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Prevention method of automated vehicle collision system using the internet of things

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Abstract

This effort shows the idea to avoid collision among vehicles in rural zones using idea of Internet of Things. It furnishes the diverse situations with development of vehicles. In this paper the concept considered is interaction of multiple cars or trucks at the crossing point with the arrangement of vehicles that are connected by the remote correspondence. In order to minimise the injuries of drivers which is itself a critical issue now a day's, it is required to control collisions on the road. For this concern it presents a controlling element utilizing the approach of fuzzy logic for controlling the development of vehicles that keeps up a separation between vehicles. The issue has real necessities: wellbeing, i.e. vehicular crashes must be dodged. Vehicles should not gridlock and achieve their ultimate goals, which mean that they must overcome convergence. It exhibits the controls of vehicle development in single path, two paths, movement path, etc. The way of projection of vehicle is likewise displayed by the utilization of the controller. Their speed of propagation, separation from sides and angle of introduction are likewise estimated and assessed.

Keywords: VANET, internet of things, vehicle collision avoidance, fuzzy controller, etc

1. Introduction

The web of things is a system of physical protest or things that are implanted with gadgets, programming, and sensors being able to gather information from our general surroundings and offer information over the web in 1999, the idea of Internet of Things was introduced by individuals from the Radio Recognition Proof Evolution Network. It is exceptionally famous in light of development of cell phones, implanted and continuous correspondence, distributed computing, and information examination. Here are three C's of IoT i.e. Correspondence, Control and Automation, Cost Saving.

Savvy urban communities are territories where advancement is upheld through computerized systems and applications ^[1]. Shrewd urban communities are regularly called economical, computerized or associated urban areas ^[2]. The objective of changing over a city into a brilliant domain is to lighten the issues coming about because of urbanization and the expanded urban populace. A keen city is an urban zone that gives the conditions to feasible monetary development and personal satisfaction. Savvy arrangements, similar to activity clog shirking ^[3], green structures and present-day modern control frameworks (ICS), are a portion of the innovations that can make the present urbanization supportable. A shrewd city includes the insightful utilization of innovation to enhance how individuals live, work, drive and offer data.

A key part of a brilliant city is cutting edge vehicles that join new detecting, correspondence and social capacities as a major aspect of the more extensive Internet of Things idea. By providing versatile remote detection and correspondence, vehicles can be encouraged to receive information, which is key to making savvy urban areas a reality. The principle vision of IoT is to arrange correspondence capacities so they can connect for the social great.

These days, remote correspondence innovations are connected in various territories of day by day life. Vehicles are being outfitted with remote specialized gadgets, empowering them to speak with different autos, and with brought together frameworks by utilizing street-side foundation hubs. These correspondences offer new open doors for growing new applications for vehicles. By utilizing this innovation, the car business can enhance transportation frameworks productively. In vehicular conditions, remote advancements empower Vehicle-

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to-vehicle (V2V), and Vehicle-to-Infrastructure (V2I) communication. Thus, vehicular systems are extensively

utilized as a part of ITS.



Fig 1: Intelligent Transport System ^[1]

A VANET is a network that contains a large number of vehicles that act as a node in the system. In this case, each vehicle provides an interface to each other within the range of 100-300 m. It is a part of MANET system but the main difference is the presence of vehicles in this network. It provides safety on the roads by reducing the number of collisions. The main scenarios in VANET are vehicle to vehicle, vehicle to infrastructure or roadside, etc. In V2V, the measurements are provided w.r.t other vehicles present. In other case, it calculates the criteria w.r.t roadside or other infrastructure present.

This area gives a writing overview identified with the vehicle impact evasion framework and gives different methodologies identified with them. A few creators ^[1] depicted the possibility of shrewd video security framework usage. Creators ^[2] built up a system for handling & info mating drivers before a crash is going to happen. Analysts ^[3] exhibited an ongoing framework for impact evasion. It depended on portraying with bends using the spline method. Creators ^[4] displayed a framework using the impacts of vehicle with guardrail. Specialists ^[5] presented a determination calculation utilizing the dispute window. As the dispute determination framework in standard 802.11, paired back-off has for some time been scrutinized in light of its elevated crash likelihood in dispersion circumstance. Creators ^[6] measured the impact evasion issue at vehicular crossing points for various kinds of vehicle movement in an uncontrolled manner.

In this work, it thinks about the idea of automobile impact shirking framework with the Internet of things. Further, in segment II, it gives the data identified with the vehicle to web availability. In Section III, characterizes the proposed

execution of framework. Results are clarified in segment IV. At long last, the conclusion is clarified in Section V.

2. Vehicle to Internet Connectivity

Web network is turning into a fundamental and must have highlight of current vehicles. Remote access advancements to the web assume a noteworthy part in giving web administrations to vehicle clients. The two promising arrangements are Cellular and Wi-Fi. The cell systems, for example, 3G and 4G-LTE, can give dependable and inescapable access administrations. The roadside Wi-Fi passages can be utilized for open-air Internet access at vehicular portability. The Existing answers for interface vehicles to the Internet through generally conveyed cell arrange foundation and can be separated into three classes: Brought-in Connectivity, Built-in Connectivity and Drive-Thru Internet.

Brought-in Connectivity

The obtained decision considers 3G/4G flexible customers who grade toward tying their own specific PDA to the auto. The most predominant tying development, to be explicit Mirror Link is fuelled employing Car Connectivity Consortium (CCC). Using Mirror Link, the driver/voyagers in a vehicle can relate the phone to the vehicle infotainment structure through wires (e.g., USB) or remotely (e.g., Wi-Fi or Bluetooth), with the objective that the vehicle builds brief access to the Internet and some duplicate components of cutting edge cell phones. Mirror Link-engaged vehicle infotainment structures are starting now in the market, for instance, Toyota Touch 2. Near-Field Communication can moreover be used to relate PDA to the vehicle to get the opportunity to web. In Hyundai i20, once inside the auto,

the driver by then puts their Near-Field Communication phone in the centre console, engaging the phone to be associated with the i20's central 7-inch contact screen. All the substance set away on the phone, including music, phone contacts, radio station tendencies, particular profile settings and web get to is given to the vehicle [12].

BMW vehicle LTE Hotspot device is a Near-Field Communication decoration customers can utilise to get to speedy web all over the place. The hotspot permits a maximum of 8 customers to thusly join the car's Wi-Fi focus point by tapping their Near-Field Communication phone onto the LTE icon of the hotspot [13]. For iPhone customers, especially, Apple starting late released Car Play [5] as a standard of partner I-Phone to automobiles. Farewell spirit uses Harman's Connect Next as infotainment structure which is stacked with features like touch screen control for music, temperature, and voice-controlled movement.

Built-in Connectivity

Worked in decision organizes cell advantage in the on-board infotainment structure. The Internet affiliation relies upon the verifiable cell module, instead of cutting edge cell phones of driver/explorers. Through verifiable cell trades, BMW Connected Drive joins distinctive online applications, driver help, call centre organizations, and answers for give Internet relationship with mobile phones inside the vehicle. Audi interface [7] is another instance of an inborn game plan. Chevrolet also developed the characteristic solution for their cars which is the first and only auto association to have worked in 4G LTE Wi-Fi to their cars. Worked in decisions could give driver/explorers with more grounded affiliations and revamp organizations appeared differently in relation to got decisions.

The imperative is that the cell system can't grow once it is embedded. The central favoured point of view of inborn structures is that they don't rely upon external devices, abstaining from closeness or interoperability issues that can as often as possible be dangerous when conveying devices into the auto.

Drive-Thru Internet

The Drive-through Internet scrutinize the working of IEEE 802.11 technology to give a network access to mobile phone user in moving car. The aim of Drive-through Internet is to establish hotspots along the road, within a city, on big roads or freeways. These should be kept in a way that a moving car can get Wi-Fi access for short time. When there are infinite numbers of hotspots all around the world, Wi-Fi can be a corresponding response for vehicular Internet access easily. Deep look over on the connectivity has proved that moving vehicle has high reliability on Wi-Fi for outside internet access. The internet can be kept on usage till the extent of hotspots and this is only possible by drive-through Internet. Such Wi-Fi are deployed with a simplicity data pipe for vehicle customers, and progressing propels in Pass point/Hotspot 2.0 make Wi-Fi increasingly forceful to give grapple system and reliable meandering [8].

3. Proposed Implementation of System

Communication between different vehicles provides a better driving situation on the roads. It provides better security for drivers to move on without tension or mishappening. The safety of the driver is crucial in today's technology era. Life is going very fast and all are quite busy in their life. No one

has time to wait for some time. Due to this, technology becomes so advanced that helps to provide relaxation to drivers. There is development of Vehicular Ad-Hoc Networks technology that provides security to the drivers. Due to this, this work proposes a vehicle collision handling system in rural areas. It provides the controlling of vehicle movement by the use of the internet.

For usage of framework, it utilizes the fuzzy rationale based controller for controlling vehicle speed. In a fuzzy framework, the fuzzifier performs estimations of the information factors (input signals, genuine factors), scale mapping and fuzzification (change 1). In this way, all the observed signs are scaled, and fuzzification implies that the deliberate signs (fresh info amounts which have numerical qualities) are changed into fuzzy amounts. This change is performed utilizing participation capacities. In an ordinary fuzzy rationale controller, the number of enrolment capacities and the states of these are at first dictated by the client. An enrolment work has an incentive in the vicinity of 0 and 1. The enrolment work for speed is appeared in fig 2.

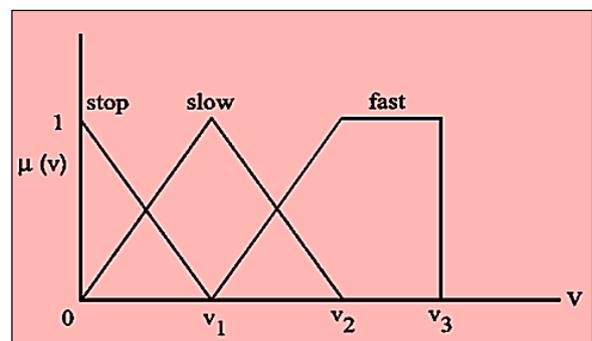


Fig 2: Speed Membership Function in Fuzzy Logic

The membership function used here is to describe all related data contained in fuzzy sets. This function helps to describe special attributes and also provides the desired response of the system. In this work, it provides a smooth range lies between 0 & 1. The input space is called a sample of discourse. For this, it provides an output mapping corresponding to the input values. It uses a trapezoidal membership function for providing speed and distance response of the system. Other membership functions were not able to specify asymmetrical membership functions. This function has a flat top and trimmed triangular shape. It is used because of its simplicity. The core and support are part of membership function. core contains $\mu_A \sim(x) = 1$ and support contains $\mu_A \sim(x) > 0$.

If x is A then y is B.

The run base characterizes (master rules) indicates the control objective activities by methods for an arrangement of semantic standards. At the end of the day, the administer base contains principles, for example, would be given by a specialist.

Table 1: IF-Then Rules for Linguistic Variables

| IF | Then |
|--------------------------------------|-----------------------------|
| Left is Distant and Right is Distant | Right is high, Left is high |
| Left is Close and Right is Close | Right is Slow, Left is high |
| Left is Close and Right is Medium | Right is Slow, Left is Slow |
| Left is Close and Right is Distant | Right is Slow, Left is Slow |

While the imagined situation of automated cars or trucks that trade data utilizing remote correspondence advance to

expand comfort on road is naturally persuading to numerous individuals. These networks are faced by different types of issues or challenges. The figure shows the connected vehicle

and transportation system. In this, the vehicle is connected to communication service providers that helps to maintain movement on the roads.

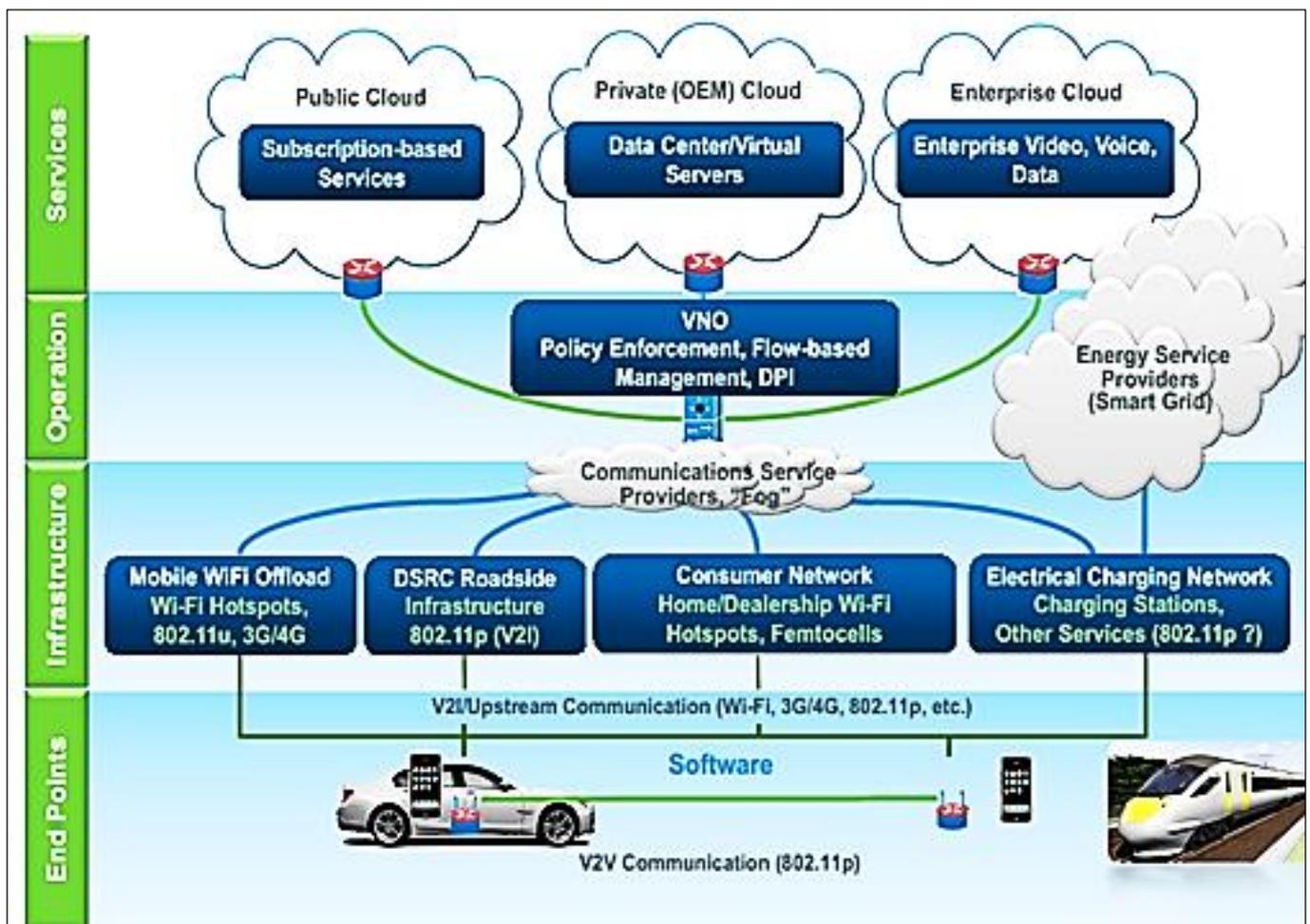


Fig 3: Connected Vehicle & Transportation

Avoiding a collision in systems administration predominantly shows up in systems with bearer sense. This depends on the rule that hubs that will transmit information need to tune in to the channel for quite a while to decide if different hubs are likewise communicating. A hub may begin communication just if a channel gives off an impression of being inactive, something else, transmissions are conceded. Crash evasion partitions the remote channels similarly among transmitting hubs inside the impact area. It's supplemented by trading solicitations to send a parcel. The system needs to help two sorts of security messages: occasional mindfulness Messages which are communicated by any vehicle to advise neighbouring vehicles about the claim Closeness and status, and in addition occasion driven alarm messages which are conveyed if there should be an occurrence of a crisis circumstance that requires a prompt notice of conceivably influenced neighbours. While intermittent messages are imagined to be just a single jump

transmitted, occasion driven messages might be dispersed over more than one bounce. The system needs to help situations in which just a modest number or up to a few several vehicles need to impart, henceforth it must be flexible and adaptable.

This work proposes a collision handling system between vehicles in various areas mainly rural, single narrow paths, etc. It helps to control the traffic and movement of the vehicle by the IoT. The Internet helps to control the velocity of vehicles by providing signals of Close by vehicle and also maintains a distance between them. Different scenarios are studied and implemented. This choice module should consider the street attributes, the claim vehicle development, the obstructions and ought to create moves that are doable practically speaking as indicated by vehicle elements and ought not shock for the drivers. The vehicle internal sensors are shown in the figure below.

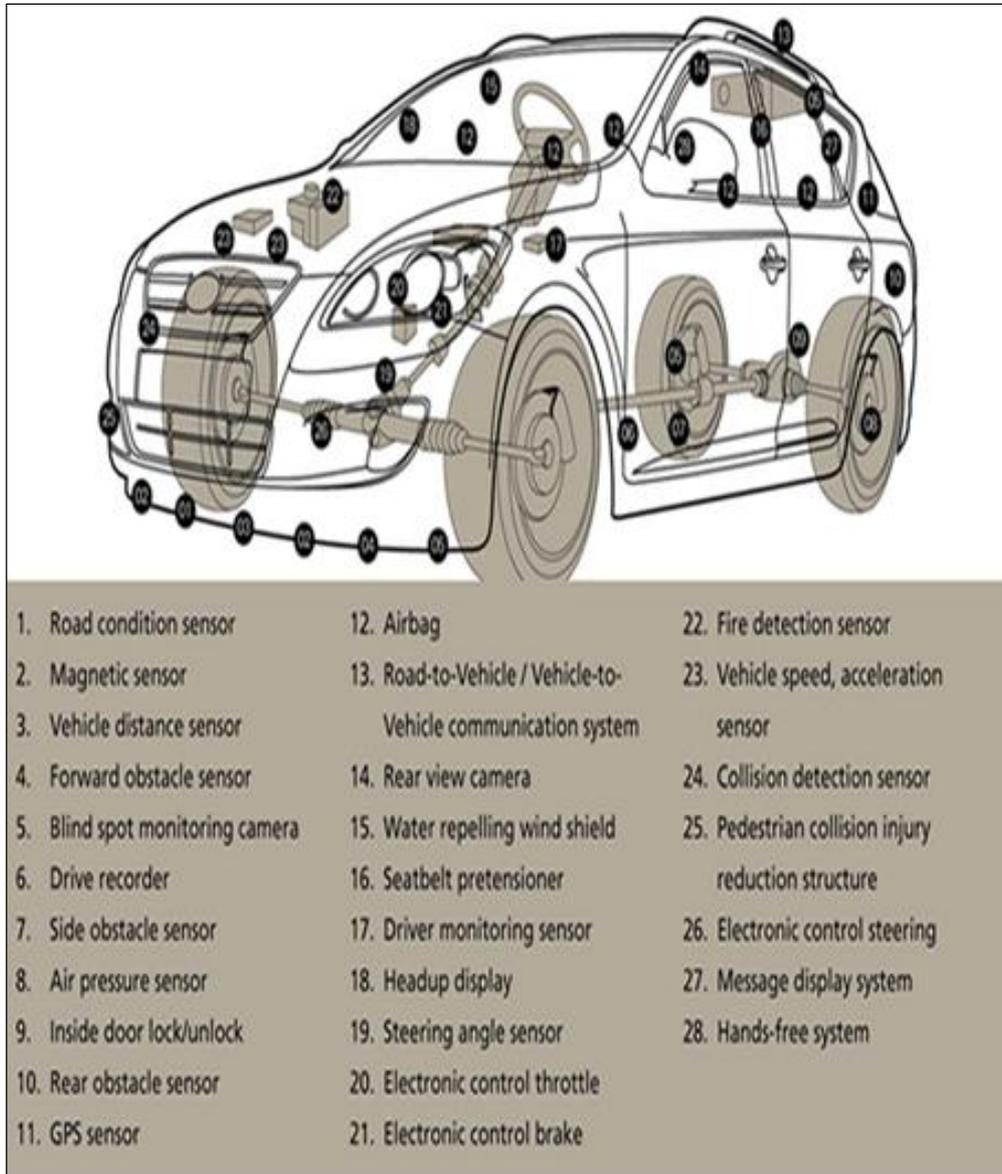


Fig 4: Vehicle Containing Internal Sensors

Step 1: Choose a path

Step 2: Movement of Vehicles in Rural Areas

Step 3: Apply Fuzzy Logic

Step 4: Apply on Various Scenarios

1: if automobile movement in same lane next

If $V \in L$ (same Lane) next

If $D < T$ (threshold) next

Base station communicate with V

end

end

If $V \in L2$ (opposite Lane) then

If $D < T$ (threshold) then

Base station communicate with V to adjust distance & velocity

end

end

End

2: If $V \in L3$ (odouble Lane) then

If $D < T$ (threshold) then

Base station communicate with V to adjust distance & velocity

End

End

End

4. Scenarios for proposed vehicle collision avoidance system

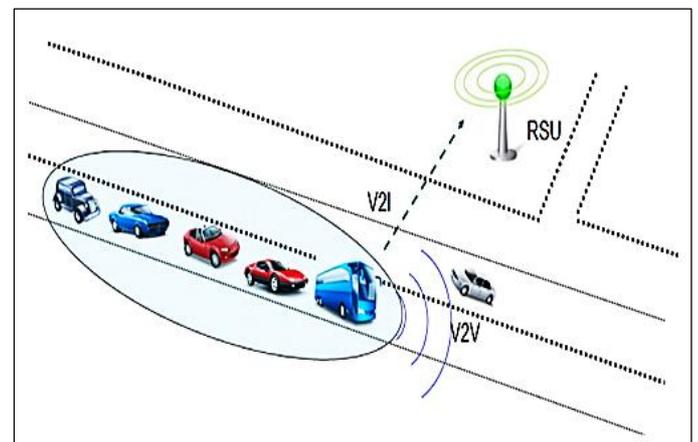


Fig 5: A Platoon of Vehicles

We know that there is an increase in the accident ratio day by day. Due to this, safety becomes a critical chapter in everyone's life. There are a large number of vehicles move on the roads daily. A lot of accident occurs due to different reasons. There is a road sign provided in every area still these are unpredictable and cause dangerous situations sometimes. In our work, it helps to reduce vehicle collisions on the roadside with the help of the internet. It provides the usage of the latest technology for reducing such kinds of things on roads. It provides the alert to the driver so that it may help to control its speed or maintain a distance from other vehicles.

In the first case, it considers the single lane to move the vehicles on both sides. Due to this, an accident may happen in large numbers. But due to the presence of smart technology in vehicles, it helps to reduce accidents. In this case, if the distance between vehicles is less or they are just close to each other for creating an accident, the driver receives an alert message immediately to reconfigure its distance and also maintain its velocity that helps to avoid accidents.

This work uses a fuzzy controller to maintain its movement. The base station is provided in each corner of the street or roadside to provide signals to the drivers. It helps to control the distance from both sides and also controls the velocity of both vehicles. Each vehicle has an inbuilt circuit or sensor elements that help to reduce collision with other vehicles. One sensor is used to locate its current location, other sensor helps to identify Close by bodies, one is to increase or decrease its velocity, etc.

In the second case, more than 2 vehicles are moving in the same lane. Due to this, they can collide with each other. But with the use of smart IoT technology, they never collide with each other. They will maintain a minimum distance between them so that collision never occurs. The sensors identify the location of other vehicles to maintain their velocity. All cases have the main objective to reduce collisions and help to stop accidents on roads. In the next case, vehicles are moving in separate lanes so their speed is also fast. It can cause an accident to them. But smart technology helps to maintain an accident-free environment.

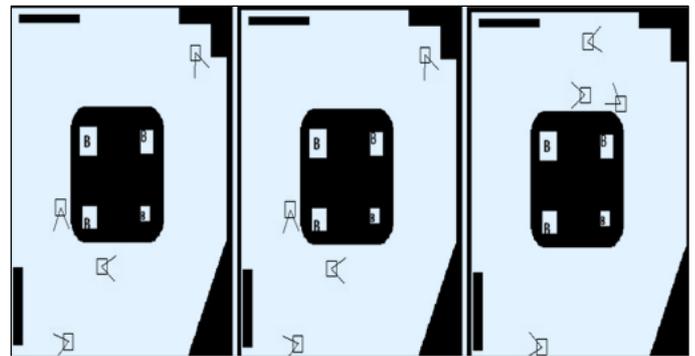


Fig 6: Automobile Controlling in Opposite Direction using IoT

The membership function used here is to describe all related data contained in fuzzy sets. This function helps to describe special attributes and also provides the desired response of the system. In this work, it provides a smooth range lies between 0 & 1. The input space is called a sample of discourse. For this, it provides an output mapping corresponding to the input values. It uses a trapezoidal membership function for providing speed and distance response of the system. Other membership functions were not able to specify asymmetrical membership functions. This function has a flat top and trimmed triangular shape. It is used because of its simplicity. The core and support are part of the membership function. core contains $\mu_A \sim(x) = 1$ and support contains $\mu_A \sim(x) > 0$.

A portion of the fuzzy control rules are actuated by the data procured by the vehicle utilizing a vision sensor. The yields of the actuated principles are weighted by fuzzy thinking and the speeds of the back driving wheels of the vehicle are ascertained. Speed of left & right wheels are meant as left-velocity (LV) and right-velocity (RV) individually. Etymological factors like "quick"; "medium" and "moderate" are characterized by left wheel speed and right wheel speed for enrolment work. Terms like "moderate", "moderate", "medium", "quick", and "quick" are considered for Speed of left & right wheels for enrolment works as appeared.

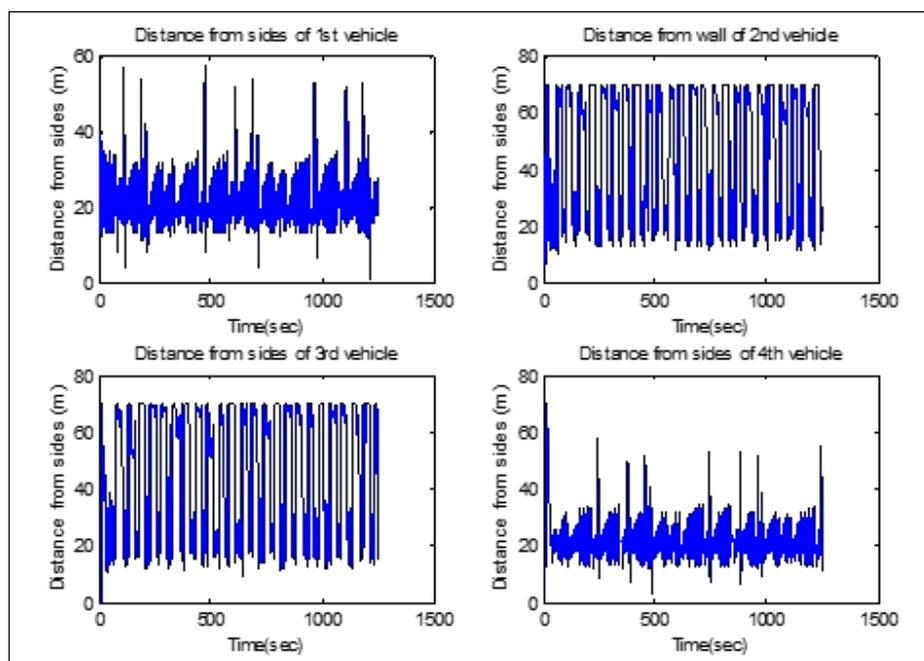


Fig 7: Distance Controlling & Estimation of all Four Vehicles

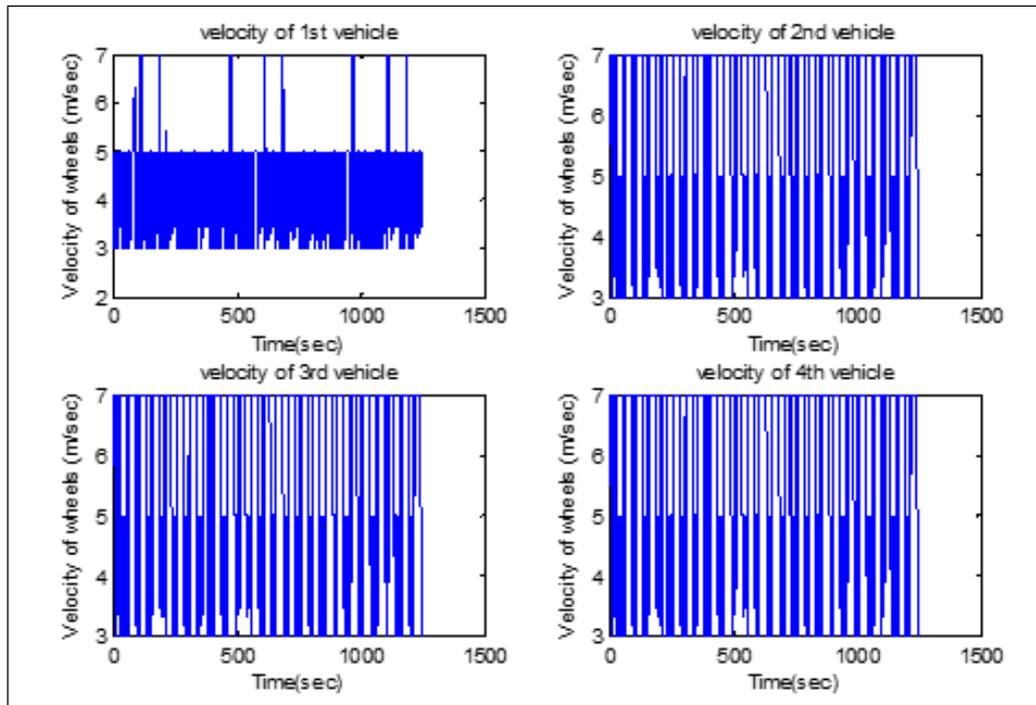


Fig 8: Velocity Controlling & Estimation of all Four Vehicles

4. Conclusions

Communication between different vehicles provides a better driving situation on the roads. It provides better security for drivers to move on without tension or mishappening. The safety of the driver is crucial in today's technology era. Life is going very fast and all are quite busy in their life. No one has time to wait for some time. Due to this, technology becomes so advanced that helps to provide relaxation to drivers. There is development of Vehicular Ad-Hoc Networks technology that provides security to the drivers. Due to this, this work proposes a method for handling the collision system of vehicles in many areas and useful for controlling of movement of the vehicle by the use of the internet. The Internet helps to control the velocity of vehicles by providing signals of Close by vehicle and also maintains a distance between them. Different scenarios are studied and implemented. Different parameters like speed and distance are measured. It provides usefulness in terms of today's technology.

The future work includes the presence of obstacles in the path and also use of ABS system in vehicles.

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