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Review of Routing Algorithms in VANET Systems

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***Abstract*—**Vehicular Ad hoc Network (VANET) is another category of a Mobile Ad hoc Network having a some advancement mechanism with objective to create an Transport System Intelligent. The routing in VANET has attracted many attentions during the last few years. Highly mobility of vehicles, irregular communication between the vehicles and the necessities of real time applications are some of the major challenges of multi-hop message delivery in VANETs. Because of the frequent changing topology of VANET it becomes difficult to route the packets effectively. In this research, we are focusing on the routing concept for the VANET i.e. principles for routing, decomposition of the routing function and requirement for Forwarding protocols unicast (Geographic based, Trajectory based and Link Stability based) and Probabilistic (Distance based) routing protocols in VANETs, To analyse the performance of the most suitable routing protocols and to determine the best efficient protocol for VANET environment.

Keywords—VANET, MANET, UNICAST, ROUTING

1. Introduction

Peoples are using the all category of vehicles very frequently nowadays. This results a problem which is related to the number of deaths from road accidents has increased with increasing use of private transport. Data transfer in the VANET is done through wireless communication using Institute of Electrical and Electronics Engineers 802.11p standard. Two models for communication: Vehicle to Vehicle (V2V); that communicate with other vehicles directly or to connect to Road Side Unit (RSU) equipment, referred as Vehicle to Infrastructure (V2I) [1]. Communication models allow sharing different types of information between vehicles, i.e. information of safety application for preventing accidents, and investigation after an accident or traffic deviation. Other types of information is non-safety application such as passenger information, Purpose of sharing information is to offer a safety message to inform drivers of risks predictable in order to avoids accidents and save life, or to offer enjoyable trips [2]. Moving vehicles at different speeds; thus generating a variable topology since the vehicles are moving out of a network and new vehicles joined to the network. It becomes hard to routing the packets successfully. In this research paper, the study the unicast and Probabilistic protocols used for routing in VANET.

2. Need of VANET

a. Overtaking vehicle: The risk of third-party exposure to prevent collisions between vehicles in a bypass mode, where a single vehicle, for example a vehicle I ready to overtake a vehicle III, whereas additional, vehicle II already achieve passing operation on vehicle III. Crash between 1 and 2 is prohibited when 2 notifies 1 to stay its passing process.

b. Driving on Wrong way: A car found to be driving in the wrong way, for example, a prohibited address, denotes to this state to other vehicles and RSUs.
c. Intersection accident: The risk of vehicle collisions that came to intersections is sensed through vehicles or through RSUs. To avoid the risk of collisions.
d. Traffic condition: Any rapid transit development detected by vehicles, and learns others vehicles and RSUs about state.
e. These applications concentrate on improving traffic flow for the vehicles, speed management and offer maps update. Some models of applications are in [3].
f. Collaboration navigation: This type used to increase efficiency of traffic by managing vehicles steering over the support between V2V and RSUs. Information of traffic and recommended route, are two example of this type[4].
g. *Globally Cooperative services*: It concentrate on information obtained from global services such as Internet, which include financial facilities, parking management, which concentration on data updates [5-7].

3. Routing Protocols in VANET

Multi_hop between source and destination connection can implemented in all models, V2I, V2V or hybrid. Message forwarded using multiple intermediary vehicles as relay nodes. Solutions of forwarding are Divide into two classes.

A. Unicast Route Forwarding: The developed protocols for unicast communication could grouping into three sub groups: trajectory based, geographic based and link stability based, as see in Table I.

1. *Trajectory based* Forwarding (TBF): is a novel group of source routing and position forwarding for VANETs. The route is selected from source to destination. Different from traditional routing algorithms, decisions in this algorithm constructed on the association to route rather ID of in-between vehicles. It's basically separate actual path naming from path. TBF context may use for all services kind (unicast, multicast and broadcast). The next hop (relay) is selected centered on space between trajectory and candidates. However, TBF use flooding method to discover trajectories, but with extra overhead. The overhead issue is treated by Trajectory-based detection (TBD) (low density road) [8]. It uses a local delay ideal to calculate the delayed delivery of probable data from distinct vehicles to the access point. Shortest predictable data transfer delay is chosen as subsequent relay. It is not a source directing tool, Unlike TBF, its assumed there is no path existing among source to destination. Its permits in-between vehicles to create decisions based on neighbor information and trajectory. Estimated delay from forwarding possibility and contact possibility in intersections. Information of Path acquired, trajectories protocols are well-found with Global Positioning System (GPS) system and digital maps.
2. *Based on Geography :*Algorithms of this class at most inspired from Greedy Perimeter Stateless Routing (GPSR) [17]. Forward Decisions are occupied fundamentally by using vehicle's information of neighbor's location. Since of high mobility of cars in VANETs, so these algorithms are highly required, then all cars sustains only local information, these methods can work with networks has a large number of cars. These cars were supposed to be well-found with

a GPS system to regulate location so that they can locate it without sustaining any expenses. All neighbors are grouped and their positions is revealed using periodic message swapped between neighboring nodes. Then, all redirects subsequent a greedy way, where any neighbor neighboring to destination is identified as the next route. Because nodes don't have comprehensive knowledge of topology, decisions to forwarding are frequently ideal locally and might not ideal globally. Therefore, these algorithms often encounter situations in which node doesn't find forward node, e.g., due to disconnection or dead ends. Solution to this problem of local optimum, GPSR method are suggested, perimeter forwarding algorithm. This answer is not appropriate in urban situations where there are multiple crossings and lanes. Numerous protocols for geographic routing resolve this difficulties by engaging a new path recovery mechanism. Like gravitational cluster routing (GCR) , GPSR [9], Greedy Perimeter Stateless Routing junction (GPSRJ+) . Global State Routing (GSR) [10] solve problems involved in city environments. It specifically aims this problems: loopy paths, network interruption because of radio difficulties and numerous hops. Current position in GSR are discovered for the desired partner communication using a reactive service, the nodes queries floods a network with position request packet for node identifier. When an identifier receives a request, reply sends of position. Node can compute shortest path by (Dijkstra algorithm) to the destination node by using Map Street. Opposite path covers arrangement of intersections that packets can range to destination.The vehicles forwarding information to neighbor's nodes instead of junction nodes. It significantly decreases packet load nearby intersections. However, this key needs extra info conversation between neighbors and junction nodes. The protocols discussed do not deal with sparse network. Low density of vehicles in these networks results interruptions in communication and fail in routing, store and forward procedure functionality is usually used to solve this problem. Packets are kept temporarily in moving vehicles while waiting to the chance for forwarding it . Store and forward procedure have also useful in urban environment where diverse streets have various densities. In [11], vehicle-assisted data delivery (VADD) protocol is solve the problem by routed packets through sections with high densities. However, such this paths may not be best delay. Since all cars trying to outing packet through high density street, channel utility may increase via these streets, so the packets might be dropped or significant delay occurs. The VADD protocol uses delay estimation model to determine minimum path delay. However, a model rely on pre-loaded map and statistics of traffic such a speed of vehicle and density of vehicles at different times. In [12], D-MinCost and D-Greedy protocols employment store and forward procedure for routing packets in urban network. Dissimilar VADD, the protocol objective are offer restricted transmission delay although reducing utilization of bandwidth. D-MinCost protocol needs information of universal traffic situations whereas D-Greedy protocol does not need information. In D-Greedy protocol, a sending node using geographic place of the destination to estimate the distance of shortest path. These selected paths assigned a delay budget that is relative to distance of each road sections. Nodes doesn't have any global information, D-Greedy protocol adopts delay budget can regularly spread amongst crossings that are sharing of shortest path. Individually, relay nodes making a decision centered on residual delay budget. And allowable to convey the packets to the next junction as lengthy as the time takes to reach the connection within assigned budget.

3. *Based on Link Stability:*Reactive and Proactive routing protocols are Topology based, which are widespread in MANET and can be implemented in VANET. But, dominant problem in VANET is that overhead experienced into path preservation and in path detection, it can be excessive due to high dynamically rate. These methods are mostly used in small scale networks and highway environments where small number of hops between sender and receiver. In order to reduce path recovery overhead and increase link stability. Mobility information can also be used to predict the continuity of a particular path and to open a new before breaking links. Movement Prediction based Routing (MOPR) protocol . Aims to expand reactive routing method by taking advantage of vehicle information such as speed, direction and location. Lifetime is estimated by predicting the upcoming location of vehicle engaged in correlation based on current location. Thus, sender node can estimate transmission time and select maximum stable path. Through discovery procedure, MOPR protocol searches specifically for in-between nodes that have related direction and speed for both sender node and destination node. Information (speed, position, street information, direction). That includes route table of all adjacent cars maintained over protocol. The table recycled during process of searching for best stability paths, analogous procedures implementing in proactive guidance . In [13], Velocity Heading based Routing Protocol (VHRP). Headings are used to expect road failure before really occurring. According to their speed vectors, vehicles are grouped. Routes involving compounds of the same group show a high stability.VHRP is especially appropriate for proactive (for example, Destination-Sequenced Distance-Vector protocol (DSDVP) and can increase the performance for car to car throughput. That includes route table of entirely neighbored vehicles preserved through MOPR. This table used during process of looking for stable pathways on the best constancy, implementing related techniques in positive guidance . Vehicle headings were used to forecast road failure before actual occurrence. Here, according to their speed vectors, vehicles are grouped. Routes involving compounds of the same group show a great level of constancy. When a car moves to another group, it is likely that the routes involving that vehicle will be disrupted. To avoid problem, VHRP protocol sends an update message to the route periodically and maintains the vehicle groups and routing table. So VHRP is especially suitable for proactive protocols and can improve performance for end to end throughput.

B. Broadcast Routing

In forwarding process, the safety applications are the main significant applications for VANETs. The information of such applications, (e.g., detour route, accident alert and construction warning) have to be transferred and received by all neighbored vehicles, for this reason the broadcast protocol used for forwarding. Classical techniques such as flooding experienced a clear problem called broadcast storm that occurred where huge quantity of bandwidth is used by spare no of retransmissions. When nodes density is high, it results to a high contention channel overhead and large no of collisions. Most researches in broadcast that used forwarding algorithms propose new philosophies to mitigate such problem. Many studies that discussed the solutions, used to adjust packet load by controlling the rate of generating packets, see e.g., [14-15], multiple techniques were suggested to account the issue of broadcast storm in (MANETs): probabilistic, distance based, cluster based, location based and counter based. The outcomes of

the simulation showed that an implementation of counter based technique could avoid no of redundant messages in high-density networks.

C. *Based on Probability*

In [28] and [35], probabilistic techniques were recommended in solving broadcast storm problem in VANETs, and they are: slotted one persistence, slotted p-persistence schemes and weighted p-persistence. Timer based retransmission and probabilistic based combined together considered as the main suppression technique of these algorithms. In weighted p-persistence method, automobiles are repeating broadcasting of packages depending on the probability p. Thus, the top high value is allocated to the farthest nodes. Within one time slot the Slotted p-persistence plus slotted 1-persistence keys are correlated to the probabilities of rebroadcasting in a package. However avoiding messages from dying out, vehicles should store message for a certain time then transmitting it if nothing in neighborhood re-broadcasted. These methods were used and planned in the network layer to minimize the packets number that directed from network layer toward data link layer. An improvement regarding the 1-persistence solution. This enhancement was the (micro Slotted 1-Persistence Flooding). In this technique, the time slot that is in the solution is a bunch of micro slots. It intend to show in one 1-persistence time slot, the furthest node can rebroadcast. Solution provides a high priority of retransmission to furthest node inside the coverage area associated with single 1-persistence slot.

1. *Based on Distance:*This forwarding protocol procedure is: Vehicles regulate the waiting time contrariwise proportionate to the distance from the source. Though, the motor cars with similar distance can still compete for identical channel at the same time. The research [16] Time reservation based relay selection (TRRS) algorithm afforded shortest end – to – end delay regardless node density. In this algorithm, all nodes in the connection domain of the migration node select the waiting time randomly during a specified time window. Time window variety is usually determined by rang from a previous migrated node plus the time window reservation ratio. Selected node that has a short wait time considered as a new convey node. To prevent the repetitions of radio messages receptions, TRRS blocks node that gets multiple radio messages from the previous convey node to function as the next convey node. In addition, urban multi-hop protocol for inter-vehicle communication system, processed guiding forwarding method, which eliminates frequency of broadcasting once the remote vehicle is allowed from the transmitter to re-broadcast the packet. It locates the furthest nodes by using a black burst "channel jamming signal" contention method . Universal Measurement Bus (UMB) protocol use 802.11 based request to request to send/ clear to send (RTS/CTS) handshake to evade problem of hidden terminal by dividing the highway into sections. To deal with line-of-sight problem, UMB protocol used repeaters in joints to retransmit the messages. Ad hoc Multi-hop Broadcast (AMB) [17] an extended protocol of UMB, in order to deal intersection situations more efficiently. It differs from UMB, the AMB protocol, picked out vehicles that crossed through intersections to deploy packets in different directions.In [18], Multi Hop Vehicular Broadcast (MHVB) approach was defined. By using MHVB the information regarding the application of traffic safety would be efficiently broadcasted, like (speeds and positions). This method includes two features: first one is a detection algorithm that cares for traffic congestion to prevent extreme beacons due to traffic jamming. Second one is: backfire algorithm that retransfer the packets over network. The algorithm discovers whether the motor cars are in the mid of a traffic jamming, by count how

many nodes presented around the detected node. After that adjusting the conveying period consequently. Backfire algorithm: on another side forwarding the packet is coming over network by selecting subsequent hop depending on the distance from the original node. Before rebroadcasting, relay motor cars compute waiting period, that is contrariwise proportionally to the space from the source. The backfire area is mainly enclosed in a circular zone. MHVB protocol is improved in two places. Firstly, backfire area is improved to sectional are instead of circular by applying its angles to be an additional parameter. Via regulating the sector angle, the zone enclosed by back fire algorithm can be modified. This leads to a flexible and directional backfiring area. Secondly providing optimization through using the Scheduling algorithm which is used to distinguish between the packets that to be sent. Packets are prioritized on the basis of "processing" packets received from different vehicles. In specific, nodes that located at a space beyond 200m are made to convey the information received earlier than all other nodes in the network.

4. Conclusion

Routing is the fundamental issue of the network. So the major challenge to protocol design in VANET is to get the better Protocols reliability and to minimize a delay time and the packet retransmission. In this research, we have elaborate and surveyed on the unicast and Probabilistic routing protocols for VANET. The key challenge in designing algorithms for VANETs forwarding is to offer reliable transmission of packets with least delay, highest throughput, and little overhead of communication. Most of these algorithms target only subclass of these requirements within specific situation arrangements. Various unicast forwarding algorithms like (PROMPT, TBD and MDDV) protocols are proposed, combine adaptable trajectory based in combining with location based solutions affording facility to deal with local optimal and disconnection problems. Likewise, some studies on addressing subjects that related to broadcast transmission, a main approach of packetexchange in VANETs. Methods like "weighted p-persistence and UMB" are forcing the combination of both methods probability and distance based approaches to decrease broadcast storm problem. Future research should focus on protocols that target mixed systems to handle a multiple quality applications of service requirements.

5.Future Work

The role of vehicle network is very important technology related with many applications .There many existing probles which needs the art of improvement for many specific reasons . Forwarding algorithms: most important task of designing VANET forwarding systems was to offer dependable packet transformation by low communication overhead, smallest delay and supreme throughput. Upcoming research should emphasis on the security of the data flow over the network .Various schemes for secured, reliable, context aware and multipath routing may be implemented in the future by considering the vehicle communication for urban scenario. Software agents were employed to offer adaptable, flexible and collaborative services. An intelligent agent framework can be used to act as a 'conscious' software agent framework to

provide human-like intelligence for the computation of reliable, secured and context aware multiple paths . Implementing the solution of defined work will be the future scope of research

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