Reliable Location Aware Navigation in VANET

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***Abstract*-Vehicular Ad-hoc network is a promising technology which draws the attention of various researchers nowadays. Each participating vehicle in a network acts as node and establishes a communication link for location information exchange. It is important to position the vehicles in the VANET environment in order to improve the road safety and to provide comfort driving. Since VANET is dependent on localization system like GPS it is a challenging task to define a reliable routing algorithm due to its changing network topology and mobility of nodes. This paper aims to ensure reliable location service by incorporating hybrid mechanism. Based on trajectories routing decision is made and hence we obtain improved QOS in vehicular ad-hoc network.**

Keywords: GPS,VANET,Localization,Cluster.

I. INTRODUCTION

The Global Positioning System (GPS) was devised by US Department of Defense and organized based on NAVSTAR satellite constellation orbiting in six planes [1].GPS system is made up of 24 satellites revolving around the earth at an altitude of about 20200km which transmits radio signals that is being received by the GPS receiver installed in the vehicles.GPS is a navigation system that locates the vehicles anywhere in the earth and at anytime.GPS system uses at least four satellites to provide location data to the GPS receiver. With the signals received the exact point at which the vehicle lies is estimated based on triangulation. There are several potential problems in GPS systems which have lead researchers to find out alternative approaches for positioning the vehicles. The difficulties in GPS systems include signal blockage by obstacles like tall buildings, rocks, dense foliage etc. This causes unavailability of signals inside tunnels or on multi floor bridges, underground parking and forest areas resulting in safety issue. Other defect encompasses localization error in GPS receivers. Since not all the vehicles contains GPS device and also vehicles with GPS device may not always receive signals from satellites, in such situations vehicles self-organize themselves into a network of vehicles and provide location information. In VANET vehicles are considered as wireless nodes. Vehicles in the range of some 250m to 300m form a wireless network and exchange information to nearby vehicles or vehicles in the network [2].VANET offers two possible means of communication namely Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I). To setup VANET sensors and Onboard Units (OBU) must be installed in the vehicles which collects information and reveal it to the drivers[3]. The Onboard Units comprises of processor, Memory, GPS unit, Transreciever, antenna, and communication modules. VANET employs Dedicated Short range communication to establish secure link among vehicles[4]. These communication links permit data transfer for different VANET applications and provides service reliability. Vehicles may even travel in areas where GPS signals are not accessible. So it is necessary to locate the vehicle in the absence of GPS data. [5]To serve the purpose several localization techniques have been emerged.

II. RELATED WORK

Many researchers have propounded GPS as an efficient technique for localization in VANET. Since GPS positioning is not always accurate a new tactic named Cooperative Positioning [6] was introduced. With the estimated distance from its neighbors each node precisely measures its own position based on the transmission range. In [7] a hybrid approach using GPS and RFID is incorporated to compute accurate position. With a single peer localization scheme location of node is estimated when GPS signal becomes temporarily unavailable. In comparison with other routing protocols an Edge Node Based Greedy Routing approach was proposed to ensure success rate in packet delivery. Eun-Kyu Lee introduced an RFID assisted localization scheme [8] to improve GPS location estimate accuracy. RF-GPS provides location accuracy by considering reference node for broadcasting GPS error to nearby vehicle to correct their position based on received data from road side units. The EBGR [9] algorithm selects an edge node within broadcast range to forward packets by gathering neighbor node details and their direction with respect to destination node.

The problems of existing broadcast routing are resolved by Optimal broadcast algorithm viz, ODAM-C. Broadcast storm and link interference problems [10] are tackled efficiently by incrementing redundant links to ensure increased packet delivery rate. A new decentralized method had been proposed to reduce location inaccuracy by adopting a Bayesian approach [11].The position measurement is obtained by merging together the information of its own position with the inter-vehicular distance found in the cluster. To prove the efficiency of this approach Kalman Filter is used and more accurate position measurements are achieved. Tan Yan proposed a grid based scheme [12] where when vehicles are directing towards target through GPS, at the same time the GPS looses their signal due to entry of vehicles in tunnel or somewhere else it is assumed that vehicles equipped with a wireless card self-organize into a Vehicular Ad Hoc Network and communicate with each other for location information. A multiagent system approach [13][14] was proposed to maintain route stability. The agent chooses the best cluster and optimizes the communication between nodes.

III. PROPOSED ALGORITHM

We propose a new hybrid clustering approach where two parameters like speed and direction of vehicles are considered for cluster head selection. Assume that there are 'n' numbers of vehicles moving with various speeds 'v' and direction'd'. Initially all vehicles updates its position and speed at certain time interval. Then it shares the information to its neighbors by Hello message. The Hello packet contains node ID, velocity, status and neighbors information. Vehicles moving in same direction and within same transmission range form a cluster. After cluster formation vehicles elect a Cluster Head for data forwarding. In route discovery source will generate RREQ and destination will generate RREP when receiving the RREQ from source. Here always nodes will depend on Cluster Head for either data transmission or reception. In Clustering mechanism the CH is responsible for reducing the hop distance by forwarding the data to destination vehicle through CH instead of forwarding it through each member node in the cluster. It takes place when the destination is within the same cluster. If destination is in different cluster CH from each cluster communicate through a inter cluster communication and establishes a path from source to destination.

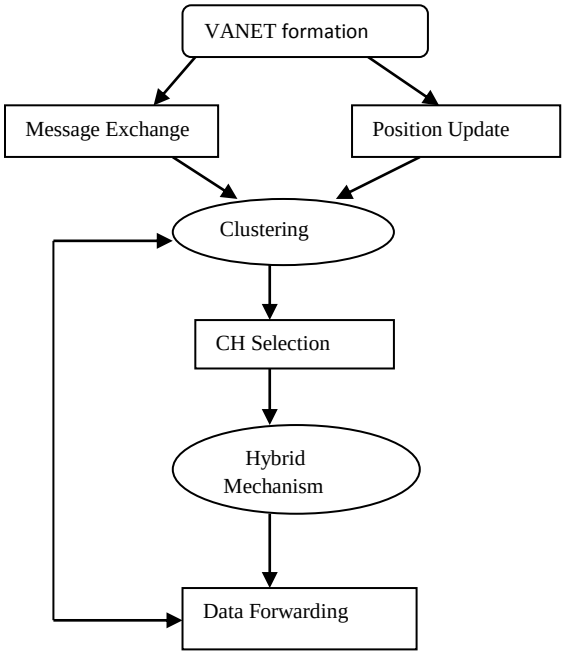

Fig: Proposed Solution flowchart

We also introduce a hybrid trajectory based routing where each node estimate the delivery delay to AP based on the trajectory. The trajectory data is collected from all the vehicles and stored in the CH. Based on this it predicts the future position of nodes. Finally the source node takes decision regarding which route has less delay and forward the data on the predicted route. Since each node
along the path checks the packets arrived it ensures no packet loss or link failure.

IV SIMULATION MODEL

The proposed scheme has been simulated in ns2
simulator. We assume *n* number of vehicles moving in a lane with varying speed and direction. Communication range between each vehicle is considered to be V_R. Following are the various scenarios that are simulated for reliable location service.

Scenario 1: VANET Formation

We assume that each vehicle self-organize into a vehicular ad hoc network where each vehicle contains a wireless card by which they communicate with neighboring vehicle. Through the periodic exchange of beacon packets vehicles identifies its nearest neighbor vehicles. To obtain the location information vehicle broadcasts request *Req_msg* to neighboring vehicles and sets a timer t_i.
If a vehicle is aware of its location its send response *Res_msg* back to requested vehicles. If the response is not reached within timeout a new *Req-msg* will be initiated.

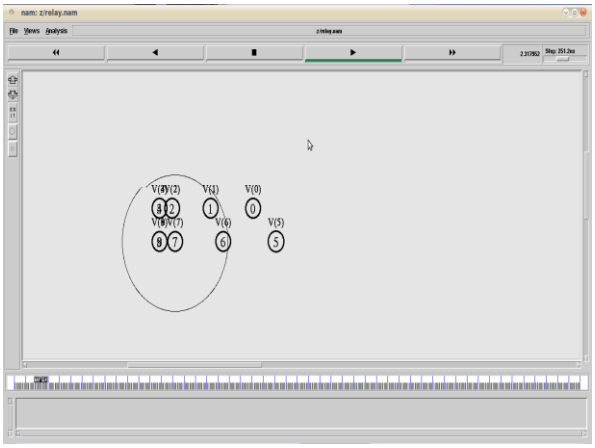

Fig 2: VANET formation

Scenario 2: Cluster Formation

Vehicles moving in same direction and with constant speed form a cluster. The cluster size is determined based on the Cluster Head transmission range. Vehicles compute the average speed of neighboring vehicles and check the vehicles that moves as close to average speed and make it as Cluster Head. The CH sends CH_Packet which contains Pkt_ID, Src_ID, Destin_ID and CH_ID to all the cluster members. If new vehicle joins again the cluster is reformed.

Scenario 3: Route Discovery

Route discovery is initiated based on demand. The source vehicle checks if the route to destination is available by broadcasting route request packet.

Initiate Route_Req_Pkt
If route= not exist within t_i
Check neighbor_table
Forward Route_Req_pkt
End if

If nearest neighbor is identified the Route_Req_Pkt will be forwarded to that vehicle. If no nearest neighbor is found the request will be broadcasted to all vehicles. The Route Reply will be send 1) if the Route_Req_pkt is the first one to be send from the requested source vehicle. 2) If the vehicle received the Route_Req_Pkt is itself the destination. If it is a intermediate vehicle it forwards the request to nearest neighbor vehicle and updates its routing table. It is repeated until the route is discovered.

If the destination is within the same cluster proactive routing is incorporated where the route packets are updated periodically. If destination is in different cluster reactive routing is incorporated and updates the routes whenever necessary. If there is a breakage in link to destination the route will be locally repaired by the intermediate vehicle and packet drop can be reduced. Then the route with minimum hop is chosen by the CH to forward the data to destination vehicle. If it is not possible to repair the route error packet will be send to the source vehicle which initiated the request. Thus the end-to-end delay can be avoided and data transfer rate increases thereby reliable location service is achieved.

V. CONCLUSION AND FUTURE WORK

In this paper clustering and hybrid routing are adopted for data transmission. The prime factor considered in identifying the cluster member is the average speed difference. Here we have analyzed the localization techniques that benefit the location determination of vehicles and the effect of node mobility on packet delivery and considers the improvements brought about in reliability. Further we have planned to analyze and control the overheads in vehicles with varying mobility values.

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