An Efficient Prediction Based Clustering with CRCN

Yash Sharma[1], Manish Mittal[2]

[1]Punjab Technical University, ACET, Bhawanigarh-Patiala Road, Punjab, India

[2] Assistant Professor, Punjab Technical University, ACET, Bhawanigarh-Patiala Road, Punjab, India

Abstract: ***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. Routing protocols are use to communicates between the nodes. After that we introduce the cognitive radio network. 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. After it we introduce predictive clustering approach. The task of predictive clustering combines elements from both prediction and clustering. Than allocate the Channel for the transmission of message. Communication starts between the nodes. We will use DSR protocol for routing.***

Keywords: VANET, DSR, CR, V2V, V2R.

1. Introduction

1.1 VANET

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). While, in the early 2000s, VANETs were seen as a mere one-to-one application of MANET principles, they have since then developed into a field of research in their own right. By 2015, the term VANET became mostly synonymous with the more generic term inter-vehicle communication (IVC), although the focus remains on the aspect of spontaneous networking, much less on the use of infrastructure like Road Side Units (RSUs) or cellular networks [6].

1.2 Characteristics of VANET

1.2.1 High Mobility: The nodes in VANETs usually are moving at high speed. This makes harder to predict a node's position and making protection of node privacy.

1.2.2. Network topology: Due to high node mobility and random speed of vehicles, the position of node changes frequently. As a result of this, network topology in VANETs tends to change frequently [7].

1.2.3. Unbounded network size: VANET can be implemented for one city, several cities or for countries. This means that network size in VANET is geographically unbounded.

1.2.4. Frequent exchange of information: The ad hoc nature of VANET motivates the nodes to gather information from the other vehicles and road side units. Hence the information exchange among node becomes frequent [8].

1.2.5. Wireless Communication: VANET is designed for the wireless environment. Nodes are connected and exchange their information via wireless. Therefore some security measure must be considered in communication. Time Critical: The information in VANET must be delivered to the nodes with in time limit so that a decision can be made by the node and perform action accordingly [9].

1.2.6. Sufficient Energy: The VANET nodes have no issue of energy and computation resources. This allows VANET usage of demanding techniques such as RSA, ECDSA implementation and also provides unlimited transmission power.

1.2.7. Protection: The VANET nodes are physically better protected. Thus, VANET nodes are more difficult to compromise physically and reduce the effect of infrastructure attack.

1.3 Cognitive Radio

The CR innovation is an empowering innovation for sharp range use, which straightforwardly advantages different types of vehicular correspondence. In such a system, each CRV actualizes range administration functionalities to 1) distinguish range opportunities over advanced (TV) recurrence groups in the ultrahigh recurrence (UHF) range, 2) choose the channel to utilize in light of the QOS solicitations of the applications, 3) transmit on it, yet without bringing about any hurtful obstruction to the authorized proprietors of the range [10].

1.4 Cognitive Radio Spectrum Sensing

In many areas cognitive radio systems coexist with other radio systems, using the same spectrum but without causing undue interference. When sensing the spectrum occupancy, the cognitive radio system must accommodate a variety of considerations [1]:

1.4.1 Continuous spectrum sensing: It is necessary for the cognitive radio system to continuously sense the spectrum occupancy. Typically a cognitive radio system will utilize the spectrum on a non-interference basis to the primary user. Accordingly it is necessary for the Cognitive radio system to continuously sense the spectrum in case the primary user returns.

1.4.2 Monitor for alternative empty spectrum: In case the primary user returns to the spectrum being used, the cognitive radio system must have alternative spectrum available to which it can switch should the need arise [2].

1.4.3 Monitor type of transmission: It is necessary for the cognitive radio to sense the type of transmission being received. The cognitive radio system should be able to determine the type of transmission used by the primary user so that spurious transmissions and interference are ignored as well as transmissions made by the cognitive radio system itself [3].

1.5 Types of cognitive radio spectrum sensing

There are a number of ways in which cognitive radios are able to perform spectrum sensing. The ways in which cognitive radio spectrum sensing can be performed falls into one of two categories [3].

1.5.1 Non-cooperative spectrum sensing: This form of spectrum sensing occurs when a cognitive radio acts on its own. The cognitive radio will configure itself according to the signals it can detect and the information with which it is pre-loaded.

1.5.2 Cooperative spectrum sensing: Within a cooperative cognitive radio spectrum sensing system, sensing will be undertaken by a number of different radios within a cognitive radio network. Typically a central station will receive reports of signals from a variety of radios in the network and adjust the overall cognitive radio network to suit[4].

2. Protocol Used

DSR: Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.

Determining source routes requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is coached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node.

3. Related Work

Dusit Niyato "Optimal Channel Access Management with QOS Support for Cognitive Vehicular Networks", Author considers the problem of optimal channel access to provide quality of service (QOS) for data transmission in cognitive vehicular networks. In such a network the vehicular nodes can opportunistically access the radio channels (referred to as shared-use channels) which are allocated to licensed users. Also, they are able to reserve a channel for dedicated access (referred to as exclusive-use channel) for data transmission. A channel access management framework is developed for cluster-based communication among vehicular nodes. This framework has three components: opportunistic access to shared-use channels, reservation of exclusive-use channel, and cluster size control. A hierarchical optimization model is then developed for this framework to obtain the optimal policy. The objective of the optimization model is to maximize the utility of the vehicular nodes in a cluster and to minimize the cost of reserving exclusive-use channel while the QOS requirements of data transmission (for vehicle-to-vehicle and vehicle-to-roadside communications) are met, and also the constraint on probability of collision with licensed users is satisfied. This hierarchical optimization model comprises two constrained Markov decision process (CMDP) formulations one for opportunistic channel access and the other for joint exclusive-use channel reservation and cluster size control. An algorithm is presented to solve this hierarchical optimization model [1].

Xiao Yu "A Novel Sensing Coordination Framework for CR-VANETs" This paper introduces a novel framework of coordinated spectrum sensing in cognitive-radio-enhanced vehicular ad hoc networks (CR-VANETs). The proposed sensing coordination framework intends to initiate a graceful compromise between stand-alone and cooperative sensing by taking the better of the two while mitigating their respective disadvantages. With a sensing coordination node temporarily defined, the fine sensing activities of all the surrounding secondary users are coordinated and scheduled such that better sensing precision and efficiency can be achieved. [2].

Kazuya Tsukamoto *"On Spatially-Aware Channel Selection in Dynamic Spectrum Access Multi-hop Inter-Vehicle Communications"* The use of dynamic spectrum access techniques has a great potential in future inter-vehicle communications, while it must cope with (i) temporal and spatial spectrum utilization changes introduced by the primary and secondary users (environmental changes); and (ii) topology changes due to movement of vehicles (spatial movement). In the present paper, along this line, dynamic per-hop channel switching in multi-hop vehicular ad hoc networking is investigated. After defining a set of simple metric-based dynamic channel selection schemes with/without spatial-awareness, the basic performance (the total communication duration and the amount of transmitted data) are evaluated. These spatially-aware schemes estimate the maximum communication period, and tend to select a channel with a large amount of possible data transmission within the period. The simulation results demonstrate the advantages of the proposed spatial-awareness, especially in the multi-hop and highly congested environments with high-speed mobility [3].

Husheng Li and David K. Irick "Collaborative Spectrum Sensing in Cognitive Radio Vehicular Ad hoc Networks: Belief Propagation on Highway" Cognitive radio technique is applied to Vehicular Ad hoc Networks (VANET) to increase frequency bandwidth. Spectrum sensing for opportunistic spectrum access is carried out collaboratively among neighboring vehicles. For the collaborative spectrum sensing, Belief Propagation (BP) is applied to tackle the distributed observations and to exploit redundancies in both space and time. The corresponding performance is analyzed for a three vehicle case and is demonstrated using numerical simulations [4].

Qi Chen **"**Overhaul of IEEE 802.11 Modeling and Simulation in NS-2".This paper presents a completely revised architecture and design for these two modules. The resulting PHY is a full featured generic module able to support any single channel frame-based Communications. The key features include cumulative SINR computation, preamble and PLCP header processing and capture, and frame body capture. The MAC accurately models the basic IEEE 802.11 CSMA/CA mechanism, as required for credible simulation studies. The newly designed MAC models transmission and reception coordination, back off management and channel state monitoring in a *structured* and *modular* manner. In turn, the contributions of this paper make extending the MAC for protocol researches much easier and provide for a significantly higher level of simulation accuracy [5].

4. Problem Formulation

VANET'S is an extension of MANET. VANET'S is vehicular Ad-hoc network which is used for intelligent transport system for the drivers the ad-hoc network is used to transmit various types of message over the network. Safety message has to transmit for the security reasons on the vehicle and road transportation various routing protocols have been utilized for the purpose of message transmission. GPRS, AODV, DSR, PUMA these are various routing protocol utilizes for message transmission VANET'S'S scenario is used for mainly V2V and V2R purposes. V2V is vehicle to vehicle communications and V2R is vehicle to roadside communication. In various scenarios message transmission is done according to vehicle density available on the road. Based on the real time road density vehicle establish reliable route for the communication on packet delivery

The main issue of road density is due to high load on road message communication get overhead due to less amount of network bandwidth to overcome this issue cognitive radio bandwidth can be utilize for data transmission by channel sensing and message can be transmit through cognitive radio channels.

5. Proposed Work

Phase 1: In this phase VANET'S scenario is initialized by defining the no. of vehicle/nodes in reverse direction of their mobility.

Phase 2: In this phase various communications between different vehicles and roadside unit will take place using energy efficient predictive clustering approach for the communication process.

Phase 3: In this phase cognitive radio bandwidth has been utilized for the transmission of packets from vehicle to vehicle and vehicle to RSU and RSU to vehicle by sensing channel. The channel which is free that can be allocated for communication.

6. Results and Discussions

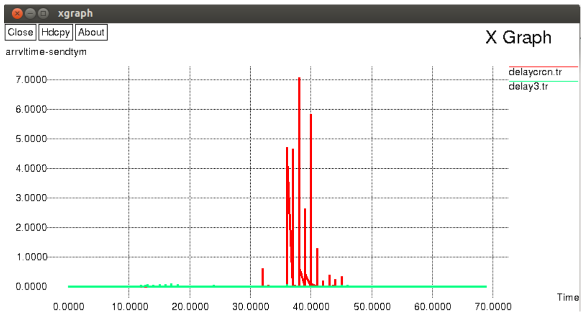

Figure 6.1: Delay

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.

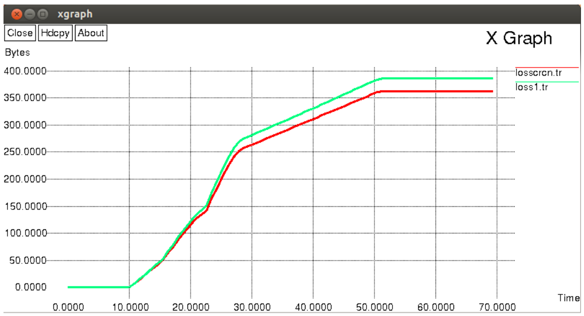

Figure 6.2: Loss

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.

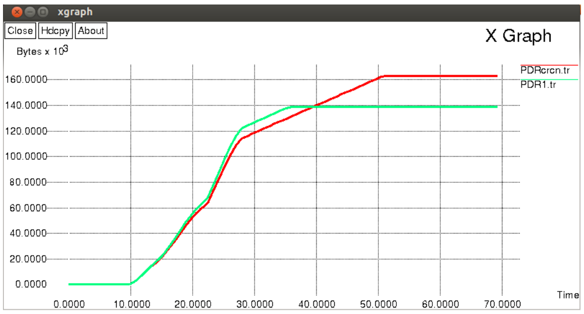

Figure 6.3: PDR

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.

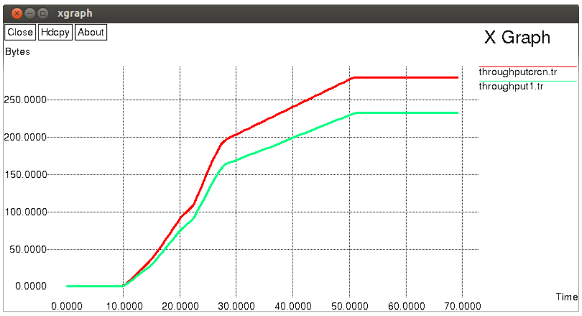

Figure 6.4: Throughput

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.

7. Conclusion

VANET'S is vehicular Ad-hoc network which is used for intelligent transport system for the drivers the ad-hoc network is used to transmit various types of message over the network. Safety message has to transmit for the security reasons on the vehicle and road transportation various routing protocols have been utilized for the purpose of message transmission. GPRS, AODV, DSR, PUMA these are various routing protocol utilizes for message transmission VANET'S'S scenario is used for mainly V2V and V2R purposes. The main issue of road density is due to high load on road message communication get overhead due to less amount of network bandwidth to overcome this issue cognitive radio bandwidth can be utilize for data transmission by channel sensing and message can be transmit through cognitive radio channels. 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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