A Review on Efficient Data Transmission in Vehicular AD-HOC Network using Cognitive Radio

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Abstract: The most important protocol used is WAVE (Wireless Access in Vehicular Environment) to provide spectrum for vehicular communication. I have analyzed that WAVE is not able to allocate required spectrum for efficient exchange of safety related information. In other words, Delay in message transmission and Loss of data packet is not acceptable and increases the requirement of the system. In this paper, I have reviewed a current work [1] which provides guarantees to the delivery of data using Cognitive Radio technology in high density Vehicular ad hoc network. The main goal of that work is to generate safety packets and transmitted during the same period of time. This system continuously monitors the delay veteran by the vehicles on CCH where all the safety related information ought to be transmitted. In any case, if the delay experienced by the vehicles is more than the threshold value, the system needs to extend the bandwidth of the channel using cognitive Radio networks. The RSU (Road Side Unit) contains feedback control design in which extra bandwidth is included to drive the delay that is below the threshold value. I have reviewed theAnalysis of various parameters such as Delay, Packet Delivery Ratio, Throughput and Loss which give the guarantees of data delivery in VANET and increases safety on the road.

Keywords: VANET'S, RSU, MANET'S Cognitive Radio.

Introduction

VANET

VANET is a smart automated communication system in which all nodes are trying to communicate with each other and also with the Road side units (RSU). It is continuously gaining popularity in all around the world. Cooperative driving and Communication between the vehicles on the roads is possible only with the help of Vehicular ad hoc network [2]. As we all aware that number of tragedies on the roads such as accidents is increasing day by day. Mostly accidents takes place at crossing points because driver is not able to see what is coming on other side which collides with his vehicle. Security in VANET [3] has become the most important task because of the propagation of information in the open access environment. Few years ago, VANET has given full attention for safety on the roads.

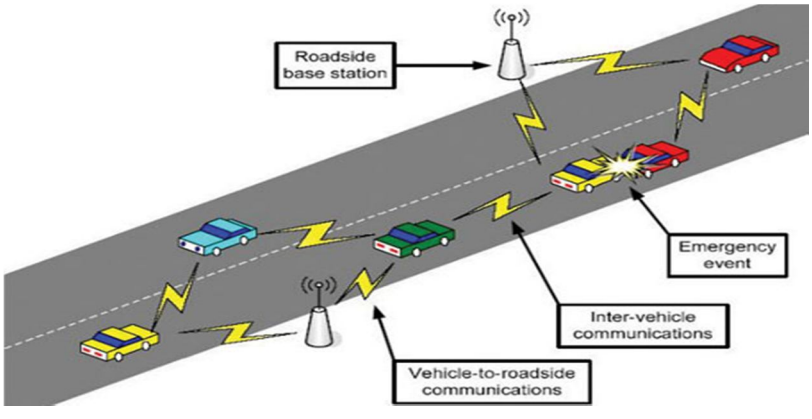

Fig 1: VANET

The exchange of data takes place from one automobile to other, automobile to road side unit and road side unit to central unit which is responsible for the entire system. VANET is most useful in different applications such as single-hop information, multi-hop information over large distances. The most important concern is VANET's are most similar to MANET's in the working but different in the architecture [2]. In the VANET's, all the vehicles tend to move in an organized manner rather than moving at random. The routing with road side bases likely be takes place in the same way as that of MANET's and most vehicles are restricted to follow the path in the range of motion [3].

ITS and WAVE are the two design style which are available today for the automobiles [3]. Accordingly, there are two possibilities of communication.

1. V2V (Vehicle-to-vehicle) communications: In V2V, all the vehicles on the roads exchange information and data with each and every vehicle without any coordination with infrastructure [4].
2. V2I (Vehicle-to infrastructure): In V2I, all the automobiles on the roads try to communicate with the road side unit to provide the information related to all the obstacles coming along the roads and vehicles take route accordingly. Morever, (Vehicle-to-person or vehicle-to-pedestrian) link is established to improve functionalities of ITS and WAVE. V2P helps to increase the safety of the pedestrian's by activate the communication with automobiles. V2R (vehicle-to-roadside) is another type of V2I. V2I and V2V is an amendment of IEEE 802.11 standard. The IEEE 802.11 is also called as Dedicated Short-Range Communications (DSRC) standard. DSRC supports high data exchange automobiles and the fixed infrastructure in the band of 5.9 GHz [5].

Coginitive Radio

Cognitive Radio is an enhanced version of Remote communication. Cognitive radio checks for the availability of the electromagnetic spectrum and permits the changes of the parameters automatically using interaction with the environment. The main goal of this technology is to occupy the available spectrum opportunistically to the users with lesser distortion [7]. During the vehicles in the transit, Present and future automobiles will provide details for the transmission of vehicular codes and dynamic access to remote services. In this work, cognitive radio technique and its processing is used for automotive industry.

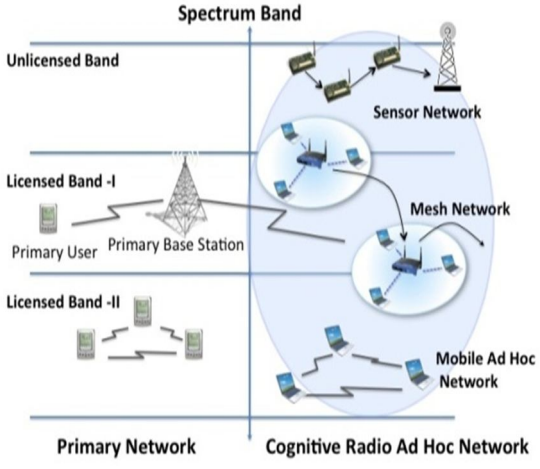

Fig 2: Cognitive Radio

Cognitive radio increases the efficiency of the spectrum for the available frequency band in the area. CR checks for the availability of the spectrum and when it is found, its transceivers will adapt to operate in that frequency band. CR works in a cyclic manner which monitors, sense and adjust frequency automatically in accordance with the environment.

The most fundamental part in a cognitive radio network is Spectrum Sensing (SS). Higher Packet delivery ratio and low delay in the transmission of information and data can be seen by analyzing the occupancy of the channel [8]. Wide range of spectrum sensing techniques are available which can be adopted by the cognitive radio networks. Energy detection, cyclostationary detection and Matched filtering detection are used to improve the efficiency of the system. Now, the combination of these techniques can also be used in recent researches. There are various new applications of cognitive radio[10] are introduced in different scenario. Some of them are:

- TV White Spaces and regulation.
- Smart Grids.
- Wireless Sensor Networks (WSN).
- Public safety and medical networks.

- Power Line Communications.
- Vehicular networks.

Literature review

Ghandour et al [1] author proposed that the most important protocol used is WAVE (Wireless Access in Vehicular Environment) to provide spectrum for vehicular communication. In the previous work, it has been proved that WAVE is not able to allocate required spectrum for efficient exchange of safety related information. In other words, Delay in message transmission and Loss of data packet is not acceptable and increases the requirement of the system. In this work, author introduce a new system which provides guarantees to the delivery of data using Cognitive Radio technology in high density Vehicular ad hoc network.

Gupta et al. [3] proposed introduction of new feature in VANET'S. Vehicular Ad-hoc network is presently taking up more attention towards the safety on the roads because of typical circumstances in transportation system. Routing in Vehicular network is considered as an Intelligent transportation System (ITS). VANET is a variation of MANET. In VANET'S, vehicles considered like as hubs and switches which interacts with one another by sending data and information. The two type of communication are possible in Vehicular ad hoc network. First one is vehicle to vehicle (V to V) interaction and second one is vehicle to roadside interaction (V to R). Currently, it is more specific towards the security issues in Vehicular networks. There are different kinds of problems like larger Delay, More loss, lesser Throughput and Packet delivery ratio. In this work, different types of VANET's are discussed.

Ghandour et al [5] proposed investigate that an agreeable range detecting plan, through which vehicles can identify accessible range assets on the 5.8 GHz ISM band along their way and forward the information to an altered foundation known as Road Side Units (RSUs).

Pagadarai et al [6**]** proposed present quantitative and subjective results got as an after effect of a TV range estimation battle. Author utilized these estimations to describe empty TV channels along significant interstate roadway (I-90) in the condition of Massachusetts, USA.

Felice et al [7] Author proposed that Cognitive Radio (CR) innovation has got critical consideration from the examination group as it empowers on-interest range use, in view of the solicitations of the end-clients. An intriguing application zone of CR innovation is Vehicular Ad Hoc Networks (VANETs).

Cacciapuoti et al [8**]** proposed investigate that in subjective radio systems (CRNs), range detecting is vital to deft range access while keeping any inadmissible obstruction to essential clients' correspondences. As a component of our push to illuminate/mitigate this issue, we consider the effect of sensor versatility on range detecting execution in a joint enhancement structure for sensor collaboration and detecting planning.

Ebers. et al [9] proposed different applications of VANET. In most cases, it can contradict each other if it will permit for interoperability. Meanwhile, the rarely used different kind of data formats and does not share any definition and semantics. They could not mutually understood and use each other's information. In addition, in this work author proposed a VANET Ontology for explaining the syntax of VANET important terms and a most important. VANET Data Representation to incorporate interoperability between different VANET applications.

Review of current proposed work

I have understand and reviewed the current work [1] that WAVE (Wireless Access in Vehicular Network) is not able to give required spectrum for the efficient exchange of data over the congested network. In this paper, I have understand the method to overcome this problem and reviewed that how a novel cognitive radio architecture is introduced to dynamically extend the Control channel (CCH) for the transmission of safety related information used by the automobiles.

I have reviewed the implementation of coordinated spectrum sensing scheme, with which automobiles can monitor the availability of the spectrum on the band of 5.8 GHz ISM [11] along their route and send the information to Road Side Unit (RSU). In order to achieve the required result, I have reviewed that author in the current work [1] have dynamically extend the bandwidth of the CCH in the congested network by utilizing the unused frequencies detected by the sensor. The effectiveness of the system can be seen from the simulation results by allocating spectrum resources and increasing the performance of the system. In the current work [1], Firstly scenario is initialized by taking some number of nodes and the used the WAVE protocol. After that spectrum sensing technique is applied which monitor, sense and extend the bandwidth of the channel automatically according to the environment. At the last, all the vacant frequencies have been utilized and the analyze the performance of the parameters related to the safety related information.

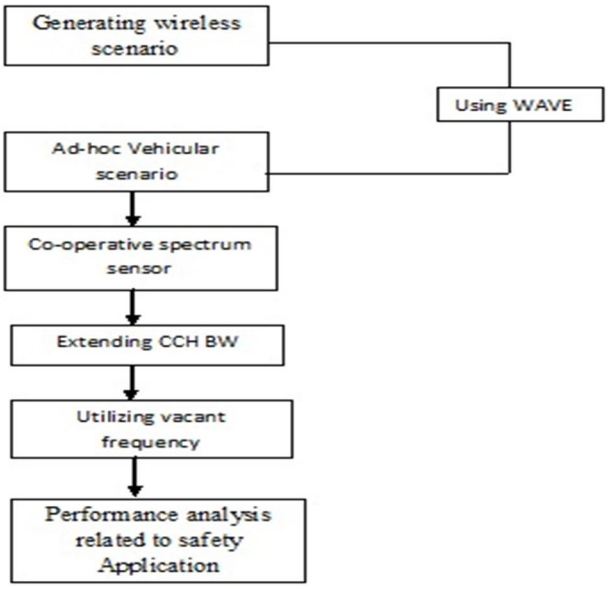

Fig 3: Flow of Work

Research Objectives

The objectives of the current system work reviewed are:

- To introduce the concept of Cognitive Radio in VANET'S environment.
- To utilized free radio band for secure transmission of safety messages.
- To reduce traffic load on RSU using spectrum sensing.
- To review the analysis of the parameters and performance of the system**.**

Software Requirements

1. Ubuntu 14.04 LTS: It is open source linux operating system. This operating system is named after the name of the south African scientist i.e Ubuntu. The development of Ubuntu software is taken care by the UK canonical Ltd. Enterprise whose owner is South African Researcher. It is publically available to everyone on the internet.
2. Network Simulator 2: NS version 2 (ns-2) was introduced by the person named Steve McCanne based on refactoring. It's core is also written in C++ but the simulation objects of C++ are totally attached to shadow objects in OTcl. OTcl language which is an enhance version of Tcl scripting language is used in ns-2 for writing the Simulation script.

Terminologies used

The various parameters analyzed for efficient and safety message transmission in VANET are:
Delay: Delay means the time interval between the packets with respect to time.

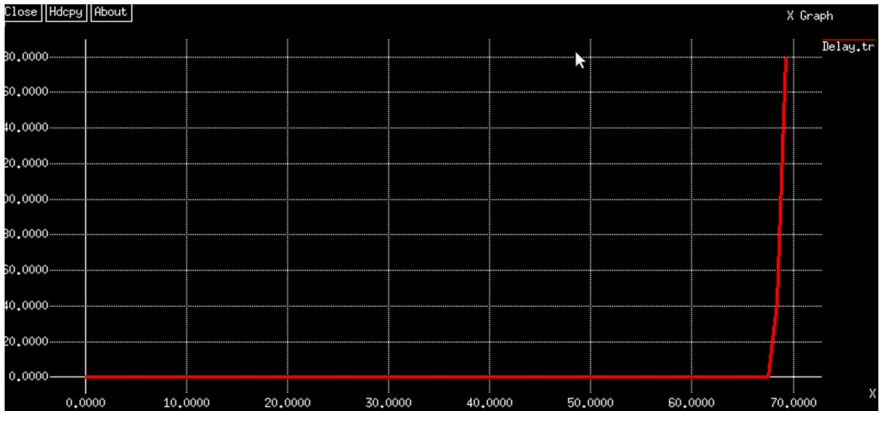

Fig 4: Plot of Delay

Packet delivery Ratio: It is the number of packet deliver with respect to time or within one second.

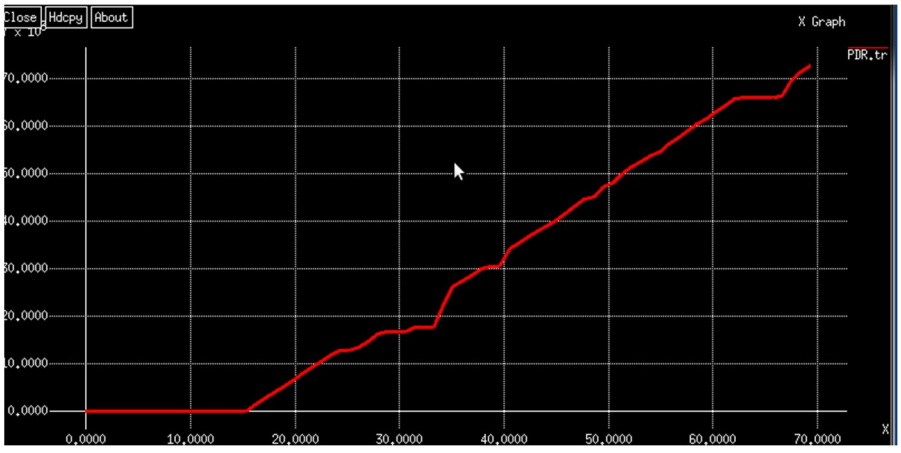

Fig 5: Plot of PDR

Throughput: Throughput means number of packets which delivered successively.

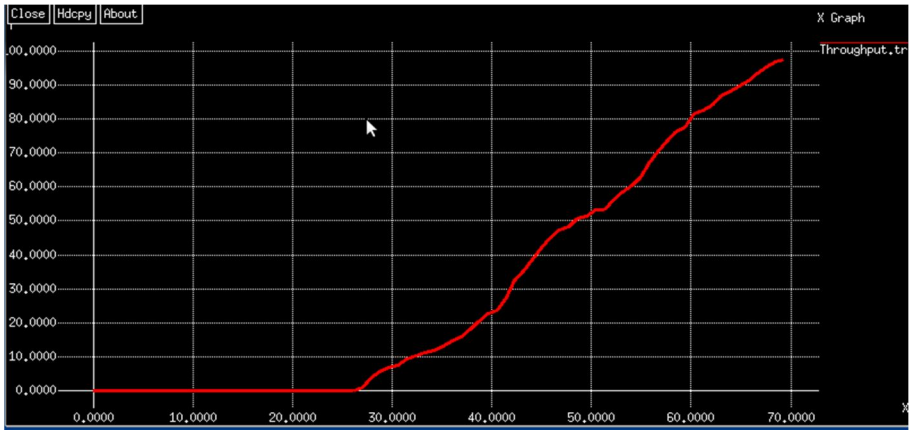

Fig 6: Plot of Throughput

Loss: Packet loss i.e number of packet loss during transmission.

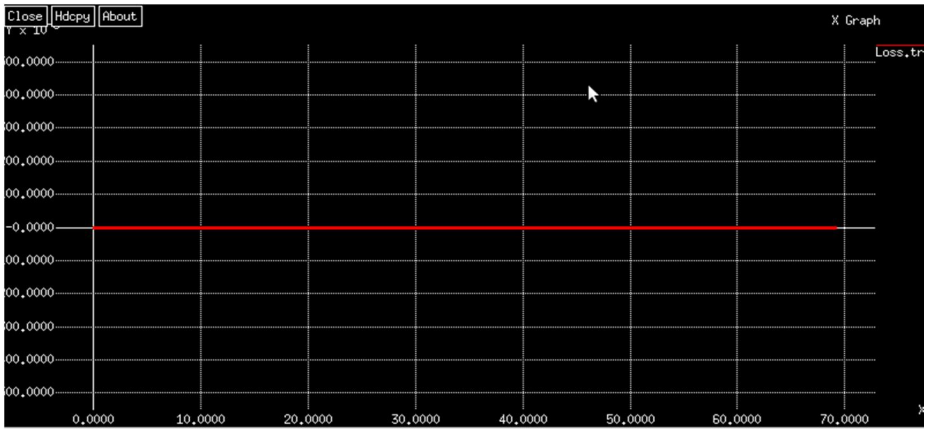

Fig 7: Plot of Loss

Scenario 1:

Fig 8: Initialization of nodes

This Scenario is used to represent the movements of nodes in there assign position.

Scenario 2:

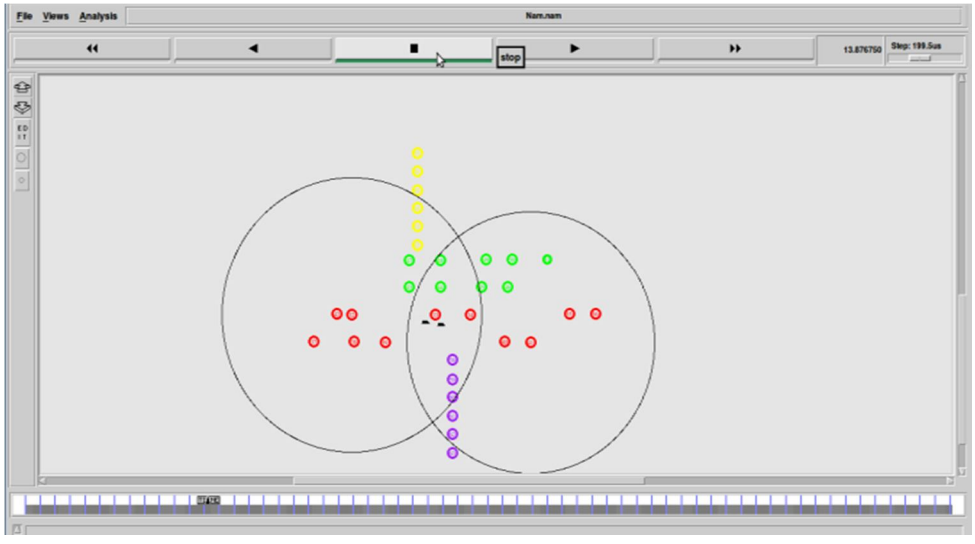

Fig 9: Routing Occur

This Scenario is used to represent routing. All the nodes communicate with each other through routing. Here the yellow color and purple color nodes does not move because of presence of red nodes in front of them and green color nodes are moving.

Scenario 3:

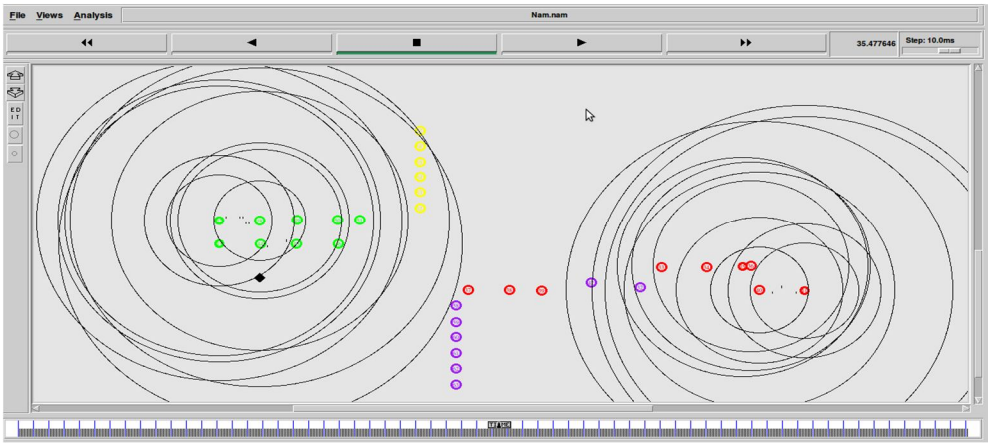

Fig 10: Collision between nodes

This Scenario is used to represent collision between nodes. Front nodes send the message of collision to previous nodes and after getting that message previous nodes change their path.

Conclusion

The communication in Vehicular ad hoc network by using the technology of Cognitive radio is helpful for the smart automated transport system. The safety messages are required to be transmitted for security purpose to the automobiles. In order to achieve this target, various protocols have been utilized. There are large number of protocols such as GPRS, AODV, DSR and PUMA which can be used for the purpose of routing. In VANET's, two scenario are possible mainly V2V and V2R. V2V is a type of scenario which provides the communication between the vehicles. Whereas, V2R is used to provide the communication between vehicles and Road Side Units (RSU). In current work Cognitive radio is used. In this multiple channel are used. Whenever, any channel is busy, sender can send the information through other channel. This improves the throughput, Delay, Packet delivery ratio and loss.

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