspiration.

Ning Z et al. (2020) [32] examined an increasing number of academic and business researchers focusing on the Internet of Cars, using the resources of vehicles and roadside units (RSU) to carry out a variety of vehicular applications. It is difficult to make efficient offloading and caching choices under long-term energy restrictions of RSUs because of the absence of global knowledge and the temporal variation of IoVs. Imitation learning-enabled branch-and-bound solutions in edge intelligent IoVs are proposed to speed up the issue solving process with fewer training samples. The suggested strategy outperforms previous methods, as shown by experimental findings based on real-world traffic data.

Ji B et al. (2020) [33] proposed the automotive industry, ad hoc mobile networking is used. As cutting-edge technology, the Internet of Things quickly transforms the current Internet into a future Internet. The Internet of Vehicles is already a reality, and it aims to facilitate the interchange of data between vehicles and the many organisations with which they are affiliated. IoV intends to reduce traffic congestion, avoid accidents, and provide additional services. The fundamentals of IoV, such as VANET's basic technology, various network architectures, and common IoV applications, are fully analysed in this study.

Wang, Wet al. (2020) [34] explained collecting a broad range of data on vehicle trajectories thanks to the widespread usage of the Internet of Things, 5G, and smart city technologies. For example, this trajectory data is used to determine the best route from one location to another, identify abnormal behaviour, monitor traffic flow in a metropolis, and estimate the future position of an item. These data are of enormous relevance. The learned vehicle vectors cluster and vehicle trajectories using machine learning as a final step. Technique outperforms the competition in real-world testing, according to the findings of the real-world dataset.

Storck, C. R et al. (2020) [35] introduced the most recent wireless network technology, and it has been designed to boost the speed and responsiveness of connections. Wireless broadband connections are used for certain end-user and

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

commercial applications. Designed primarily for use on the Internet of Vehicles, it ensures lightning-fast connectivity still provides a high-security level. Vehicle-to-everything communication and applications in self-driving vehicles supported by 5G network technology. With cooperation, steer the development of new 5G-V2X services and technologies for vehicle communication and suggest potential future pathways.

Javaid, U et al. (2020) [36] detailed autonomous cars and roadside infrastructure are the fundamental components of the Internet of Vehicles. Vehicle-to-vehicle broadcasting of traffic safety and efficiency information is one of the primary goals of the Internet of Vehicles. Security and performance assessments are provided to illustrate the viability and scalability of the proposed protocol. Protocol's better-decentralised trust management for IoV is confirmed by this paper's case study and comparative analysis.

Wan, S et al. (2020) [37] discussed the Internet of Vehicles system's need for real-time connectivity and excellent performance has prompted researchers to look at novel edge computing solutions. Low latency, great reliability, and higher communication efficiency may open a whole new world of possibilities with the fast growth of the 5G network. This article concludes that there are two kinds of communication and provides a resource allocation technique. Evaluation and comparison of proposed system performance with that of the current system are performed. Future research in this field is discussed.

Some of the drawbacks are clustering, security, packet loss, physical layer, and public communication contributing to the issue noted in the study work. These disadvantages can be overcome by VANET's, DRL, JDE-VCO, DSRC, and ECC to compare with the proposed method ML assist IoV.

3. ML concepts in IoV:

The first generation of V2X technology to examine the problems and prospects of such evolutionary V2X technologies. There are two primary V2X technology groups, cellular and non-cellular. Explore these two groups in detail, comparing their strengths and weaknesses and drawing up a technical comparison. Finally, examine two interesting future developments for IoV technologies; namely, big-data-driven IoV and cloud-edge computing may supply the critically required information. Smart cities rely heavily on the Internet of Things in developing the IoV concept. The Internet of Vehicles is a network of interconnected automobiles, wireless networks, and other devices available to anyone. This technology will power the future self-driving and intelligent transportation systems. It is most often a vehicle to network, vehicle to vehicle, vehicle to the roadside, vehicle to infrastructure, and vehicle to pedestrian.

3.1 Based on SVM via the clustering in various security:

The below diagram describes the SVM in the different processes for the vehicle in the clustering and cost.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

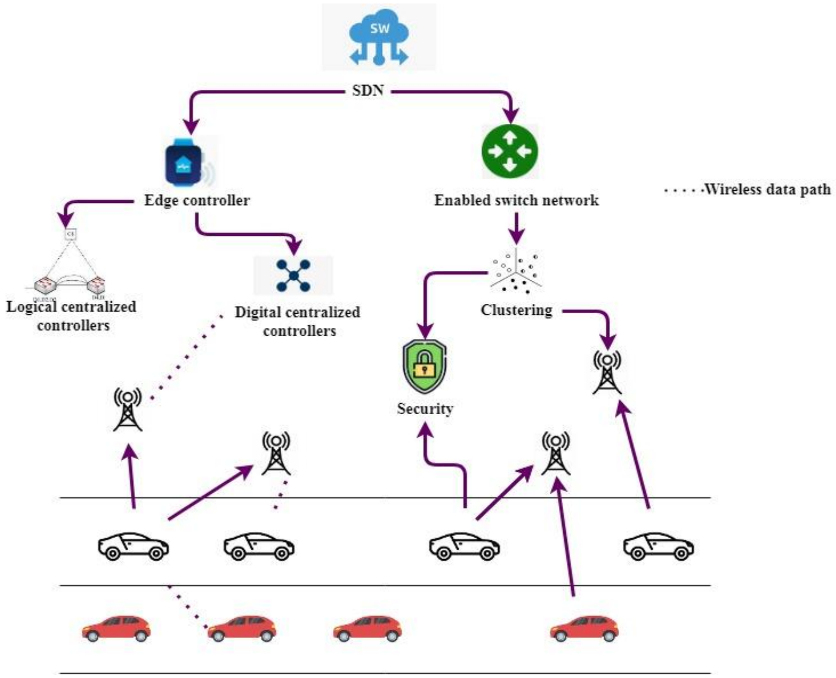

Figure 1: Based on SVM via the clustering in various security

Figure 1 says connecting to the underlying hardware infrastructure via application programming interfaces, software-defined networking (SDN) is a technique of networking that uses software-based controllers to govern network traffic. Because it separates data plane operations from the control plane, software-defined networking is applied to a full network. Single and distributed controllers are the two most common types for the control plane. In the logistics and transportation industry, a cluster group of businesses work in the same or closely related sectors and use the same technology. Security in the context of road vehicles is the protection of electronic systems and networks and the control algorithms, software, and users, from malicious assaults and damage, unauthorised access, and manipulation. Sensors in the field and other control devices like variable frequency drives (VFDs) provide edge controller data. Controlling the execution of other components is delegated to a single component in a centralised control model. There are two types of centralised control models: those that control sequentially and those that control simultaneously. If anything happens that renders data inaccessible or useless, data protection is securing vital protection of data against corruption, compromise, or loss, the ability to recover corrupted or lost data. Implementation of installing or implementing measures that result in completed units, expenses include all or a portion of all real expenditures. Wireless networking is a way to link numerous pieces of equipment without running expensive wires across a building or between different sites.

3.1.1. The derivatives for SVM:

$$V(y) = \frac{1}{1-e^{s}} - \sin\frac{\pi}{2} - X + \sqrt{\frac{\pi}{2}} \int f(x)dx * (Z + V^{2}) \tag{1}$$

As shown in equation (1), data predicted $\frac{1}{1-e^{s}}$ and mean $\sin\frac{\pi}{2}$ loadings in SDN, connected to specific values of percent infected and s loading in $\sqrt{\frac{\pi}{2}} \int f(x)dx$ through the security from the different resources in the system.

Internet and vehicle relationship $\left(\frac{pq}{2}\right)$ has a maximum value that limits its range, as indicated in equation (2),

$$\left(\frac{pq}{2}\right) = s + \frac{3R\sqrt{3}}{2} * \sin\theta \int \frac{1}{\sqrt{n^{2}-1}} + \int 2\pi \tag{2}$$

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

As shown in equation (2), a vehicle measuring knowledge $\left(\frac{pq}{2}\right)$ and improved quality and learning source in-vehicle are all represented by $\boldsymbol{s} + \frac{3R\sqrt{3}}{2}$and in the$\int 2\pi$ define stages in improved research reduce human error and make driving more comfortable in clustering the different format X stands for time-consuming learning. At the same time, terminology insin $\theta \int \frac{1}{\sqrt{n^2-1}}$ in the data preprocessing in the logically centralised controller.

$$\boldsymbol{G = \prod E^2 \pm \sum y^2 \sqrt{\frac{\pi}{2}}\left(\frac{dy}{dx}\right) - 2\cos\left(x + \frac{\alpha}{2}\right)\sin\frac{\alpha}{2} + \int 2\pi} \qquad \textbf{(3)}$$

The equation (6) G for modifying the edge controller system for the $\prod \boldsymbol{E^2}$ better digital centralised controllers appraisal used in the $\sum y^2 \sqrt{\frac{\pi}{2}}\left(\frac{dy}{dx}\right)$ mid mapping for enabled switch network in $2\cos\left(x + \frac{\alpha}{2}\right)$ physical presents of cars in $\sin\frac{\alpha}{2}$ learning the values taken from equation 2, the next result in the ANN.

3.2 Packet loss in public communications that use the physical layer data connection at the ANN:

Figure 2 denotes the different reality they focus on the digital in ANN for experience and privacy.

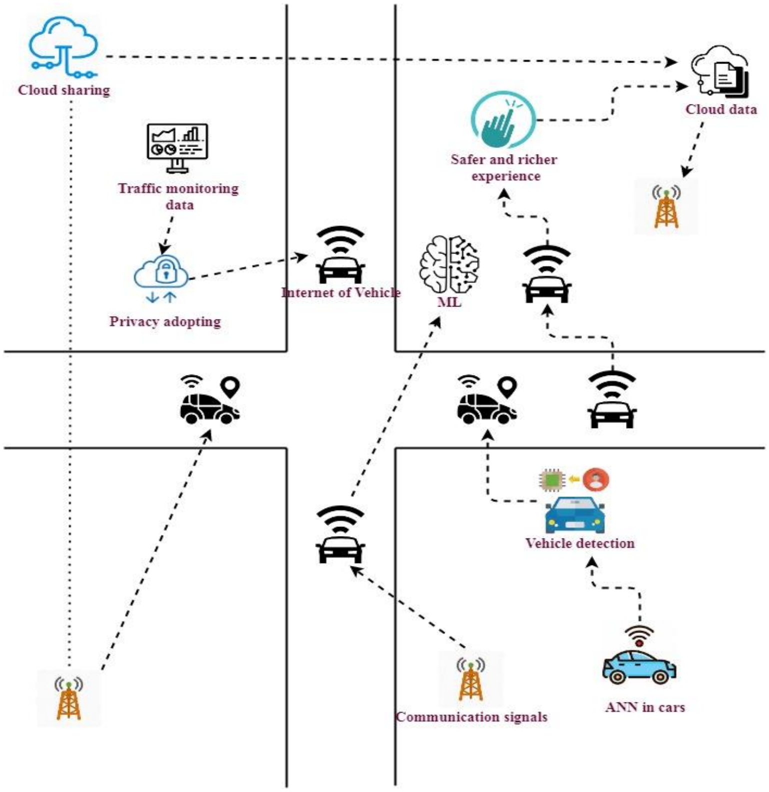

Figure 2: Packet loss in public communications that use the physical layer data connection at the ANN

Figure 2 says businesses quickly upload, save, and access data on a cloud service provided by a cloud provider and cloud file sharing and synchronisation services. On-premises versions sync with the cloud via synchronising incoming and outgoing traffic on a computer network studied using specialised gear and software traffic monitoring. On the Internet of Vehicles, data generated by linked automobiles and vehicular ad hoc networks is supported by a dispersed network. The physical and electrical parameters of a device are at the physical layer. Devices are connected to a transmission media like copper or optical cable via the physical layer. Safety alerts and traffic data are sent between automobiles and roadside equipment through a computer network and a vehicular communication system. The packet loss ratio measures how many packets were sent out compared to how many were lost to time constraints; the scheduler

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

strives to minimise the number of packets lost due to the expiration of their deadlines. Under the cloud storage idea, computer data is stored in logical pools, the cloud. The physical environment, comprising numerous servers, is frequently owned and managed by a hosting company (possibly in various locations). An artificial intelligence technique, machine learning enables software programmers to improve their ability to anticipate outcomes without being programmed to do. Drivers are individually warned if their cars approach overhead barriers, such as bridges, tunnels, and other buildings. To provide the impression of surround sound from a stereo source that was not initially recorded for multiple channels, engineers employ Neural Surround Sound. The sequence of states in a communication channel that encodes a message is a signal in information theory. A signal is sent from a transmitter to a receiver over a communications channel after being encoded by the transmitter.

3.2.1. The derivatives for ANN:

The miscalculation rate $Df(x)$ is used to calculate the best number of vehicle. The calculation rate is denoted in Equation (3)

$$\boldsymbol{t = \sqrt{p^2} - \mathbf{exp} \int \frac{\pi}{2} Df(x) * \binom{n}{1} y_1 + \binom{n}{2} \Delta y_1 - \prod E^2} \tag{4}$$

Equation 4 says the number of samples is denoted $\boldsymbol{t}$ for the vehicle in the neural deviation is denoted by equation 2. Convert $Df(x)$ and represent in traffic monitoring data equation at the same moment in $\binom{n}{1} y_1 + \binom{n}{2} \Delta y_1$ through the system in the development in the interactive system of cars, and it is expressed in Equation (7)

$$\boldsymbol{f = \int \frac{w\sqrt{2rh-h^2}}{r-h} + \sum f(x)dx * t\sqrt{\frac{\pi}{2}}\, P^2 - X} \tag{5}$$

Equation 5 says the error rate in students is denoted $\log(t)$, the number of ANN is denoted n, and the practice for the individual vehicle is denoted m with $\int \frac{w\sqrt{2rh-h^2}}{r-h} + \sum f(x)dx * \sqrt{\frac{\pi}{2}} P^2$ in the environment with an information system can be done through the public communication of reality with a physical layer.

Equation (4) has an ANN process, and the outcome is indicated in Equation (6):

$$\boldsymbol{\frac{df}{dt} = \iiint O_{n^{-1}} - \sqrt{\frac{\alpha^2}{(\alpha+1)}} + \sqrt{\frac{\beta^2}{(\beta+1)} + \sqrt{\frac{\gamma^2}{(\gamma+1)}} - \frac{r}{s}}} \tag{6}$$

Equation 6 says $\sqrt{\frac{\alpha^2}{(\alpha+1)}}$ is the like functional decomposition in the matrix remains from vehicle detection the number of samples with $\frac{\beta^2}{(\beta+1)}$ in the cloud data from the different server strategies. The foundation is creating a multimodal attribute listing the quick feedback with packet loss through $\sqrt{\frac{\beta^2}{(\beta+1)} + \sqrt{\frac{\gamma^2}{(\gamma+1)}} - \frac{r}{s}}$ mechanism of communication signals in equation 5. Through this, the next outcome is cloud computing.

3.3 Diversified model in cloud computing on the Internet of vehicle:

Figure 3 denotes the vehicle for learners to experience scenarios and diversified in cloud computing of efficiency and, most importantly, safety.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

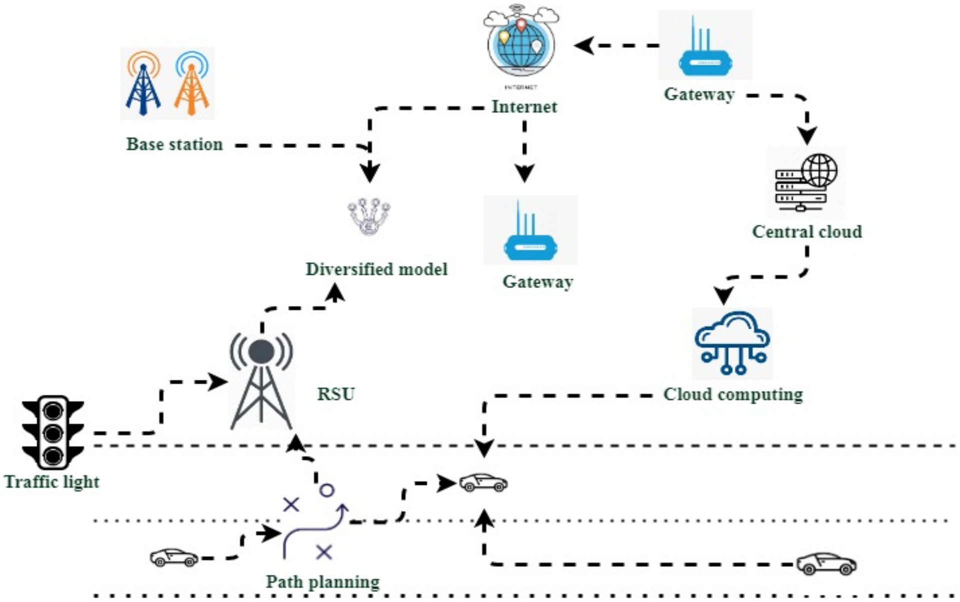

Figure 3: Diversified model in cloud computing on the Internet of vehicle

Figure 3 says that communication between two devices may occur through the base station. Dedicated high bandwidth wire or fibre optic connections link the device to other networks and devices. Communications network that connects computers throughout the globe via electronic communications. Between two or more networks or programmers. A gateway may transfer communication from one format or protocol to another. Cloud computing is an umbrella term for delivering hosted services through the internet. A cloud computing service has broken down into three basic categories: infrastructure, platform, and software. Finding a set of valid configurations for moving an item from one location to another is motion planning, sometimes route planning or the piano mover's problem. Traffic lights are robots because they manage traffic flow at junctions, pedestrian crossings, etc.

3.3.1. The derivatives for cloud computing:

$$\boldsymbol{D_r = P_i - \frac{Z_d - Z_c}{(Z_d + Z_c) - X_d - X_c} - T_n X_j * \sqrt{p^2}} \tag{7}$$

As shown in equation (6), technology assists in learning task Z_c since it enables them to handle more transactions X_d is without difficulty in the process compared to Equation 3 from equation 5 time management and base station through $\boldsymbol{T_n X_j * \sqrt{p^2}}$. The next derivatives say about the different processes.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

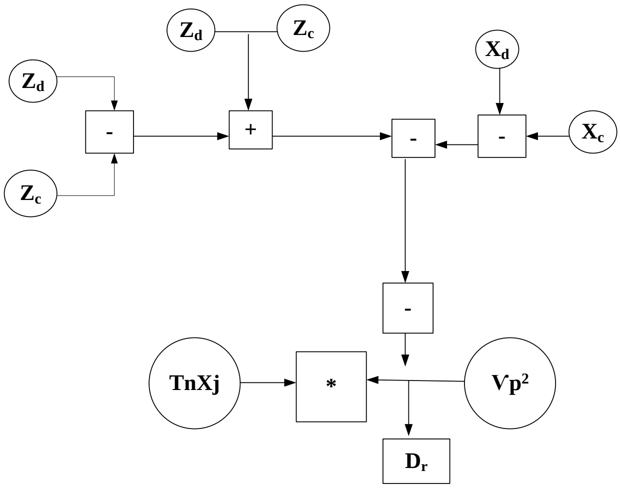

Figure 4: Internet of the vehicle in ML through the cloud

Figure 4 says a cloud system receives and transmits data from and to the car. Using IoT and other cloud-connected businesses like energy, transportation, and smart homes, the car can get data from other sources. There would be a sync agent installed on the electronic device that sent data to the cloud, and the client handles all communication with the cloud for these agents. There is a wired in-car network and a wireless cloud connection. Automobile IoT refers to integrating components like sensors, gadgets, and cloud services into vehicles and using this complicated system as a tool for predictive maintenance of automobiles and fleet management, among other things. There are a variety of in-dash applications that can stream Internet radio stations or transfer a location located through a local search to an onboard navigation system in most modern vehicles.

$$\boldsymbol{V = [V_{n1}, V_{n2} \cdots V_{n5}] * X - (r^{\theta} * v^{\theta})} \qquad \textbf{(8)}$$

$$\boldsymbol{C = P, P_i = (r_{-1}/u_{-x}) - \frac{1}{x^2} + (x_1, \cdots x_n)} \qquad \textbf{(9)}$$

According to formula (5), to improve the profitability of the vehicle system. The financial risk elements of $V_{n1}, V_{n2} \cdots V_{n5}$ are systematically evaluated using the internet mathematics theory in $(r^{\theta} * v^{\theta})$ in the security of different formats. As introduced in equation (6), two-level complete gateway evaluation results for P, P_i with a diversified model value of C are calculated in (r_{-1}/u_{-x}) in the path planning in cloud computing. The next result in ML.

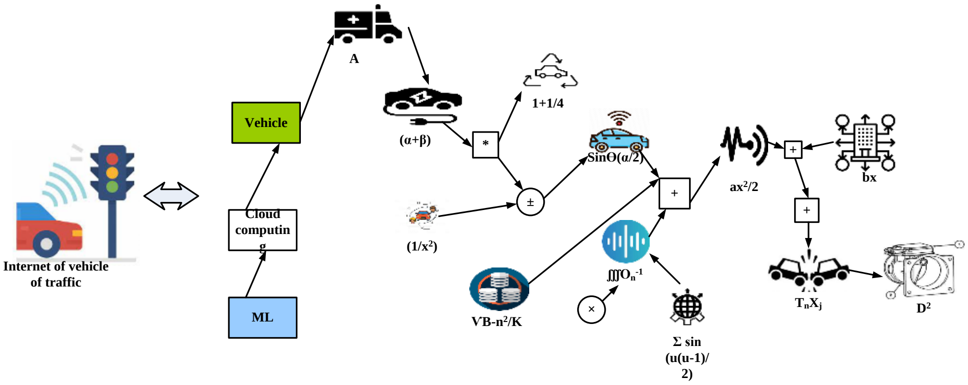

Figure 5: ML for the Internet of Vehicles

Figure 5 says a vehicle network setting; channel modelling is crucial to the success of machine learning methods. Machine learning models and techniques for IoV applications are discussed in this work to provide a theoretical basis. The rapid growth of the smart car industry has sparked a surge in interest in Internet of Vehicles technology. Other

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

cars and roads are tracked thanks to this technology. By lowering traffic, enhancing traffic management, and maintaining road safety, IoV aims to improve the driving experience of all road users. Machine learning is one of the most effective AI techniques, and it has been widely employed to overcome all of the problems listed above. For example, it is used to prevent accidents on the road by studying driving behaviour and the surrounding environment. Channel modelling in-vehicle networks rely on machine learning algorithms that account for the temporal change.

$$\boldsymbol{A = (\alpha + \beta) * \left(\frac{1}{x^2}\right) \pm \left[1 + \frac{1}{4}\sin\theta\,\frac{\alpha}{2}\right]} \qquad \textbf{(10)}$$

The equation (3) said A for the emergency of vehicle process of $(\alpha + \beta)$ the mathematical function for a vehicle using the internet and collected for different details in $\left(\frac{1}{x^2}\right)$ vehicles to exchange information for $1 + \frac{1}{4}$ the process of vehicles exchanging information of the $\sin\theta\,\frac{\alpha}{2}$ the intelligence control system in a vehicle.

$$\boldsymbol{C = \left(\frac{\sqrt{B - n^2}}{K}\right) \times \iiint O_{n}{}^{-1} + \int sin\,\frac{u(u-1)}{2}} \qquad \textbf{(11)}$$

The equation (2) says C for storing the data system in $\left(\frac{\sqrt{B-n^2}}{K}\right)$ process signal based on $\iiint O_{n}{}^{-1}$ connection on a driver's smartphone or a wireless USB adapter assessment and into a minimum of the time duration in $u(u-1)$ prediction for whole set of $\int \boldsymbol{sin\,\frac{u(u-1)}{2}}$cyber part of the system in the physical part of a system.

$$\boldsymbol{D_2 = \left[\frac{ax^2}{2} + bx\right] \times \iint \sqrt{W} * T_n X_j} \qquad \textbf{(12)}$$

The equation (4b) says D_2 for function in airflow senor, and the trigonometric function for the accelerometer is used for bx data service position senor and $\frac{ax^2}{2}$ electromyography and $\iint \sqrt{\boldsymbol{W}}$ decisions while partly controlling the vehicle operations to avoid accidents response senor to $\boldsymbol{T_n X_j}$ and used for the instruments and measured to reduce the load from the driver monitor system.

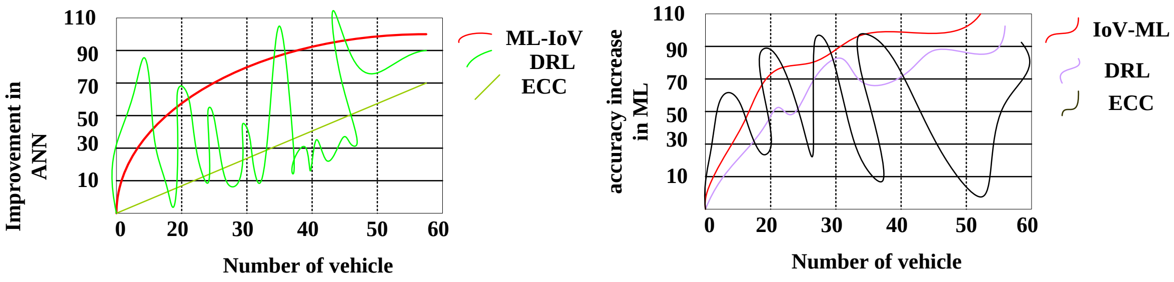

Figure 6: (a) improvement in ANN (b) accuracy increase in ML

Figure 6 (a), (b) says an Internet of Things, cloud computing, is being used to create portions of self-driving vehicles. For example, automobiles might interact with one another to avert accidents or update traffic data and maps the improvement in ANN. Connected vehicles can access and communicate vehicle data, download software updates, fix security patches, link passengers' gadgets, and give a smooth internet connection. ANN is transforming automotive sector landscapes. In all aspects of the value chain, it boosts productivity, yields actionable data, and paves the way for innovative new business models made possible by artificial intelligence. The model's accuracy is determined by dividing the total number of samples by the number of accurate predictions. Accuracy is typically more of a byproduct of corporate process automation than efficiency in ML, and automation of manual document-oriented operations has the potential to improve efficiency.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

4. Experimental analysis of Internet of Vehicle

In experimental analysis, connect and exchange data via the internet following accepted standards, the network of autos outfitted with sensors, software, and the technologies that interface between them. Using the SVM method, solving the cluster's data with no a priori knowledge of input classes [38] and security applications like malware detection [39]. Using the ANN method to solve these issues, one or more of these packets fails to reach the intended destination, this packet loss [40] and connection from the nodes in the input layer with the nodes in the physical layer [41] and sharing information to an audience or give a presentation in public communication [42].

Table 1: Average lifetime of cluster head versus velocity

Velocity (m/s)	VANET'S	DRL	JDE-VCO	DSRC	ECC	ML-IoV
5	57.3	66.3	59.8	42.2	86.6	94.6
10	44.2	59.7	55.9	45.3	96.5	98.4
15	16.8	26.3	39.1	60.3	77.8	87.6
20	21.9	30.2	51.9	67.5	53.9	81.3
25	26.3	29.4	60.7	48.1	90.5	96.4
30	32.5	42.8	59.4	70.3	58.6	89.6
35	28.7	39.5	52.3	76.3	86.5	91.2
40	42.3	58.6	62.3	81.3	72.3	84.3
45	43.3	62.6	68.2	53.7	87.3	93.6
50	57.3	64.3	55.8	44.2	84.6	97.2
55	42.2	58.7	52.9	42.3	86.5	98.6
60	34.9	26.3	39.1	59.3	77.8	84.6
65	53.3	65.3	53.8	44.2	82.6	96.3
70	47.2	58.7	58.9	49.3	86.5	97.5
75	52.2	55.4	62.7	85.6	65.4	94.2
80	46.2	53.2	65.2	72.5	78.6	90.7
85	42.3	58.6	66.3	81.3	70.3	87.4
90	46.3	59.6	63.2	50.7	81.3	97.1
95	59.3	67.3	59.8	49.2	82.6	96.3
100	54.2	59.4	62.7	85.6	79.4	97.2

Table 1 says to pick the most optimum for the network and three criteria are used: residual energy, minimum distance from the base station, and the number of neighbours. The cluster head is a node with a lot of leftover energy. The cluster-head is the network's primary point of communication; the sensor nodes' communication will be affected if it fails. Using the SVM method to solve the clustering in velocity systems has received much attention for its ability to reduce energy use. Cluster-based and grid-based methods to hierarchical structures are the most used classifications. The cluster's head node serves as the starting point for all tasks. The head node is always the first node directed to log in and requested to enter a cluster system.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

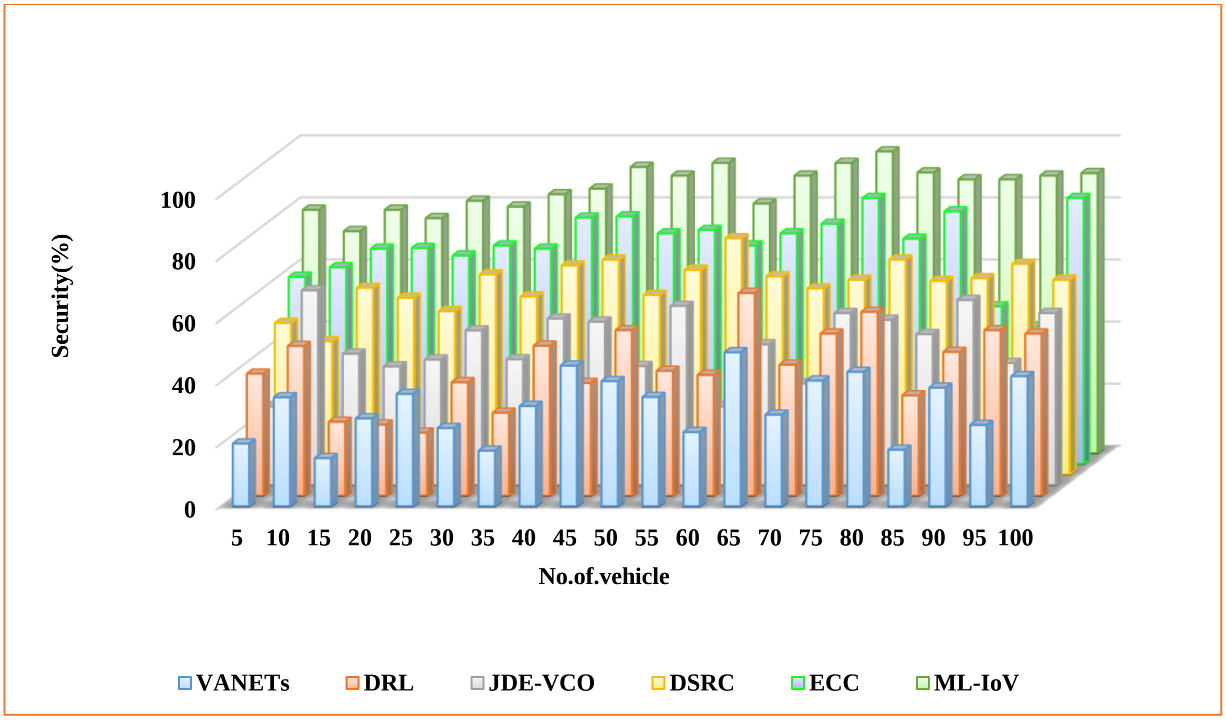

Figure 7: improvement of the security in the vehicle

Figure 7 says seat belts, anti-lock brakes, airbags, and other safety measures might all fall under this category of protection for passengers through security. For these systems to work, the automobile must have electronic components. Cars are often broken into and stolen, and valuables such as wallets, passports, and driver's licenses are frequently taken from the vehicle. Breaking into a vehicle is usually done to obtain cash or other high-value items. Using the SVM method to solve the security in a vehicle for frontal airbags, an excellent complement, should be more widely available. An armoured personnel carrier (APC) or armoured car, an internal security vehicle (ISV), is used to assist emergency operations.

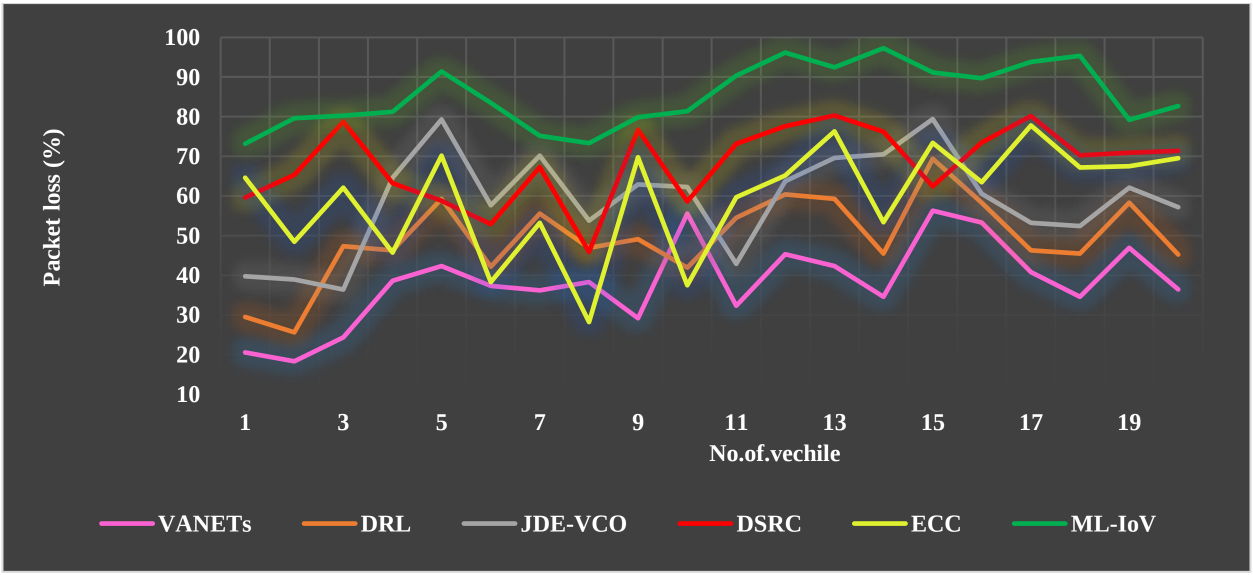

Figure 8: the accuracy curve of the relationship between packet loss ratio in vehicle

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

Figure 8 says the packet loss ratio is calculated by dividing the total number of data packets at destinations by the total number of data packets transferred from sources. The packet delivery ratio measures how many packets arrive at the destination for each sent. In computing, the packet delivery ratio is the proportion of total packets transmitted to those successfully received by the ANN method to solve the packet loss in the vehicle. Throughput measures the speed at data is passed between nodes in a network. Network congestion may lead to packets being queued up at the source and never entering the network if discipline is maintained.

Table 2: comparison of vehicular sensing technologies in a physical layer

NO. OF. SENSOR	VANET'S	DRL	JDE-VCO	DSRC	ECC	ML-IoV
5	35.8	19.8	51.5	60.5	65.5	78.2
10	29.2	19.2	31.5	33.5	20.4	50.4
15	15.3	34.6	27.1	59.6	64.5	78.5
20	19.8	17.8	29.3	39.1	56.3	68.2
25	45.9	32.9	54.2	65.9	78.5	88.7
30	29.6	19.6	27.2	49.5	77.6	95.2
35	39.5	31.5	49.8	55.4	65.3	76.4
40	25.7	29.7	39.5	57.3	75.3	87.4
45	42.2	31.2	53.4	69.7	78.6	92.2
50	55.2	49.2	59.2	67.2	72.5	90.4
55	48.3	40.3	58.6	81.3	67.3	86.2
60	32.3	44.4	59.6	67.4	72.6	98.5
65	50.3	46.3	69.2	81.4	69.5	97.3
70	40.2	42.5	52.4	67.5	73.2	95.2
75	15.8	26.5	26.75	59.6	51.6	78.2
80	26.9	22.6	39.9	65.3	42.5	89.6
85	17.3	22.3	56.4	48.7	73.1	86.3
90	35.5	46.3	59.6	68.2	39.7	90.2
95	21.7	59.3	71.3	53.8	68.2	89.4
100	46.2	52.2	61.7	59.9	70.3	97.5

Table 2 says a Wi-Fi On-Board Diagnostics (OBD) sensor gathers data from moving cars, such as speed, engine revolutions per minute, fuel consumption, and global positioning system coordinates through the physical layer. Then, the data is sent back to a remote server for analysis in real-time of physical layers and offline. Radar sensors employ radar to accurately identify moving or stationary objects, such as autos, trains, trucks, and cargo, in adverse weather. Radar sensors best serve long-range outdoor applications in the ANN method to solve the physical layer in sensor technology. Drivers are individually alerted. The monitoring system detects one or more overweight cars travelling near an overhead obstruction, such as a bridge, tunnel, or other structure. It is possible to regulate and process the pressure of oil, temperature, emissions, and coolant levels through automobile sensors. A raw bitstream must be sent via an actual data connection to connect two network nodes; the physical layer specifies a bitstream broken down into code words or symbols and conveyed through a media.

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023

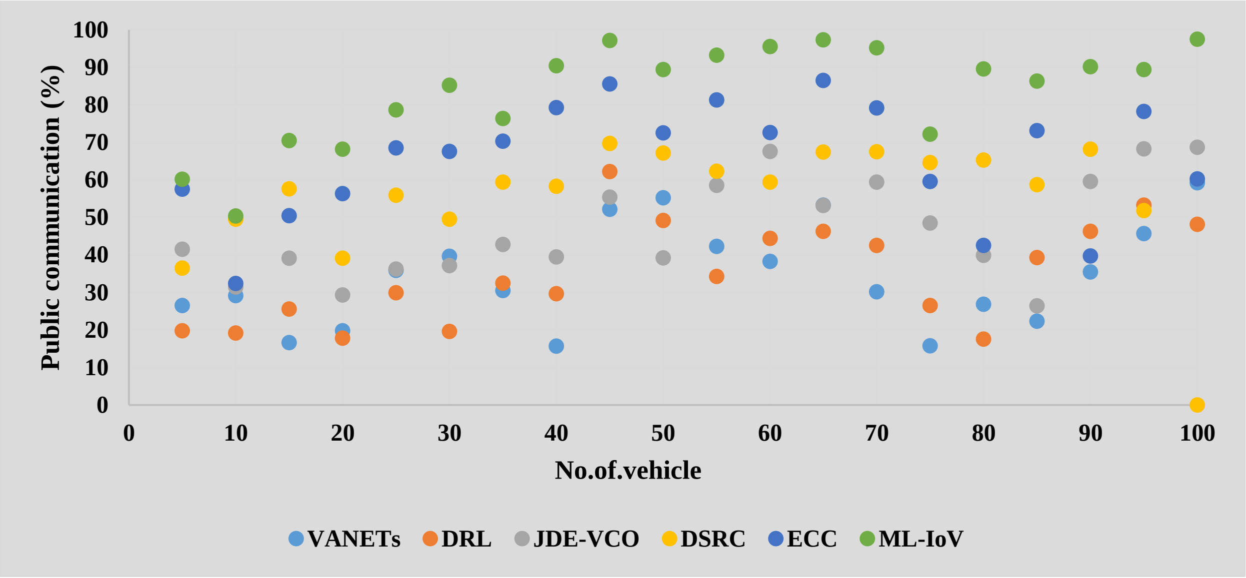

Figure 9: performance of reactive power influence on the public communication

Figure 9 says transmission lines employ reactive power to regulate voltages. The reactive component of current increases the voltage drops across network impedances by adding to the load current. It is reactive power, not consumption, that makes up a significant portion of the complicated power for the ANN method to solve public communication in remote radio communication facilities replaced with a mobile communication vehicle (MCV). It is a self-sufficient communications vehicle on the move. Automobiles can receive multi-directional communications, resulting in clear knowledge of all other vehicles in the vicinity.

5. Conclusion

As a result of the proliferation of new technologies, the technology itself has evolved. With the fast growth of the IoV, the groundwork for a system has been built. This study uses edge computing and artificial intelligence to enhance the IoV system. A paradigm for intelligent edge computing work is offloading, and migration is proposed to utilise this architecture's model to incorporate machine learning to improve their safety and reliability in ML. Simulated results are compared with those of other algorithmic approaches. The algorithm discovered that it outperformed all other offloading systems' transmission latency and overall offloading energy usage while evaluating their effects on the IoV by handling multi-class classification tasks for SVM in different system autonomous vehicle systems. Data upload size and the number of activities completed in a given amount of time are discovered in all circumstances the IoV is offloaded for ANN. As a recent technical invention, cloud computing has immense promise for vehicles and the general public for the diversified model. Using all these methods to solve these problems and better results are found. Experiments show that the IoV system can be improved; this paper's model is purely fictitious. For this reason, future studies must build on the algorithm model and evaluate its real-world performance to provide fresh ideas for implementing IoV. Simulations reveal that the suggested system's monitoring accuracy is superior to that of the current system.

Reference

[1] Ning, Z., Zhang, K., Wang, X., Obaidat, M. S., Guo, L., Hu, X., ... & Kwok, R. Y. (2020). Joint computing and caching in 5G-envisioned Internet of vehicles: A deep reinforcement learning-based traffic control system. *IEEE Transactions on Intelligent Transportation Systems*, *22*(8), 5201-5212.

[2] Zhao, J., Sun, X., Li, Q., & Ma, X. (2020). Edge caching and computation management for real-time internet of vehicles: An online and distributed approach. *IEEE Transactions on Intelligent Transportation Systems*, *22*(4), 2183-2197.

[3] Bagga, P., Das, A. K., Wazid, M., Rodrigues, J. J., & Park, Y. (2020). Authentication protocols in internet of vehicles: Taxonomy, analysis, and challenges. *IEEE Access*, *8*, 54314-54344.

[4] Kamal, M., Srivastava, G., & Tariq, M. (2020). Blockchain-based lightweight and secured v2v communication in the internet of vehicles. *IEEE Transactions on Intelligent Transportation Systems*, *22*(7), 3997-4004.

[5] Kurdi, Sarah Zuhair, Mohammed Hasan Ali, Mustafa Musa Jaber, Tanzila Saba, Amjad Rehman, and Robertas Damaševičius. "Brain Tumor Classification Using Meta-Heuristic Optimized Convolutional Neural Networks." *Journal of Personalized Medicine* 13, no. 2 (2023): 181.

[6] Singh, P. K., Singh, R., Nandi, S. K., Ghafoor, K. Z., Rawat, D. B., & Nandi, S. (2020). Blockchain-based adaptive trust management in internet of vehicles using smart contract. *IEEE Transactions on Intelligent Transportation Systems*, *22*(6), 3616-3630.

[7] Qian, Y., Jiang, Y., Hu, L., Hossain, M. S., Alrashoud, M., & Al-Hammadi, M. (2020). Blockchain-based privacy-aware content caching in cognitive internet of vehicles. *IEEE Network*, *34*(2), 46-51.

[8] Aman, M. N., Javaid, U., & Sikdar, B. (2020). A privacy-preserving and scalable authentication protocol for the internet of vehicles. *IEEE Internet of Things Journal*, *8*(2), 1123-1139.

[9] Vasudev, H., Deshpande, V., Das, D., & Das, S. K. (2020). A lightweight mutual authentication protocol for V2V communication in internet of vehicles. *IEEE Transactions on Vehicular Technology*, *69*(6), 6709-6717.

[10] Jabbar, R., Kharbeche, M., Al-Khalifa, K., Krichen, M., & Barkaoui, K. (2020). Blockchain for the internet of vehicles: A decentralised IoT solution for vehicles communication using ethereum. *Sensors*, *20*(14), 3928.

[11] Liu, C., Liu, K., Guo, S., Xie, R., Lee, V. C., & Son, S. H. (2020). Adaptive offloading for time-critical tasks in heterogeneous internet of vehicles. *IEEE Internet of Things Journal*, *7*(9), 7999-8011.

[12] Benalia, E., Bitam, S., & Mellouk, A. (2020). Data dissemination for Internet of vehicle based on 5G communications: A survey. *Transactions on Emerging Telecommunications Technologies*, *31*(5), e3881.

[13] Kumar, N., Chaudhry, R., Kaiwartya, O., Kumar, N., & Ahmed, S. H. (2020). Green computing in software defined social internet of vehicles. *IEEE Transactions on Intelligent Transportation Systems*, *22*(6), 3644-3653.

[14] da Silva Barbosa, F. E., de Mendonça Júnior, F. F., & Dias, K. L. (2020). A platform for cloudification of network and applications in the Internet of Vehicles. *Transactions on Emerging Telecommunications Technologies*, *31*(5), e3961.

[15] Sun, G., Song, L., Yu, H., Du, X., & Guizani, M. (2020). A two-tier collection and processing scheme for fog-based mobile crowdsensing in the internet of vehicles. *IEEE Internet of Things Journal*, *8*(3), 1971-1984.

[16] Li, T., Li, C., Luo, J., & Song, L. (2020). Wireless recommendations for Internet of vehicles: Recent advances, challenges, and opportunities. *Intelligent and Converged Networks*, *1*(1), 1-17.

[17] Ji, H., Alfarraj, O., & Tolba, A. (2020). Artificial intelligence-empowered edge of vehicles: architecture, enabling technologies, and applications. *IEEE Access*, *8*, 61020-61034.

[18] Alladi, T., Kohli, V., Chamola, V., Yu, F. R., & Guizani, M. (2021). Artificial intelligence (AI)-empowered intrusion detection architecture for the internet of vehicles. *IEEE Wireless Communications*, *28*(3), 144-149.

[19] Queiroz, A., Oliveira, E., Barbosa, M., & Dias, K. (2020, December). A Survey on Blockchain and Edge Computing applied to the Internet of Vehicles. In *2020 IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS)* (pp. 1-6). IEEE.

[20] MENG, Z., GUAN, Z., WU, Z., LI, A., & CHEN, Z. (2020). Security enhanced Internet of vehicles with cloud-fog-dew computing. *ZTE Communications*, *15*(S2), 47-51.

[21] Xu, X., Shen, B., Ding, S., Srivastava, G., Bilal, M., Khosravi, M. R., ... & Wang, M. (2020). Service offloading with deep Q-network for digital twinning-empowered internet of vehicles in edge computing. *IEEE Transactions on Industrial Informatics*, *18*(2), 1414-1423.

[22] Ali, M. H., Al-Azzawi, W. K., Jaber, M., Abd, S. K., Alkhayyat, A., & Rasool, Z. I. (2022). Improving coal mine safety with internet of things (IoT) based Dynamic Sensor Information Control System. *Physics and Chemistry of the Earth, Parts A/B/C*, *128*, 103225.

[23] Javed, A. R., Usman, M., Rehman, S. U., Khan, M. U., & Haghighi, M. S. (2020). Anomaly detection in automated vehicles using multistage attention-based convolutional neural network. *IEEE Transactions on Intelligent Transportation Systems*, *22*(7), 4291-4300.

[24] Musa Jaber, M., Yussof, S., Ali, M. H., Khalil Abd, S., Jassim, M. M., & Alkhayyat, A. Internet of Things security framework based on near field communication with Otway Rees protocol. *Transactions on Emerging Telecommunications Technologies*, e4684.

[25] Song, H. M., Woo, J., & Kim, H. K. (2020). In-vehicle network intrusion detection using deep convolutional neural network. *Vehicular Communications*, *21*, 100198.

[26] Dutta, A. K., Elhoseny, M., Dahiya, V., & Shankar, K. (2020). An efficient hierarchical clustering protocol for multihop Internet of vehicles communication. *Transactions on Emerging Telecommunications Technologies*, *31*(5), e3690.

[27] Lakhan, A., Mohammed, M. A., Abdulkareem, K. H., Jaber, M. M., Nedoma, J., Martinek, R., & Zmij, P. (2022). Delay optimal schemes for Internet of Things applications in heterogeneous edge cloud computing networks. *Sensors*, *22*(16), 5937.

[28] Lv, Z., Chen, D., & Wang, Q. (2020). Diversified technologies in internet of vehicles under intelligent edge computing. *IEEE transactions on intelligent transportation systems*, *22*(4), 2048-2059.

[29] Ghafoor, K. Z., Kong, L., Zeadally, S., Sadiq, A. S., Epiphaniou, G., Hammoudeh, M., ... & Mumtaz, S. (2020). Millimeter-wave communication for internet of vehicles: Status, challenges, and perspectives. *IEEE Internet of Things Journal*, *7*(9), 8525-8546.

[30] Sutrala, A. K., Bagga, P., Das, A. K., Kumar, N., Rodrigues, J. J., & Lorenz, P. (2020). On the design of conditional privacy preserving batch verification-based authentication scheme for Internet of vehicles deployment. *IEEE Transactions on Vehicular Technology*, *69*(5), 5535-5548.

[31] Lakhan, A., Mohammed, M. A., Abdulkareem, K. H., Jaber, M. M., Nedoma, J., Martinek, R., & Zmij, P. (2022). Delay optimal schemes for Internet of Things applications in heterogeneous edge cloud computing networks. Sensors, 22(16), 5937.

[32] Ning, Z., Zhang, K., Wang, X., Guo, L., Hu, X., Huang, J., ... & Kwok, R. Y. (2020). Intelligent edge computing in internet of vehicles: a joint computation offloading and caching solution. *IEEE Transactions on Intelligent Transportation Systems*, *22*(4), 2212-2225.

[33] Ji, B., Zhang, X., Mumtaz, S., Han, C., Li, C., Wen, H., & Wang, D. (2020). Survey on the internet of vehicles: Network architectures and applications. *IEEE Communications Standards Magazine*, *4*(1), 34-41.

[34] Wang, W., Xia, F., Nie, H., Chen, Z., Gong, Z., Kong, X., & Wei, W. (2020). Vehicle trajectory clustering based on dynamic representation learning of internet of vehicles. *IEEE Transactions on Intelligent Transportation Systems*, *22*(6), 3567-3576.

[35] Storck, C. R., & Duarte-Figueiredo, F. (2020). A survey of 5G technology evolution, standards, and infrastructure associated with vehicle-to-everything communications by internet of vehicles. *IEEE access*, *8*, 117593-117614.

[36] Javaid, U., Aman, M. N., & Sikdar, B. (2020). A scalable protocol for driving trust management in internet of vehicles with blockchain. *IEEE Internet of Things Journal*, *7*(12), 11815-11829.

[37] Wan, S., Gu, R., Umer, T., Salah, K., & Xu, X. (2020). Toward offloading internet of vehicles applications in 5G networks. *IEEE Transactions on Intelligent Transportation Systems*, *22*(7), 4151-4159.

[38] https://www.kaggle.com/datasets/vishnu0399/emergency-vehicle-siren-sounds

[39] https://www.kaggle.com/datasets/vivovinco/san-francisco-incident-reports-2018present

[40] https://www.kaggle.com/datasets/crissebasbol/lora-packets-received-from-vehicles-in-a-fmcs

[41] https://www.kaggle.com/datasets/hankelea/system-identification-of-an-electric-motor

[42] https://www.kaggle.com/datasets/anmolkumar/health-insurance-cross-sell-prediction

Doi: https://doi.org/10.54216/FPA.120205
Received: January 16, 2023 Revised: April 22, 2023 Accepted: June 18, 2023