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Enhancing VANET safety message transmission using cognitive Radio in high traffic

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Abstract: Vehicular ad-hoc network is used for auto driven system. In this system road side units available on the roads communicate with different nodes available on the roads. RSU transmit the safety message to the vehicle using allocated bandwidth. In this paper safety message has been transmitted in the high speed and high load traffic area using cognitive radio channels. Due to traffic message drop ratio increase because of congestion so by using channel sensing and GPSR predicts the nodes location and movement. Radio channel has higher band width as compare to the normal 2.54 GHz band. By using channel sensing safety message can be transmitted to the vehicle without any delay and collision can be avoided. Various parameters represents that purposed approach much better than previous approaches.

Keywords: VANET, CRCN, Spectrum sensing, CCH.

1. INTRODUCTION

1.1 VANET: A VANET turns turn participating car into a wireless router or node which allowing cars 100 to 300 meters of each other to connect and create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile network is created. It is estimated that the first systems that will be this technology are police and fire vehicles to communicate with each other for the purpose of security.

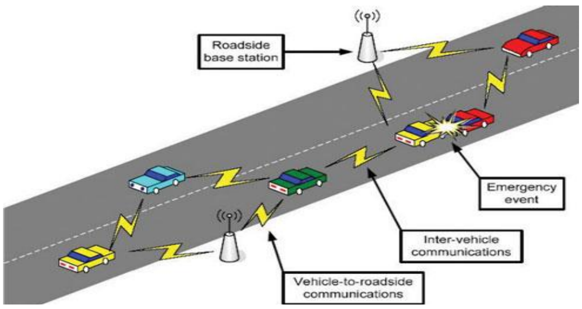

Fig 1.1: VANET

The connectivity is done among one vehicle to other vehicle and vehicle to road side infrastructure and vehicle or road side infrastructures to the central authority responsible for the network maintenance.

The basic tool for message transfer is the short range radios that are being installed in any of the nodes. The short transmission node is used by vehicular node. RSU's are spread sporadically or regularly depending on the deployment of the network in any particular region. In reality spread sporadically. They act as an intermediary node between the Central Authority (CA) and Vehicular Node (VN). Vehicular Ad-Hoc Network is the network in which communication has been done between road side units to cars, car to car in a short range of 100 to 300 m. Existing authentication protocols to secure vehicular ad hoc networks raise challenges like as certificate distribution and revocation, avoidance of computation and communication bottlenecks, and reduction of the strong reliance on tamper proof devices. In a VANET, vehicles will rely on the integrity of received data for deciding when to present alerts to drivers. This data may be used as the basis of control decisions for autonomous vehicles.

1.2 WORKING OF VANET

Vehicular Networks System consists of large number of nodes, approximately number of vehicles exceeding 750 million in the world today [4], these vehicles will require an authority to govern it, each vehicle can communicate with other vehicles using short radio signals DSRC (5.9 GHz), for range can reach 1 KM, this communication is an Ad Hoc communication that means each connected node can move freely, no wires required, the routers used called Road Side Unit (RSU), the RSU works as a router between the vehicles on the road and connected to other network devices. Each vehicle has OBU (on board unit), this unit connects the vehicle with RSU via DSRC radios, and another device is TPD (Tamper Proof Device), this device holding the vehicle secrets, all the information about the vehicle like keys, drivers identity, trip details, speed, rout ...etc.

1.3 COGNITIVE RADIO

A cognitive radio is an intelligent radio that can be programmed and configured dynamically. Its transceiver is designed to use the best wireless channels in its vicinity. Such a radio automatically detects available channels in wireless spectrum, then accordingly changes its transmission or reception parameters to allow more concurrent wireless communications in a given spectrum band at one location.

This process is a form of dynamic spectrum management. Some "smart radio" proposals combine wireless mesh network—dynamically changing the path messages take between two given nodes using cooperative diversity; cognitive radio—dynamically changing the frequency band used by messages between two consecutive nodes on

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the path; and software-defined radio—dynamically changing the protocol used by message between two consecutive nodes.

1.4 SPECTRUM SENSING

The important requirement of cognitive radio network is to sense the spectrum hole. Cognitive radio has an important property that it detects the unused spectrum and shares it without harmful interference to other users. It determines which portion of the spectrum is available and detects the presence of licensed users when a user operates in licensed band.

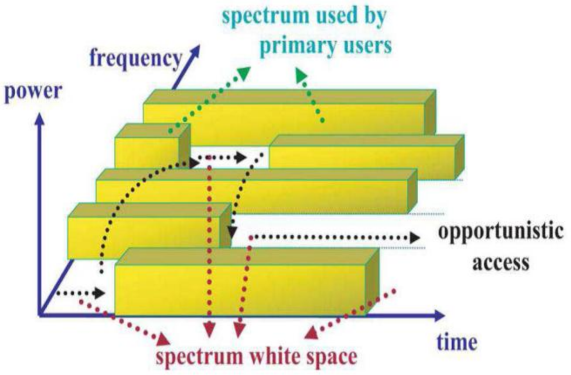

Fig 1.2: Cognitive Radio

The spectrum sensing enables the cognitive radio to detect the spectrum holes. Spectrum sensing techniques can be classified as frequency domain approach and time domain approach. In frequency domain method estimation is carried out directly from signal so this is also known as direct method. In time domain approach, estimation is performed using autocorrelation of the signal.

2. RELATED WORK

Joanne Mun-Yee Lim et al [1] "Cognitive VANET with Enhanced Priority Scheme" Vehicular correspondences are critical to guarantee crisis messages are transmitted on time to anticipate mishaps. In this way, lately, different institutionalization bodies and auto organizations have created vehicular ad hoc network (VANET) to guarantee open street wellbeing. The current IEEE802.11p plans use just activity sort to classify need levels. Then again, mis-chances are inclined to happen when vehicles are in close separation. Consequently, based on the most recent standard draft of IEEE1609.4 and IEEE802.11p, the proposed plan, to be specific Enhanced Priority VANET Plan (EPVS) is proposed where separation run between vehicles is determined and transmission need level is arranged focused around solid separation reach and information sort. Execution of the proposed EPVS is assessed in Vehicles in System Simulation (Veins) with street movement test system, Recreation of Urban versatility (SUMO) utilizing a reasonable urban map. Recreations results demonstrate that the proposed EPVS results in lower normal postponement, in examination with the default IEEE802.11p plan.

Ali J. Ghandour a et al [2] "Improving vehicular safety message delivery through the implementation of a cognitive vehicular network" The Wireless Access in Vehicular Environments (WAVE) protocol stack has been recently defined to enable vehicular communication on the Dedicated Short Range Communication (DSRC) frequencies. Some recent studies have demonstrated that the WAVE technology might not provide sufficient spectrum for reliable exchange of safety information over congested urban scenarios. In this paper, we address this issue and present novel cognitive network architecture in order to dynamically extend the Control Channel (CCH) used by vehicles to transmit safety-related information. To this aim, we propose a cooperative spectrum sensing scheme, through which vehicles can detect available spectrum resources on the 5.8 GHz ISM band along their path, and forward the data to a fixed infrastructure known as Road Side Units (RSUs).

Srikanth Pagadarai et al [3] "Characterization of Vacant UHF TV Channels for Vehicular Dynamic Spectrum Access", in this paper, Author present quantitative and qualitative results obtained as a result of a TV spectrum measurement campaign. We used these measurements to characterize vacant TV channels a along major interstate highway (I-90) in the state of Massachusetts, USA. By characterizing the availability of vacant TV channels in the 470-806 MHz frequency range, we show the trends in the availability of vacant channels from a vehicular dynamic spectrum access perspective. We also describe the design constraints imposed on a point-to-multipoint communications based architecture in such a setting. Specifically, we described a general geo-location database approach to create a spectral map of available channels in a given geographical area. We presented the results obtained by applying such a technique in the state of MA over several locations on I-90.

Marco Di Felice et al [4] "Cooperative Spectrum Management in Cognitive" Vehicular Ad Hoc Networks*",* Ion this paper, Cognitive Radio (CR) technology has received significant attention from the research community as it enables on-demand spectrum utilization, based on the requests of the end-users. An interesting application area of CR technology is Vehicular Ad Hoc Networks (VANETs). In such networks, several innovative services and applications based on inter-vehicular communication have strict requirements in terms of bandwidth and delay, which might not be guaranteed by a fixed spectrum allocation paradigm. In this paper, we propose two key contributions pertaining to CR-VANETs: (i) an experimental study of the spectrum availability and sensing accuracy in a moving vehicle and (ii) a collaborative spectrum management framework (called Cog-V2V), which allows the vehicles to share spectrum information, and to detect spectrum opportunities in the licensed band.

Alexander W. et al [5] "Impact of Mobility on Spectrum Sensing in Cognitive Radio Networks", In cognitive radio networks (CRNs), spectrum sensing is key to opportunistic spectrum access while preventing any unacceptable interference to primary users' communications. Although cognitive radios function as spectrum sensors and move around, most, if not all, of existing approaches assume

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stationary spectrum sensors, thus providing in accurate sensing results. As part of our effort to solve/alleviate this problem, we consider the impact of sensor mobility on spectrum sensing performance in a joint optimization framework for sensor cooperation and sensing scheduling. We show that sensor mobility increases spatiotemporal diversity in received primary signal strengths, and thus, improves the sensing performance. This is intuitively plausible, but has not been tested previously.

3. PROBLEM FORMULATION

In Ad-hoc vehicular scenario the dedicated short size communication frequency. This does not provide sufficient spectrum for reliable exchange of safety and emergency messages to overcome this problem. In some cases if priority is not given then emergency messages do not reach to destination. So in cognitive network architecture is implemented to extend the control channel CCH used by vehicles to transfer safety and emergency massages to achieve this cooperative spectrum sensing scheme through which the network vehicle can optimize the available spectrum resource on that bandwidth. The CCH detect the vacant frequency and use them for transmission of safety and emergency messages. The vacant frequency has been checked by using the various approaches or by sending the one bit messages.

4. METHODOLOGY

In first phase ad-hoc network will be created by initializing number of nodes and then cognitive network will be implemented in which spectrum sensing is done. Spectrum sensing is done to know about the free bands so that they can be utilizing to send emergency messages.

In second phase bandwidth of channel will be increased so as to avoid congestion and avoid loss of important data. In this phase transmission range to nodes will also be calculated.

In third phase priority will be given to vehicles. High priority will be given to those vehicles which will be close to their destination or can be said that which will be in transmission range.

5. RESULTS AND DISCUSSIONS

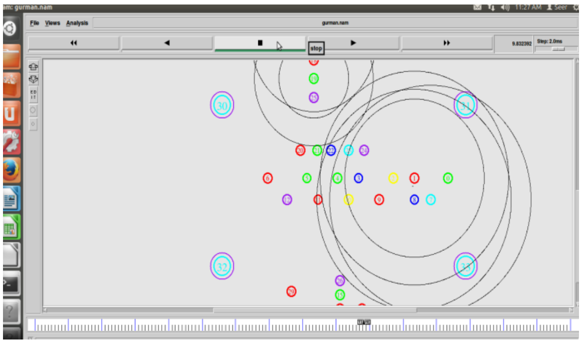

Figure 6.1: Node communications with RSU

This figure represents the communication of the vehicles of two different lanes with RSU 31 and 33. These RSU transmit the information about position and location of the nodes available in the network. These locations will used to identify the distance within different vehicles. On the basis of distance the safety message, voice and video message can be transmitted by the RSU.

In the graphs, x- axis (horizontal direction) represents the time in seconds and the y- axis (vertical direction) shows that number of bytes transferred in a particular time.

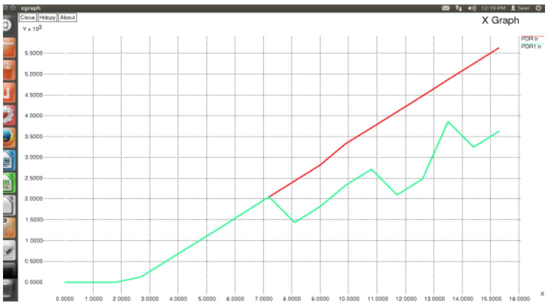

Figure 6.2: Packet Delivery Ratio

Packet delivery ratio is the ratio of total number of bytes received by total number of bytes send over whole communication. Graph in figure 4.7 shows the packet delivery ratio for network which shows that firstly when nodes just start communicate their PDR is idle then as they communicate this ratio goes on. On the other hand PDR for existing work is represented by green line which is less as compare to this research.

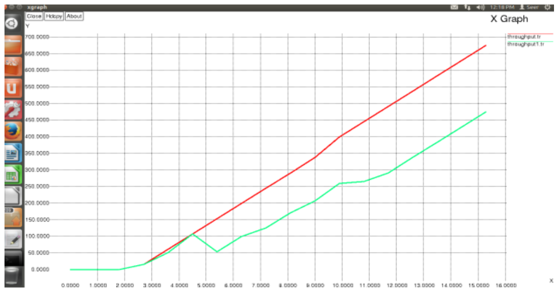

Figure 6.3: Throughput for packet delivery

Throughput is a total number of successful bytes received per unit time. So, figure 4.8 shows the calculated throughput for the nodes. In this graph red line represents current work and green line is for existing work which is very less as compare to this work.

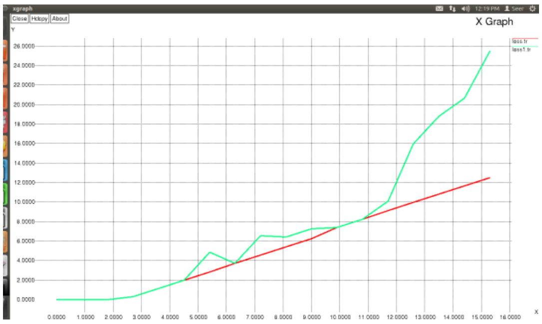

Figure 6.4: Packet Loss

Loss is defined as the difference between total numbers of bytes sent and total number of bytes received. Figure 4.9 shows that there is very less loss which shows that network is performing well. But on the other hand loss for

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existing work which is represented by green line is much more as compare to existing one.

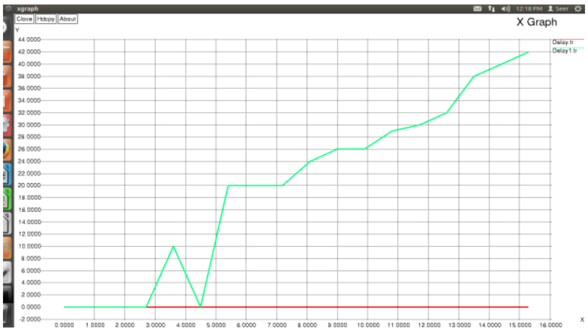

Figure 6.5: Delay Time

Delay is the time taken by bytes to reach its destination. Graph in picture shows that delay for this network is very less which means network performance is good but for existing work (represented by green line) delay is very high as compare to current work

6. CONCLUSION

Vehicular Ad Hoc Networks (VANETs) are created by applying the principles of mobile ad hoc networks (MANETs) - the spontaneous creation of a wireless network for data exchange - to the domain of vehicles. They are a key component of intelligent transportation systems (ITS). This does not provide sufficient spectrum for reliable exchange of safety and emergency messages to overcome this problem. in cognitive network architecture is implemented to extend the control channel CCH used by vehicles to transfer safety and emergency massages to achieve this cooperative spectrum sensing scheme through which the network vehicle can optimize the available spectrum resource on that bandwidth. The CCH detect the vacant frequency and use them for transmission of safety and emergency messages. The vacant frequency has been checked by using the various approaches or by sending the one bit messages. In this we got various types of parameters & on the basis of these parameters we conclude that our system gives us better results.

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