Vehicular Communication Based Traffic Control Platform

A Thesis Submitted to the Academic Faculty in Partial Fulfillment of the Requirements for the Degree of BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

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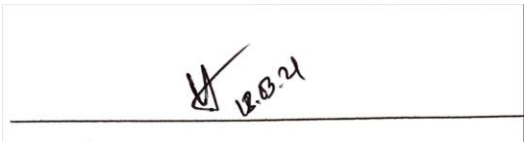

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Dedication

we dedicated this work to Allah (S.W.A) without whose support we would have been nowhere and then to our parents, brothers, sisters and friends for their concern and backing throughout. May the almighty Allah count the support they have been rendering to us upon their heavenly treasures, AMEEN!

Acknowledgement

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Declaration of the Author

This thesis, or any part of it, has not been sent to any other institution for the award of a degree or diploma.

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Abstract

This Communication Project is an additional benefit to Drivers or Vehicle Users during traffics along the road. This project with the help of google map, which would collect data analysis that will notify Users beforehand for any traffic ahead. There are different known uncertainties, example of which are due to critical weather conditions (Heavy rains, and Foggy weather), another is traffic jams (either cause by accident or due to rush hours), and in addition to will be the traffic caused by accidents or emergency cases which lead from Light to heavy Traffics. Upon which set examples and known natural and unnatural occurrences, we would like to put a solution to it with our “Communication Project”.

It is designed as an aide for vehicular communication, a system on which there will be a network of roadside units and or communication nodes which will provide each other with information, which includes warnings and traffic information. By importing google map to our application software, Use data converter as an example “android studio”. Making an API for collecting data to avoiding accidents and traffic congestion.

Keywords: GPS, V2V, vehicular communications, trakers.

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Symbols and Acronyms

ADAS	Advanced driver assistance systems
V2V	Vehicle-to-vehicle communication
GPS	Global Positioning System
V2P	Vehicle-to-Pedestrian
V2N	Vehicle-to-network
V2I	Vehicle-to-infrastructure
V2X	Vehicle-to-everything
WPAN	wireless personal area network
TCP	Transmission control protocol
BS	base station

Chapter 1 Introduction

Bangladesh is a highly populated country and the economy is growing every day. Its cities, such as Dhaka, which is the capital, are wracked by terrible traffic congestion. Every year, approximately a thousand people are killed in traffic accidents. In the field of traffic management, road traffic safety has been a fascinating problem. One option is to send traffic information to vehicles so that they can analyze the situation. It can be accomplished by vehicles exchanging information about traffic conditions. In addition, the majority of the vehicles are driving through a diverse area. As a result, a self-organizing mobile network that can operate without infrastructure support is needed. With the advancement of microelectronics, it is now possible to combine nodes and network devices into single units and to link them wirelessly. Furthermore, this network has developed into a mobile network made up of groups of self-organized wireless stations that do not need any pre-existing infrastructure. Vanets (vehicular ad-hoc networks) are a fascinating and rapidly developing area of research. As a result, we're attempting to investigate the existence of such networks that would enable an application to solve the traffic problem. One of the methods used was VANET, which is flexible and cost-effective. This method necessitates the gathering of crucial data. The driver is normally lacking vital details. As a result, injuries are more likely to occur in foggy weather. He can't see the traffic because he can't see it. As a result, this app will reduce incidents and have a safety net ahead of time. One of the methods used was VANET, which is flexible and cost-effective. This method necessitates the gathering of crucial data. The driver is normally lacking vital details. As a result, injuries are more likely to occur in foggy weather. He can't see the traffic because he can't see it. As a result, this app will reduce incidents and have a safety net ahead of time. In 2001, the German Aerospace Center (DLR) continued to develop SUMO, an open source traffic simulation suite. Since then, SUMO has evolved into a full-featured suite of traffic modeling utilities, including a road network that can read a variety of source formats, demand generation and routing utilities from a variety of input sources (origin destination matrices, traffic counts, etc.), a high-performance simulation for single junctions as well as entire cities, and a “remote control” interface (trc). SUMO is not only a traffic simulation, but also a set of software that aid in the implementation of traffic simulations. Due to the fact that the traffic

simulation "sumo" requires the representation of road networks and traffic in its own format, both must be imported or created from different sources.

1.1 How is GPS in mobile phones used

GPS receivers capture signals from satellites, as we learned in sections 1.1 and 1.2. When we're concerned about the place, it's important to know what time it is on a satellite. The phone first determines how far away it is from a satellite; each satellite broadcasts radio signals that fly at the speed of light from space to your phone. The arrival time of the signal is recorded by your phone, which is then used to measure the distance to the satellite using a simple formula.

distance =c x time

[The speed of light is c, and the signal's travel time is time.]

Since light travels at a speed of 299,792,458 meters per second, if we could only measure light to the second, every position on Earth and far beyond will appear to be the same distance from the satellite. To measure the distance to within a few hundred feet, we'll need the inter atomic clock (the greatest clock ever invented), some of which are so accurate that they wouldn't gain or lose a second even though they run for the next 300 million years. Quantum physics allows atomic clocks to work. A constant frequency is needed for all clocks. In other words, a clock must perform some repetitive operation to mark off equal intervals of time; an atomic clock's role is maintained by an atom's transition between two energy levels.

According to quantum mechanics, atoms carry energy, but they can't take on any amount. Instead, atomic radiation is limited to a specific range of values. These are what we refer to as quanta. Consider pulling a car onto a highway as a basic example. Normally, when you increase your pace, you will go from, say, 20 miles per hour to 70 miles per hour.

20mph ……. 70mph

You wouldn't accelerate in a linear fashion if you had a quantum atomic vehicle. Instead, you'd hop, or transition, from one speed to the next in a moment.

1.2 Types of GPS tracking

There are different types of GPS tracking and it's not only one or two it's more than that. In this topic you will learn about different types of GPS tracking and how they work.Significance of the study

1.2.1 Personal Trackers:

It is used to track moving living things (people and animals/pets), it is mostly used for people in need, it can be a bracelet, ear phone, you activate the device and when it gets activated you can remotely locate and follow the device. For example, some dog owners use this tracking device on their dogs and they put them in their collars so if they ever lose their dog they can easily find them using the device instead of putting posters all around and giving them out.

1.2.2 Asset Trackers:

Mostly used in shops and it's used to track objects. For example, some supermarkets use this tracking device in their shopping carts because of the amount of shopping carts that used to get stolen, after adding those tracking devices in shopping carts, cart theft started to decrease. This GPS device starts working when you pass a specific line after leaving the supermarket and if it seems like you're going further and further it stops the cart from moving.

1.2.3 1.4.3 Cell-based GPS vehicle tracking

More like vehicle tracking done with satellite networks or cellular and is one of the most common types of GPS. The data from the vehicle is captured using a device and is reported by using cell towers. For example, delivery companies use GPS to track their customers order.

1.3 Problems GPS may face

• Human error will occur, such as leaving the GPS in dead reckoning (DR) mode.

•Atmospherics: Unusual behavior in the earth's atmosphere can interfere with satellite signals.

• Local issues: The availability and accuracy of GPS signals in certain areas can be problematic. When satellite signals collide with structures or mountains, errors are likely.

• Jamming, spoofing, and hacking are examples of deliberate actions that can disrupt the GPS signal..

However, in the event of a GPS failure, the operator must be able to correct the vessel's location using conventional methods. This may involve the following:

• Make a map of the location: Ranges and bearings can be calculated using landmarks or navigational features.

• Make a map of the area: You can measure ranges and bearings by using landmarks or navigational features.

• Indexing in parallel

• The ship's plotted location can be confirmed using an echo sounder.

• Beam bearings: When changing direction, beam bearings will visually validate it.

• Change of course: The location of the vessel should be plotted before and after the course change to ensure that it is in the correct position.

1.4 Advantages and disadvantages of GPS

1.4.1 Disadvantages of the Global Positioning System:

• Since GPS can fail for a variety of reasons, it's a good idea to keep a backup map and directions on hand.

• If you're using GPS on a battery-powered unit, the battery can die, necessitating the use of an external power supply, which isn't always possible.

• GPS signals are sometimes inaccurate due to signal barriers such as buildings and trees, as well as extreme weather conditions such as geomagnetic storms.

• GPS chips are power-hungry, draining the battery in 8 to 12 hours. The battery must be replaced or recharged on a regular basis.

• GPS signals do not pass through solid walls or structures. It is also afflicted by large structures or constructions.

1.4.2 Advantages of Global Positioning System:

- GPS makes navigation a breeze because it informs you the direction of all your turns; otherwise, you'll have to guess your way to your destination.
- Since GPS works in any weather, you won't have to worry about it as you would for other navigation systems.
- In comparison to other navigation systems, GPS is a very low-cost option.
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    -

Chapter 2 Literature Review

2.1 Introduction

Communication between vehicles is one of the most important communications because lately most people use vehicles for transportation, so if it was hard for vehicles to communicate a lot of accidents are going to happen around the world. All vehicle companies are trying their best to make their vehicles as smart as possible for less accidents. The advanced driver assistance system [ADAS] is a system designed to assist drivers in driving and parking functions by alerting the driver to avoid collisions. Global positioning system [GPS] is used to track positions or locations and it's also used for navigation. There are a couple of techniques that companies are applying using while making vehicles, in this chapter we will be talking about vehicle to-vehicle communication technique [V2V], Vehicle to-pedestrian [V2P], Vehicle to-network [V2N], Vehicle to-infrastructure [V2I], Vehicle to-everything [V2X].

2.2 Advanced Driver Assistance Systems

There are different examples of ADAS such as:

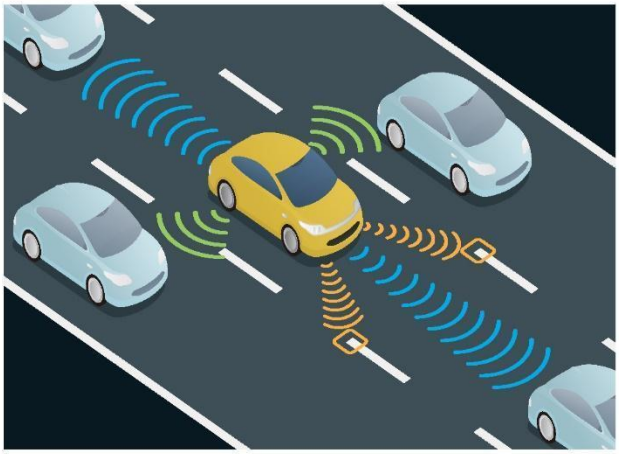
- Radar system: tracks traffic problems that you may not be aware of.
- Blind spot warning light: found on the side view mirror which is a monitor that detects other vehicles to avoid collisions as you shift lanes.
- Forward collision warning, lane departure and adaptive cruise control: monitors the drivers vehicle speed, the speed of the car in front of it and the distance between the vehicles.
- Traffic sign recognition
- Automatic parking: helps inform drivers of blind spot

2.3 Vehicle to vehicle communication technique

V2V system technology are systems with dedicated wireless communication systems between vehicles and it provides the driver with crucial information needed and it also provides them with a warning of potential crash. This communication technique provides drivers with 360-degree awareness within a range of approximately 300 meters or 984 feet. This system is completely secure since it keeps personal information anonymous and it doesn't track your vehicle.

2.4 Types of data collected in V2V include:

- Vehicles position
- Motion such as speed and direction



- Size of vehicle

Figure 2: This image shows what areas a vehicle can sense

There are variety of application in V2V communication technique:

-Warns the driver when passing a slow-moving vehicle in front of them is not safe. v2v and v2i technologies are shown in Figure 2.1.

- Blind spot warning application:

-Allows drivers to virtually see what's happening in the driver's blind spot to prevent crashes

- Forward Collis

2.5 Vehicle to pedestrian

This involves cars and roads infrastructure purposely prepared to communicate with each other.

Two main V2P protocols exist:

- **Handheld devices** may be used to detect pedestrians in the area and warn motorists so that a collision is avoided. Most V2P technologies in production are based on it.
- In some situations, Non-vehicular traffic can be detected **by in-vehicle systems** such as forward collision warning and blind-spot warning.

2.6 Vehicle to everything:

it's to improve traffic safety and efficiency. Infrastructure and all road-users, including vehicles, trucks, motorcycles, and in the future pedestrians, securely exchange messages in order to indicate their location, speed, direction and other properties.

2.7 v2I meaning:

The two-way sharing of information between vehicles, trucks, buses, traffic lights, lane markers, and other smart road infrastructure over a wireless link is known as vehicle-to-infrastructure communication (V2I). Vehicle infrastructure technology's overall objectives are to increase road safety, minimize accidents, help the work environment, and control traffic.

Two relevant technologies for converting vehicles to infrastructure are as follows: The two-way sharing of information between vehicles, trucks, buses, traffic lights, lane markers, and other smart road infrastructure over a wireless link is known as vehicle-to-infrastructure communication (V2I). The overarching objectives of vehicle infrastructure technologies are to increase road safety, avoid collisions, and ensure that vehicles are properly maintained.

Infrastructure elements such as lane markers, road signs, and traffic lights can wirelessly transmit vehicle information and vice versa. V2I communication is allowed by a wireless and bidirectional system of hardware, software, and firmware.

Vehicle-to-infrastructure (V2I) connectivity is the wireless exchange of data between vehicles and road infrastructure. Rich and timely data can be used to allow a number of safety, mobility, and environmental benefits with so much data being collected and shared. This is the most basic navigation tool of water since we are often misled in larger bodies of water due to a lack of proper directions.

- The GPS signal can be found all over the world. As a result, consumers would not benefit from it.

a. As compared to other navigation systems, GPS is very inexpensive.

b. The most appealing aspect of this strategy is its complete coverage of the globe.

c. It also lets you look for nearby restaurants, hotels, and gas stations, which comes in handy when searching for a new spot.

d. It's very simple to incorporate into other systems, such as the telephone, due to its low cost.

e. The United States Treasury Department updates the device on a daily basis.

f. anywhere.

g. GPS can be used anywhere in the world because it is operated by world satellites, so it can be accessed from anywhere. All you need is a good tracking device and a GPS receiver..

Chapter 3 Methodology

3.1 Introduction

In this chapter we'll talk about how mobile applications work. It helps drivers avoid accidents by notifying drivers in case of bad weather such as fog or heavy rain. Blurred vision can cause an accident so we think to use our knowledge to help drivers communicate in need to save lives. Managing distance between vehicles is important Technique is right there are many new theologies like v2v and v2x ext. But not all drivers can have these technologies so we can provide similar to it to make all drivers have it. Using GPS systems identifying the distance and sending feedback to vehicles.

Our project type of research we did is text analysis. We collected data from different resources like google YouTube books and researches. We chose those methods because they are the easiest and most accurate way.

3.2 Concept of safety:

What is the road safety issue covered by the ISA?

Speeding is the source of the road safety epidemic, accounting for approximately 30% of fatal accidents (TRB, 1998). In most cases, 40 to 60% of EU drivers exceed the limit (ERSO speed and Text web speed management). According to research, small differences in speed may have a major effect on the incidence and severity of road accidents and injuries. According to studies, a 1% reduction in average speed results in a 2% reduction in trauma injuries and a 3% reduction in fatal accidents. The number of fatal collisions has decreased by 4%, and the number of fatal collisions has decreased by 4%. A rise of 5%. An increase in average speed will result in a 20% increase in fatal accidents, and vice versa. (Elvik, 2009; Nelson, 2004)

3.3 Project overview:

The project is made up of three applications: a server written in C++ and running on Windows using the Qt A system, and two clients, one for Android and one for Windows Phone. TCP (for general data transmission objects) and UDP (for mouse motion requests, because UDP does not perform any of them) are the protocols used by clients to link to the server over the network. Correct data checks will not cause any delays) and control of the cursor and keyboard will be taken over.

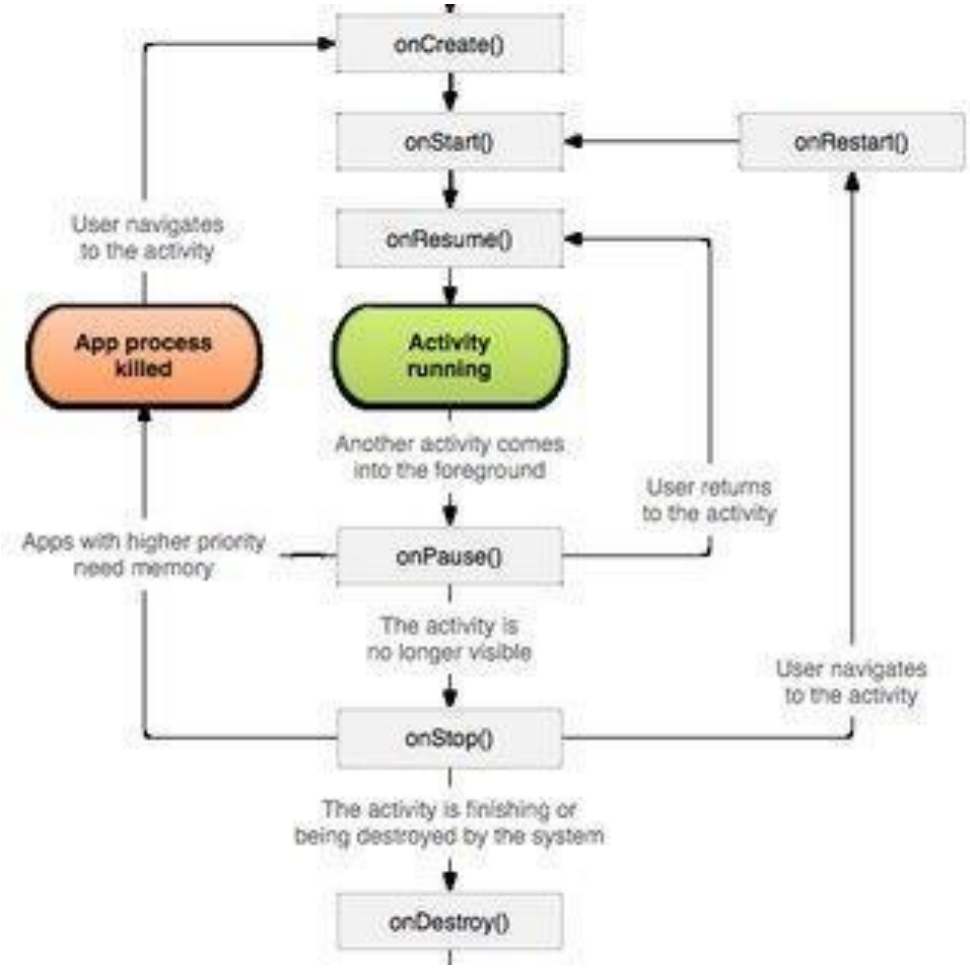


Figure 3 Android: Activity Lifecycle

In Android, there are two types of alerts: toast and updates on the top screen. Toasts are brief bursts of text that appear for a few seconds at the bottom of the screen. Just one toast message can be shown at a time. If the app tries to show two or more tokens at once, they will be queued and shown one at a time over a fixed period of time.

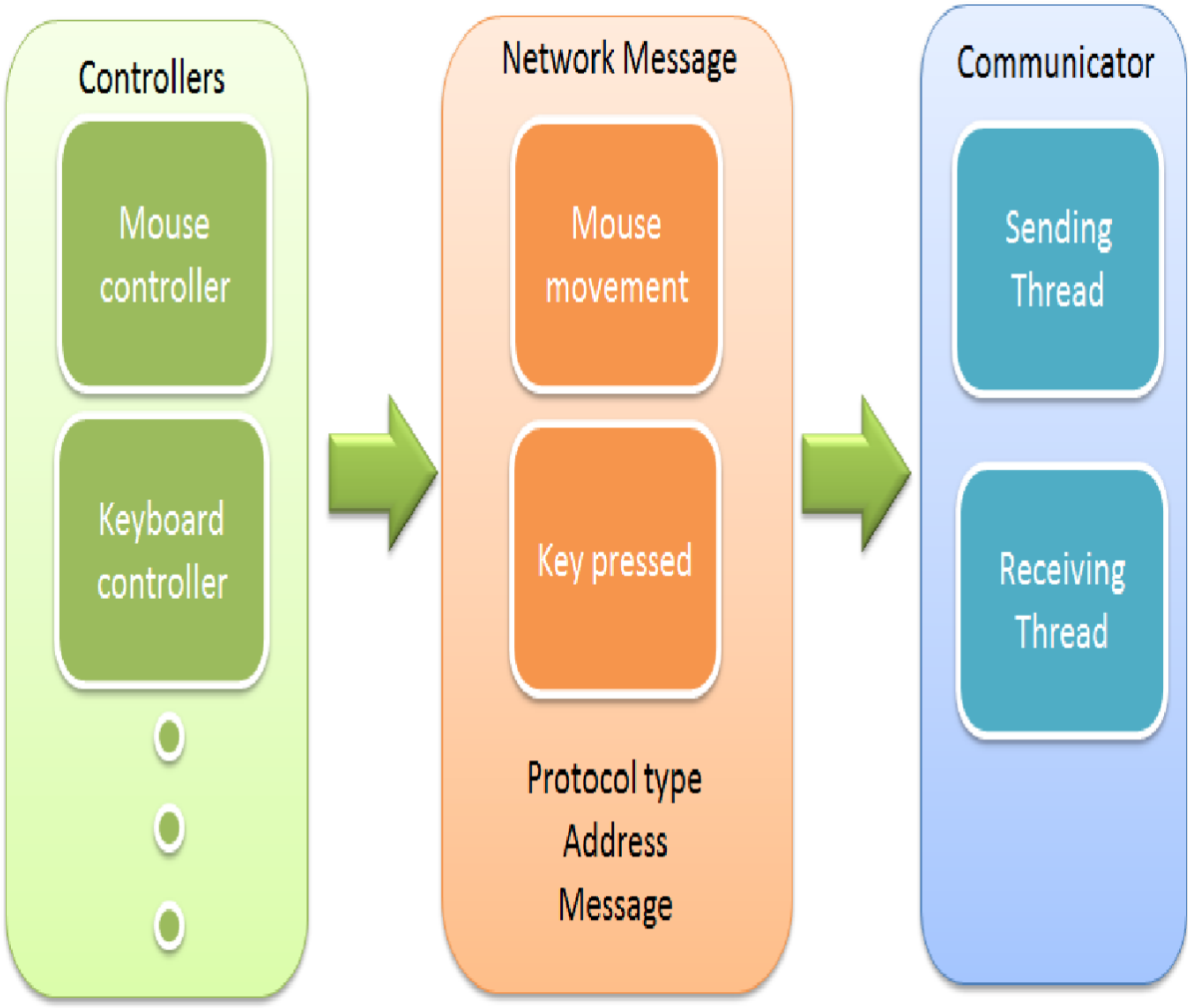


Figure 4 Network message generation

- **Result**

3.4 Congestion detection scale

The proposed approach is based on congestion detection using single-hop dedicated short range communications (DSRC) between the subject vehicle and nearby vehicles in this research. In reality, the DSRC coverage range varies with the environment due to obstructions such as houses, trees, and oversize vehicles. According to proving ground testing, the successful contact distance of DSRC is between 200 and 500 meters. The scale of DSRC-based congestion detection in our study is changeable, which is described as a road segment with varying length determined by the maximum single-hop distance of DSRC in the specific area. According to the simulation results, the proposed approach can detect congestion at a scale of 700 meters on average. We can use multi-hop DSRC and roadside communication units to transmit congestion information identified by the vehicle in a longer road segment to extend the size of congestion detection, which will be done in future research.

3.5 V2V communication network congestion

Data transmission should be reduced in IoV applications to reduce network overhead and meet the needs of traffic reliability and safety applications by ensuring low delay and packet loss. To accomplish this, the proposed approach used a "congestion cause" technique, in which the vehicle does not share traffic congestion information with its neighbors before traffic congestion occurs, which is a theoretically efficient method. As a result, when the proposed traffic congestion detection system is used, it is important to test the overhead of the communication network. The number of back-off time slots of the ten vehicle nodes in the test section are counted, and ten vehicles running in the test section are chosen as test subjects. This is because the proposed V2V-based road traffic congestion detection system employs the congestion trigger mechanism, which means that when a vehicle senses traffic congestion, no congestion information will be exchanged between linked vehicles. Since the simple access mode of the MAC layer of the IEEE 802.11p network protocol is a distributed coordination mechanism of carrier sense multiple access with collision avoidance, and the random back-off algorithm is chosen as the method of collision avoidance, the value of the vehicle node's back-off time slots is taken as an interval value. The findings indicate that the approach proposed in this study can effectively minimize V2V communication network congestion.

- # CONCLUSION

The implemented system aimed to gain intelligent control over traffic and as a vehicle having automotive control over it by emergency speed control, alert before lane change, maintain safe distance, and so on. It reduces roadside accidents by allowing an emergency vehicle to pass. Emergency vehicles, such as ambulances and fire engines, must arrive at their destination as soon as possible. If they spend a lot of time stuck in traffic, the lives of many people could be jeopardized. If a car attempts to change lanes in the same lane that is soon to be filled by another vehicle, it receives a warning. It is important to maintain a reasonable distance between vehicles so that a collision does not occur at the intersection point. Using V2V communication, both of the vehicles remain in contact at all times. Based on the results of the experiments, the efficiency of the Hard Brake Vehicle System is 57.13 percent higher than that of a Smart Vehicle System, and the accuracy is 21.6 percent higher than that of a Smart Vehicle System listed in the literature.

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