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An Implemented approach of VANET using Location Information based Technique for safe city and vehicle

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Abstract— VANET is an important technique that provides communication between vehicles over the wireless link. There are many protocol proposed for VANET that provide many type of the services to the network but they cannot provide service according to location of the vehicle for packet forwarding. This paper proposed Location information based routing technique that provide better path according to vehicle location when a vehicle meets accident on the path. This protocol broadcast the information packet in which direction that path go to the city or vehicle near by the city or control room of the city to provide quick response for the accidental vehicle. This protocol reduce flooding of the packet over the network and provide efficient path to get better and quick service required by the accidental vehicle.
Keywords— VANET, MANETs, AODV, Neighbour, HLAR, GPS

I. INTRODUCTION

These VANETs are considered as a unique wireless network due to the characteristics of the environments surrounding the vehicles and vehicles (nodes) properties. These characteristics can be described in four main aspects

A. Scenario and Network Topology

Although vehicles on streets move with different speeds, this movement is restricted by a physical map of streets, roads, avenues, highway, junctions and traffic lights. In Mobile Ad hoc Network (MANET) on the other hand, the movement of nodes is random in free space since there is no restriction on mobility [2].

B. Mobility Pattern

Vehicles are restricted by pre-determined streets. It is expected that a high density of vehicles may occur at certain points such as crossroads or tolls while sparse distribution may occur in other places.

C. Mobility Properties

In VANETs, vehicles can move at different speeds ranging from low to very high speed. For instance, two vehicles can be a neighbor at a given instant of time, and shortly, may be out of range due to their speed differences. Kim and Lee [3] stated that network disconnection problems have been noted as a crucial research.

D. Node Properties

All vehicles have to be attached with special communications devices such as Global Positioning System (GPS) to determine the location information, and other devices to provide a communication interface that allows a vehicle to communicate with each other and with roadside infrastructure.

II. ROUTING PROTOCOLS FOR VANET

Routing protocols in VANET can be categorized based on information used in forwarding into topology-based and Position-based routing [2]. This paper focuses on position routing protocol.

In a proactive routing protocol, each node maintains and updates its routing table information of a given network at all the times. Routing updates are sent periodically regardless of network status. A route to any node within the network is available whether it is required or not, since each node periodically maintains a routing table of network topology. However, this kind of protocols has two disadvantages:

- Overhead due to periodic update of routing tables.
- For distance nodes the propagation information updates might carry outdated information about routing because of rapid changes of VANET network topology.

In a reactive routing protocol, the source node initiates the path to a destination on a demand or needed basis. In order to establish a communication session with new nodes that are not having connection with, a global search procedure is employed by flooding Route Request (RREQ) message to other nodes. Once the RREQ is received by destination or intermediate nodes that have a valid route to the destination, a Route Reply (RREP) is sent back to the source of the RREQ. Then route is created between them. A common example of this category is Ad hoc On-demand Distance Vector (AODV) [4] and Dynamic Source Routing (DSR) [5].

Another approach of routing called a geographic routing protocol and it can be defined as a stateless type of routing protocol. Currently, the geographic routing protocol is gaining significant attention due to improving the service of location information. It uses location information of destination to make routing decisions. In this type of protocol, it is assumed that each vehicle is equipped with location service devices in order to know its location information. Nowadays, most cars are equipped with GPS devices, which can provide the location information easily.

Based on aforementioned bases of geographic routing protocols, several works have been proposed as a combination of these techniques. This section describes the most relevant and recent routing protocols for VANET networks. The common part of these proposed works is that: the sending node employs the location service to find the geographic position of destination.

Routing Protocols-based Link Lifetime: Greedy Perimeter Stateless Routing with lifetime (GPSR-L) [13]: proposes the concept of lifetime to GPSR in order to overcome the problem hello message in GPSR (each node maintains the knowledge of its one-hop neighbours nodes by exchange the Hello message) GPSR-L sets a lifetime timer (Lt) for each neighbour node, instead of using only hello time. Therefore, when the hello time expires, the node checks the lifetime of neighbour node, if it is expired the node assumes the neighbour node is out of the range.

Menouar et.al in [8] proposed a Movement Prediction based Routing Protocol (MOPR). MOPR is a mechanism used as Add-on to other routing protocols, in other words it is an enhancement method of existing protocols. Such as in [8] MOPR based-GPSR or Ad hoc On Demand Vector (AODV) [12]. MOPR based on GPSR selects the most stable route from source to destination based on communication life time by choosing the best links of intermediate vehicles.

Movement-Based Routing Algorithm MORA [7]: MORA is also proposed to enhance GPSR which exploits only position of neighbours' nodes to perform the routing decision. MORA employs the information about moving direction of neighbour vehicles to compute the link lifetime between two connected vehicles.

Connectivity Aware Routing (CAR) [9]: CAR is proposed mainly to solve frequent disconnections caused by rapid topology changes can be partially solved using carry-forward mechanism, which may incur higher delay, CAR selects the route based on least probability of disconnection. It developed a geographic routing protocol that works as follows, first models the probability of connectivity for each road segment and selects the road with the highest probability of connectivity based on the product of probability of all road segments along the route to forward the packets.

Connectivity-aware minimum-delay geographic routing (CMGR) for VANETs [11] is an enhanced version of CAR routing protocol, it was designed to avoid roads with high congestion (high vehicle density) in order to select the route with minimum delay. CMGR considers multi-hop routing from sending vehicle to the gateway. This work proposed multi-hop routing from the sender to Gateway (GW) station, so GW determines all junctions and attached to Route Reply RREP and

send it back to sender. Each vehicle computes vehicle density rate (ri) and attached to route discovery or RREQ, GW calculates the trip time (TTj) from generation time of the route discovery message to the received time at GW of RRWQ.

Hybrid Location-based Ad hoc Routing Protocol for VANETs (HLAR) proposed in [10]. The work addressed the problem of frequent disconnections of communication links between vehicles. Such link interruption requires fast response from routing protocols that increase the probability of increasing overhead and degradation of network scalability.

HLAR combined the features of the reactive protocol (AODV) and location based routing protocol. The work in [10] is aimed to use location information available to minimize the overhead and then switch to reactive protocol to select the full route. HLAR create route discovery on demand basis. The source node sends a RREQ including its location and destination coordinates and that RREQ is forwarded to any closer neighbour node to destination using greedy forwarding. If no closer neighbour node is available, RREQ is flooded to all neighbour vehicles. This procedure is repeated till it reaches to the destination.

Geocasting packet transmission Protocol [11] is an IEEE802.11p based vehicular network broadcasting technique could increase the contention level thus increasing information dissemination delay. We assume that each vehicle is equipped with a GPS and knows its position on the road. This is a realistic assumption as most modern vehicles enjoy the facility of the GPS. If a vehicle meets an accident or experiences a fault, it broadcasts this information to the vehicles behind it; an emergency message is only received by a vehicle if that message is not a duplicate. After the packet is received, a distance based back-off is calculated such that vehicles at the farthest distance from the source have a lower contention window. The contention window at each vehicle is chosen according to the formula

$$Congestion\ Window = [X, X + CWmin]$$

where $X = B * X$

$$B = \frac{(Tr + Dc) - Dsd}{Dc}$$

Where

Tr= One hop Transmission Range

Dc= Distance between car

Dsd= Distance between source and destination

The proposed protocol selects the farthest vehicle for re-broadcast with the help of a new back-off window design which reduces the number of packet transmissions thus lowering the contention levels. This paper is only used to forward packet to which car that is behind it but there may be many road or cars that receive this packet and respond it either it is for from main city or it may be going to wrong direction. So this may cause problem because all car which receive this message is not going into right direction. We are proposing new technique to overcome this problem by utilization the GPS information provided by each node.

III. PROPOSED WORK

Proposed concept is a new approach of packet forwarding technique that provides exact direction to the packet broadcast when any misshapen occurs on the road. In this protocol, the entire vehicle is enabled with VANET properties. When any node or vehicle meets accident on the road side then it broadcast the message in backward direction [10] to inform the neighbor vehicles but it cannot consider the direction of the vehicle. If vehicle going to city direction and accident happen then, it broadcast accident information in wrong direction.

For the solution of this problem, we proposed a new concept of VANET using location information of the city and vehicle. This technique has following steps:

1. When a vehicle meets the accident on road side then it generate a information packet to inform the control center and neighbor vehicles.
2. Find the city direction from the vehicle and calculate the distance of the city from the vehicle according to the GPS information.
3. Calculate the expected zone and requested zone (Rectangular requested zone) to send the packet.
4. After calculation of these information source vehicle broadcast the packet in city direction according to requested zone with source location information.
5. When any vehicle receives this information packet then it calculates the value of requested zone according to information in the packet. If vehicle lies in the requested zone then it broadcast the packet to its neighbour else drop the packet.

Algorithm of the **proposed method** is as follows:

Algorithm for Vehicular Ad-hoc Network

When a new car receive a broadcast packet

```
If (sequence_no == old_pkt_sequence_no)
{
Drope the packet;
}
else
{
Calculate requested zone by using (x, y) coordinate of the
source;
If (node lies in requested zone)
{
Broadcast the packet in city direction;
}
else
{
Drop the packet;
}
}
```

IV. SIMULATION RESULTS

In order to validate the proposed protocol and show its efficiency we present simulations using MATLAB. It is a very popular network simulation tool. MATLAB is an interactive software package which was developed to perform numerical calculations on vectors and matrices. The simulation environment settings used as the network area is 35x 35 that include variable number of mobile nodes ranging from 15 to 35. The radio transmission range is assumed to be 5 to 7(in Matlab plot). The scenario of nodes mobility is generated randomly based on random way point model where a mobile node moves to a new position .

Figure 1.1 shows that the proposed protocol provide better result in terms of broadcast overhead. Base protocol generate more broadcast overhead because it broadcast information packet into reverse direction without any restriction but proposed protocol provide less number of broadcast overhead because it use location information of the city and restrict the packet according to minimum and maximum slope between source node and city.

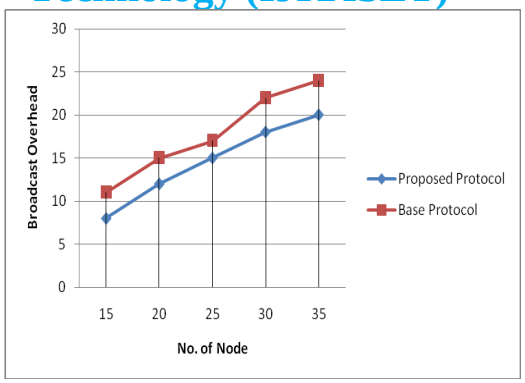

Fig.1.1

Figure 1.2 shows that when number of node increases then packet delivery ratio increases accordingly. Base protocol provide good result in terms of packet delivery ratio but our proposed protocol provide better result than base protocol.

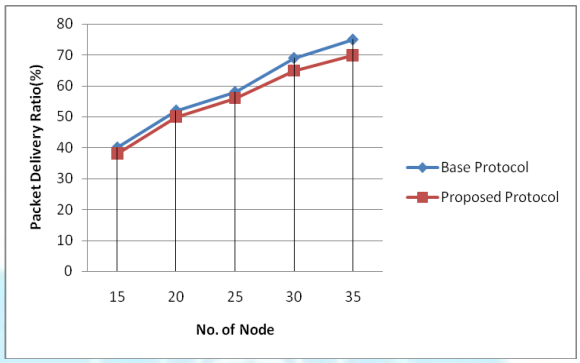

Fig.1.2

V. CONCLUSION

Proposed approach is a better approach for VANET when any vehicle meets accident. This concept provides the exact direction to broadcast the packet. By using this concept city direction vehicle provide the help to accidental vehicle as soon as possible and it forward the packet into city direction to reach this packet to city control center. So this concept provides the exact path to packet and reduces the packet broadcast and save the power of the vehicle. Simulation result shows that proposed result provide better result in terms of broadcast overhead and packet delivery ratio due to location information of the city and maximum and minimum slop restriction.

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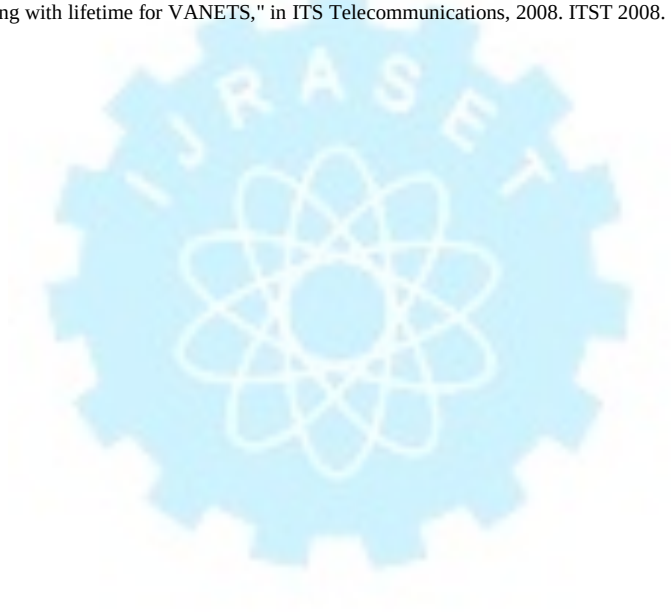

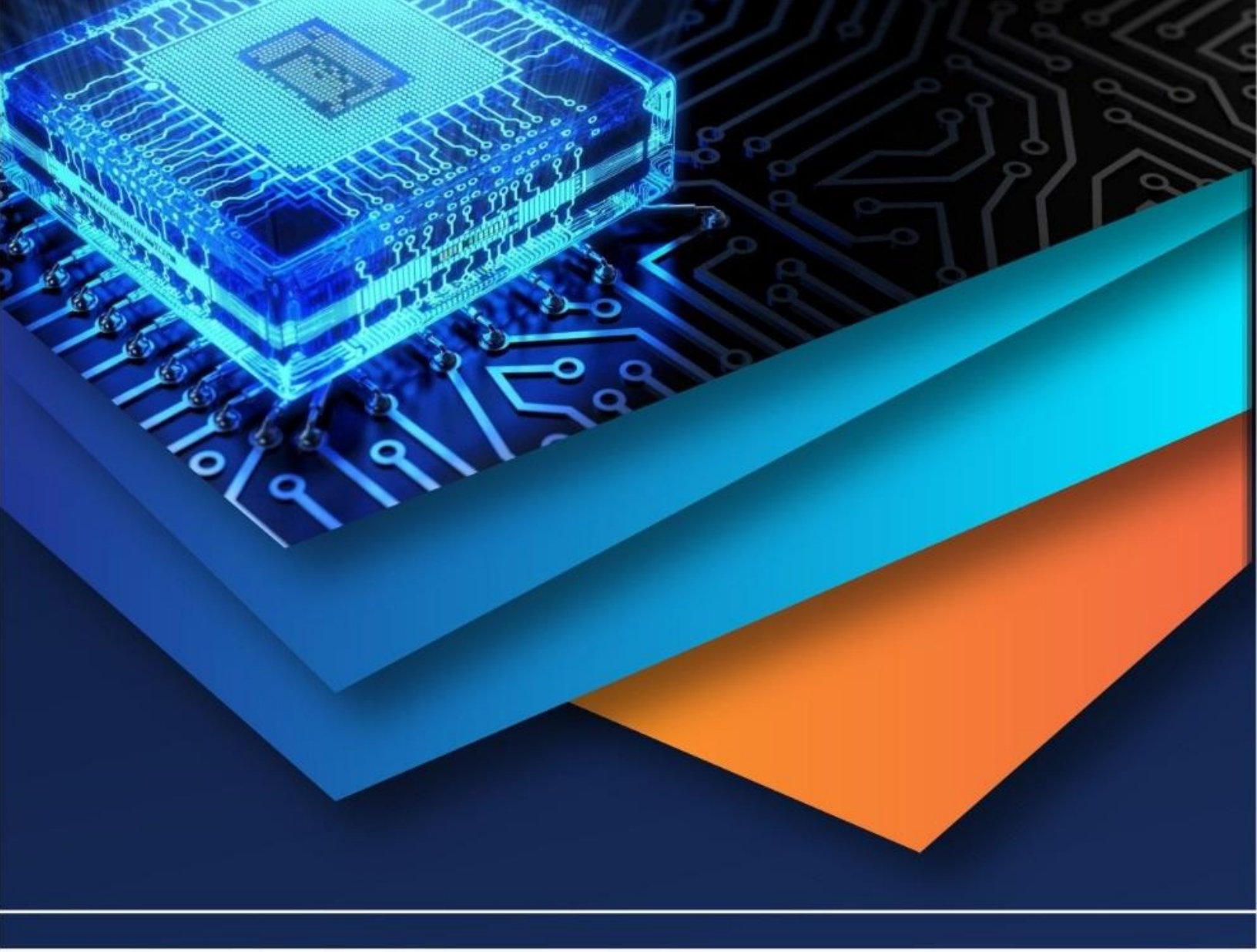

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