Vehicular ADHOC Networks for Emergency Vehiclea Review

Kirti Tripathi* and Suraj Dhalwar**
*MIMIT, Malout
**Vellore Institute of Technology,Vellore
*kirtitripathifzk@gmail.com
**surajdhalwar@gmail.com

Abstract: A rising trend of wireless sensor networks in smart transport system for safety purpose leads to add an autonomous feature which prevents accidents. An overview of highway cooperative collision avoidance (CCA), which is an emerging vehicular safety application using the IEEE- and ASTM-adopted Dedicated Short Range Communication (DSRC) standard is given along with the DSRC architecture. The concept of CCA and its implementation requirements in the context of vehicle to vehicle wireless network introduced, primarily at the Medium Access Control (MAC) and the routing layer. Interactions between CCA and its underlying networking protocols. These Results are also used to demonstrate the need for network data prioritization for safety-critical applications such as CCA.

Keywords: Emergency Vehicle,VANET,DSRC,CCA.

Introduction

With the advancement and development of wireless communication technologies, significant study have been made in the field of inter vehicle communication. Now a days safety and comfort is the key point for the driver while driving. To avoid possible collisions smart vehicles are used which improved vehicle to vehicle communication. To convert all these future necessities into reality is a challenge. Thus, understanding the communication desires of aimed application is the key to select proper communication channel. To accomplish this, there is a requirement to state set of communication parameters on the basis of communication medium inside a particular surrounding.In this paper, a study of communication requirements for intelligent transport system (ITS) applications and give some procedures to select appropriate technologies to achieve their communication needs based on the following set of parameters[1].The automobile industry is experiencing a major tactical move in the direction of more environmental and protected vehicles, presenting smart vehicular services such as ecodriving support and Internet access. Though, it will take several years awaiting most of the vehicles in our highways are equipped with these innovative functionalities. Communication mode can be divided into two categories vehicle to infrastructure (V2I) and vehicle to vehicle communication (V2V)[4].

Methodology

In this paper, By proposing a hybrid architecture that combines vehicle to vehicle communication and vehicle to roadside sensor communication[3]. From the wide range of possible use cases, choosing accident prevention and post-accident investigation, which regard as important future services.

For accident prevention, roadside sensor nodes measure the road condition at several positions on the surface, aggregate the measured values and communicate their aggregated value to an approaching vehicle. The vehicle generates a warning message and distributes it to all vehicles in a certain geographical region, potentially using wireless multi-hop communication[4]. For post-accident investigation, sensor nodes continuously measure the road condition and store this information within the Wireless Sensor Networks (WSN) itself. When an accident occurs, road condition data stored over a sufficiently long duration can be used for forensic reconstruction of road accidents[5]. In contrast to the accident prevention service, such a liability service needs to be restricted to a well specified group of end-users, e.g. insurance companies or the road patrol. Information stored within the WSN can also be utilized to judge a driver's driving style according to the road condition at the moment of an accident[6].

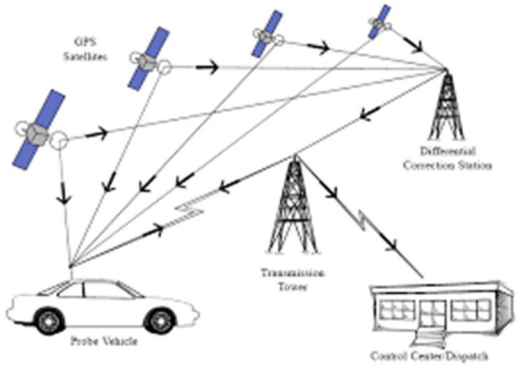

Figure1.General communication framework

Communication Through VANET

Vehicles connected to each other through an ad hoc formation form a wireless network called "Vehicular Ad Hoc Network". Vehicular adhoc networks (VANETs) are a subgroup of mobile ad hoc networks (MANETs). It includes V2V communications and V2R communications and is important component of ITS. Nodes are expected to communicate by means of North American DSRC standard that employs the IEEE 802.11p standard for wireless multi-hop communication. It contains:-

- *On-Board Unit (OBU)*:- A device which is inside the vehicle and processes the data collected from various sensors fitted inside the cars and gives conditions of the vehicles is responsible for communication with outside network i.e. with other vehicles and infrastructure.)
- *Road Side Unit (RSU):-* Infrastructure for communication between the cars for sharing and information from various vehicles.
- *VANET Server:*-VANET Server receives messages from vehicles and sends those messages to all other vehicles belonging to the same geographical region as of sender. Geographical regions are predetermined by VANET Server.

The VANET server segregates the area based on geographical location. It generates a table based on geographical locations and vehicles belong to a particular geographical location. The VANET server will make an analysis based on those information received by vehicles travelling a particular area and feed them into table. This table will contain geographical location id, identification numbers of vehicles in that location, speed, the information provided by that vehicle, analysis made by the server, and vehicles trustworthiness[7]. Other vehicles can access this information from the table and can also check trustworthiness of a particular vehicle. The server also creates another table which contains geographical location id, location description, average speed, time. From this report server can analyses about the average condition of a particular area. From these report vehicles can map their journey beforehand. This will help the smooth traffic flow. For example, if there is a road block in a particular area, then all the cars moving through that area will generate road block message and there speed will also be 0 (zero). So other cars moving towards that direction can check with all the cars present in that geographical area and take the decision about moving toward that direction. In case a car is generating a false message other cars in that geographical area can contradict it.

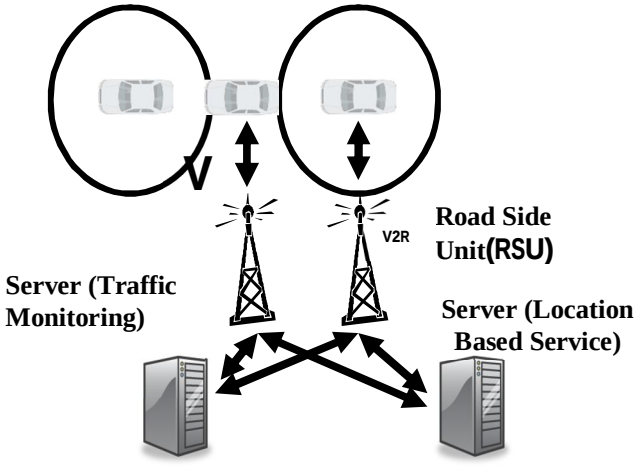

Figure 2. VANET communication framework

Characteristics of VANET**:**

- High mobility of nodes
- Rapidly changing network topology (predictable to some extent)
- Unbounded network size
- Potential support from infrastructure
- Real-time, time-sensitive data exchange
- Crucial effect of security and privacy

Communication Methodology

A message transmitted by a vehicle is received by all other vehicles residing in the transmitting range of the sender vehicle and the MANET infrastructure present in that area (mobile phone tower). If the message is a "short message" type then it will not be accepted by MANET infrastructure, hence not received by VANET Server. Other types of messages will be received by VANET Server. When a vehicle sends message it will travel to all other vehicles traveling through a particular geographical area. As traffic increases, the numbers of messages will also increases. This leads to network congestion and packet loss. To overcome this problem propose a dual stage efficient communication method to improve channel utilization and to reduce packet loss. In the first stage, a vehicle sends messages to other vehicles within its transmission range and to the VANET server thru mobile communication network. The database of VANET server is updated with these messages. In the second stage, VANET server sends messages to other vehicles within that particular geographical location. Other vehicles, from other geographical region, would not get the messages unless they explicitly ask for that information from the VANET server[8]. Therefore the message passing around the vehicles is performed in two steps, one is through vehicle to vehicle communication and other one is with the intervention of MANET.

Types of Communication

In general, the vehicular communication is of two types based on its application. It is divided into:

Vehicle to Vehicle Communication

It demonstrates properties of both peer-to-peer network and mobile ad-hoc network. In Peer-to-peer systems participants rely on another for service rather than solely relying on a dedicated and centralized infrastructure. A mobile ad hoc network is a collection of mobile hosts with wireless communication capabilities forming temporary network.

Vehicle to Infrastructure Communication

It provides high bandwidth link with vehicle and roadside equipment. The Information is available from roadside sources. It uses 63 GHz band. The communication is traditionally via microwave or infrared techniques, more recently through GPS technology.

Ex- Electronic Toll Collection (ETC)

It allows for electronic payment of highway tolls. In this, an electronic monetary transaction occurs between a vehicle passing through a toll station and the toll agency.

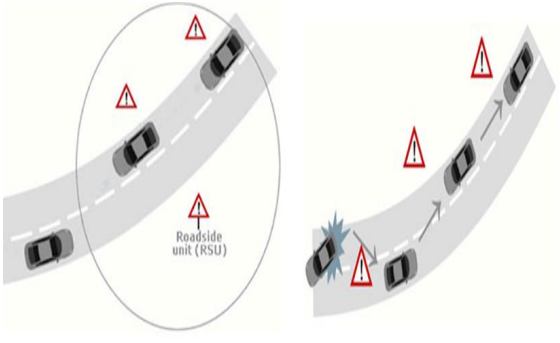

Figure 3.Vehicle to Vehicle communication

Conclusion

This paper proposes a Vehicular to vehicle Communication (VVC) protocol to improve road safety. In particular, it defines congestion control policies for emergency warning messages so that a low emergency warning message delivery delay can be

achieved and a large number of co-existing abnormal vehicles can be supported. It also introduces a method to eliminate redundant emergency warning messages, exploiting the natural chain effect of emergency events.

Over and above the present protocol is simple minded, easy to implement and cost effective. Cost effective in the sense that it does not require much extra equipment, on the contrary it used the MANET infrastructure. But the proposed protocol is not free from some minor limitations. In the rural areas where the wireless connections are very feeble the connection between the VANET server and the vehicles breaks down, so in remote and rural areas in absence of MANET equipments the algorithm is not expected to perform. It is wise to apply the presentVANET algorithm in hilly areas where, the accident-prone zones and the turning of roads occurs in ample.

In Near future, the vehicles will be equipped with wireless communication devices, allowing for vehicle to vehicle and vehicle to infrastructure communication based on short range wireless technology (IEEE 802.11 like). These VANET enable a new set of application to improve safety, traffic efficiency and driving comfort. Such as traffic group can warn other traffic group regarding accident, road condition, entertainment etc.

References

[1] Rao, K.C. and Panem, C.A., 2014. Accident Detection in Vehicular Networks Using Android-based Smartphones. International Journal of Scientific Research in Computer Science (IJSRCS), 2(1), pp.24-26.

[2] Zaldivar, J., Calafate, C.T., Cano, J.C. and Manzoni, P., 2011, October. Providing accident detection in vehicular networks through OBD-II devices and Android-based smartphones. In Local Computer Networks (LCN), 2011 IEEE 36th Conference on (pp. 813-819). IEEE.

[3] Williams, B., 2008. Intelligent transport systems standards. Artech House.

[4] Hernandez, U., Perallos, A., Sainz, N. and Angulo, I., 2010, June. Vehicle on board platform: Communications test and prototyping. In Intelligent Vehicles Symposium (IV), 2010 IEEE (pp. 967-972). IEEE.

[5] Chong, C.Y. and Kumar, S.P., 2003. Sensor networks: evolution, opportunities, and challenges. Proceedings of the IEEE, 91(8), pp.1247-1256.

[6] Sproull, R.F. and Cohen, D., 1978. High-level protocols. Proceedings of the IEEE, 66(11), pp.1371-1386.

[7] International Journal of Emerging Technology &Research " http://ijetr.org/finalpdf/1399707229.pdf".

[8] Introduction to VANET - SlideShare." "https://www.slideshare.net/Akanksha_Upadhyay/vanet0".

[9] Secured Geocast Routing in VANET "http://research.ijcaonline.org/volume53/number12/pxc3882405.pdf.