DYNAMIC CHANNEL AWARE NEIGHBOUR SWITCHING PATH OPTIMIZATION TECHNIQUE FOR VANETs

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ABSTRACT - Cognitive radio for Vehicular Ad hoc Networks is an emerging technology that offer functionalities for the transmission of intra-vehicular commands and dynamic access to wireless services, while the vehicle is in transit. The spatiotemporal correlations among historical spectrum sensing data are exploited to form prior knowledge of channel availability probability, and Bayesian inference is used to derive posterior probability of channel availability. The sensing process is initiated with the channel probe and channel aware sensing. Historical sensing lacks channel detection and overhearing of channel probe which results in higher channel access time and higher transfer rate. To overcome the drawbacks of the spatio-temporal sensing, we propose Dynamic Channel State Information (CSI) based channel allocation using dual consideration of Lateration technique. In dynamic CSI, the status of the last used channel is updated forehand to the requesting users and Lateration based neighbor detection implies for the number of available vehicles. The integrated approach minimizes channel access delay and improves the transmission rate of the CR-VANET improving the optimal performance of the network.

***Index Terms*—**Vehicular ad-hoc networks, Cognitive radio, Channel availability prediction, Spectrum sensing, Data mining.

I. INTRODUCTION

1.1 VEHICULAR ADHOC NETWORKS

Vehicular Ad hoc Networks (VANET) technology is to provide linkage among vehicles for safety information sharing purposes which decreases the probability of collisions. It addresses issues which concern with car-to-car communication. VANET utilizes ad hoc multi-hop communication among cars with diverse mobility patterns. Vehicle to Infrastructure network which can also be referred to as Vehicle to Roadside network utilizes statically deployed Access Points or Base Stations to connect moving cars. The main purpose of VANET is to ensure safety on the roads. In addition to safety applications, VANET also allows users to enjoy comfort applications, such as web browsing and multimedia data downloading. Standards for VANET such as the Institute of Electrical and Electronics Engineers (IEEE) P1609 Wireless Access Vehicular Environment, Dedicated Short Range Communication, and IEEE 802.11p have been developed to accommodate to VANET’s requirements.

With the growing demand for VANETs, cognitive radio network seems to be a promising solution to solve spectrum scarcity. The main challenges for cognitive radio network with VANET are to deal with high mobile nodes under dynamic channel conditions while providing fair spectrum share among nodes. In addition, varying and unpredictable nature of VANET, scheduling efficiency, security, priority assignment, and high nodes mobility are main challenges in ensuring a deployable VANET.

Ad hoc means a system of network elements that combine to form a network requiring little or no planning. VANET will become world largest ad hoc network. In vehicular communication system there are two main types of communication [13]:

- Vehicle to vehicle communication
- Vehicle to infrastructure communication

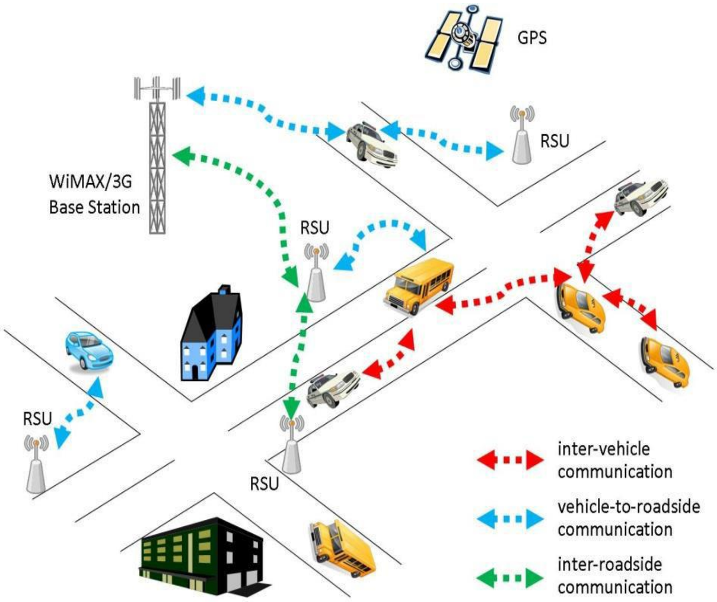


Figure 1.1.1 Schematic representation of VANET

1.2 COGNITIVE RADIO WITH VANET

VANET is a special class of MANET, with nodes in VANET generally representing highly mobile vehicles. Cognitive radio network on the other hand is a method which addresses the spectrum scarcity in the network. While mobile nodes move in a random manner in VANET, spectrums are being utilized in a high density environment. A general idea of how to incorporate cognitive radio network with VANET is discussed in this section. A large amount of spectral congestion due to high vehicle density might act the performance of the network. A distributed channel coordination scheme that exploits the data transmission rate and the range of various frequencies is proposed for vehicle-to-vehicle communication. A channel utilization model which utilizes each channel changes temporally and spatially for both primary and secondary usage is also developed. Even under temporal and spatial changes, the proposed scheme is able to utilize the unused frequency reliably. The method employs data sent by the cars to road side units to forward the aggregated data to a processing unit which created the data contention locations and generated spectrum scheduled to be dispatched to the passing cars. Advanced wireless architectures and its applications on vehicle networks are addressed in cognitive radio by seeking better spectrum reuse via Peer-to-Peer, ad hoc, and multi-hop solutions.

To improve the performance of cognitive radio technology in vehicular networks, a model which uses cognitive agent concept for realizing intelligent information dissemination is method. In order to minimize channel allocation time and management overhead, the limited bandwidth allocated to a region is divided into prefixed overlapping spatial clusters, whereas the channel in each cluster is divided into time slots. These time slots are allocated to vehicles according to the priority of request and the availability of the channel. The contention delay experienced by cars can be monitored on a control channel. If the contention delay exceeds a delay threshold, the RSU increases the spectrum allocation to the control channel using cognitive network, whereas if the contention delay is measured below delay threshold, the measured values are used as reference input for the controller. Dedicated protocols and frequency resources show the potential of cognitive radio network in VANET.

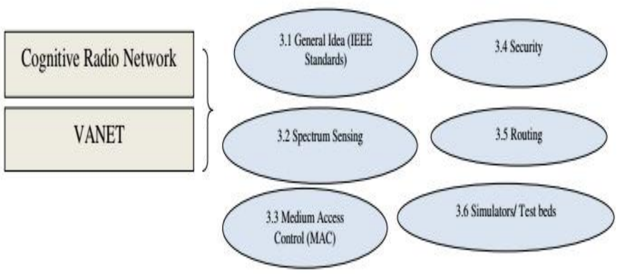


Figure 1.1.2 Current advancement of CR-VANET

II. EXISTING SYSTEM

The AP at the beginning of the road broadcasts the derived channel availability rules to all vehicles, while the AP at the end of the road collects the historical spectrum sensing data from all vehicles that have just passed through the road. The server at the end of the road will run the historical sensing data mining algorithm [6] to derive the channel availability rules and the fused channel availability information will be passed to each vehicle at the beginning of the road as prior knowledge to predict the best channel for CR. With the prediction algorithm, a vehicle with CR always selects the channel with the greatest probability of availability for communications and enhances the robustness of CR-VANET communication significantly and improves the safety. The spectrum allocation is done by checking and assigning the available spectrum for channel and processed on previous transmission characteristics like rate of transmission, delay and congestion.

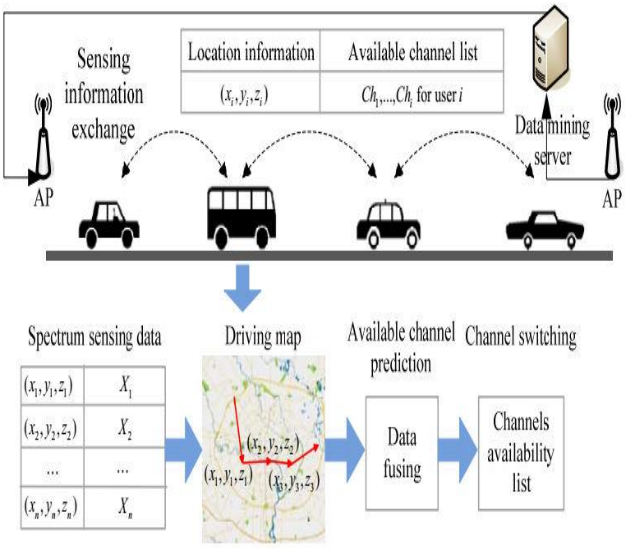


Figure 2.1. Architecture diagram of existing system

ISSUES

- Channel access time is high is due to increasing density and flooding service requests.
- Channel reconnection probability which leads to non-seamless transmission despite variable velocity of vehicle.

SOLUTIONS

We propose a manifold process of Dynamic Channel State Information (DCSI) based channel allocation for available neighbors that are updated using dual consideration of Lateration technique. In DCSI, the status of the last used channel is updated fore-hand to the requesting users and the users are prevented from waiting for a longer time intervals till the availability of the channel.

Lateration based neighbor detection implies for the number of available vehicles in the range and the number of channels that are to be allocated. It updates the current traffic information and vehicle density to prevent overlapping channel access. The integrated approach minimizes channel access delay and -improves the transmission rate of the CR-VANET improving the optimal performance of the network.

PROPOSED SYSTEM

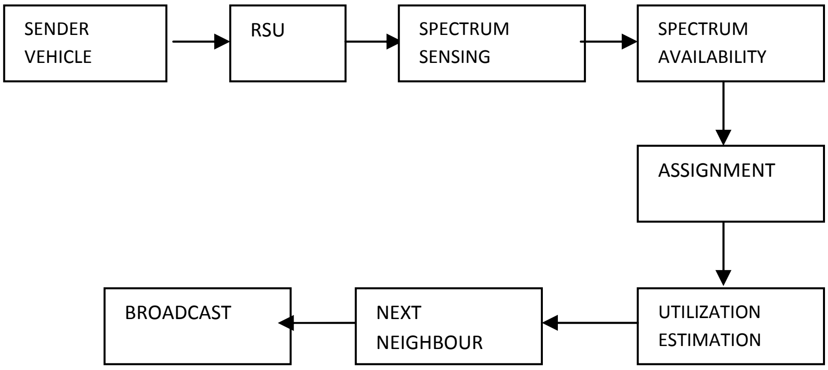
A vehicle which has to calculate its position, receives signals from a collection of reference points. All these reference points have their connectivity metric above a predecided threshold. Connectivity metric is defined as the ratio of the total number of signals received by a vehicle to the total number of signals sent by a vehicle. Once the vehicle receives the signal, it calculates its position as the centroid of the positions of all the reference vehicles as:

$$(Xest, Yest) = ((Xi1+\dots+Xik)/k, (Yi1+\dots+Yik)/k)$$

where Xi1, Yi1 gives the position of the first reference point, Xi2, Yi2 gives the position of the second reference point and so on [12]. The accuracy of the estimate can be determined by calculating the lateration error. By increasing the range overlap of reference points, the accuracy of the location estimate improves. Another work describes the prototype implementation of a model based on the above techniques. The prototype was found to be feasible for outdoor use in restricted domains.

In our proposed method we consider the vehicles and the anchors i.e the reference vehicles as static, we should find the lateration of the vehicle. The distance is estimated estimated with various geometric techniques namely trilateration or multilateration [10]. The total RSSI that occurs in estimating the distance and positioning is calculated i.e at the transmitter and the receiver. Here the transmitter is the anchor vehicles and the receiver is the unknown vehicle.

3.1 SYSTEM ARCHITECTURE



3.2 IMPLEMENTATION DETAILS

3.2.1 DYNAMIC CSI BASED SPECTRUM SENSING AND ALLOCATION

Each node in the cognitive mesh network has an infinite buffer for storing packets of fixed length. The finite buffers case could also be accommodated into our model with slight modifications to the optimization problem formulated in the next section. The duration of a time slot is enough for the transmission of a single packet (in addition to the sensing time and ACK/NACK feedback). Multiple data connections or streams are present in the network. The state (idle or busy) of any of the *N* primary channels is modeled using a two state Markov chain. Using the stationary distribution of the Markov chain, at any given time slot channel will be idle (Markov chain in the off state) with probability. The evolution of any channel is independent from all other channels. The main model assumptions can be summarized as follows:

- Primary and cognitive networks both employ a time slotted transmission structure.
- Cognitive nodes have access to perfect spectrum sensing information.
- All cognitive nodes use the same fixed transmission power in a given time slot, a cognitive node can use at most one channel for packet transmission

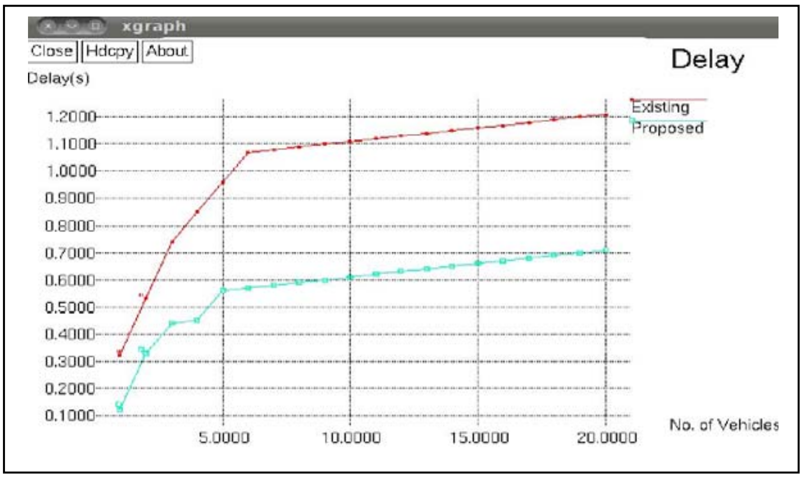
3.1.2 LATERATION BASED NEIGHBOR VEHICLE IDENTIFICATION

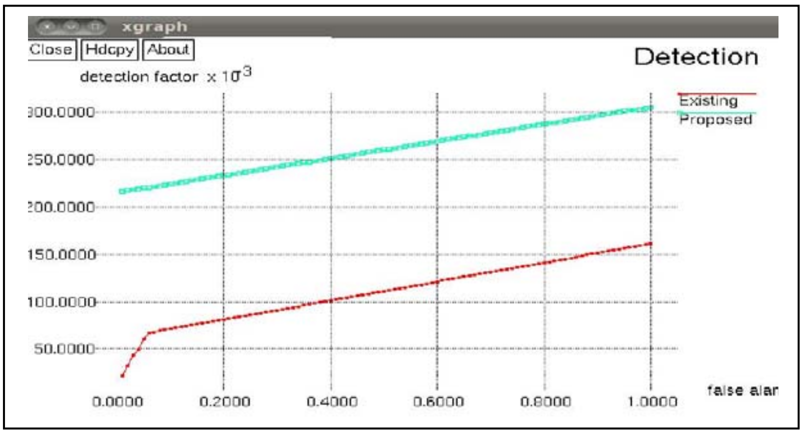
The angle of each reference point with respect to the mobile vehicle in some reference frame is used to determine the location. A vehicle, which has to calculate its position, receives signals from a collection of reference points. All these reference points have their connectivity metric above a pre-decided threshold. Connectivity metric is defined as the ratio of the total number of signals received by a vehicle to the total number of signals sent by a vehicle. Once the vehicle receives the signal, it calculates its position as the centroid of the positions of all the reference vehicles as:

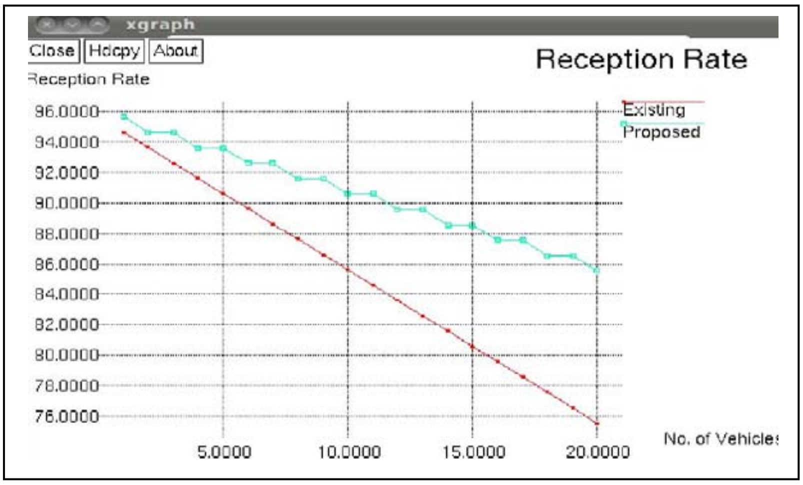
$$(X_{est}, Y_{est}) = \left((X_{i1}+\ldots+X_{ik})/k,\ (Y_{i1}+\ldots+Y_{ik})/k \right)$$

where Xi1, Yi1 gives the position of the first reference point, Xi2, Yi2 gives the position of the second reference point and so on. The accuracy of the estimate can be determined by calculating the lateration error.

COMPARISON GRAPHS







IV. CONCLUSION

To mitigate the problem of channel allocation and sensing in CR-VANETs, we propose opportunistic channel allocation scheme with neighbor information. The two-fold approach improves vehicle independency in communication with minimal day for allocation. Besides Lateration provides neighbor specific information for allocating limited channels at the time of vehicle request. The overall process improves CR-VANET performance by increasing reception rate by 15.47%, detection by 66.1% and decreasing delay by 42.1%.

V. FUTURE ENHANCEMENT

In the future, we will extend our work to a process of street concentrated routing and message classifier can be integrated with location aware transmission schemes under heterogeneous VANETs and location aided services.

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