Design of Alternate Route Discovery Based on Congestion in Vehicular Network

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Abstract: *Vehicular Ad-hoc Network communication is needed to implement in an efficient way so that congestion can be avoided and alternative paths for congestion avoidance can be consider. In this paper, we have presented an efficient mechanism based on geo-cast region based protocol for providing efficient alternative path to destination which successfully avoids congestion and message from one vehicle to other is transferred easily and accurately. The aggregate throughput of the propose scheme is increased around 19% more as compared to normal communication. The proposed scheme provided 19% more throughput, 6% more packet delivery, 10% less drop when compared to already existing techniques. We have elaborated the complete results and basic experimentation of proposed schemes.*

Keywords: Vehicular Ad-hoc Communication, Gateways, Intermediate Relay, Geo-cast Communication protocols, Originator node communication.

1. Introduction

There are two variations of mobile wireless networks for communication. The first is known as infrastructure networks, i.e., those networks with fixed and wired gateways. The bridges for these networks are known as base stations. A mobile unit within these networks connects to, and communicates with, the nearest base station that is within its communication radius. The second type of mobile wireless network is the infrastructure less mobile network, commonly known as an ad-hoc network. Infrastructures less networks have no fixed routers; all nodes are capable of movement and can be connected dynamically in an arbitrary manner. Nodes of these networks function as routers which discover and maintain routes to other nodes in the network. Example applications of ad-hoc networks are emergency search-and-rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrains [1, 2].The term ad hoc networks generally means networks that consist of a continuously changing amount of hosts, wherefore the topology of an ad hoc network could be much more dynamic than that of fixed networks. Ad hoc networks offer an easy way for hosts to join them on the fly without forcing the hosts to do any manual configuration. This paper we have solved the issue of communication in vehicle with efficient technique for avoiding congestion.

2. Proposed Work

We are representing automatic route finding in case of a Vehicular Ad-hoc Network. In this we use vehicles as moving nodes to represent the proposed work. In this proposed work we used a concept of traffic light, traffic, congestion and an accident in a scenario where we are considering a city area. The vehicle searched their path by using effective shortest path routing. In this network, we have taken a specific city area with one or two lane roads. At each junction there exists a traffic light which route the vehicles accordingly. As a vehicle detect that there is an accident or a congestion on a network then a message is build and sent to base station through roadside units and to other vehicles coming on same lane in same direction . After receiving the messages through other vehicles in same direction or through a base station, the vehicles will search their path automatically by taking the observation of surrounding traffic, obstacles on the way and the congestion on the path.

The major problem is to find the appropriate route path to respective destinations and a network or geographical areas with more overhead for add on responsibility. In our research, we are maintaining the reliability with less overhead by introducing 8 bit information of data in message header. In case of any drop of data, bit information will be used to create the traces for data and will complete the duplicity of data. This mechanism will avoid big overhead which is introduced due to complete duplicate copy of data with each vehicular node agent so to decrease the congestion.

3. Experimentation

Our research is based on communication of vehicles in vehicular ad-hoc manner so that the congestion in the network would be less and efficiency of message transmission is increase. Our research focused on the reduction of overhead by maintaining the reliability by introducing information of data in message header. In case of any drop of data, bit information is used to create the traces for data and complete the duplicity of data. This mechanism has avoided big overhead which is introduced due to complete duplicate copy of data with each vehicular node agent so to decrease the congestion. SO this process is developed in Network Simulator 2. We deployed stationary nodes and street view for showing communication of mobile nodes. Basic traffic simulation parameters such as speed and number of nodes are decided by administrator. The simulation randomly generates 20 nodes in the range of 1500m×1100m plane. The coordinate of the Sender and receiver is also decided in our simulation after processing of

exact location with geo-cast routing is found. Scenario considered for experimentation is shown below in figure 1.
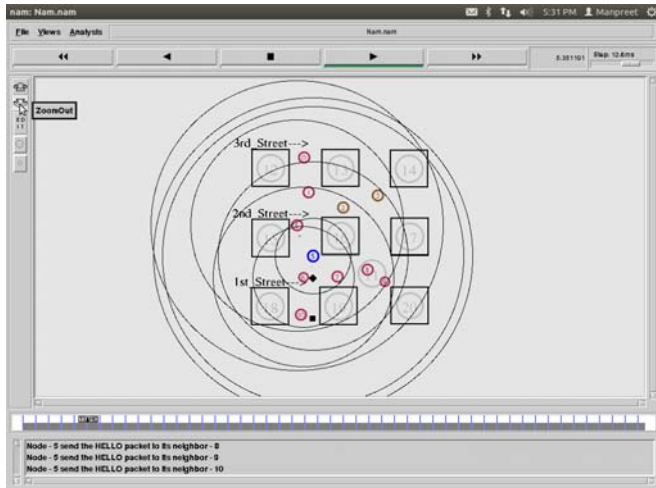

Figure 1: Simulation scenario for experimentation

Now for implementation of proposed work, we used traffic movement, congestion and an accident (in form of dense traffic) in proposed scenario and have considered city area in grid formation. In proposed scenario, mobile nodes represent vehicles performed an automatic discovery of route based on congestion by observing the data received from other vehicles. For efficient message transmission, we have used originator node which is used to update the traffic parameters and use to start sending information regarding congestion to other vehicles. Data rate from originator is considered are 16 Mbps. Geo-cast areas are marked based on the location locking for particular vehicle so that message transmission should be accurate. Further it showing the communication initiated by random vehicle and geo-cast region marking according to the congestion. This region is used to initiate the packet processing in header of the packet which maintained information trace of route so that when message transmitted to other vehicles then route finding should be very easy and fast. Various analyses are obtained by comparing parameters like Packet Delivery Ratio, Throughput, Energy Consumption and Drop. Various parameters used for experimentation are given in below table.

Table 1: Parameters used for the experimentation

Parameters	Value
Simulator	NS2
Simulation Time	50 sec
No of Streets	3
No of Mobile Nodes	10
No of Stationary Nodes	9
Traffic Model	CBR

Speed	16 mps
Type of connection	Single

For experimentation we have used network simulator version 2 with animation for the concept of efficient communication for vehicular ad-hoc networks. Various parameters used for proposed experimentation is shown in above table 1.

Figure 2: Communication of the nodes for efficient message passing

The detailed experimentation has been considered in the network simulator 2 with optimized header processing for finding route while transmitting message to other vehicle. A server used for saving traces of data too so that in case of lost information, data is still available by recovery of meta data information. In figure 2, concept of the intermediate vehicle communication is shown and vehicles from other street can communicate with other street node for checking congestion of the road route.

The results are based on the simulation of efficient message transmission scheme. Results are judged on the bases of Throughput, Packet Delivery ratio, Energy consumption and Drop. The results obtained from proposed work are discussed below.

4. Results and Discussion

We implemented proposed scheme using network simulator with fixed grid area for simulation. The results are discussed below.

A. Packet Delivery Ratio

Packet Delivery Ratio is always used to decide the performance of the network and its processes so we have considered the experimentation with packet delivery ratio with our proposed scheme. Figure 3, showing the packet delivery ratio analysis for proposed work.
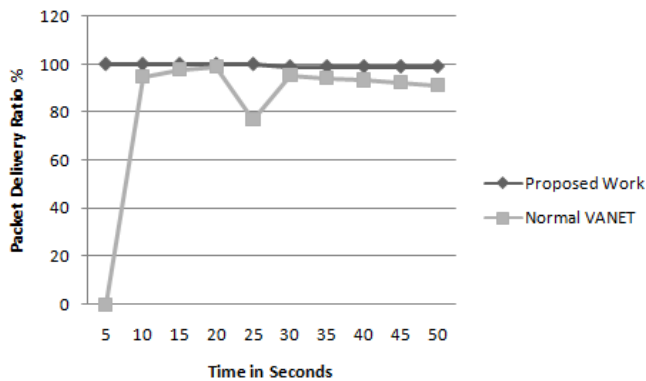
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Figure 3: Comparison of optimized VANET network and existing geo-cast -GPSR in term of Packet Delivery Ratio

In proposed scenario, our proposed work shown higher packet delivery ratio than the already existing geo-cast based communication scheme. Our PDR value retain the steady phase for almost complete simulation as compared to existing scheme which shown glitters in PDR value and shown lower values in simulation before attaining steady phase.

B. TCP Throughput

Throughput of network is very essential when we carried different processes in judging the behavior and productivity of the network. Figure 4, showing the throughput analysis for proposed work. Comparison for the proposed work is done with existing geo-cast based mechanism in vehicular ad-hoc network is shown. The comparison shows that throughput of proposed solution is more than the already existing geo-cast processes.
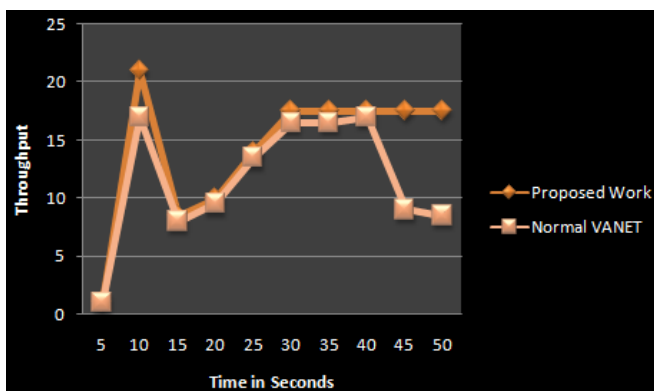

Figure 4: Comparison of optimized VANET network and existing geo-cast -GPSR in term of throughput

Throughput shown in proposed work is higher than shown in previous techniques due to less overhead in network. So this is clear from figure 4, that throughput for proposed work is much higher as compared to already existing geo-cast protocol. There is 19% improvement in throughput in proposed work as compared to geo-cast protocol.

C. Energy Consumption

In this research, we have considered controlled message sending process by managing information of the data as backup and also doing multicast for information passing to the other vehicles so energy consumption of our proposed

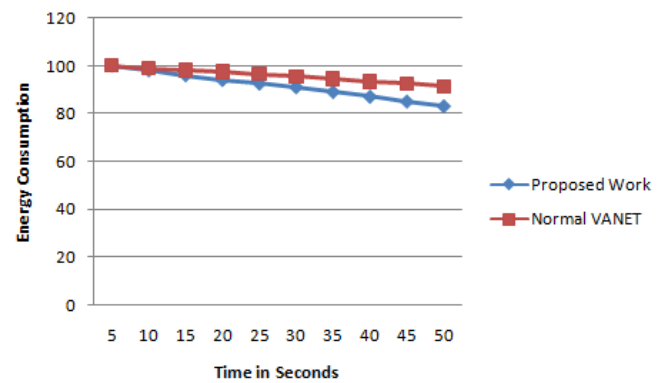work is slightly more than already existing geocast network.

Figure 5: Comparison of optimized VANET and existing GEOCAST-GPSR in term of energy consumption

Energy consumption shown in proposed work is very more than shown in previous techniques due to header management in alternative route selection concept in vehicular ad-hoc network.

D. Packet Drop

In this research, we have considered packet drop for testing the efficient message transmission of data. Figure 6 showing the drop comparison.
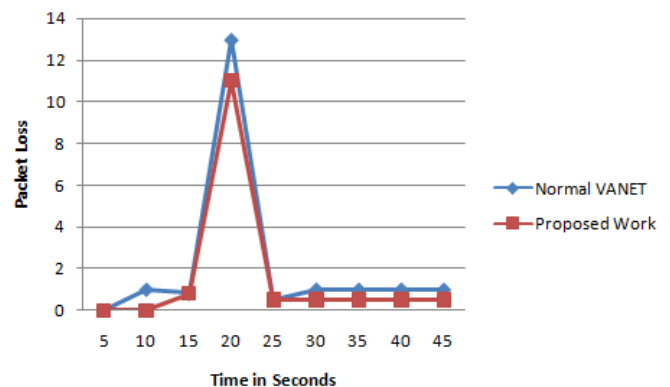

Figure 6: Comparison of optimized VANET and existing GEOCAST-GPSR in term of packet drop

Packet drop in proposed work is less than the existing scheme.

5. Conclusion

Our research focused on the reduction of overhead by maintaining the reliability by introducing information of data in message header. In case of any drop of data, bit information is used to create the traces for data and complete the duplicity of data. This mechanism has avoided big overhead which is introduced due to complete duplicate copy of data with each vehicular node agent so to decrease the congestion.

The simulation scenario shows the impact of increasing congestion and message transmission on the optimized performance of vehicle communication. Proposed scheme shows the throughput with the various numbers of mobile

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nodes. The aggregate throughput of the propose scheme is increased around 19% more as compared to normal communication. However, the aggregate PDR slightly higher than expectations when the message transmission is done.

The proposed scheme provided 19% more throughput, 6% more packet delivery, 10% less drop when compared to already existing techniques. This research is very useful in providing seamless communication in vehicular ad-hoc networks. The solution for congestion in communication without increasing overhead and latency with successful communication in vehicles has been solved by proposed work.

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