Review Article CODEN: IJPAKY Impact Factor: 4.226 ISSN: 2319-507X
A. S. Dudhe, IJPRET, 2015; Volume 4 (5): 84-93 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

A REVIEW ON TRAFFIC COLLISION AVOIDANCE SYSTEM DUE TO DRIVER IMPAIRMENT USING VEHICULAR AD HOC NETWORKS (VANETS).

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Accepted Date: 13/12/2015; Published Date: 01/01/2016

Abstract: - Recently, immense increase in the number of automobiles on the road made driving difficult and unsafe. Roads are routinely replete with vehicles, and therefore, safe-separation distance and sensible speeds do not seemed to be valued anymore. Immediate effect of this situation is an exponential increase in number of Road accidents. Road traffic accidents (RTAs) have turned out to be India's biggest emerging challenge. Millions of people around the world die every year in vehicle accidents and many more are injured. Implementations of safety information such as speed limits and road conditions are used in many parts of the world but still more work is required. There are many solutions proposed to avoid the problem. Vehicular Ad-hoc Network (VANET) is becoming the most suitable solution for driving assistance and traffic monitoring in the current scenario. Vehicular Ad Hoc Networks (VANET), collect and distribute safety information to massively reduce the number of accidents by warning drivers about the danger before they actually face it. A VANET provides vehicle to vehicle connectivity and can be used as an alert system in the vehicles. The desire to improve road safety information between vehicles to prevent accidents is the main motivation behind the development of vehicular adhoc networks (VANETs).

Keywords: VANET, Intelligent transportation systems (ITSs), inter-vehicle communication, alert, safety

PAPER-QR CODE

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How to Cite This Article:

A. S. Dudhe, IJPRET, 2015; Volume 4 (5): 84-93

INTRODUCTION

The original motives behind vehicular communications is safety on the road, many lives were lost and much more injuries have been incurred due to vehicle crashes. In 2013 alone 137,572 people died in road accidents 494,893 people got seriously injured[1]. India witnessed one road accident every minute in 2011 which claimed one life every 3.7 minutes, one of the highest in the world[2].Table1.Shows the analysis of total number of road accident, person killed and injured during 2002-2011[10].According to the World Health Organization(WHO), between 20 and 50 million people suffer non-fatal injuries each year as a result of road traffic accidents, many of them are left disabled as a result of their injuries (WHO, 2011).World Health Organization (WHO) predicted that in 2030, RTAs will be one of the main causes of disability-adjusted life expectancy [11].

No. of Accidents and No. of Persons involved: 2002-2011					
Year	No. of Accidents		No. of Persons		Accident Severity*
	Total	Fatal	Killed	Injured	
2002	407497	73650(18.1)	84674	408711	20.8
2003	406726	73589(18.1)	85998	435122	21.1
2004	429910	79357(18.5)	92618	464521	21.5
2005	439255	83491(19)	94968	465282	21.6
2006	460920	93917(20.4)	105749	496481	22.9
2007	479216	101161(21.1)	114444	513340	23.9
2008	484704	106591(22)	119860	523193	24.7
2009	486384	110993(22.8)	125660	515458	25.8
2010	499628	119558(23.9)	134513	527512	26.9
2011	497686	121618(24.4)	142485	511394	28.6
*Accident severity: No. of Persons killed per 100 accidents					

Table I. No. of Accidents and No. of Persons involved: 2002-11

From above figures it can be observed that road accidents are consistently increasing every year. There are various reasons which are responsible for accidents to occur. The details of causes of Road accidents as given in figure 1[10] is summarizes as follows.

i) Due to Driver (77.5%)

ii) Weather Condition (1.0%)

iii) Vehicle Condition (1.6%)

iv) Pedestrian's fault (2.4%)

v) Cyclist's Fault (1.3%)

vi) Road Condition (1.5%)

vii) Other (14.8%)

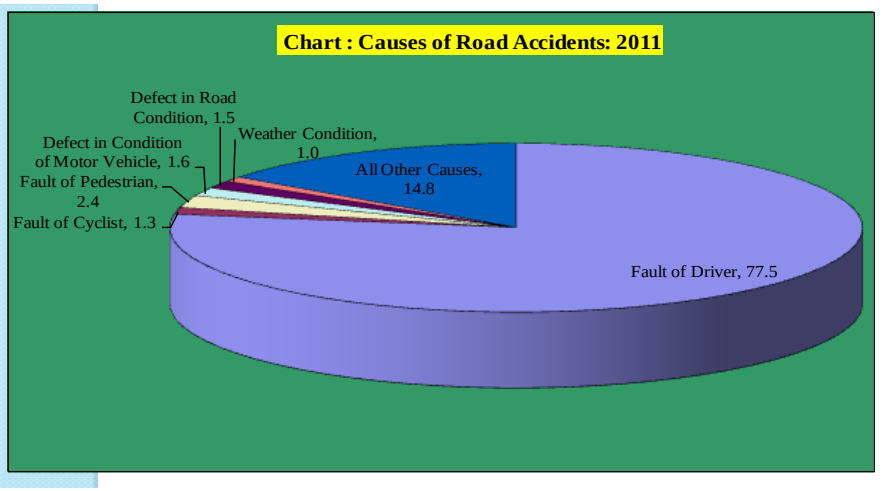

Fig1: Causes of Road Accidents

The analysis of road accidents in terms of causal factors reveals that drivers fault is the single most important factor responsible for accidents, fatalities and injuries. Drivers fault accounted for 77.5 % of total accidents.

To enhance the safety of drivers and provide the comfortable driving environment, system that alert the driver about the risky situations is needed. If a driver get a warning message on time collision can be avoided. The driver can be alerted through a signal by the other vehicle i.e. through the inter-vehicular communications.

In this paper the source is the VANET communication, A VANET is defined as a spontaneous ad hoc network formed over vehicles moving on the road. Such a network can be formed between vehicles with V2V communication or between vehicles and infrastructure with vehicle-to infrastructure (V2I) communication. When *communication has been* established between vehicles then the vehicle user will able to know about the arrival of other vehicle, so the driver will be alert of the vehicles arrival.

2. Literature Review:

a. Sreevishakh. K.P, et.al., describes an inexpensive and efficient accident prediction and intimation system based on the concept of inherent magnetic feature of vehicle bodies to provide crash insight to vehicles. Anisotropic magneto-resistive (AMR) sensors which are optimized to work in the Earth's magnetic field range and sonar or ultrasonic sensors are adopted for development of the proposed sensor system. AMR sensors are used to measure the magnetic field disturbances caused by vehicles to Earth's inherent uniform magnetic field and to get presence and relative position of vehicles. AMR sensors are able to work at small inter-vehicular distances down to 0 meter having high refreshment rate and highly inexpensive and compact. Achieving zero road accidents is practically impossible, but with the help of effective accident prediction and notification, the severity can be reduce to the minimal level. Here GSM and GPS based notification system are integrated which provide the timely intimation including the crash location to the nearby police station or hospitals which will ensure post-trauma medical care within minimum time. Accident severity and vehicles involved can also be predicted by the proposed system. A brief review on technologies to predict the collision between vehicles and notification systems are also covered in this paper[1].

b.Vikram Singh Kushwaha, et.al., proposes a new dimension in order to allow early response and rescue of accident victims; saving lives and properties. The system uses the capability of GPS and GSM along with the android phone to provide a solution which can be used to precisely detect the accident spot and to send the emergency notification to the nearby hospitals ICU and to the victims relatives. The proposed system consist of two unit namely, Crash Detector Embedded Unit and Android Control Unit. Crash Detector Embedded Unit is responsible for detecting the accident condition using three-axis accelerometer sensor, position encoder, bumper sensor and one false alarm switch. Bluetooth module (HC-05) is used to send the accident notification to the victims android phone where an android app will get the GPS location of accident spot and compare it with all the nearby hospitals location in order to calculate the shortest path and send the notification to the nearest hospitals ICU in the form of SMS[2].

c.G.Mary Valantina et.al., describe PP-AODV, which is a portable VANET routing protocol that learns the optimal route by employing a fuzzy constraint Q-learning algorithm based on ad hoc on-demand distance vector (AODV) routing. With the help of fuzzy logic it is estimated whether a link is good or not by considering multiple metrics which are specifically the available Bandwidth, Delay, packet collision probability. The protocol can understand vehicle movement based on neighbour information when position information is unavailable[3].

d.M.A.Berlin et.al., describes DHRP, Direction based Hazard Routing Protocol for transmission of road hazard messages in highways with the use of smart RSUs. RSUs provide a feasible and cost-effective option for disseminating road hazard messages and provide a reliable alternate to V2V communication, especially, in highways where the vehicular traffic is sparse. DHRP carries out selective transmission of hazard message based on the location of hazard and the direction in which the vehicles are travelling. The proposed protocol has been implemented and tested using SUMO simulator to generate road traffic and NS 2.33 network simulator to analyze the performance of DHRP.The performance of the proposed protocol was also compared with simple flooding protocol . According to the comparision, In DHRP protocol, only the vehicles in the hazard zone (moving towards the hazard) would transmit the hazard message, but in flooding technique all vehicles that receive the HM would re-broadcast the message[4].

e. Arpita Chaudhari et.al., describes a new identity Based secure algorithm for VANET. Because the deployment of Vehicular Communication is strongly dependent on their security and privacy feautures. Privacy , Authentication, Confidentiality and non-repudiation are the most desired security attributes for all VANET applications. This newly proposes algorithm is based on a unique identifier, which is used for identification of vehicles and by using this unique identifier, the security of every vehicle can be ensured.

3. Problem Definition

A driver realizing the brake lights of the vehicle in front of him has only a few seconds to respond, and even if he has responded in time vehicle behind him could crash since they are unaware of situation. The original motive behind vehicular communications is safety on the road, many lives were lost and much more injuries have been incurred due to vehicle crashes.

Recent advances in hardware, software, and communication technologies are enabling the design and implementation of a whole range of different types of networks that are being deployed in various environments. One such network that has received a lot of interest is the Vehicular Ad-Hoc Network (VANET). VANET has become an active area of research, standardization, and development because it has tremendous potential to improve vehicle and road safety, traffic efficiency, and convenience as well as comfort to both drivers and passengers. VANETs is a subset of MANETs with a unique characteristic of dynamic nature or node mobility, frequent exchange information, real time processing, self-organizing, infrastructure less nature.

4. Proposed System

VANETs (Vehicular Ad-hoc Networks) are the emerging network technology for the moving vehicles and emerged as a popular research area . VANET turns every participating vehicle into a wireless router or mobile node, enabling vehicles to connect to each other and, in turn, create a network with a wide range. The nodes are detecting to each other approximately 100 to 300 meters range. If cars or nodes faraway to the given range the signal drop out from the network and on the other hand new cars or nodes can detect the other and join into the network, that's by a mobile Internet is created.

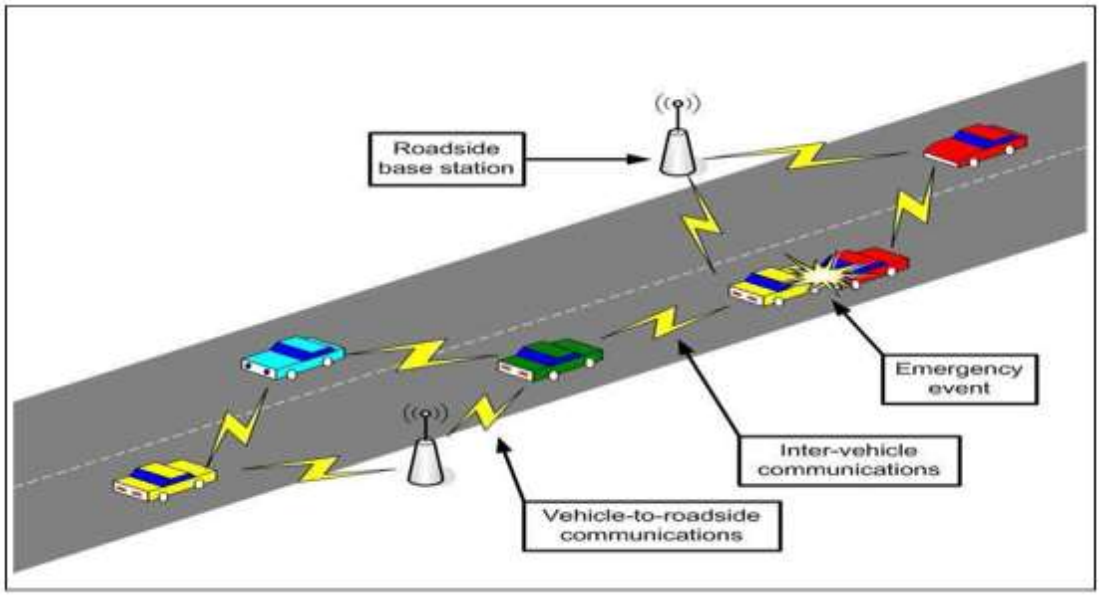

Fig.2: VANET,s Architecture

Fig.2. shows the structure of VANET. A VANET consists of vehicles and roadside base stations that exchange primarily safety messages to give drivers the time to react to life-endangering events.

The communicating nodes in VANETs are either vehicles or base stations. Vehicles can be private (belonging to individuals or private companies) or public (i.e., public transportation means, e.g., buses, and public services such as police cars). Base stations can belong to the government or to private service providers. We assume a communication channel supported by an IEEE 802.11-like technology.

4.1. Intelligent transportation systems (ITSs)

Vehicular ad-hoc network or VANET is also known as intelligent transportation system (ITS). In intelligent transportation systems, each vehicle takes on the role of sender, receiver, and router to broadcast information to the vehicular network or transportation agency, which then uses the information to ensure safe, free-flow of traffic. For communication to occur between vehicles and Road Side Units (RSUs), vehicles must be equipped with some sort of radio interface or OnBoard Unit (OBU) that enables short-range wireless ad hoc networks to be formed Vehicles must also be fitted with hardware that permits detailed position information such as Global Positioning System (GPS) or a Differential Global Positioning System (DGPS) receiver. Fixed RSUs, which are connected to the backbone network, must be in place to facilitate communication. The number and distribution of roadside units is dependent on the communication protocol is to be used. For example, some protocols require roadside units to be distributed evenly throughout the whole road network, some require roadside units only at intersections. Following Figures depict the possible communication configurations in intelligent transportation systems. These include vehicle-to-vehicle, vehicle-to roadside, and routing-based communications.

4.1.1. vehicle-to-vehicle communication

The inter-vehicle communication configuration (Fig. 3) uses multi-hop multicast/broadcast to transmit traffic related information over multiple hops to a group of receivers.

In intelligent transportation systems, vehicles need only be concerned with activity on the road ahead and not behind. There are two types of message forwarding in inter-vehicle communications: naïve broadcasting and intelligent broadcasting. In naïve broadcasting, vehicles send broadcast messages periodically and at regular intervals. Upon receipt of the message, the vehicle ignores the message if it has come from a vehicle behind it. If the message comes from a vehicle in front, the receiving vehicle sends its own broadcast message to vehicles behind it. This ensures that all enabled vehicles moving in the forward direction get all broadcast messages. The limitations of the naive broadcasting method is that large numbers of broadcast messages are generated, therefore, increasing the risk of message collision resulting in lower message delivery rates and increased delivery times.

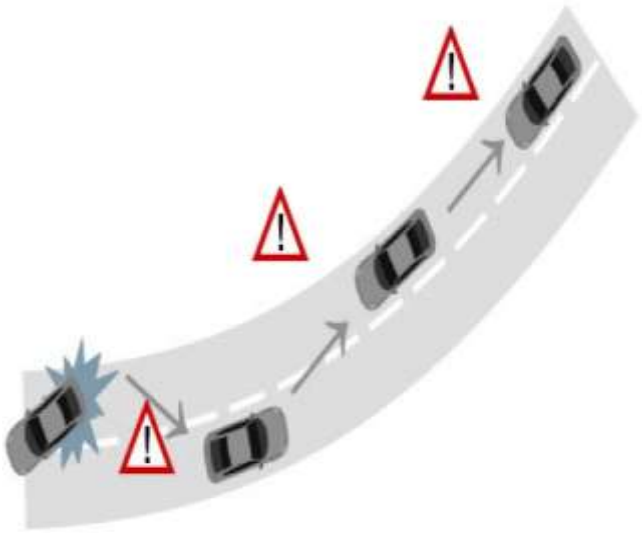

Fig. 3. Inter-vehicle communication

Intelligent broadcasting with implicit acknowledgement addresses the problems inherent in naive broadcasting by limiting the number of messages broadcast for a given emergency event. If the event-detecting vehicle receives the same message from behind, it assumes that at least one vehicle in the back has received it and ceases broadcasting. The assumption is that the vehicle in the backwill be responsible for moving the message along to the rest of the vehicles. If a vehicle receives a message from more than one source it will act on the first message only.

*4.1.2.*Vehicle-to-roadside communication

The vehicle-to-roadside communication configuration (Fig. 2) represents a single hop broadcast where the roadside unit sends a broadcast message to all equipped vehicles in the vicinity.

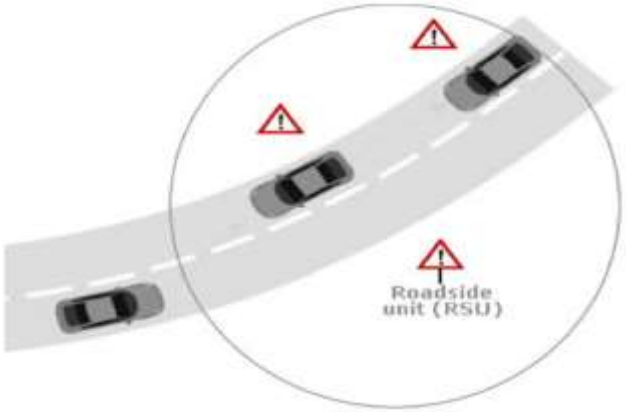

Fig. 3. Vehicle-to-roadside communication

Vehicle-to-roadside communication configuration provides a high bandwidth link between vehicles and roadside units. The roadside units may be placed every kilometer or less, enabling high data rates to be maintained in heavy traffic.For instance, when broadcasting dynamic speed limits,the roadside unit will determine the appropriate speed limit according to its internal timetable and traffic conditions. The roadside unit will periodically broadcast a message containing the speed limit and will compare any geographic or directional limits with vehicle data to determine if a speed limit warning applies to any of the vehicles in the vicinity. If a vehicle violates the desired speed limit, a broadcast will be delivered to the vehicle in the form of an auditory or visual warning, requesting that the driver reduce his speed.

4.1.3. Routing-based communication

The routing-based communication configuration (Fig. 4) is a multi-hop unicast where a message is propagated in a multi- hop fashion until the vehicle carrying the desired data is reached.

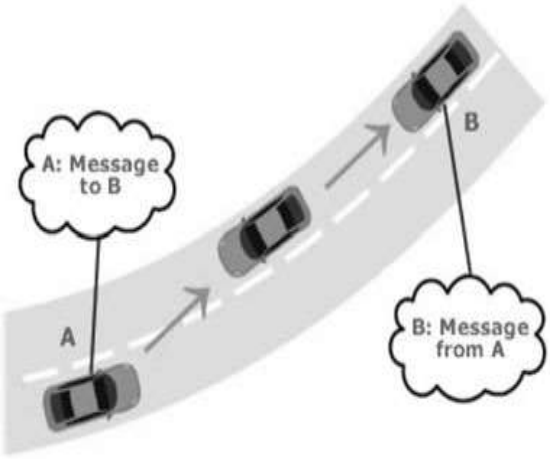

Fig. 4. Routing-based communication

When the query is received by a vehicle owning the desired piece of information, the application at that vehicle immediately sends a unicast message containing the information to the vehicle it received the request from, which is then charged with the task of forwarding it towards the query source.

5. MECHANISM FOR SIMULATION

Simulation is an essential step before the implement of new technologies in VANETs. The simulation is done using NS-2 simulator.NS2 is an object-oriented, discrete event driven network simulator which was originally developed at University of California-Berkely. The programming it uses is C++ and OTcl (Tcl script language with Object-oriented extensions developed at MIT). The usage of these two programming language has its reason. The biggest reason is due to the internal characteristics of these two languages. C++ is used to implement the detailed protocol and OTcl is used for users to control the simulation scenario and schedule the events. NS-2 is available on several platforms such as FreeBSD, Linux, SunOS and Solaris. NS-2 also builds and runs under Windows with Cygwin.

6. CONCLUSION

As seen from the above facts and figures, it is clear that stringent measures are required to prevent the causes of road accidents .Improving the walking lanes for pedestrians and properly channelizing the road traffic can efficiently solve this problem to a greater extent. In this paper we have provided an overview of vehicular networks. As vehicular transportation has become an integrated part of our daily routine, there is a growing demand for inter-vehicle communications and in-vehicle computing. VANETs can realize V2V and V2I communications. This emerging vehicular networking paradigm is considered promising, enabling a wide spectrum of new on-the-road applications including safety, convenience, and comfort services. Vehicular communications are a major component of a future intelligent transportation system. Vehicular networks will not only provide safety and life saving applications, but they will become a powerful communication tool for their users.

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