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Optimizing the Ad-hoc Applications in Vehicular Network: A Study

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Abstract: ***As per today's scenario, wireless networks are becoming more popular day by day as it is difficult for people to constrain their needs to the wired networking. MANET is mobile ad hoc network wherein mobile nodes can communicate with each other through radio waves. It does not need a fixed infrastructure or any centralized control. Vehicular ad-hoc network also called as VANET is a type of MANET that uses vehicles as nodes that communicate with each other. VANET works on the basis of real time system where the vehicles move as nodes and travel with a very high speed on roads. This kind of networks are self-configuring networks composed of a collection of vehicles and elements of roadside structure linked with each other without requiring any infrastructure, sending and receiving information of current traffic situation. Nowadays, Wi-Fi (IEEE 802.11 based) technologies are most commonly used for the initialization of VANET. There are many security issues like authentication, tunnel attacks, intelligent system approach, collision detection, congestion avoidance, communication system approach etc. A number of methods have been proposed to deal with various issues in VANET. Delay is a major issue that has to be dealt with as this may happen due to accidents taking place in VANET which can pose serious problems for smooth networking. Delay has to be reduced in order to transmit the data in time to all the vehicles present in that network.***

Keywords: VANET, V2V, V2I, Delay, congestion

1. Introduction

Vehicular ad hoc network also called VANET is a type of mobile ad hoc network in which vehicles act as mobile nodes to transfer data in a network. These kinds of networks are self-configuring networks composed of a collection of vehicles and elements of roadside structure linked with each other without requiring any infrastructure, sending and receiving information of current traffic situation. Vehicles act as routers that transfer information from one vehicle to another in the defined network area. Nowadays, Wi-Fi (IEEE 802.11 based) technologies are the most commonly used for the initialization of VANET.

Basically, communication in VANET systems can take place in the following ways:

V2V/V2I/I2V: The Vehicular networks potentially have two types of communication scenarios: car to car communication and other is car to infrastructure scenario. There are so many hotspots along the road such hot spots can operate individually at home or office by the help of internet service provider or integrated operated. Vehicles can communicate with other vehicles directly without communication infrastructure; all the vehicles cooperate and forward information on the behalf of each other. Combination of these deployment cases is also possible.

It can be categorised into three parts:-

A. In-vehicle communication

In-vehicle communication can be used to exchange the information between different components of the vehicle. This may include GPS system, music control etc.

B. Vehicle to road side/vehicle to infrastructure side communication

In vehicle to road side communication is also called a vehicle to infrastructure communication. In this time vehicles communicate from the vehicle to a fixed infrastructure. This communication in the two forms is unidirectional or bidirectional fixed infrastructure.

C. Inter vehicle communication

This is a vehicle to vehicle communication in which the vehicles directly communicate with each other. This may be single hop or multi hop on the basis of communication with the adjacent vehicles or the other ones.

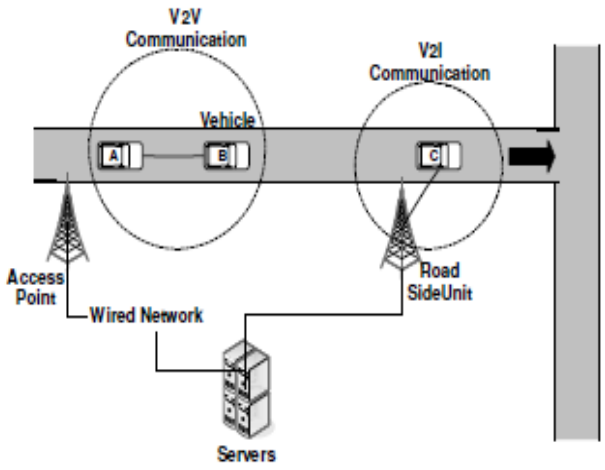

Figure 1: Diagram showing V2V, V2I types of communication in transport network

2. Issues in VANET

As we know that VANET has no infrastructure and it is used in wide range, there are some issues in VANET. These are as follows:

2.1 High Mobility

Due to high mobility, all the nodes are not able to interact properly with each other because they have to have the

knowledge about each others' behaviour first as it is mostly the first time in such a network that two nodes communicate with each other. It also decreases efficiency of the system.

2.2. Real-time Guarantee

VANET applications are used for hazard warning, collision avoidance, and accident warning information, so applications involve strict deadlines for proper message delivery. The messages related to such kind of problems have to be delivered in a particular span of time else being useless.

2.3 Privacy and Authentication

A proper authentication system must be set up to ensure privacy in the networks. Only the required information must be provided to each node without leaking out any other nodes' private data. A system to ensure the authentication in VANET should be established which will also increase the throughput of this network.

2.4 Location Awareness

For the proper location awareness GPS system is required to handle the VANET application. If there is no Proper system for location identification, it may increase delay in the system.

3. Delay in VANET

Delay in VANET is a major issue that has to be sorted out. If an accident occurs in a VANET network, it is possible that jam may occur in the network and may lead to congestion and non delivery of the required information. When vehicles away from the accident site have no knowledge about the accident they will not be able to take any measures to find a new way or alike. The smart transport system deals with transferring information from a vehicle to another so that the scenario can be well known by all the vehicles in the network. This has to be in time because it is real time application of the ad-hoc networking. Delay is a severe issue that makes the network overflow and also decreases the output of the system. So steps have to be taken to deal with this problem in VANET system.

4. Steps Taken to Reduce Delay Problem in VANET

Routing of data in VANET is a challenging task due to rapidly changing topology and high speed mobility of vehicles. A greedy position based routing approach called EBGR (Edge Node Based Greedy Routing), has been used to forward packets to the node present in the edge of the transmission range of source/forwarding node for handling the issues in VANET [7]. Potential score of the neighbour node selects the most suitable next for transmission of message. At the end result shows that end to end delay in packet transmission is minimized considerably compared to current routing protocols of VANET.

A delay-bounded routing protocol has measured the effect of traffic lights. Whenever a vehicle passes a junction, it will congregate the information of traffic light and traffic load of the next road section and thus it can make a more accurate prediction and adopt a more proper strategy to deliver message. Simulation results show that the protocol can make a better usage of the available time and uses less radio resource to deliver the message in time. The protocol uses linear regression to guess the available time and the travelling distance and thus the vehicle can switch to a proper delivery strategy at a proper moment and can reduce the number of relays by radio [8]. This protocol has two schemes: the greedy and centralized schemes. The greedy scheme uses simply the sampling of current data to calculate the available time and make a decision to decide when to switch the delivery strategy. On the other hand centralized scheme uses the global statistical information to choose a minimum cost path. Simulation results validate the effectiveness of the protocol.

The technique known as Vehicle-to-X— represents a handoff procedure between V2V and V2I or I2V in order to keep vehicles connected independent of mobility issues and traffic scenarios [9]. The time delay is used as a performance metric for protocol switching and presents the time propagation rates which occur when vehicles are transmitting warning messages, via V2V or V2I. Simulation results show how the simultaneous usage of pre-existing network communications, together with inter-vehicular communications, provides low delays; while traditional opportunistic vehicular communications increases the transmission time delays and does not guarantee seamless connectivity to vehicles.

To improve the QoS i.e delay in terms of path selection over the network a new routing algorithm is proposed using ant colony optimization in vehicle routing. The main concern is to improve the DYMO algorithm of VANET combined with ant colony optimization. It gives better path for new path to avoid congestion. If there is no congestion problem then delay can be reduced [10].

5. Future Scope

The various algorithms discussed have been advantageous in one or the other way. But our main aim lies in the one that we talk about as the most promising in future. There are a number of bio inspired algorithms like max min system, rank based system, convergence techniques etc. These have various features that will solve the various traffic problems in future. Using these algorithms, new techniques for optimizing a number of factors in VANET can be obtained hence being one of the best methods to solve these problems. Ant based systems represent the best optimal paths because of them being real time in the sense of moving traffic.

6. Conclusion

As VANET is the vehicular ad hoc network that is a type of mobile ad hoc network which is a self configuring network. It has no fixed infrastructure and that is a major cause of the issues that happen to take place when working with VANET. VANET deals with a number of issues like high mobility, low privacy and delay problem. Delay is the major problem that has many consequences that may lead to failure of such network. Delay leads to congestion and that may again lead to overflow of the network which makes the network of no

use. Many solutions have been proposed that have been already discussed with their major features and usage. As VANET is the conceptualization of a real time system, a biological concepts used by ants can be inferred in this to make the vehicles follow a particular path when congestion happens. This can use ACO approach to find out the most optimal path. Various research works have been performed and we tend to work in the same field with an aim to improve the earlier measures so that issues like delay and throughput can be dealt with. Our main aim is to make the system more efficient and improve throughput.

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