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BCAS: A Blockchain Model for Collision Avoidance to Prevent Overtaking Accidents on Roads

Nadeem Malik[1,*], Saud Altaf[2], Muhammad Azeem Abbas[3]
[1,2,3]University Institute of Information Technology - PMAS Arid Agriculture University
*** Correspondence**: Nadeem Malik (**poprp@uaar.edu.pk**)

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Overtaking at high speeds, especially on non-divided roadways, is a leading cause of traffic accidents. During overtaking maneuvers, humans are more likely to make mistakes due to factors that cannot be predicted. For overtaking operations in autonomous vehicles, prior research focused on image processing and distant sensing of the driving environment, which didn't consider the speed of the surrounding traffic, the size of the approaching vehicles, or the fact that they could not see beyond impediments in the road. The past researches didn't focus on the speed of the surrounding traffic or the size of the approaching vehicles. Moreover, most of the techniques were based on single agent systems where one agent manages the source vehicle's (autonomous) mobility within its surroundings. This research conducts a feasibility study on a remote Vehicle-to-Vehicle (V2V) communication framework based on Dedicated Short-Range Communication (DSRC) to improve overtaking safety. This work also tries to improve safety by introducing a blockchain-based safety model called BCAS (Blockchain-based Collision Avoidance System). The proposed multi-agent technique strengthens the ability of real-time, high-speed vehicles to make decisions by allocating the total computation of processing responsibilities to each agent. From the experimental results, it is concluded that the proposed approach performs better than existing techniques and efficiently covers the limitations of existing studies.

Keywords: Road Accident; Overtaking; Blockchain; V2V routing and Machine Learning

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Introduction

When we talk about the causes of traffic accidents, unsafe overtaking is one of the leading causes, and driver's mistakes cause more than 70 percent. These mistakes include a lack of driver experience, poor psychological quality, failure to maintain a safe distance, and poor speed judgment on the part of the vehicle in front of the overtaking vehicle. Researchers have been developing an overtaking road system that uses advanced technology to boost the passive safety of motor vehicles [1]. On the road, human drivers must always be on high alert when passing lead cars or other drivers passing them in their vehicles. Figure 1 displays global road accident fatality rates data from the World Life Expectancy Report. This figure is based on the 2018 World Health Organization (WHO) data, which evaluates the fatality rate per 100,000 accident cases [2].

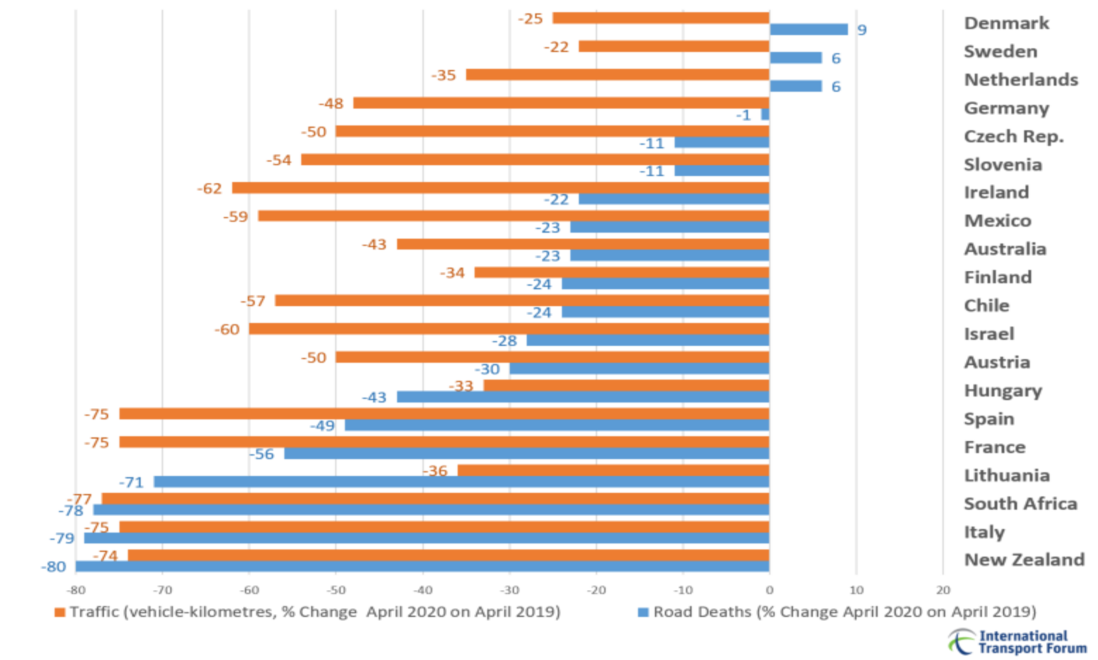


Figure 1: Road Accident Death in 2021 (International Transport Forum)

Collisions on the roadways are often caused by inexperience, a lack of expertise, and habits that include taking unnecessary risks [3]. Moreover, drivers fall short in numerous ways, including maintaining a safe distance from leading vehicles while overtaking [4]. On one-lane roads, irresponsible lane changes without the correct signal indicators can make it challenging for the driver of the adjacent or opposing vehicle to maneuver [5]. Head-on or side collisions result from this. Driving is also impacted by physical limitations like aging, poor vision, hearing issues, stress, fatigue from continuous or lengthy travel, and poor road lighting [6].

Intelligent transport systems (ITSs) have greatly multiplied admiration in recent ones. In intelligent transportation systems, numerous Vehicular Ad Hoc Networks (VANETs) based strategies are becoming the most promising research strategies for all such situations [7]. VANETs-based solutions utilize modern IT techniques with the sensor that guides the car drivers to adapt the surroundings and take immediate actions to avoid road mishaps, as shown in figure 2. All such solutions deliver safety and comfort for passengers and drivers [8]. The primary mechanism that underpins vehicular networks allows cars to produce and broadcast messages to enhance both the safety and effectiveness of traffic flow. However, since these surroundings are not trustworthy, it is difficult for cars to judge their communications reliability [9]

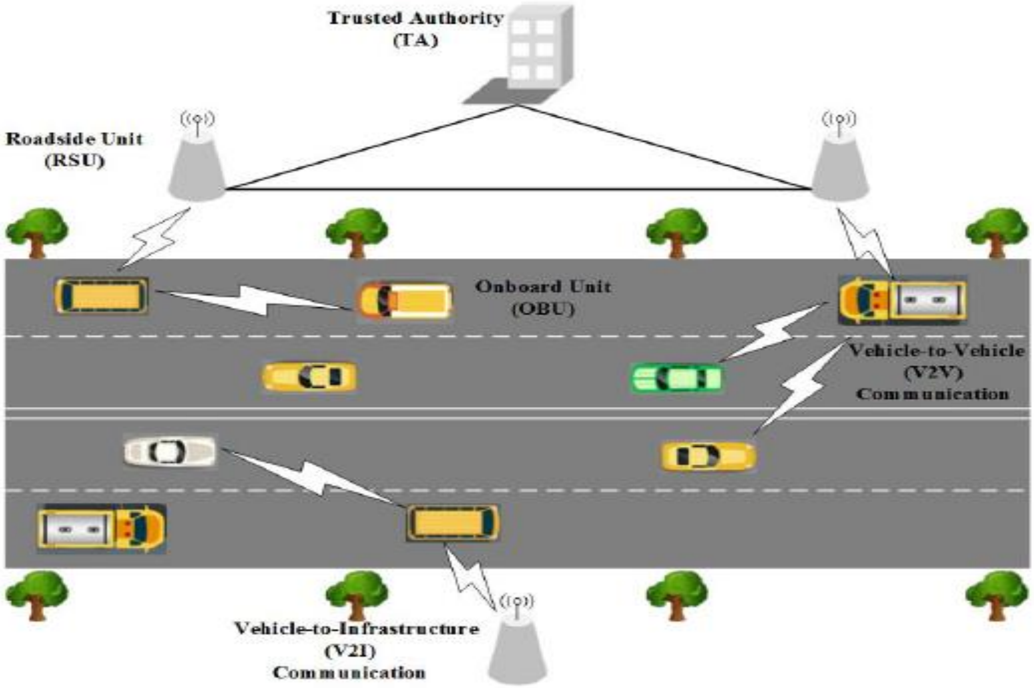


Figure 2: System Model of Vehicular Ad hoc Networks (VANETs).

.Most models are based on evaluating automobiles and assigning an appropriate level of confidence to each vehicle. Either directly or indirectly, one should establish trust. Using the trust value, we can determine which nodes are trustworthy, secure, and dependable while communicating with other nodes on the network. Based on vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication, vehicular ad hoc networks (VANETs) are distinguished [10].

Vehicles converse with neighboring vehicles for information exchange in V2V communication, while cars directly connect with the roadside units (RSUs), as exposed in Figure 1 [11]. A couple of IEEE criteria can be utilized for V2V and V2I communications in VANETs, along with dedicated short-range communication (DSRC) radio [12]. VANET uses IEEE 802.11 p standard as a transmission convention. In comparison, IEEE 802.11 p is a supported alteration to add remote access in vehicular conditions for simple and successful correspondence between vehicles with dynamic versatility. In any case, most VANET concentrates on IEEE 802.11 [13] which is in the phase of exploration, and the down-to-earth applications are significantly less because the equipment of IEEE 802.11 p is uncommon available. IEEE 802.15.4 convention can likewise be utilized in V2V correspondence. The wellbeing application in VANET expands the security of travelers by trading wellbeing important data in V2V posts, for example, crisis advance notice and traffic conditions cautioning. Crisis cautioning messages can be conveyed between vehicles utilizing IEEE 802.15.4 [14] convention. It works on 2.4GHz and arrives at the exchange pace of 250 Kbit/s. Front End Module (FEM) has included equipment to extend the correspondence range.

To cope with the above glitches, most researchers uses machine learning and Artificial Intelligence (AI) based models that are complex and may sometimes fail in critical situations where their actions are required [15]. Furthermore, most AI-based models work on agents that are the essential actors of collision avoidance. Although this approach is quite remarkable, the coordination among agents when a collision is near to occur is difficult and may require a complex programming-based algorithm [16]. Blockchain is primarily acknowledged as one of the disruptive technologies which uphold failing and tamper-proof records deprived of a centralized bank and permits distributed nodes to trade with each other [17]. Moreover, blockchain has been widely studied and applied in quick decision-based scenarios due to its extraordinary security and reliability like decentralized storage [18], content delivery [19], and critical management [20]. Blockchain technology is applied to provide an assistive approach that follows multi-agent collaborative and cooperative techniques for collision-free multi-hop overtaking maneuvers in this research work. [21].

Research Contribution:

The critical contribution of this research work is as follows:

- To analyze the development in the technology of overtaking safety systems and identification of the core encounters faced by the design of overtaking.
- To propose an assistive approach based on a Blockchain mechanism that follows multi-agent collaborative and cooperative techniques for collision-free multi-hop overtaking maneuvers.
- To simulate the proposed approach for its validation and to evaluate the proposed system for its accuracy and performance.

The remainder of the paper is composed in an accompanying manner: Section 2 examines the past literature. Section 3 presents the proposed conceptual model—section 4 includes results and discussion. Section 5 describes the conclusion with future recommendations.

Literature Review

In many countries, road traffic accidents are a significant public health issue. Every year, an estimated 1.2 million people lose their lives in traffic accidents, and another 20 to 50 million are injured. Around 6 percent of these collisions are caused by overtaking. Overtaking is a complex driving maneuver with numerous influencing factors. However, drivers are physically and mentally incapable of rationally capturing all influencing factors and deciding based on weighting. This section discusses some of the key models that have been developed in the past to prevent road accidents due to overtaking.

The work of Perumal et al. [22] proposed a model to assist human drivers who are attempting to overtake. Their study suggested an Intelligent Overtaking Advice System (IOAS). IOAS is designed to accurately anticipate the lead vehicle velocity and the Time to Collision (TTC). Their work was based on a Time-to-Collision Network (TTC) (TTC-Net) strategy driven by a Velocity Network (VNet) to improve accuracy, robustness, and response time. The presented TTC-Net and VNet were skilled in the ground truth dataset, which was huge in volume. Their given TTC-Net and VNet delivered 98 percent and 97 percent precision individually, according to an evaluation of their IOAS performance. To prevent overtaking accidents, their suggested IOAS was incorporated as an extension of the Advanced Driver Assistance System (ADAS) into actual vehicles.

A progressive Driving Assistance System (ADAS) that helps those who drive while passing bicycles were developed to prevent accidents' severity [23]. In this work, the Human–Machine Interface (HMI) was designed to show the information in several different modalities and included several warning levels. A blend of Time-to-Danger (TTD) along lateral clearance (LC) factors was utilized as an activation criterion for the ADAS. Numerous experiments were performed using a driving simulator with a medium level of realism at the Transportation Research Institute (IMOB) of Hasselt University in Belgium. Forty-eight car drivers participated in the experiment by driving the rural experimental two-lane route twice, once in the zero states and once with the ADAS activated, to test three different overtaking scenarios. The proposed in-vehicle driving assistance system was put through a series of statistical tests, and the results showed that the performance of the proposed model was excellent.

Hamid et al. [24] examined that there are various Vehicle Ad-Hoc Network (VANET) applications that give safe path (overwhelming) components between vehicles out and about. They additionally asserted that overwhelming could result in significant mishaps for travelers utilizing cars along the roadway. In their article, they proposed another suitable pursuit technique and path exchanging calculation for self-loader vehicles (S-AV), which assisted with keeping up with solace and wellbeing rules between vehicles to accomplish safe street travel progressively, regardless of the presence of cars moving at high velocities on the roadway. Their calculation recognized various kinds of safe surpassing between vehicles on the road under different moving settings. They were separated into significant gatherings and assessed seriously founded on multiple exhibitions. The solace level and wellbeing of vehicles utilizing the course were ascents on their proposed calculation. At long last, they likewise presented a proposition for future examination of ways to deal with creating and advancing logical exploration connected with VANET to research how to guarantee the fitting choice to continue securely between vehicles on the interstate and inside metropolitan urban areas.

Another review examined how safe driving circumstances among companions positively affected youthful Chinese drivers' prosocial [25].About 300 52 young Chinese drivers between the ages of 18 and 25 years consented to take part in this review and finished the survey. The inquiries on the poll were connected with a safe driving environment among companions, traffic locus of control, and forceful and prosocial driving ways of behaving. Direct impacts were applied to prosocial and destructive driving ways of acting by having a protected driving environment among companions and a traffic locus of control. Besides, an inward locus of power was a mediator in the relationship between correspondence on the prosocial driving way of behaving. Afterward, a connection was shared to show an obligation to safe driving and a forceful enterprising way of conducting. Their work showed a relationship between friendly expenses and prosocial behavior. Toward the end, they infer that the effect of a protected driving climate on prosocial and forceful behavior changes with the degrees of traffic locus of control displayed by the drivers. Their review added to the extension of existing hypothetical structures and can be utilized in producing mediations and preparing for youthful drivers.

Due to increased vehicles on the roads Sri Lanka is facing exponential incres in traffic and road accidents. The statistical findings show that 70 to 80 percent of incidents were caused by human error, with driver behavior being the primary contributor. Manuja et al. [24] suggested a proactive approach to accident prevention that helps drivers by giving them precise warnings and raising road awareness. The Road Infrastructure Broadcast (RIB) module and the Vehicle module were the two critical sections in their work. The network was automatically configured using available nodes using a wireless ad hoc mesh network to maximize availability. The suggested remedy provided three different types of warnings to help drivers. Helping the driver with notifications about upcoming traffic, vehicle speed warnings, and informing about the risk of overtaking were the factors that were determined using a fuzzy logic method. Their suggested system could assist drivers in traveling in unfamiliar places with confidence and more concentration by offering specific warnings. Some of the literature is also described in Table 1.

Table 1: Literature Review of Road Accident Prevention Strategies

Reference	Technique	Strength and Achievements
Satheesh et al. [26]	Image processing and Deep Learning	• Machine Learning, Image Processing, Convolution Neural networks, Raspberry Pi, and Vehicle to Vehicle Communication are some of the keywords associated with this topic. • The RPi and several mobile devices were utilized to test the proposed system.

		• The suggested system yields positive results and consumes a lower bandwidth than other systems, making it suitable for application in remote locations like roads where the network strength is weak.
Anna-Maria et al. [27]	Velocity Network (VNet) and Time to Collision Network (TTC)	• To determine the factors associated with objective risk, 204 overtaking collisions were analyzed. • The risk perception of these elements was investigated. • Conditions during the day and night both played a role in the outcome. • The findings can potentially contribute to the development of user-centered autonomous overtaking systems.
Nishant M Pawar et al. [28]	Generalized Linear Max Model (GLMM)	• In time pressure conditions, a 36–63 percent reduction in the minimum time to line crossing was achieved. • The likelihood of a collision went down as the minimum time to line crossing, and the CVS were increased. • Although they made riskier driving decisions, male drivers were involved in fewer accidents.
Shih-Ting Huan et al. [29]	Vehicle Control Unit and Controller Area Network	• Intelligent overtaking systems have been created that include an OPS and (OACS). • An autonomous vehicle may then be driven with the help of this technology. • The Overtaking Prevention System (OPS) uses image recognition technology to identify nearby vehicles and lane lines. This information is then used to compute the time to lane crossing (TLC), which is the basis for determining whether you should overtake another vehicle or stay in your lane.

The explanation above suggests that most research involves complex machine learning and AI-based models, which occasionally fail when their actions are crucial. Additionally, most AI-based models employ agents as the primary actors in collision avoidance. Although this method is pretty impressive, coordination between bots when a collision is about to happen is challenging and may call for a complicated programming-based strategy. In this research work, a blockchain-based BCAS system is proposed with the accepted challenges. The suggested model is a multi-agent technique that improves the decision-making capabilities of real-time, high-speed vehicles by delegating the whole calculation of processing chores to each agent. The key parameters considered in this work are the length, speed, the distance between cars, and intent of the vehicle's driver.

Proposed Conceptual Model

The motivation of the presented work is shown in this section with a completely independent environment. Subsequently, the normal process in the given model has been introduced, depicted in Figure 3 through a simple example. While in the end, the critical steps of the proposed conceptual model will be presented.

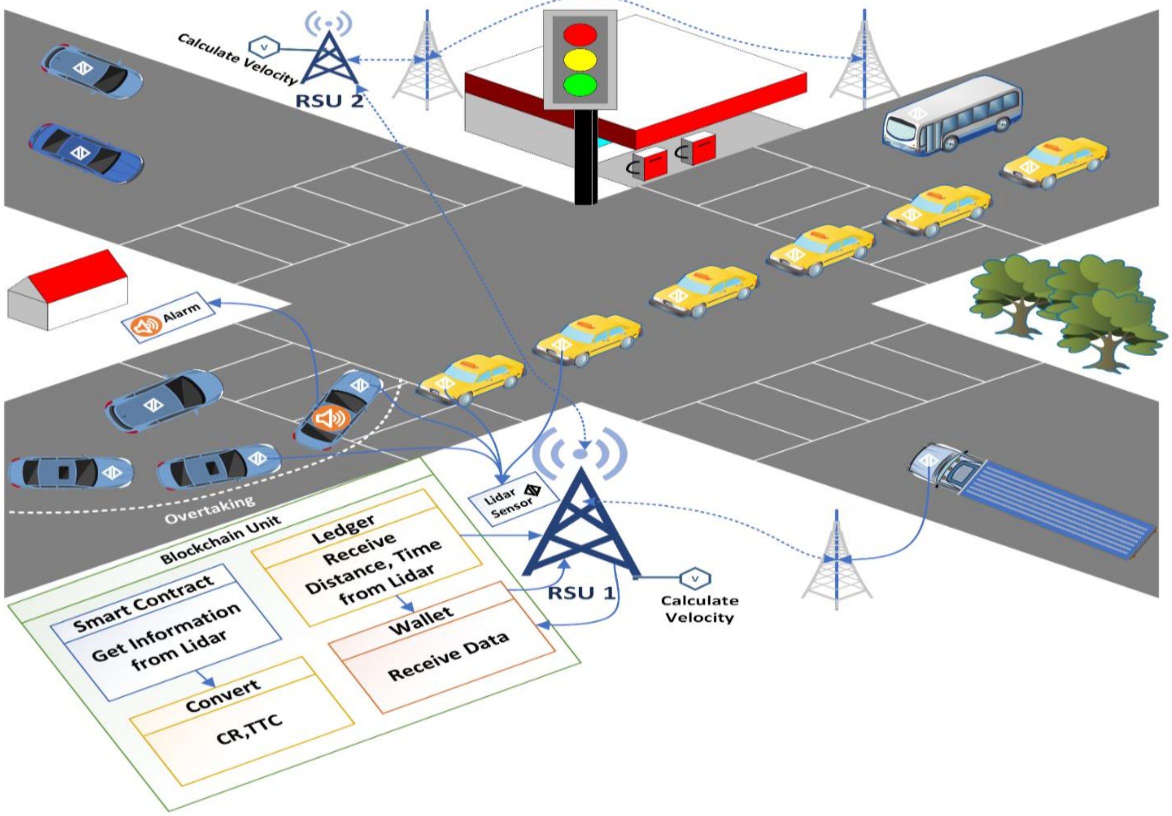
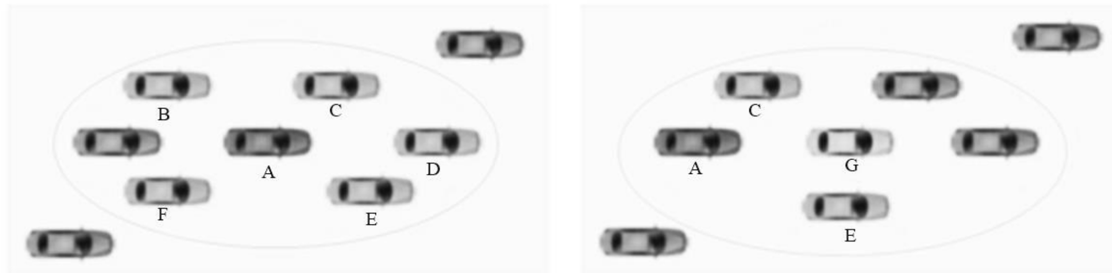


Figure 3: Proposed BCAS System

The Motivation for Our Work

Before presenting our proposed model for crash-free voyaging, we initially delineate our inspiration with the accompanying street situation, as exhibited in figure 4. In the past connections, as displayed in Figure 4(a), vehicle "A" cooperated with a few close-by vehicles, for example, "B" and "F," and gathered specific trust levels. In a likely collaboration, as displayed in Figure 4(b), "A" and its new neighbors, for example, "G," is peculiar to one another.

In this scenario, most of the past cooperation accomplices of A (e.g., B, D, and F) are a long way from G, and there is no dependable trust between them. So G can gather the trust data about A from a couple of past cooperation accomplices of A, such as C and E, in certainty they may not exist. The more significant part of past trust data of A, such as with B, D, and F, must be disregarded when building the new trust connections among A and G. Thus, with the rapid development of A, its trust data is, for the most part, disposed of and revamped over and over. It is unmistakably absurd and is only the inspiration of this work. The key focal point for collision avoidance is the most effective method of rapidly constructing new trust connections using past trust data.



(a) Past Interactions (b) Potential Interactions

Figure 4: Fully self-organized Scenario (where A and G denote vehicles)

A blockchain-based mechanism is proposed to illuminate the issues identified with dependable message scattering in collision avoidance. The methodology is new as we utilize the idea of a changeless circulated open database for secure message spread in vehicles, where any hub can get to the data. The event data, for example, car influxes, street mishaps, and ecological dangers are essential to a specific land area. Every vehicle can realize their situation by utilizing area endorsement dependent Proof of Location (PoL) [30].

Parameter Assumptions

In this section, we discuss certain assumptions regarding upon our proposed BCAS model:

- It has been assumed that cars can speak with different substances utilizing Vehicle to Everything (V2X) and Vehicle to Vehicle (V2V) interchanges. Also, these can associate with the web effectively.
- It has been assumed that all vehicles require to have equipment like GPS, sensors, and OBUs.
- We acknowledge that the amount of veritable RSUs is more critical than the malicious RSUs. The RSUs are regularly fixed substances close to the roads. The genuine RSU makes a starting block to start the blockchain subject to intimate occasions.
- We accept that vehicles with high registering force and trust levels are considered total hub vehicles that can take an interest in the mining procedure. Likewise, the malignant vehicles have a restricted capacity to bargain more than fifty rates of the vehicles in the system.
- We expect the important occasion messages to be dispersed inside a locale of interest (RoI) in a particular topographical area. The important messages are not encoded with the goal that those messages can be accessible to any close by vehicles.
- We expect the number of messages to affirm the occasion to be fifteen, so the message is considered correct.
- It is assumed that the roads in this study only have two lanes and are flat, without potholes, curves, or slopes that could interfere with passing operations.

Components of Proposed Model

i. ***Road Side Unit (RSU):*** The RSUs are utilized for V2I correspondence and are in charge of confirmation and giving an area authentication to the vehicles inside its correspondence run. The real RSU makes a beginning block dependent on the nearby events.

ii. ***Vehicles:*** The vehicles are the critical parts of the proposed system. There are two vehicular centers: the entire center point and the convention center. Mining the blocks is the responsibility of the whole center, which has a high trust level and a high handling force. What's more, different hubs are ordinary hubs that help amid mishaps and send and check the messages in the message age.

iii. ***Sensors:*** Autonomous cars rely heavily on LiDar sensors, which offer a 3D image of their environment.

iv. ***Blockchain Messages:*** There are generally two kinds of messages in the proposed framework. They are signal messages and security occasion messages. At times, the sign messages are imparted to enlighten neighbor vehicles regarding driving status and spots of cars to achieve good care among other vehicular centers making the rounds similarly concerning traffic the executives. The wellbeing occasion message is imparted when actual events occur making the rounds, for instance, car accidents, road risks, etc. We consider just security messages as a trade in the blockchain, thinking that they expect massive work in confirming the life and property of the driver.

v. ***Blocks:*** A block involves a block header and a block body. The block header involves past block hash, nonce, inconvenience target, timestamp, and Merkle root. The block body contains a summary of prosperity occasion messages that carry on as trades in the block body.

vi. ***Location Certificate:*** A location certificate dependent upon PoL is utilized to give proof about the area of a vehicle at a given time [31]. Every vehicle expects PoL to confirm that the car is situated in an area close to the event spot. Furthermore, the PoL is utilized s area evidence in an event message that aids the blockchain.

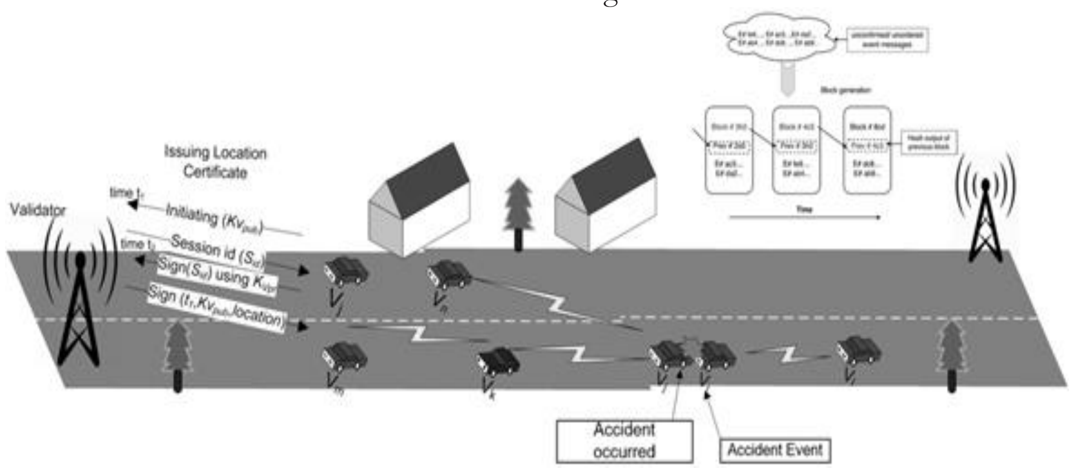


Figure 5: Secure Message Discriminations in BCAS

Working Mechanism Of The Proposed Model

For ease of understanding, it is considered that in the proposed work, human drivers are assumed to have adequate vision and physical fitness. They abide by the laws and rules of the road. They pay careful attention when driving. However, it is anticipated that human drivers will underestimate the speed of other lead vehicles. Figure 4 depicts an overtaking scenario with V1, V2, and V3. It is assumed that V1, V2, and V3 have corresponding velocities of V1× km/h, V2×km/h, and V3×km/h. Due to human driver's errors in judgment, there is a chance that the V1 could collide with both the V2 and the V3 when it passes the V2. Their collision region is called a Critical Region (CR). The key component of the proposed BCAS is blockchain and RSU. The blockchain is subdivided into a ledger, smart contract, peer network, membership, Event, and system management. Figure 5 shows the proposed BCAS mechanism environment.

The blockchain intelligent contract-based module is responsible for transforming the distance data that is given by the virtual LiDAR sensor into different types of information, for example, CR data, impact time, and guidance for overwhelming, which human drivers will then utilize to decrease the gamble of impacts happening during surpassing moves. The blockchain record gets the ongoing distance somewhere between V1 and V2/V3 from the virtual LiDAR sensor for each time occurrence. To assist the human driver during surpassing moves, the distance information will be powerfully provided in the record, yielding the ebb and flow speeds of V2/V3 and time to crash (TTC) separately. Deprived of getting slightly expressed messages from V2/V3, the proposed calculations allow V1 to determine the velocity of V2/V3 accurately. The V1 will be able to decide on the TTC between the V1 and V2/V3 once the speed of the V1/V2 has been determined.

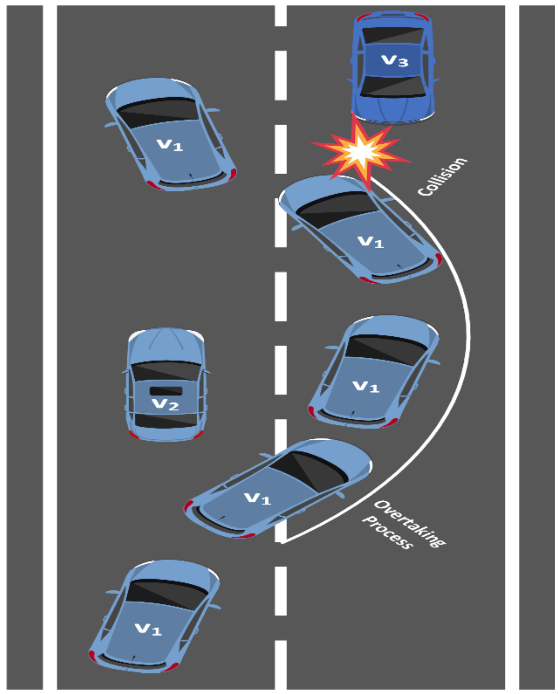


Figure 6: Overtaking Scenario

Consider a point P1 on the front end of V3, which is enclosed by V3 of V1, as shown in figure 6. Let D initial represent the separation between V1 and V3. The distance between the V1 and the opposing vehicle reduces over time based on their velocities since they move in opposite directions.

Let the displacement of V1 be d1, d2,…………ion at a time t1, t2,………..in. For V2, the removal is E_1, E_2,…………E_n at a time t_1, t_2,………..i_n. There will be a collision between V1 and V3 at the moment, which will occur when both vehicles reach the CR and their distance from one another is reduced to zero. During this situation, the value of the space is read by the virtual LiDAR sensor every instant. The proposed BCAS receives information from the virtual sensors about the current velocity of V1, denoted by the acronym V_{V1}. From which the BCAS's RSU calculates the rate of V2 using the following statistics:

Equations 1–5 calculate the velocity of a single point P1 on the front surface of the V2 covered by the V3 of V1. These equations apply to any number of points.

$$V_{V1} = x_i/t_i \tag{1}$$

$$x_i = V_i \times t_i \tag{2}$$

$$D_i = y_i + D_{i+1} + x_i, \text{where} i = 1,2,3, \dots, TTC - 1 \tag{3}$$

$$y_i = D_i - D_{i+1} - x_i \tag{4}$$

$$V_{v2} = y_i/t_i \tag{5}$$

When the V2 moves at a constant pace of 17.5 meters per second, the actual distance of 400 meters between V1 and V2 shrinks down to 0 meters after 13 seconds, it is patently evident that the collision between V1 and V2 will probably take place sometime after 13 s and before 14 s. The proposed BCAS model is a blockchain-based network that would transform the data from the virtual LiDAR sensors into knowledge such as the velocity of V1/ V2. At that time, the suggested BCAS takes four parameters for analysis and only one for output. The BCAS requires the following information as inputs: the initial distance between V1 and V2, the velocity of V1, the time frame (t), and the distance between two vehicles V1 and V3 after 5 seconds. The BCAS will predict the speed of V2 based on the supplied values.

For the avoidance process, each vehicle's tailgate has a total of six electromagnetic proximity sensors affixed to it, and these sensors are connected to the RSU unit. In addition, there is a video camera that is situated at the very end of the vehicle's cargo area. The RSU has one input and two outputs in its configuration. The video feed from the camera is displayed on a screen attached to either the rearview mirror or the dashboard. When another vehicle reaches the proximity sensors at the back of the car, those sensors send an output signal to the control unit. The proximity sensors at the back of the vehicle are constantly operational. The control unit will then do two activities simultaneously: it will send an activation signal to the event of the blockchain, and it will send an output signal to the video camera, instructing the video camera to begin recording, which will subsequently be saved in the Wallet of the blockchain. In this step, two actions take place simultaneously: the fixed speaker produces an alarm sound as a result of the input received from the RSU unit, which causes the driver to look at the monitor, which by that time would have received an input signal from the video camera located in the back of the vehicle; and the RSU unit sends an alert to the fixed speaker, which causes the selected speaker to produce the alarm sound.

More Safety

To provide some additional safety, the intelligent contract section of the blockchain is programmed with several Digital Image Processing Techniques. The video frames that are captured by the camera that is installed on the dashboard of the vehicle are sent to the smart contract is responsible for operating the Electronic Control System in the car to continuous monitoring the image of the driver's face to determine whether or not the subject's eyes are open. If it can be seen that the eyes of the driver are empty while they are behind the wheel, this indicates that the driver is aware and is paying attention to the road. On the other hand, if the image shows no evidence of open eyes on the driver's face, it is reasonable to assume that the driver is not awake. When the system notices that the driver's eyes are about to close, it promptly sounds an alarm to warn them.

Discussion

The stability of the proposed model has been evaluated in a real-time environment to validate the proposed solution to the addressed problem. Using the abovementioned components, a setting has been created on a straight rove. As far as vehicles are concerned, they all utilize the blockchain to communicate. Almost five different iterations based on the proposed technique have been performed to evaluate the trustworthiness. After successful iterations, it has come to light that the performance of the proposed model is up to the mark.

After iteration, the number of epochs and the correctness of the result were tracked and examined. This was repeated in the same manner for a Loss throughout the iterations, and the highest accuracy that could be achieved was approximately 97 percent. To guarantee a high level of accuracy and robustness, the proposed BCAS is put through extensive testing with over one hundred thousand different permutations of the parameters that are input.

The virtual LiDAR sensor has consistently examined the distance between the V3 and V1 for every period quick at any point in the overwhelming meantime technique was started. The space was noted right later, 5 seconds considered, and the contribution of BCAS predicts the Vv1. When the BCAS has made its forecast of the speed of V1, it will be provided to the Wallet alongside other info boundaries like the underlying distance somewhere in the range of V1 and V2, and V3, so the Wallet might make its expectation of an opportunity to impact (TTC) somewhere in the field of V1 and V2. The TTC was resolved involving the ground truth values as well as the expectations made by the BCAS.

Table 2: Accuracy of the proposed work with Ground Truth

S.No.	V1 (Km/h)	D_i in V1→V2 (m)	Actual Result (KM)	Predicted Result (KM)	Accuracy in %
1	15.02	302	20.27	20.03	99.50
2	14.07	300	19.50	19.00	99.05
3	13.55	299	19.75	19.01	99.22
4	16.5	303	21.55	20.52	98.51
5	17.2	305	19.66	19.00	99.06
6	15.3	301	20.23	20.55	99.05
7	14.5	301	19.7	19.11	99.22

It can be shown from table 2 that the TTC values predicted by the proposed BCAS are pretty near to the ground truth values that correspond to them. This accomplishes a higher level of accuracy than 99 percent.

Conclusion

High-speed overtaking, particularly on divided highways, is a significant cause of traffic accidents. When a slower-moving vehicle comes in front of a car, it must pass through the oncoming traffic lane, which is a dangerous and challenging maneuver. Previous research did not consider the speed of surrounding traffic or the approaching vehicle size. Furthermore, most of the techniques were based on single-agent systems, in which one agent ultimately manages the source vehicle's (autonomous) mobility within its surroundings. In addition, a single agent occasionally miscalculated car-approaching parameters in real time. This study conducts a feasibility study on a remote Vehicle-to-Vehicle (V2V) communication framework based on Dedicated Short-Range Communication (DSRC) to improve overtaking safety. This work also attempts to improve safety by introducing a blockchain-based safety model called BCAS (Blockchain-based Collision Avoidance System). Compared with ground truth reality, it has been observed that the proposed technique produces a better result. In the future, the proposed work can further be enhanced by taking better models such as deep learning.

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