Intelligence in Transportation Using Vanet

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***Abstract*- Intelligent Transportation System (ITS) has been developed to improve the safety, security and efficiency of the transportation system. It enables new mobile applications. Each vehicle equipped with different sensors and transceivers can sense the changes in environment and together they form a vehicular network. Equipped vehicles with various kinds of on-board sensors and V2V (vehicle to vehicle) and V2R (vehicle to roadside) communication capabilities will allow large- scale sensing and decision/control action in support of these objectives.**

I. INTRODUCTION

Providing Intelligent to vehicles means loading them with sensors which will be controlled by a telematics box inside the car. The box in turn communicate with the driver and will be its guide. The main benefit of VANET is seen in active safety systems that increase passenger safety. Dedicated Short Range Communication (DSRC) is a key enabling technology for VANET applications and services. The designing of efficient Medium Access Control (MAC) protocol to secure VANET against abuse. The MAC protocol can provide secure communications while guarantee the reliability and latency requirements of safety related DSRC applications for VANET.

II.RELATED WORKS

Vehicular network has been emerged as on of the central focus of interest to researches for the last decades or so. The paper introduces an efficient, opportunistic strategy by exploiting the infrastructure through access points to enhance reliable vehicle-to-vehicle communication. The main contribution of the paper is to provide an efficient way to collect and disseminate real time congestion information. The systemuses global positioning system participate, the more reliable the performance will be. In this paper, we have discussed the possible location of installation.

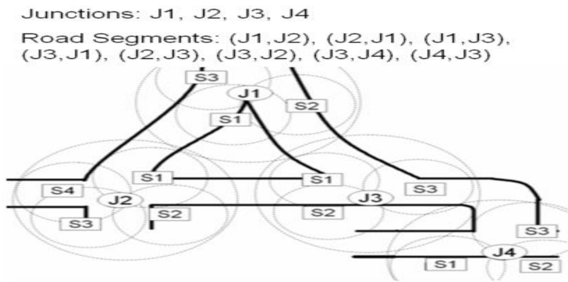
Vehicular Collision Warning communication (VCWC) protocol uses congestion control policies, service differentiation mechanisms, and methods for emergency message dissemination. The protocol also reduces the number of redundant emergency warning messages. Vehicles build an ad hoc service infrastructure on top of vehicular network and establish on demand dynamic ad-hoc groups. These peers then collect, communicate, and combine information to resolve an incoming request.

All the research works mentioned above aims at satisfying the requirements for safety message and overlooked other applications offered by vehicular network. In our system, we have considered diversified application requirements and developed a novel scheme for build up infrastructure that can support various vehicular applications without the help of GPS.

III.INFRASTRUCTURE DEPLOYMENT

A.DSRC DEVICES AT JUNCTION

Junctions are points of a highway where more than two road segments meet together. Here by road segments we mean a one way road on which when a vehicle is running it cannot change the road until it reaches a junction. Vehicles enter in a junction by using one road segments and leave junction by using another road segment. The road segments that vehicles use for leaving a junction is called outgoing road segments of a junction. In order to build up infrastructure we have proposed to use one DSRC devices at each junction. We call it junction device. We set sensors at each road segments of a junction to identify the outgoing road of the vehicle. This can be done using auxiliary DSRC devices at each outgoing road segments. These devices inform junction device about any vehicle leaving the as outgoing road segment by sending vehicle id and road id through which it is leaving the junction. So each junction one DSRC device and one auxiliary DSRC devices per outgoing road segments.



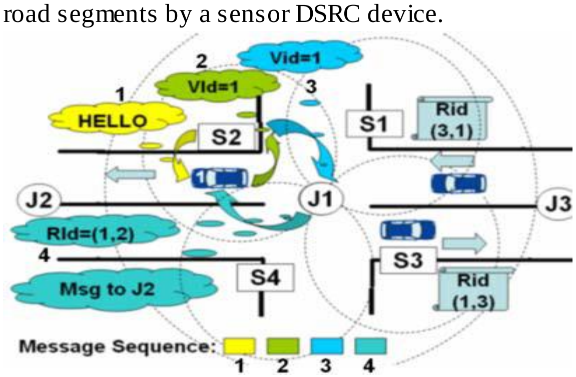
In figure, a portion of street map composed of 4 junctions is depicted. Each junction has auxiliary DSRC radio devices used as vehicles sensors at each outgoing road segment.

B.AUXILIARY DSRC DEVICES

These devices are placed at each outgoing road segments of a junction and they generate 'hello' messages at certain interval eg.1 sec. This type of 'hello' message inform a vehicle that it is leaving a junction. Vehicles getting this message reply with vehicle id. Then these devices send the vehicle id along with outgoing road is to junction device. Note that radio devices at each outgoing road segments should be placed at sufficient distance so that they do not interfere with the signal for any other out going road segments.

IV.CONNECTION WITH AUXILIARY DSRC SENSORS AND JUNCTION DEVICE

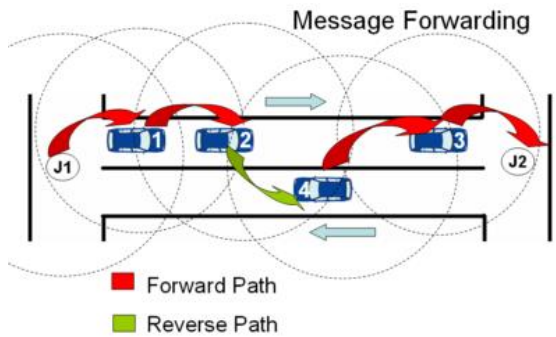
There are cases when sensors at each outgoing road segments should be wired connected to junction devices to avoid perceiving any unintended signal from any other outgoing road segments except own road segments by a sensor DSRC device.



DSRC devices at outgoing road segment.

V.MESSAGE PASSING TO NEIGHBOUR JUNCTIONS

A junction sends messages using store and forward approach to neighbor junctions using the vehicles running towards the adjacent junctions from it. If a vehicle gets other vehicle within its audio range then it forwards the stored messages to those vehicles. Otherwise, it stores it until it gets any vehicle within its radio range. A vehicle can use vehicles running same direction and/or opposite direction to it. We named this two as forward and reverse path vehicle. Clearly using forward path vehicle yields faster transmission but situations in which there is no forward path vehicle, vehicle use reverse path vehicle to get optimal result.



Message dissemination

In the above figure, there is no forward path vehicle to pass the message, so vehicle 2 uses reverse path vehicle 4. Vehicle 4 passes the message to forward path vehicle 3. There may be cases when there is no vehicle near to it. In that case the vehicle just stores the message until it gets the carrier vehicle. After successful forwarding vehicle does not discard the messages rather it saves the message to directly pass to the destination junction. This feature increases reliability of information. However, receiver junction discards duplicate messages.

VI.MESSAGE PASSING TO NON-NEIGHBOUR JUNCTIONS

For passing messages to non neighbor junction a junction device need some routing decisions to be made based on current traffic and receiver's position relative to sender junction. For this purpose a junction need to have physical map of all junction of entire highway. Effective bandwidth created by a road segment depends on uniformity and density of vehicles running through the road segment.

VII.SUPPORT FOR VEHICULAR APPLICATIONS

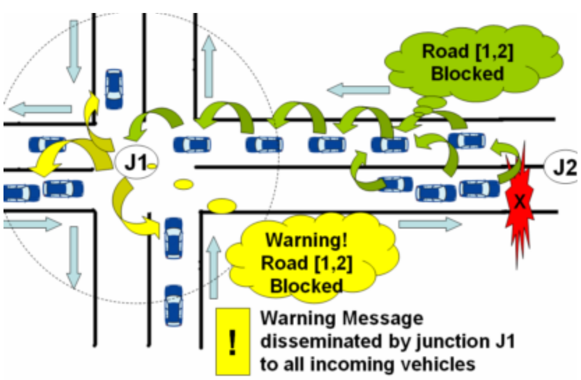
Our proposed infrastructure can provide support for various cutting-edge vehicular applications and services.

VIII.EMERGENCY EVENT NOTIFICATION

Roads can be blocked for two main reasons, congestions and accidents. If we can warn the vehicles coming towards the blocked road, they can avoid that road. When three vehicles are blocked near the junction J2 they send the message to the entry junction of the road J1 by using vehicles going towards J1. Junction J1 wants all incoming vehicle to that junction by broadcasting warning message. So, the vehicles can avoid going blocked junctions. Any emergency events can be notified in this way.

IX.CONGESTION DETECTION NOTIFICATION

A vehicle can detect congestion in the following way. When its speed lowers below certain level it sends 'hello' message to its neighbors. This 'hello' message is different from the hello message generated by junction devices.

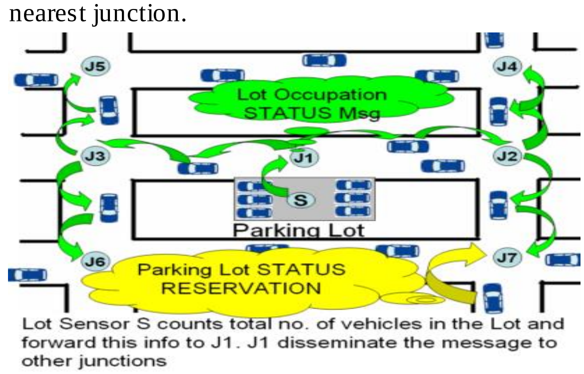


Emergency message dissemination

If its neighbors' speeds also below that level then they also generate vehicles around it by counting distinct 'hello' messages. If number of its neighbor is higher than a threshold value, then the road is said to be congested and it will send congestion notification message to the entrance junction of the road using vehicles going towards entrance junction. After getting the congestion message the entrance junction warns all the vehicles approaching to it about the congested road by broadcasting waning message.

X.SUPPORT FOR DISTANT TRAFFIC INFORMATION

A junction continuously disseminates traffic information to nearby junctions through passing vehicles. Similarly it always receives traffic information of its neighbor junctions from incoming vehicles. Thus, a vehicle gets traffic information of any distant junction, road or other infrastructure (i.e. parking lots) by just making a simple query to the nearest junction.



Traffic information dissemination

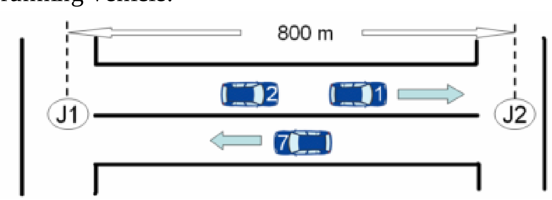
In figure, DSRC device S counts total number of vehicles in the parking lot using hello messages. This is different from the hello message generated by the junctions or vehicles for congestion detection. After counting the number, it sends a message containing parking lot information to junction device J1. J1 sends this message to J2 and J3 through running vehicles and the process continues. When the vehicle near junction J7 needs parking lot information at junction J1, it makes a query to junction J7. If the junction is within the DSRC range of the vehicle then it sends the query message directly to the junction device. Otherwise, it forwards the message to the preceding vehicles. The forwarding continues until the message reaches to the junction. The junction sends the reply message using vehicles running in opposite direction of that vehicle. Similarly any other distant traffic information can be obtained using this scheme.

XI.TRAFFIC MONITORING

A modern traffic system needs to monitor overall traffic condition of the city, collects statistical data and controls overall traffic system. Junctions communicate with central server either using direct Wi-Fi connection or using its neighbor junctions as intermediate hops.

XII.POSITION DETERMINATION OF A VEHICLE

Our proposed infrastructure divides the entire street/highway into distinct road segment. So if we can determine the road segment a vehicle is currently running and the position of the vehicle in the road segment then we can determine the position of the vehicle in the highway. A vehicle runs on a road segment which is incident to the junction it has most recently passed away. We can get the id of the junction that a vehicle most recently crossed by comparing message history between junction device and vehicles for all junctions. Central server can do this comparison. Again we can approximate the position of a vehicle by analyzing message history of vehicles running towards or opposite direction to that running vehicle.



Vehicle position approximation

Here vehicle 7 most recently passed junction J2. Now, we want to approximate the position of vehicle 7 with respect to junction J2 from the message passing history of vehicle 1 and 2.

For example, vehicle 1 reaches junction J2 at 10:30am [junction J2 Time] and it gives J2 following information.

1. It gets message from junction J1 40 sec ago at J2 time 10:29:20am
2. It gets messages forwarded by vehicle 7 at 5, 6 and 7sec ago.

From the above information, we get vehicle 1's average speed in the road segment. (v1=800/40=20m/s)

We also find that vehicle 1 met vehicle 7 at average (5+6+7)/3=6sec ago or at 10:29:54am J2 time at 6*20=120m before junction J2.

Again we suppose, vehicle 2 reaches junction J2 at 10:30:02am [Junction J2 time] and it gives J2 following information:

1. It gets messages from junction J1 41 sec ago.
2. It gets messages forwarded by vehicles 7 at 6, 7 and 8 sec ago.

From that, vehicles 2's average speed in the road segment was 800/41=19.5m/s and vehicle 2 met vehicle 7 at average (6+7+8)/3=7sec ago or at 10:29:55am J2 time at 7*19.5=136.5m before junction J2.

From above two timing information, we get that in 1sec (10:29:54am to 10:29:55am), vehicle 7 approaches (136.5-120)=16.5.

So at 10:30:05am (10 sec from 10:29:55am) vehicle 7 will be approximately at 136.5+16.5*7=252 m away from the junction J2.

XII.CONCLUSION

Vehicular ad hoc networking is a promising wireless communication technology for improving highway safety and information services. In the paper we proposed a secure MAC protocol for VANETs with different message priorities for different types of applications to access DSRC channels. The secure communication protocol is designed to guarantee the freshness of the message, message authentication and integrity message non-repudiation, and privacy and anonymity of the senders. Stimulations results show that the proposed MAC protocol can provide secure communication while guarantee the QoS requirements of safety related VANET DSRC applications. Future work is continuing on the performance of V2V based secure communication scenario.

REFERENCE

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