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MultPath Routing Algorithm for Multi-Constrained QoS Routing in MANETs

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ABSTRACT

Vehicular ad hoc networks (VANETs) is an emerging technology which has received lot of attention due to its potential to improve vehicle and road safety, traffic control, efficiency as well as convenience for users. VANET is a sub category of mobile ad hoc network (MANET). A lot of research in VANET is done on routing, broadcasting, Quality of Security (QoS) and security. This paper proposes a novel path planning algorithm for efficient routing. The proposed system will traditionally distribute the work load over alternate paths in order avoid congestion and reduce travel cost. It will also ensures reliable routing with less bandwidth requirement and high packet delivery ratio as it avoids packet loss. VANET may be affected by attacks on routing leading to altering messages and routes which will affect QoS parameters. The proposed algorithm will deal with providing security measures over the routing process. Therefore we obtain routing algorithm subject to multiple QoS constrains for secure VANET communication.

Keywords : Vehicular ad hoc network, Path planning algorithm, Multi-constrained, Reliable routing

I. INTRODUCTION

Vehicular Ad Hoc Networks (VANETs) are a form of wireless network made by vehicles acting as nodes in the network which communicate among themselves and with road side base stations or the road side units (RSU). A wide range of services have been developed for VANETs ranging from safety to information applications. Also, Intelligent Transportation System (ITS) provide fast and safe traffic system, so the interest in wireless communication studies and VANET commercializing VANET is growing. A primary requirement for such services is that they are offered with Quality of Service (QoS) guarantees in terms of service reliability and availability. Furthermore, due to openness of VANET's wireless channels to both internal and external attacks, the application of security mechanism is mandatory to protect the offered QoS guarantees.

The proposed algorithm will help vehicles to bypass congestion and balance traffic evenly in the whole network. The algorithm set its main objective at providing alternate paths for vehicles to avoid congestion or accident and ensure secure and reliable routing satisfying multiple QoS constrained. Maintaining alternate paths to move to destination will also reduce the need for bandwidth as the traffic will be distributed. Previously some work has been done on VANETs which considered multi vehicle path planning which had some disadvantages such as it did not deal with average travel cost and drivers preference. The ACO rule tries to find optimal path to destination where other ants would follow the path of leading ant. In this case congestion avoidance was not taken into account. Whereas in our proposed method we will design a new system that will ensure global path planning algorithm which will fully utilize the network resources so that the average total cost of vehicles are considerably reduced and will avoid traffic congestion. As VANETs are highly dynamic in nature it may subject to internal and external adversaries raise important technical challenges in terms of reliable, reduces cost and secure routing. There is a possibility that messages between vehicle to vehicle (V2V)

or vehicle to road side units communication about safe driving can be manipulated which may lead to accidents. There are different security mechanisms such as digital signatures, hash chains, plausibility checks, etc. could be applied together to protect the routing control messages (RCM). In order to prevent the network from such attacks the algorithm implies strong privacy preservation by making use of asymmetric key cryptography and hash function. This will lead to a secure communication over a reliable and efficient route.

In this paper we survey routing method [1], [4] to achieve an reliable and secure routing in vehicular ad hoc networks. In Section 2 we have done literature survey of related work to solve the problem of routing and security in VANETs. In the third section we discuss our proposed system algorithm and it's description. Finally, in Section 4 we present a general conclusion of proposed model.

II. LITERATURE SURVEY

This section consist of survey of different papers related to routing algorithm and security in VANETs. As per our studies there is no previous research done on providing secure routing using path planning in VANETs. Both these aspects are implemented individually.

In paper [1] the author has proposed Secure Ant Colony Optimization based Multi-Constrained QoS aware routing algorithm (S-AMCQ) to compute feasible routes in VANETs subject to multiple QoS constraints determined by the data traffic type. This routing algorithm considers the class of applications having only a single destination, i.e., unicast routing. Further, the VANET-oriented evolving graph (VoEG) model is implemented to perform plausibility checks on the routing control messages exchanged among vehicles. Different types of routing algorithm have been proposed for VANET's. In paper [2] the author has proposed moving-zone based architecture in which vehicles collaborate with one another to form dynamic moving zones so as to facilitate information dissemination. It introduces moving object modeling and indexing techniques from the theory of large moving object databases into the design of VANET routing protocols. In [3] author surveys and discusses different metaheuristics applied to solve the routing problem within VANET. Furthermore, technical challenges and future trends are treated and presented. Routing algorithms such as Particle Swarm Optimization (PSO), Genetic Algorithm (GA) and Ant Colony Optimization are discussed in detail. It provides a comprehensive survey on the main uses of these methods with the challenges faced by VANET. In [4] this paper establish a hybrid intelligent transportation system (ITS), i.e., a hybrid-VANET-enhanced ITS, which utilizes both vehicular ad hoc networks (VANETs) and cellular systems of the public transportation system to enable real-time communications among vehicles, roadside units (RSUs), and a vehicle-traffic server in an efficient way. Then, author propose a real-time path-planning algorithm, which not only improves the overall spatial utilization of a road network but reduces average vehicle travel cost for avoiding vehicles from getting stuck in congestion as well. A stochastic Lyapunov optimization technique is exploited to address the globally optimal path-planning problem. Finally, the transmission delay of the hybrid-VANET-enhanced ITS is evaluated in VISSIM to show the timeliness of the proposed communication framework. In [5] the author has proposed a system employing the situational awareness (SA) concept and an ant colony system (ACS)-based algorithm to develop a situation-aware multi-constrained QoS (SAMQ) routing algorithm for VANETs. SAMQ aims to compute feasible routes between the communicating vehicles subject to multiple QoS constraints and pick the best computed route, if such a route exists. In [6] the author has proposed a shortest path algorithm using bidirectional search, whose complexity is deduced to be ,where and represent the number of nodes and links in the network, respectively. Then it shows that bidirectional search can significantly accelerate the convergence of several existing QoS routing algorithms. Finally a novel cost-effective bidirectional multi-constrained routing algorithm, which can greatly alleviate the forwarding state scalability issue by supporting stateless QoS routing in IP networks via IP tunneling or constraints-based alternate routing in MPLS networks via label stacks. In [7] the author has proposed a novel bi-velocity discrete particle swarm optimization (BVDPSO) approach and extends its application to the nondeterministic polynomial (NP) complete multicast routing problem (MRP). First, a novel bi- velocity strategy is developed to represent the possibilities of each dimension being 1 and 0, where 1 stands for a node being selected to construct the multicast tree, whereas 0 stands for being otherwise. Second, BVDPSO updates the velocity and position according to the learning mechanism of the original PSO in the continuous domain. In [8] This paper proposes an AODV-based routing algorithm for VANETs. This routing algorithm uses a routing metric, which includes the length of each hop as well as the link remaining lifetime. In [9] the author has provided detailed

categorization of various routing techniques and discussion on each categorization with respect to its advantages, disadvantages, various constrains and its applications. The above survey concludes with all of the routing algorithms studied for VANET's.

After routing of VANET it is important to secure the routing control messages in order to ensure secure VANET traffic flow. The following papers deal with providing secure communication in VANETs. In [10] the author proposes RBEM/CBEM handshake mechanism to enhance the broadcast protocol, which is dedicated to the emergency message broadcast in urban road environment. The reliability of emergency message dissemination can be improved by reducing the packet delivery failures caused by the collisions. In [11] author has proposed optimal resource allocation problem, at the base stations is to select optimal receiver vehicles to establish D2D links and assign proper channels for them, in order to minimize the total delay. The problem is equivalent to a maximum weighted independent set problem with dependent weights (MWIS-DW) which is NP-hard. To calculate the weights, an analytical approach is developed to model the expected end-to-end delay. Further a greedy based algorithm is proposed to solve this problem and develop a theoretical performance lower-bound for the algorithm. In [12] the author has proposed a new TDMA protocol called PTMAC based on a novel way of predicting encounter collisions and effectively reducing the number of collisions. This work [13] proposes a provenance-based trust framework, namely PROVEST (PROVEnance-baSed Trust model) that aims to achieve accurate peer-to-peer trust assessment and maximize the delivery of correct messages received by destination nodes while minimizing message delay and communication cost under resource-constrained network environments. In [14] this paper, author proposes a new mechanism to maintain QoS for data dissemination among the different vehicles in VANETs. An intelligent forwarding mechanism is used by newly defined metric which assigns weights to the different routing paths from source to destination. Separate algorithms are designed for route construction, and maintenance in the proposed scheme. In [15] the author proposes an efficient decentralized public key infrastructure using the concept of Bayesian coalition game. Finally, in [16] the author has proposed a DOVE scheme inspired by processor scheduling treating roads as processors to optimize the workload assignment and improve the efficiency of on-road dissemination.

III. PROPOSED WORK

- Providing alternate paths
- Avoid congestion
- Minimize end to end delay
- High packet delivery ratio
- Reliability
- Secure routing
- Improved performance

The aim of this survey is to investigate how routing techniques can be utilised to facilitate multi-constrained QoS in VANETs as well as to avoid security threats to the routing process. For that purpose, we employ the Path Planning Algorithm technique to develop our Path Planning based multi-constrained QoS (PPMCQ) routing algorithm. The following discussion briefly describes the proposed algorithm.

1. Path Planning based Multi-Constrained QoS Routing **Algorithm (PPCQ):**

In our proposed system we have chosen path-planning algorithm for routing in VANET. This algorithm is used to avoid congestion in urban areas which will help in providing reliable routing services. It is an efficient traffic management tool which improves utilization of road network and tries to reduces average vehicle travel cost for avoiding vehicles from getting stuck in congestion. While driving it is drivers choice to select route to move to his destination. Thus it becomes difficult to develop an algorithm for path planning. The path planning algorithm will provide alternate paths for same destination so that the traffic is distributed over the network and driver can choose one of the optimal path to move to its destination. With the help of ITS it is possible to have communication between vehicles and road side units. The overall spatial utilization of road in VANETs is improved by avoiding congestion. Once the congestion is avoided we can easily achieve QoS constrains such as minimize end to end delay and maximize packet delivery ration which will lead to reliable routing in VANETs.

IV. METHODOLOGY

Secure Routing Process:

In VANETs the communication in network takes place between vehicle to vehicle or vehicle to road side units. The communication needed for transferring routing

control messages. Even though we design a good routing algorithm we also need to protect this routing information to ensure secure and reliable routing. Thus, messages need to be protected from attacks which may take place in VANETs. The attacks may lead to altering of message details which will change the routing details and may put the network in congestion. To avoid such kind of adversaries in network we need to provide security to the routing process. For implementing security in VANETs the following parameters need to be considered: Authentication of message, Availability of message, Non-repudiation of message, privacy of message and verification of data. To achieve this objective we will implement public key cryptography. In our scenario to secure the routing control messages and converting it into unreadable format we will make use of Elliptic Curve Cryptography (ECC) algorithm and Elliptic Curve Deffie Hellman (ECDF) algorithm. It will generate public and private key for vehicles from Certificate Authority (CA). The CA can be a local transportation authority or the vehicle manufacturer. This will ensure secure routing message transfer in VANETs.

V. CONCLUSION

In this study we have summarized the survey on path planning algorithm to propose path planning based multi- constrained QoS routing in VANETs. Path planning algorithm is implemented in urban road scenario where it helps in providing alternate paths for destination avoiding congestion in VANETs. The proposed algorithm will ensure reliable routing by satisfying multiple QoS constrains such as minimize delay, increase delivery ratio and avoiding traffic jams. The routing process is secured by applying cryptographic operations on the routing control messages. Therefore our proposed algorithm will ensure secure and reliable routing in VANETs.

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