STDMA BASED INTELLIGENT TRANSPORTATION SYSTEMS

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ABSTRACT - This paper presents a STDMA access technique with real-time global path-planning algorithm for autonomous systems in order to avoid the vehicles from congestion. The main advantage of this algorithm is to enhance the system autonomy as well as the behavior with increase of efficiency of transportation systems. In addition, it supports the variations in spectrum occupancy such as vehicles joining or leaving the company. Hence it can be adapted to any application. Generally it presents a generic, self-organized, and scheduled medium access control mechanism. The traffic signal controller reduces the traffic congestion by conveying the efficient telemetry messages to master to master system to objects through RTU devices. The future work is to detects the position forging attacks occurring on VANET thereby providing security to passengers.

Key word-STDMA, RSU, VANET, Secret Key.

I. INTRODUCTION

The emerging field of cognitive radio (CR) networks is to alleviate the problem of spectrum shortage by transmitting on other vacant portions of the spectrum. The emerging technology of ITS has more attentions in cooperating safety systems for vehicles In order to avoid the road side accidents the self scheduled access control in VANET is preferred by access technique STDMA which enables various users to make safer, and smarter. The recent interest in Intelligent Transportation System (ITS) has lead to rapid increase in the number of vehicular applications such as Traffic safety application, Variable speed limits, Collision avoidance systems, Dynamic traffic light sequence etc [11]. Accordingly, the FCC has allocated 75 MHz of spectrum in the 5.9 GHz band for WAVE. The IEEE 802.11p spectrum band is divided into seven 1 MHz channels as , consists of one control channel (CCH) which is assigned for safety and control message and six service channels (SCHs) for both safety and non-safety usage .The participating device should monitor the CCH where the high priority control and safety messages are transmitted. In vehicular ad-hoc networks (VANETs), devices typically travel along different paths at different speeds. As the result, the propagation channel changes rapidly due to the relative motion between transmitter and receiver .It is proved that the channel condition in vehicular communication is highly dynamic.

The need of the media access control (MAC) is to improve the probability of successful transmission by resolving contention among all users and to estimate the dynamic channel condition[4]. Duration between the time when SCH is selected and when SCH is used for communication is too long compared with the short channel coherence time in vehicular environments. Hence the channel information used for selecting the SCH may be stale at the time for actual data transmission. In this paper, we present Cognitive MAC for VANET with access technique such as STDMA. Cognitive MAC for VANET splits the spectrum access at both long-term and short-term time scales. In long-term spectrum access, the MAC capacity is enhanced via concurrent transmission using cognitive radio technology. Meanwhile in short-term spectrum access, the multi-user diversity is employed by wideband spectrum pooling method.

First, we employ cognitive radio and MAC protocol with STDMA access technique to fit the self organization with wireless environments . it achieves both goals of avoiding the vehicles from congestion in an urban environment and to enhance the timeliness of data collection and dissemination.
Second, we present details of the traffic signal controller which reduces the traffic congestion and also detects the position forging attacks thereby providing security to passengers [7]. We will randomly change secret key of each vehicles while entering from one network to other network based on fast randomized algorithm, and evaluate through analysis and simulations.

II. SYSTEM MODULE

A. STDMA

IEEE802.11p is the standard which provides the protocol to support the safety application for the VANET communication. It includes the improvement to the Physical layer (PHY) and Medium Access Control (MAC) for the support of ITS. This includes communication links between vehicles and with a roadside infrastructure[3]. The current MAC method uses randomized algorithm and It is known that delays limits the value of safety-related services. The most effective effort is to design a MAC protocol that suits vehicular traffic and safety-related service constraints. Self-Organizing Time Division Multiple Access (STDMA) is a suitable alternative, this structured channel access, predictable delay and self-organizing character[10]. This design were acquired during a real-world experiment in the 5.9 GHz band.

![Fig 1. Channel Allocation for VANET](image)

B. COGNITIVE RADIO

Radio spectrum is a limited resource - contested by many, granted to few. The increasing demand for this precious resource and current fixed spectrum allocation policy, have on one hand created starvation for the resource and on the other have led to underutilization of allocated spectrum. It was shown under the observation of the Federal Communication Commission that over 70% of the allocated spectrum is not used at any given time even in a crowded area where the spectral usage is intensive. Therefore, there is a call among the researchers to come up with solutions that would not only solve the problem of under usage of spectrum but also improve the current usage. Cognitive radio is a novel method to solve the underutilization of the radio spectrum. Cognitive radio users use the frequency bands allotted to licensed users, whenever these bands are detected free. The licensed users are often called primary users and the unlicensed opportunistic users are called secondary users. Research in cognitive radio MAC designing centers around developing efficient and robust medium access and sharing schemes to be deployed in networks with the presence of both primary and secondary users.

Different from the existing methods of opportunistic medium access in CRN’s, we aim to exploit the channel state information in scheduling data transmissions in a network of connected nodes through a competitive contention mechanism. Simulations show that our changed MAC scheduling protocol for distributed CRNs is capable of selecting interference free links among various competing links across the spectrum. We try to simulate the protocol in a situation that has the presence of both primary and secondary users, wherein spectral opportunities available to secondary users are limited and eclipsed by presence of primary users. Efficient communication among the cognitive users ultimately demands spectral mobility and dynamic spectral sharing. Use of channel state information makes a user self-aware of the surroundings it is operating in and guides it to decide its own contention schedule. Our contention mechanism is adopted from, channel aware aloha that is basically designed for single channel, and channel aware ad-hoc networks.

The objective of our medium access control protocol is to not only distributive choose between the competing links ones those agree
with user and spectral limitations and are obviously, better among other possible selections, but also to embed the concepts of spectral mobility and dynamic spectral usage in a wireless multihop network that has the presence of both primary and secondary users.

II. PERFORMANCE EVOLUTION

A. PERFORMANCE MEASURES

This section derives the performance measures as throughput, delay, packet delivered ratio, period, channel access delay and efficiency.

Throughput

Throughput is the number of useful bits per unit of time forwarded by the network from source address to destination, excluding protocol overhead, and excluding retransmitted data packets.

\[
\text{Throughput} = \frac{\text{No of packets received}}{\text{(simulation time)}}
\]

Delay

It is defined as the average time taken by the packet to reach the server node from the client node.

\[
\text{Delay} = \frac{\text{No of packets sent}}{\text{(simulation time)}}
\]

Packet Delivery Ratio

Packet Delivery Ratio is defined as the average ratio of the number of data packets received by each receiver over the number of data packets sent by the source.

\[
\text{Packet Delivery Ratio} = \frac{\text{No of packets collected by the receiver}}{\text{Total No of packets sent}}
\]

Efficiency

Forwarding efficiency is the total number of data packets transmitted by any node in the network, divided by the total number of packets received by all the receivers.

\[
\text{Efficiency} = 100 \times \frac{\text{No of packets Received}}{\text{No of packets sent}}
\]

III. SIMULATION RESULTS

The simulation results which include the parameters as the Throughput, Delay and Packet Delivered Ratio.

The first graph shows the throughput increases consistently till the packet transmission take place and then it maintain linearly.

Fig 2. Throughput

This graph shows that the number of data packets received by each receiver over the number of data packets sent by the source is increased and the delay. This shows that the system is efficient.

Fig 3. Packet Delivered Ratio
Fig 4. Delay

IV. CONCLUSION

The proposed system utilized the STDMA access technique with the combination of MAC protocol CR techniques to fulfill the requirements of intelligent transportation systems. The purpose of cognitive radio (CR) networks is to alleviate the problem of spectrum shortage by transmitting on vacant portions of the spectrum in CR platform. By having the analysis and simulation result, it is concluded that this mechanism fulfill the requirements of real time communication with improved throughput and less channel access delay because of the self organizing nature of the STDMA. As well it supports the variations in spectrum occupancy such as vehicles joining or leaving the company. Hence it can be adapted to any application. Effectively it presents self-organized intelligent medium access control mechanism. Since STDMA does not require slot synchronization and position information to function.

V. FUTURE SCOPE

The future work is to detects the position forging attacks occurring on VANET thereby providing security to passengers by assigning the master key to the following vehicles.

REFERENCES


