

ACCIDENT PREVENTION IN VANET: A REVIEW

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Abstract: *The opportunities presented by VANETs are unlimited. Vehicular networks offer tremendous opportunities to increase the safety of the transportation system and reduce traffic fatalities. The protocols and accident safety measures find their scope in the current VANET applications to avoid vehicle collisions and prevent accidents at intersections. Human conduct, Red Light jumping, traffic rules violation, accident prevention, vehicle tracking etc. are some of the main application areas. In this paper, various accident prevention techniques in VANET are analysed in order to identify the areas where there is possibility of more optimization.*

Keywords: *Vehicular networks, Accident prevention and avoidance*

I INTRODUCTION

Now a days, on road accidents is a major problem of concern. Road accidents happen due to various different reasons such as street development, surge hours, human conduct, drunken driving, red light jumping etc. Increase in urban population have led to increase in road traffic and road accidents. VANETs provides various methods to provide road safety. Maximum number of accidents have occurred at intersections with good visibility in urban areas. The advancement in Vehicular Ad hoc Network have led to various organizations, institutes to focus on the methods of street security and it is widely used now a days. VANET is a prominent way to provide street security and prevent vehicles from collision by using various methods like message dissemination, traffic management etc. As population is increasing, the highway road accidents are also increasing. The eventual goal is to prevent road accidents and avoid vehicle collisions at intersecting roads. In this paper, various collision avoidance challenges, requirements and a survey of existing solutions to the security challenges in VANET is presented.

II VANET FACTORS SUPPORTING COLLISION AVOIDANCE

The various factors involve in collision avoidance are as follows:

1. **Information about the vehicles:** In this, information about the vehicle speed, velocity, distance, direction, position is involved. The communication between the vehicles can be vehicle to vehicle or it can be vehicle to infrastructure.
2. **Prediction of the trajectory followed by vehicles:** This factor involved the information about the vehicles about the path followed by the vehicles. This can be achieved by using some mathematical method or by some algorithms. These formulae can vary according to the methods and scenarios.
3. **Calculating the probability of the collision:** The probability can be predicted by assigning some threshold value and then the probability of the collision can be calculated. The threshold value can be different for different methods, different scenarios and different users.
4. **Warning messages:** This factor is very important in the collision avoidance system. The warning messages are sent to the vehicles to alert adjacent or approaching vehicles about the collision. Then accordingly, the vehicle can take appropriate action. These warning messages must be reached to the intended vehicle within the time limit. If there is any delay occur in the delivery of these warning messages, then it can cost the lives of the people.

III EXISTING ACCIDENT PREVENTION SOLUTIONS FOR VANETS

Various authors present various solution in context with the road safety in order to prevent accidents and avoid collisions. These are described as below:

- a) **Solution for car-pedestrian collision:** To avoid car-pedestrian collision a parameterized and reliable design is used to avoid car-pedestrian collision using VANET [7]. Long Term Evolution (LTE) communication network is used to retrieve information about the pedestrian movement across the area surrounding the car. For positioning, Global Positioning System (GPS) in cars and mobile phones is employed. A server is designed to retrieve information about the location from both cars and mobile phones. The server has all the information about the position of cars and pedestrians. If the server detects that the pedestrian is going to enter car's area, then it will inform the cars and mobile phones to establish P2P communication using 802.11b so that they can decide the best course of action. A car cluster algorithm is designed which is based on the overlapped breaking distances to reduce the load on the infrastructure [8][9]. To reduce the load in the LTE network proposed an adaptable pedestrian position reporting design is proposed which is based on the distance from the VANET's road side unit. RSU's are used to report the cars location and speed. The RSU's then send alerts to the cars about the collision.

- b) **Warning Service Mechanism to prevent Accidents:** In this method, vehicles are assumed to be equipped with sensors which are able to determine weather conditions like humidity, temperature etc. Also, Vehicles are assumed to have GPS positioning and communication capabilities through the use of IEEE 802.11p standard. The author used Participatory Sensing method [10] to reduce the installing cost of expensive and complex sensing units thus provide a better view of the area. Vehicles send the status message to the nearest RSU thus avoiding redundancy in the network. The RSU will then calculate the density of the traffic with the previous RSU. The status message contains a 4-bit field, 2 bits for traffic density and 2 bits for weather information. Vehicles get the weather information from weather on-board sensors. To compute traffic density GPS embedded device and the transmission of hello messages are used. Each RSU receives messages containing traffic statistics from vehicles and update their traffic density statistics. The traffic density statistics are updated in the RSU by using Exponential Weighted Moving Average (EWMA). RSU's also update the weather information and store the results. These statistics are then shared with the other RSU'S on the same road.
- c) **Smart City Framework for Intelligent Traffic System using VANET:** A solution is provided for the road traffic by sending information about the traffic condition so that the driver can take necessary actions. The solution involves framework of a smart city consist of Intelligent Traffic Lights (ITLs) at the intersecting roads of a city [11]. The information about traffic density is gathered by ITLs and update the statistics that is congestion in the city. These statistics are sent to the vehicles so that vehicles can select the best possible path which is free from congestion. If in case accident occurs, then these ITLs send the warning message to the vehicles informing about the accident so that no further collision cannot occur. A method is proposed that manages the traffic information so as to avoid accidents [12-14]. The information here is gathered from the vehicles itself, so no infrastructure is needed in this proposed work. The vehicles are having a GPS, on board unit and full map of the city including the positions of ITLs. Every vehicle sends hello messages from which the exact location of each vehicle is determined and using this information traffic density of the city can be calculated.
- d) **Red Signal Delay method to prevent accidents:** This method consists of traffic light, camera and a controller [15]. The controller is used to control the camera and traffic lights. Camera is used to capture the image of the vehicles which are arriving at the left turn. Controller is responsible for red signal delay to avoid vehicle collisions turning left at intersection. The author used various methods to determine the speed of the vehicle and entry at the intersection [16-17].

If the signal of the left-turn lane turns into red then vehicles move straight. It is because the signal of the waiting lane turns into green from red signal. In this scenario, if vehicles can't able to go completely through intersection and other vehicle approaches the intersection from the waiting lane, then probability of the vehicle collisions increased. So, to avoid this situation, the author increases the red signal timing that is, the timing of the red signal is delayed.

- e) **Collision Avoidance using Congestion Control Concept:** In their scheme, the two types of safety messages. These are beacon messages and event-driven messages [18]. Vehicles and RSU s are assumed to be equipped with short range wireless communication devices which is based on IEEE802.11p so that the vehicles can communicate with each other. These messages are must be disseminated within an area with certain delay limit. The scheme works by sending the beacon messages which are also known as Hello messages. This message contains information about the vehicle position, speed, location etc. Event-driven messages are generated when any abnormal situation is detected. Beacon messages are sent by vehicles to RSUs periodically to inform about vehicle position, direction, speed with the neighbouring vehicles and to make them aware of their environment. These event-driven messages must be delivered to vehicles as fast as possible. To avoid congestion in this scheme author uses 802.11p protocol. The congestion in the traffic is reduced by reducing the transmission time of beacon messages. The author achieved this by using higher data rates. If large number of vehicles transmit beacon messages at high frequency rate then the bandwidth will get exhausted completely. Due to this, packet collision occurs which in turn cost the lives of the people. So, to overcome this problem, congestion detection method is used by providing dynamic time slot reservation to the vehicles that generates warning messages. If the vehicle does not find any time slot then the author provides unoccupied time slots from the adjacent segments.
- f) **Vehicular Cloud environment:** It consists of three layers: V2V, V2I, RSU to static cloud and vehicle to dynamic cloud. It is assumed that every vehicle is equipped with on board unit with built-in navigation system [19]. The on board unit transfers data through 3G or 4g communication devices like Wi-Fi, WAVE, Wi-max etc. If the vehicle is detected with abnormal behaviours like sudden lane change, exceeding speed limit, accelerating with reverse direction etc. then an emergency warning message will get generated and is send to the cloud storage and vehicles. The second layer is vehicle to Infrastructure layer. This layer is responsible for transmitting the movement, location of the vehicles and traffic related information. The third layer is RSU to static cloud which is used to store all the information related to the RSU data on static cloud and is also responsible for creating free space for future use.
- g) **Traffic Load Detection on Highways:** A system is proposed to overcome the road accident issue by using real time simulation. A decision server is used to collect the information about the traffic from RSUs. RSU devices are used as Wi-Fi and also used for connecting link nodes [20]. Authors take vehicles as devices to send and retrieve data from other devices. The scheme is proposed for this system mainly to utilize the decision server which are used to retrieve information from the RSUs. The scheme is also used to assess the performance of various routing protocols. The scheme is designed as a rule based technique to detect the congestion and also to prevent it. The scheme is implemented in three different scenarios. First, they choose the better communication method for V2V communication using Weighted Cluster Algorithm (WCA) to improve the performance of network in different

scenarios [21-22]. The scheme involves four different parameters such as connectivity to check vehicles are in same range, speed to check the moving speed of the vehicle, distance to check the distance between vehicles and mobility.

IV COMPARISON STUDY

Table 1 shows comparison among various existing techniques used for accident avoidance in VANET

V CONCLUSION

As VANETs have been used in various applications with the goal to provide safety and comfort to passengers, hence, there is a requirement of optimized solutions for accident prevention in VANETS. Also, due to large number of nodes and lack of routers, a network scheme may cause serious scalability and hidden terminal problems. In VANETs, a possible solution to above problem is the use of efficient accident prevention algorithm. However, there are number of challenges that need well designed solutions. Some of these challenges are high mobility of vehicles, sparse connectivity in some regions and warning message dissemination.

S.no	Name	Issue Discussed	Approach and method	Limitations	Simulation
1.	Hassan Artail, Kareem khalifeh[1]	Collision between car and pedestrians	- The system is designed on LTE network - Car cluster algorithm is designed to reduce load. - Server is designed to retrieve information about car and pedestrians.	Users are not necessarily equipped with LTE connection. If the mobile users are on the call then the LTE connection did not work.	NS2 SUMO to generate car movement file
2.	Estrella Garcia-Lozano, Carolina Tripp Barba [2]	Message dissemination system to handle various types of messages	- Sensed environment data is collected from vehicles on the road. - Data is processed by RSUs and shared with other RSUs. - Processed information is send to vehicles.	The solution is not feasible to highly dense scenarios.	NS-2.34 (Network Simulator)
3.	Ganesh S. Khekare, Apeksha V. Sakhare [3]	Information sending about traffic condition to vehicles so that driver can take necessary action.	- Designed a smart city framework having Intelligent Traffic Lights. - Traffic Density Information is retrieved by ITLs and send to vehicles. - AODV protocol is used	AODV Protocol is to forward the packets, it needs end-to-end paths. This is not easy to maintain in VANETs.	NS2 (Network Simulator)
4.	Mi-hye Lee, Sun-young Im [4]	Vehicle Collision at Intersection	- Controller is used to control the camera and traffic lights. - Camera is used to capture the image of the vehicle. - Increases Red signal time at intersection to avoid vehicle collision probability from increasing.	The interval time of vehicular traffic is assumed between 8 A.M and 10 A.M. and the arriving rate of vehicle change from 1 to 5.	C Language on Visual Studio
5.	Vaishali Manwar, Sayali N. Mane [5]	Prevent accidents of vehicles while intersected at crossing.	- Use congestion control concept to avoid collisions at intersection. - IEEE 802.11p is used to avoid congestion of vehicles. - Use two types of safety messages: Beacon messages containing vehicle location, id , speed and event-driven messages for alerting the driver.	The event-driven messages may be lost or can be delivered to its recipient with higher delay.	NS2 (Network Simulator)
6.	Sumit A. Khandelwal, Ashwini B. Abhale, Uma Nagaraj [6]	Reducing road accident and pollution control under cloud environment	- On-board unit sends data using 3G communication devices like Wi-Fi, Wi-Max, Wave. - Emergency warning message will be generated and send to cloud storage and vehicles in case of any abnormal conditions.	Protocols, Architecture, Congestion and Privacy Issues.	SUMO simulator

Table 1 Comparison Table

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