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Minimization of Delay using CRCN in Vehicular Ad-hoc Network

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Abstract
A VANET is type of MANET that allows vehicles to communicate with roadside equipment. The vehicles may not have a direct Internet connection the wireless roadside equipment may be connected to the Internet that allows data from the vehicles to be sent over the Internet. In Ad-hoc vehicular scenario the dedicated short size communication frequency. The Wave protocol which does not provide sufficient spectrum for reliable exchange of safety message to overcome this problem cognitive network architecture is implemented to extend the control channel CCH used by vehicles to transfer safety 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 message.

Keywords
VANET, CRCN, CCH, DSRC, Wave Protocol.

I. Introduction

A. VANET
Vehicular ad-hoc network (VANET) is sub class of mobile ad-hoc network (MANET). MANETS are type of ad-hoc networks that can change position and configure it. As the MANETS are mobile i.e. changing their location so they use wireless connection to connect to the network like Wi-Fi connection, satellite or cellular transmission. A VANET is type of MANET that allows vehicles to communicate with roadside equipment. The vehicles may not have a direct Internet connection the wireless roadside equipment may be connected to the Internet that allows data from the vehicles to be sent over the Internet. Because of the dynamic nature of MANETs, they are not very secure, so it is important to be take care what data is sent over a MANET.
Ad hoc network do not have any pre-existing infrastructure. They are self-organized, self-configured, and self-controlled networks. This type of network can be set up or deployed anywhere and anytime because it poses very simple setup and no or minimal central administration. The primary challenge in building a wireless ad hoc network is to equip each device to maintain continuous flow of information among vehicles. This means if link breakages occur the network has to stay operational by building new routes.

B. Routing in VANET:
VANET commonly used ad hoc routing protocols which are initially implemented for MANETs and then they are evaluated for the VANETs environment. VANET uses these address-based and topology-based routing protocols require that each of the participating nodes be assigned a unique address. Three main routing protocols are:

1. Protective Routing Protocol
Proactive routing protocols employ standard distance-vector routing strategies (e.g., Destination-Sequenced Distance-Vector (DSDV) routing) or link-state routing strategies (e.g., Optimized Link State Routing protocol (OLSR) and Topology Broadcast-based on Reverse-Path Forwarding (TBRPF)). They maintain and update information on routing to all nodes even then also when the path is not used. Route updates are periodically performed regardless of network load, bandwidth constraints, and network size. The main limitation of such approaches is that the maintenance of unused paths may occupy a significant part of the available bandwidth if the topology of the network changes frequently.

2. Reactive Routing Protocol
Reactive routing protocols such as Dynamic Source Routing (DSR), and Ad hoc On-demand Distance Vector (AODV) routing implement route determination on a demand or need basis and maintain only the routes that are currently in use, thereby reducing the burden on the network when only a subset of available routes is in use and this limit the bandwidth wastage. Communication among vehicles will only use a very limited number of routes, and therefore reactive routing is particularly suitable for this application scenario.

3. Position-Based Routing
Position-based routing protocols require that information about the physical position of the participating nodes be available. This position is made available to the direct neighbors in the form of periodically transmitted beacons. A sender can request the position of a receiver with the help of a location service. The routing decision at each node is then based on the destination's position contained in the packet and the position of the neighbor of the forwarding node. Consequently, position-based routing does not require the establishment or maintenance of routes.

C. 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.

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

E. 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.

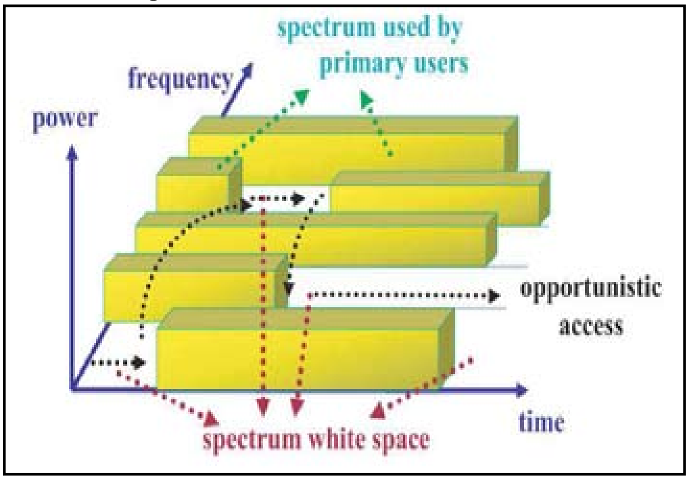

Fig 1.1: Cognitive Radio

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.

II. Related Work

Mule, S.B, 2015

Basis of cognitive radio is to exploit unused frequency channels in licensed bands. Recently standardized IEEE 802.22 set of cognitive radio protocols envisages fixed and nomadic receivers at below 800 MHz bands. Existing mobile communication system uses CDMA in 800 MHz band and GSM in 900 MHz band. Research works has established that there are some vacant channels in these mobile communications bands which are permanently available and can be deployed as Cognitive Control Channel (CCC) and Cognitive Pilot Channel (CPC). Dynamically available vacant channels in these frequency bands can be deployed for cognitive traffic. In the present study, conventional Radiofrequency scanners available for different bands and dedicated engineering handsets are used for measurement of data speed in these bands. Drive tests were carried out in dense city of Kolkata across the length and breadth and spectral efficiency value was measured from data speed. The results can be utilized to take decision for appropriate Radio Access Technologies (RAT) to deploy for mobile cognitive radio in uplink and downlink directions in these frequency bands [1].

Ali J. Ghandour, 2013

Presented 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. Author 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) [2].

Srikanth Pagadarai, 2009

Presented quantitative and qualitative results of TV spectrum measurement expedition paper used these measurements to characterized vacant TV channels on major interstate highways and show the trends in the availability of vacant channels from a vehicular dynamic spectrum access perspective and describes general geo-location database approach to create spectral map of available channels in given geographical area. Paper present the results possessed by applying such technique. Paper presented discussion on the implications of the non-contiguous channel availability in the TV spectrum on the design of perceptional radio transceiver from the perspective of vehicular communications [3].

Marco Di Felice, 2011

Presented 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 application area of CR technology is vehicular Ad Hoc Networks (VANETs). In this paper it proposes two contributions pertaining to CR-VANETs. First is an experimental work on spectrum availability and detect accuracy in moving vehicle. Second is collaborative spectrum management framework called Cognitive Vehicle-to-vehicle, which detect spectrum in licensed band and allows sharing spectrum information? In this paper it shows the design of collaborative detecting and decision algorithm and to share spectrum information [4].

Alexander W. Min, 2009

Presented cognitive radio networks spectrum Sensing is rectification to opportunistic spectrum access during intercepting any unacceptable interference to primary user's communication. Although cognitive radios function as spectrum sensors and move around all of existing approaches assume stationary spectrum sensors, thus giving inaccurate sensing results. To solve this problem in this paper it considers the impact of sensor mobility to increase spatiotemporal diversity in received primary signal strengths and improves the sensing performance [5].

III. Problem Formulation

Cognitive radio (CR) is a form of wireless communication in which a transceiver can intelligently detect which communication

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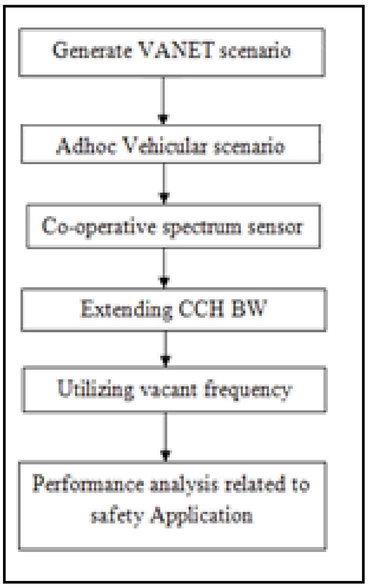
channels are in use and which are not, and instantly move into vacant channels while avoiding occupied ones. This optimizes the use of available radio-frequency (RF) spectrum while minimizing interference to other users. There are two main types of cognitive radio, full cognitive radio and spectrum-sensing cognitive radio. Full cognitive radio takes into account all parameters that a wireless node or network can be aware of. Spectrum-sensing cognitive radio is used to detect channels in the radio frequency spectrum.

IV. Methodology

In the purposed work the cognitive radio vanets scenario is generated for the development of CR-Vanets communication system. In this system the vehicles are in the mobility state on the road and the RSU unit avail at the road side will transmit the safety messages to all the vehicles present in this communication. The safety message will be transmit by using the vacant spectrums of bandwidth of radio spectrums.



V. Results and Discussions

Vehicular ad-hoc network (VANET) is sub class of mobile ad-hoc network (MANET). MANETS are type of ad-hoc networks that can change position and configure it. As the MANETS are mobile that is changing their location so they use wireless connection to connect to the network like Wi-Fi connection, satellite or cellular transmission. In Ad-hoc vehicular scenario the dedicated short size communication frequency. Wave protocol which does not provide sufficient spectrum for reliable exchange of safety message to overcome this problem cognitive network architecture is implemented to extend the control channel CCH used by vehicles to transfer safety 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 message.

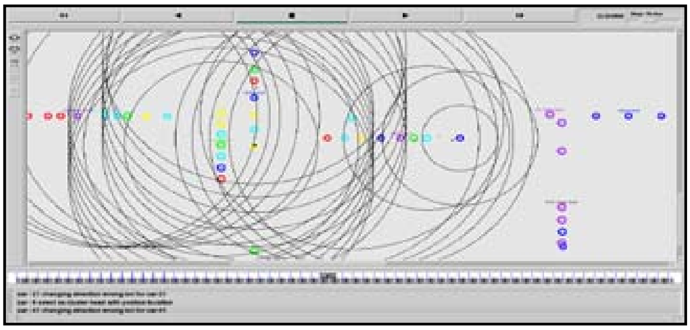


Fig 5.1: Channel Sensing

This scenario is use to represent the Channel Sensing with CRCN & increase the range of channel. Due to this the packet loss decrease or eliminate.

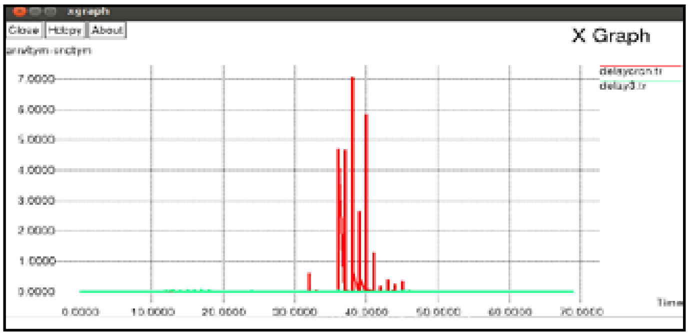


Fig 5.2: Delay

This includes all possible delays caused by buffering during route discovery, latency, and retransmission by intermediate nodes, processing delay and propagation delay. It is calculated as

$D = (T_r - T_s)$

Where, T_r is receive time and T_s is sent time of the packet.

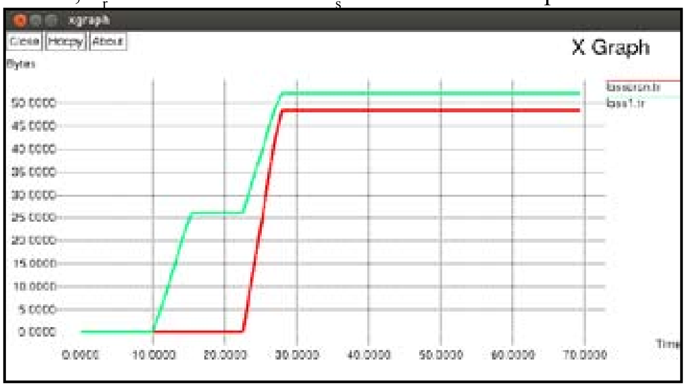


Fig 5.3: Loss

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is typically caused by network congestion. Packet loss is measured as a percentage of packets lost with respect to packets sent. The Transmission Control Protocol (TCP) detects packet loss and performs retransmissions to ensure reliable messaging. Packet loss in a TCP connection is also used to avoid congestion and reduces throughput of the connection.

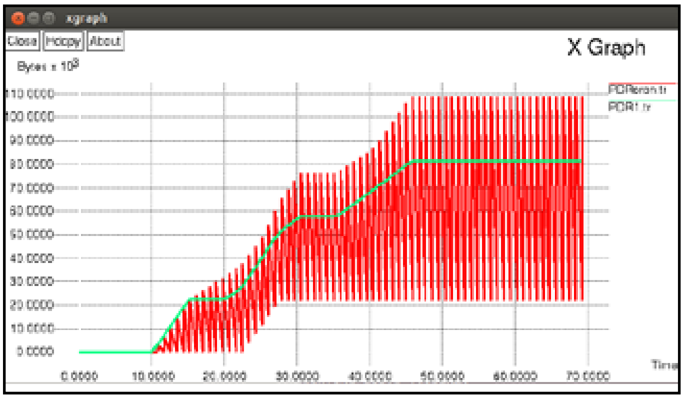


Fig 5.4: PDR

It is the ratio of all the received data packets at the destination to the number of data packets sent by all the sources. It is calculated by dividing the number of packet received by destination through the no. of packet originated from the source.

PDR = (P_r / P_s) * 100
Where, P_r is total packet received and P_s is total packet sent.

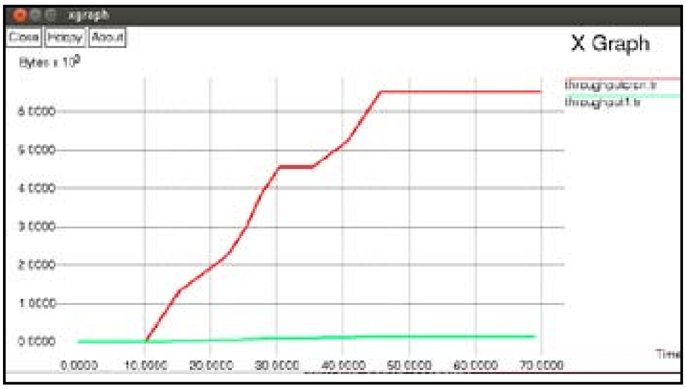


Fig 5.5: Throughput

It is the average at which data packet is delivered successfully from one node to another over a communication network. It is usually measured in bits per second.
Throughput = (no of delivered packets * packet size) / total duration of simulation.

VI. Conclusion

A VANET is type of MANET that allows vehicles to communicate with roadside equipment. The vehicles may not have a direct Internet connection the wireless roadside equipment may be connected to the Internet that allows data from the vehicles to be sent over the Internet. Because of the dynamic nature of MANETs, they are not very secure, so it is important to be take care what data is sent over a MANET. Vehicular networks have been developed to enhance the safety, security and efficiency of the transportation systems and enable new mobile applications and services for the travelling public. In Ad-hoc vehicular scenario there is dedicated short size communication frequency. Wave protocol which was used earlier do not provide sufficient spectrum for reliable exchange of safety message to overcome this problem cognitive network architecture is implemented to extend the control channel CCH used by vehicles to transfer safety 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 message. 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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