Vehicle Mobility Modeling and Time Estimation for Connectivity Analysis in Vanet

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***Abstract*— Vehicular-Ad-hoc networks which in short form called as Vanet's consist of different types of protocols. In this vanet the Road Based Vehicular Traffic which in short form called as R B V T is one of the major routing protocol available in vanet's. R B V T out performs better than all the present being routing protocols in vehicular-Ad-hoc networks. R B V T provides the actual time information of vehicles in the traffic which are considered as nodes in the traffic by creating road based paths. The IEEE 802.11 which is a standard and a set of MAC and physical layer specification for implementing wireless communication between the vehicle nodes is used for communication. In the proposed work with the help of the IEEE 802.11 standard, all the real time vehicular information of a vehicle is transmitted to other vehicles identifying the nearest path starting from the source node and ending at destination node via Road Side Units [RSU's] to the base station in the real time environment in the occurrence of any accident or any kind of emergency.**

Keywords* — *RBVT protocol, VANET's, Road Side Units [RSU's].

I. INTRODUCTION

Overview of Vehicular-ad-hoc networks

Vehicular-Ad-hoc networks are the beautiful topic of the intelligent transportation system, which plays a important role in the real time environment. Each vehicle in the traffic are considered as a nodes and which are called as vehicle nodes and each vehicles takes a job of the sender, the receiver and the router for transmit or broadcasting the message till the wireless ad hoc networks or a transportation agency.

The major advantages of these vehicular-ad-hoc networks are that it ensures safety of a person, safety of a vehicle and free flow of traffic. The information is broadcasted from the vehicles to RSU's and to the base station. For communication to occur in between the vehicles and the RSU's, a thing like radio interface must be equipped with the vehicles that provides near range ad-hoc wireless network and communication. The vehicle's must also provide some exact information of the position for the purpose the hardware needs to be fitted to the vehicle's.

For an effective and good communication the Road Side Units [RSU's] must be placed at a distance from which the vehicle's can communicate with it. The number of Road Side Units that should be distributed depends based on the communication standard that is being used. Few protocols may require the Road Side Units [RSU's] to be distributed through entire road, few protocols requires the RSU's to be distributed only in the road intersections, some may require the Road Side Units [RSU's] at the region border.

Possible communication in the intelligent transport systems are (a) Inter Vehicle communication, (b) Vehicle to Road communication, and (c) Intra Vehicle communication. Whatever the type of communication it may be, it should ensure quick and accurate delivery of the message to the vehicle's and Road Side Units [RSU's]. The communication uses technologies and standards such as Bluetooth and ZigBee which are the standards of IEEE 802.11 and IEEE 802.15.4 respectively that will support the communication within the vehicle's and the RSU's.

Inter Vehicle Communication

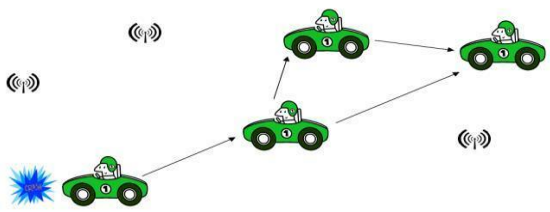


Figure 1 : Inter Vehicle Communication

The Inter Vehicle Communication in which the communication takes place in between vehicle's present in the road or traffic i.e. the message is transmitted within the vehicle's.

Vehicle to Road side Communication

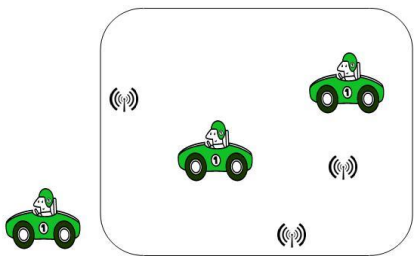
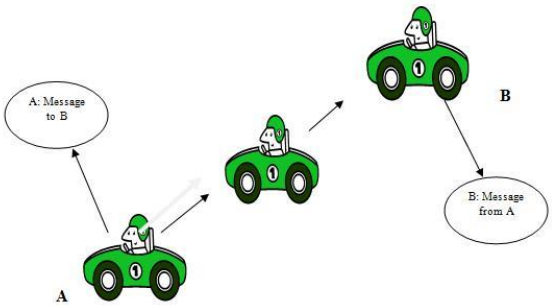


Figure 2 : Vehicle to Road side Communication

Vehicle to Road side Communication in which the vehicle's in the traffic will communicate with road side units that are placed on the sides of roads i.e. the message will transmit only in between the vehicle's and road side units.

Routing Based Communication



3: Routing Based Communication

The Routing Based Communication in which no road side units participate in the communication. The message will be transmitted from the source to destination using the protocols present in the Ad-hoc network's.

RBVT Protocol

Road based Vehicular traffic [RBVT] protocol is the communication protocol used in the intelligent transport system that is VANET's. RBVT protocols take the real time information of the vehicular traffic for the purpose of creating road based paths.

RBVT has two types of protocols in creating paths: (a) Pro-Active protocol (RBVT-P) and (b) Re-Active protocol (RBVT-R).

I. LITERATURE SURVEY

Investigations of conventional steering conventions for portable specially appointed systems MANETs showed that their execution is poor in Vanet [6], [7]. The principle issue with these conventions, e.g., impromptu on-interest separation vector AODV [8] and dynamic source steering DSR)[9], in vanet situations is their course shakiness.

The customary hub driven perspective of the courses (i.e., a set up course is a fixed progression of hubs between the source and the destination) prompts incessant softened courses up the nearness of vanet high versatility. Therefore, numerous bundles are dropped, and the overhead because of course repairs or disappointment notification and significantly expands, prompting low conveyance proportions and high transmission delays.

In MANET protocols where topological end-to-end paths were created used to predict the life time of paths and decrease the number of route breaks. This protocols couldn't identify road interactions that was present on the travel from start to end [1] [2] [3].

A topic of Anchor-Based-Routing in wireless sensor networks was introduced into VANET environments. Source node used to identify the closest road based traversal till the destination node. These routing protocols did not include empty roads [4].

A Recipient based next bounce determination was proposed at this layer. The remaining separation to the destination was minimized [5]. Beneficiary based next-jump choice is proposed at the steering layer (e.g., [29]) and at the Mac layer. In [9], all neighbours get the whole bundle, however one and only neighbour will rebroadcast it.

This neighbour is the one that wins a period based conflict stage in which the hub nearest to the destination is favoured. Minimizing the remaining separation to the destination is likewise the target in [3], [6], and [4], which work at the Mac layer.

II. METHODOLOGY

Vehicular-Ad-hoc networks are the skill which uses the moving vehicle's on the road as the nodes and will create a network. VANET's will turn every vehicle in the road into a node or a wireless router that transmit the information from one vehicle to another vehicle. Each and every vehicle in the network can be connected with each other and can communicate with each other. The information transmitted from one vehicle to another vehicle can be any sort of information about vehicles like vehicle condition, location etc.

The major vehicles that need to be connected to the networks are police vehicles, fire vehicles and ambulances that are the major vehicles for safety purpose and it can be the base station. Road Side Units [RSU's] integrated on the roads will provide all the above information to the base station. Let us consider an example of the VANET architecture as shown in figure 4.

Let us consider a vehicle A as the source node where there is a problem in the vehicle A. It will transmit its information to its next vehicle say Vehicle B and then Vehicle B to Vehicle C and so on, till it communicates with a Road Side Unit [RSU's]. The Vehicle A can also interact with road side units or Vehicle B and Vehicle C can also communicate with its nearest road side units. The road side units will store a copy of the information received from the vehicles and transmit the same to the base station which will be near to that of Road Side Units [RSU's], so that the rescue or help will come for the source vehicle A

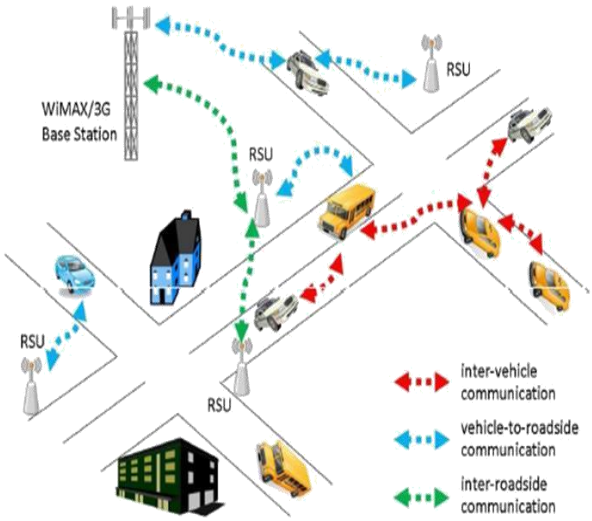


Figure 4: VANET Architecture

Selection deploy of Ready to Send/Clear to Send

R B V T influences the Ready to Send/Clear to Send trade to supplant the sender choice of following bounce along a recipient own race certainly wipes out the expenses connected with regular "hi" data in geological sending on compressed systems. Basically, shows of Ready to Send edges get to be demands on next-bounce own decision. Ready to Send edges are altered to convey the place of sender and the place of objective end point and are utilized with own decision. Ready to Send outlines likewise convey a bit to demonstrate for every accepting hubs that ought to handle, perhaps provide the response for casing (first system, just planned collector procedures, response a Ready to Send outline).

Accurately, every hub that gets the modified RTS outline ascertains a holding up period, and later it'll transmit a Clear to Send outline back to sender. Holding up period is a marker to know how great hub; i.e., less the holding up period is the best competitor hub gets to be.

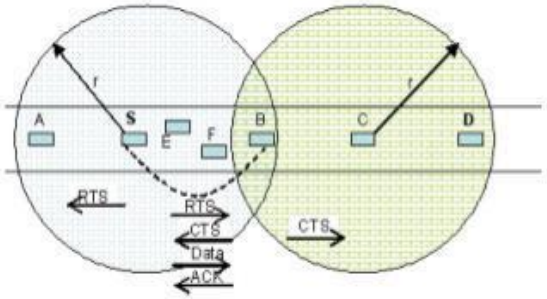


Figure 5: RTS/CTS Exchange

Clear to Send starting from beneficiaries shows a superior applicants presence, and no hopeful collectors to catch and respond. The transmitter gets the Clear to Send message thorough best next jump applicant and advances the information casing onto hub, which later recognizes the information outline.

Beaconless dispersed recipient based decision

Beaconless dispersed recipient based decision of next jump, considering no uniform radio proliferation. This strategy utilizes light medications of the solicitation Ready to Send/Clear to Send (RTS/CTS) instrument. A multi criterion priority capacity is acquainted with select the next better jump utilizing the separation within the following bounce and the end point, energy level and separation to transmitter as numbers.

Geographical Routing

An elective methodology is offered by geological steering conventions, like Greedy Face Greedy [10], ravenous different Adaptive-Face-Routing [11], and Greedy-Perimeter-Stateless-Directing [12], that decouples sending by the hubs personality. The conventions don't set up courses however utilize the place of the end point and the place of the neighbour hubs to transfer information. Not at all like hub driven directing, has topographical steering had the point of interest that any hub that guarantees result at the end point can be utilized in sending. [6] [13]

Universal Asynchronous Receiver/Transmitter Protocol

A Universal Asynchronous Receiver/Transmitter which in short form called as U A R T is a microcontroller that is embedded with a chip. U A R T I mainly used for USB to Serial communication purpose. It helps the USB cable to take the data given to it by a microcontroller and coverts the data to serial transmition. One U A R T device consists of one receiver and one transmitter. The receiver receivers the data from other devices and the transmitter transmit the data to other devices.

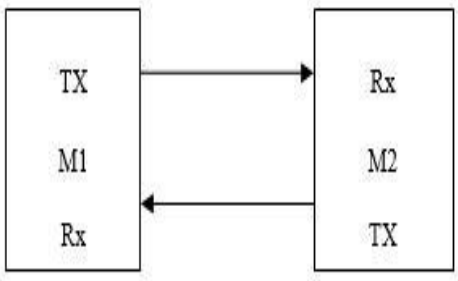


Figure 6: Universal Asynchronous Receiver/Transmitter Protocol Signal Transmission

PIC Microcontroller

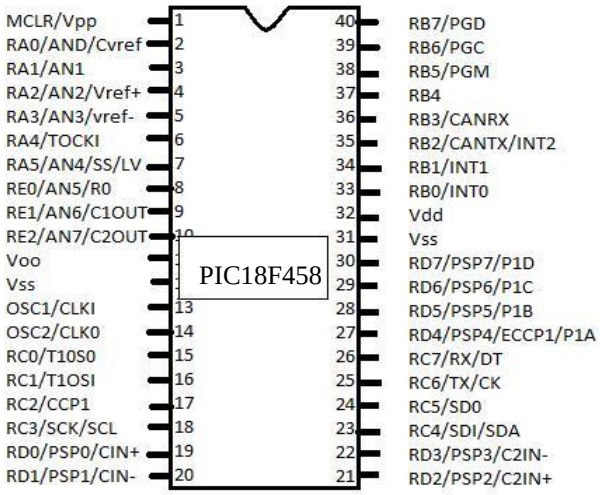


Figure 7: PIC 18f458 Pin Diagram

In this paper not only the information about vehicles, the vehicles starting time is estimated, the range between the vehicle's and RSU's are calculated, speed of the node, arrival time, departure time of the node and wait time of the nodes are also calculated, which in turn provides an improved quality of service and also mobility which is major concern in every wireless networks and also is improved.

When an accident occurs the metal sensor in a module senses the accident occurred and then automatically the node itself sends a information about the condition to all nodes in a particular area.

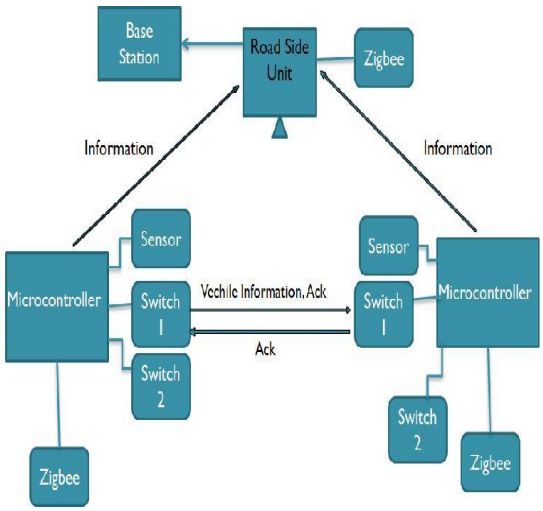


Figure 8: Vehicles attached with hardware's and flow of communication.

All the information about the VANET's calculated before implementing in real time environment, all data to be calculated are first estimated in the form simulation using a open tool Mat lab and the data is tested in the real time with help of hardware's fitted into the vehicles.

Both the simulation details and the real time details shows the advances in the Vehicular ad hoc networks. The vehicles will be attached with microcontrollers. In case of any emergency, accident and if some urgent information like traffic jam the node will transmit its information to the nearest vehicle's and RSU's. Information from road side units will be transferred to base station and copy of information is stored in road side units also.

The vehicles nodes speed time, arrival time, departure time and waiting time is also calculated starting from first node to the last node and the mobility and quality of service is also improved. Two nodes and a single base station is used.

Figure 8 indicates node 1 and shows node 2. These 2 nodes are involved in a vehicular ad-hoc networking and a base station as super node interfaced to the system in the network. During emergency conditions if one node sends a data, other node receives it this node can bypass a message to the base station, in turn it sends a data to other nodes or to the mail ids provided to it using Internet. Any node in the network involved in any emergency conditions, it can sends a data or information to all other nodes in a network by just pressing a particular button.

III. RESULTS AND ANALYSIS

The simulation results show that the vehicles are communicated with each and hence the required results are also achieved.

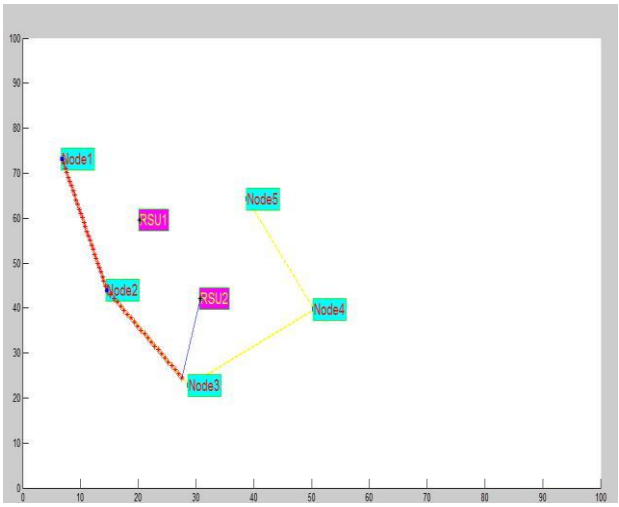


Figure 9: Vehicles communicating between each other and with road side units.

The figure 9 shows the simulation result that the nodes, road side units are created and communication i.e. the information getting transmitted from one node to another node.

Node	Wait Time	Arr Time	Speed(m/s)	Dep Time
1	9	23:53:58.592000	0.000000	23:54:8.172000
2	10	23:54:10.046000	4.135791	23:54:20.673000
3	2	23:54:22.194000	9.321298	23:54:24.325000
4	10	23:54:25.961000	13.290203	23:54:36.592000
5	7	23:54:38.219000	7.087395	23:54:45.655000

Figure 10 : Results of the communication.

The figure 10 shows the result of the wait time, arrival time, speed and the departure time of the signals or the information transmitted from one node to another node.

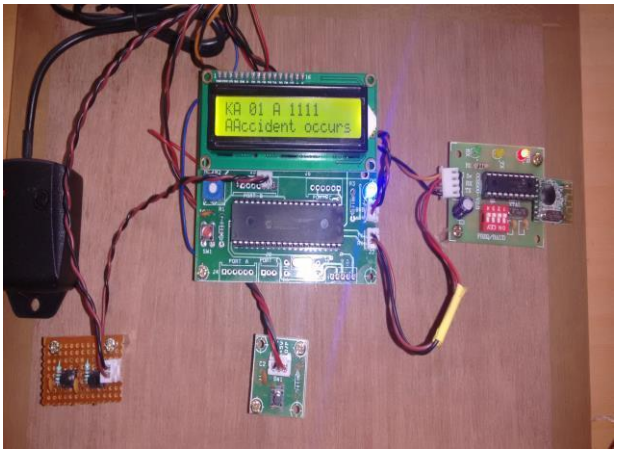


Figure 11 : Result on the hardware showing that the accident had occurred in that respective vehicle.

The figure 11 shows the hardware arrangement of the node. And the message that the accident has occurred at a particular vehicle is shown on the LCD display and the figure 12 shows the message traffic jam on the LCD display. The microcontroller used is the PIC 18F458 which is a 32 pin IC.

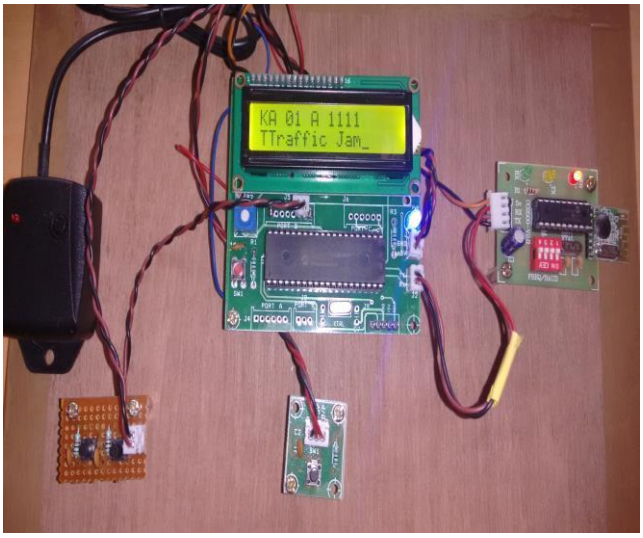


Figure 12: Result on hardware showing that the traffic jam has occurred and from which vehicle the message was generated.

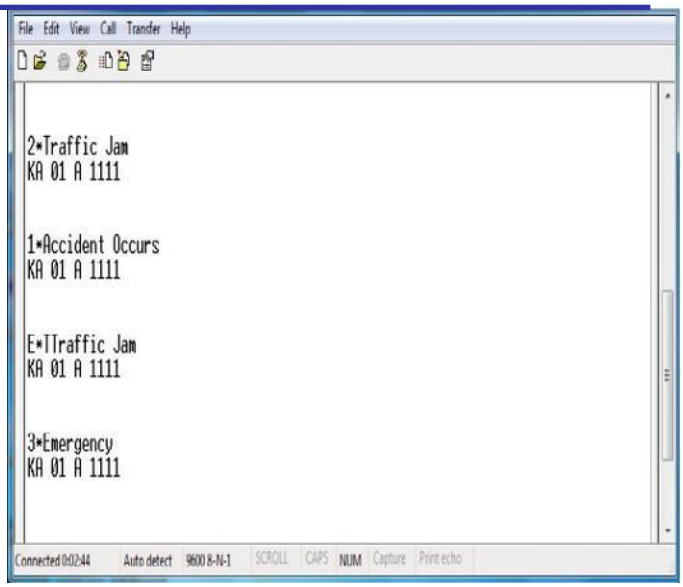


Figure 13 : Result on the base station.

Figure 13 shows all the messages that are communicated in-between the vehicle's and RSU's.

IV. CONCLUSION

The information is transmitted from one vehicle to another vehicle when any accident occurs and in turn the acknowledgement is also received by the vehicles. From one vehicle to another vehicle the information is transmitted to the nearest road side units. From the road side units the information will be transmitted to the base station where the information is needed to be stored. The vehicle starting time, range in-between vehicle's and Road Side Units, speed of the vehicle node, arrival time of the node, departure time of the node and wait time of the node are achieved.

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