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Selecting Heavy Vehicles and Their Benefits in VANET

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***Abstract*: Vehicular ad hoc network is a special kind of MANET. Now-a-days, Vehicular Ad-hoc Networks (VANETs) attract a significant amount of interest in the research. Dynamic network architectures and node movement characteristics differentiate VANETs from other kinds of ad hoc networks which provides wide variety of applications, such as road safety, content sharing of multimedia, traffic alerts etc. Position Based Routing Protocols does not require route maintenance and route construction phases. However, the path with higher connectivity or the shortest path may include numerous intermediate intersections. In this paper, we propose a distance based greedy routing with the impact of vehicle's height on the communication. On the basis of vehicle's height yields a routing path with the minimum number of intermediate intersection nodes while taking connectivity into consideration.**

***Index Terms*— GREEDY, MANET, UNICAST, VANET.**

I. INTRODUCTION

The increasing demand of wireless communication and the needs of new wireless devices have tend to research of a network without the interference of centralized pre-established infrastructure. VANET is a self-organizing network. It does not depend on any fixed infrastructure. VANETs represent an emerging wireless technology, allowing efficient communication among vehicles and devices positioned along the street with a very promising area of safety, traffic control and user applications. In VANET the network is frequently disconnected often topology changes has the result that a node is become frequently out of range.. There are two possible types of communication that could be established within a VANET:

i. Vehicle to Infrastructure (V2I)
ii. Vehicle to Vehicle (V2V)

i)*Vehicle to Infrastructure (V2I):*
V2I is a kind of wireless networks in which communication units are nodes and roadside units. V2I is a very initiative research domain. It provides application for a series of technologies which directly provide link between road vehicles to their physical surroundings. This technology provides several technology including, transport engineering, electrical engineering, automotive engineering and computer science.

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ii. *Vehicle to Vehicle (V2V):*
V2V is a wireless network which form ad-hoc network among vehicles which allow vehicles to transmit data to each other. In V2V communication, a vehicle can detect the position or location and movement of other vehicles up to a distance. Vehicles are mounted with a simple antenna. The effectiveness of a communication between source and destination is determined by the strength of the received electromagnetic signal. As a signal travels from a source to destination it is affected by obstacles in its path, such as surrounding buildings, other vehicles, foliage.

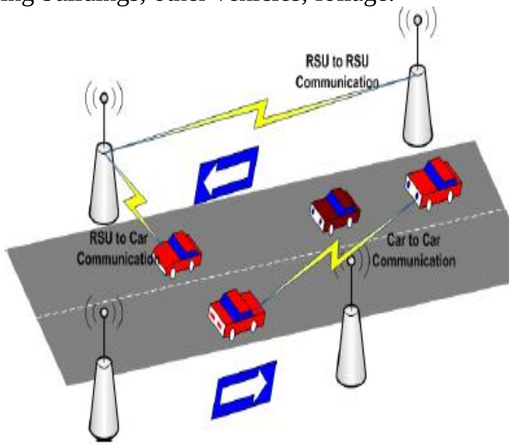

Fig no. 1: Basic Architecture of VANET

The vehicles with low height make V2V communication susceptible to obstruction. When vehicle starts communication with each other than other vehicles between the source and destination affect the electromagnetic signal [13]. The obstacles affect the LOS between the communicating vehicles. So, in this paper distinguish between heavy and small vehicles and show that heavy vehicles are significantly better relay candidates than small vehicles.

In VANET, routing protocols vehicles make forwarding decisions without neighbor knowledge. In others, it is necessary for a vehicle to learn about its neighbor. The vehicle may know the position, velocity or other parameters of neighboring vehicles with the help of GPS. Such neighbor positional knowledge becomes available when all vehicles exchange information about each other by periodic beacons. In this paper, only the Vehicle-based Unicast is taken under consideration. The endpoints in the scenarios are vehicles, in which the destination is a single vehicle endpoint of known identity whose position and identity are known through received beacons and/or a location service.

II. RELATED WORK

Because of so many characteristics of VANET, performing routing in it is a difficult task. There already have been many routing protocols in MANETs [3], but directly applying the existed routing protocols to VANETs may suffer poor performances due to the difference between the two networks [6]. And AODV [7], as one of the most important routing protocols in MANETs, also needs to be improved to apply to VANETs.

This similarity nature suggests that the prevailing routing protocol of MANET is very much applicable to VANET [12].Various routing protocols have been proposed to make routing more efficient and reliable in VANET [10].VANETs environment is a challenging one for developing efficient routing protocols [3], [4].

Many routing protocols have been developed for VANETs environment, which can be classified in many ways, according to different aspects; such as: protocols characteristics, techniques used, routing information, network structures, routing algorithms, and so on.

Due to high mobility, frequent changes in topology and limited life time are such characteristics of this network that make routing decisions more challenging [16].There exist a number of studies dealing with the propagation aspects of V2V communication. It has been shown in some work that other non-communicating vehicles often block the LOS between the communicating vehicles due to the relatively low height of vehicles [14]. This results in signal strength, received power level and effective communication range. Therefore, in this assignment, we intend to design a way to enhance the current existing position based routing protocol by using the information of vehicle heights.

III. VEHICLE BASED UNICAST OPERATION

In this paper, vehicle based unicast are taken into consideration. The Vehicle-based Unicast can be used in cases, like road safety (transmission from a vehicle announcing to a peer vehicle behind that it is decreasing speed), infotainment (delay-tolerant gaming between two vehicles with known identities), etc. The theoretical study for GeoUnicast could be easily extended to GeoBroadcast and GeoAnycast situations when analyzing the system level benefits of Tall vehicles. These operations related to two kinds of packets can be specified as:

i) Network Management
ii) Packet Handling

i)*Network Management:*

This section specifies the network management operation and their functionalities:

a) Address Configuration: In initial phase, each GeoAdhoc router itself has a self-assigned GeoNetworking address. GeoNetworking defines three methods for the address configuration:

- Auto-address configuration
- Managed address configuration
- Anonymous-address configuration

b) Location Position Vector and Time Update: A GeoAdhoc router holds the information of position and maintains a local data structure for the local GeoAdhoc router i.e., the local position vector LPV. The data entry of a local position vector in a location table entry includes geographical position, speed, heading, timestamp and accuracy of the geographical position. At start up, all the data table entry shall be initialized to 0 indicates an unknown value. The LPV shall be updated with a minimum frequency (1000ms).

c*) Beaconing****:*** Beaconing is used to periodically advertise a GeoAdhoc router's position vector to its neighbors. In initial phase, a GeoAdhoc router shall sent initial beacons to announce its presence to its neighbors. This periodic transmission of beacons is measured by a timer that depends on the transmission of packets. If a GeoAdhoc router receives a BEACON packet, then it updates the position vector for the sender in the Location Table Entry (LocTE).

d) Location Service: When a GeoAdhoc router needs to determine the position of another GeoAdhoc router then location service is used. For example, when a GeoAdhoc router which is a source does not have the position information another GeoAdhoc router which are a destination, then the source firstly process the location service.

d) Packet Handling: Packet Handling: In this section, defines two GeoUnicast forwarding algorithm for packet handling operation:

a) Greedy Forwarding algorithm
b) Contention- based forwarding algorithm.

In this paper, Greedy Forwarding Algorithm is going to be illustrated.

IV. GREEDY FORWARDING ALGORITHM

Greedy Forwarding Algorithm is defined as an algorithm that ensures the minimum distance from receiver to sender in a network. Greedy algorithm always takes the best immediate solution while finding the solution.Algorithm sometimes gives less than optimal solution when some instances of other problems are considered Algorithm is greedy if:

- It builds up a solution in small steps
- It chooses a decision at each step myopically to optimize some underlying criterion analyzing optimal greedy algorithms by showing that:
- In every step it is not worse than any other algorithm, or
- Every algorithm can be gradually transformed to the greedy one without hurting its quality.

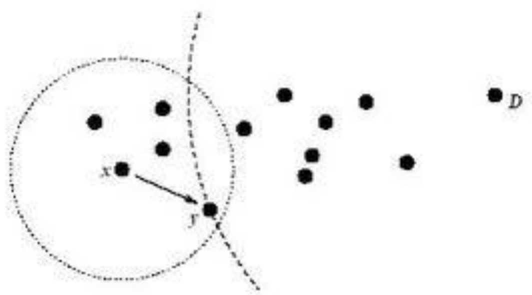

Fig no.2 Example of greedy forwarding

In greedy routing vehicle announces its address and geographic position to all of its neighbors through broadcasting. Whenever a vehicle receives beacon message from neighbors, it keeps and stores the address and position of that vehicle in a table known as neighbor table. The major advantage of greedy forwarding is it holds current physical position of forwarding nodes.
When a node forwards a packet that is nearest to the destination of the packet, then such forwarding is called greedy forwarding [3].

By using greedy approach, total distance to destination becomes less. The greedy algorithm is:
GP – is the packet to be forwarded
J-- Is the J-th LocTE
NN---the location of next hop
VCD--vehicle closest to the destination
LPV--the local position Vector
D_{PV} – is the destination position Vector in the packet to be forwarded
J_{PV} - is the position vector of the J-th LocTE

VCD= DIST (D_{PV}, LPV)
FOR (J€ LocT)
IF (J.is_ NEIGHBOR) THEN
IF (DIST(D_{PV} ,J_{PV})< VCD) THEN
NN← J
VCD ← DIST (D_{PV} ,J_{PV})
ENDIF
ENDIF
END FOR
IF (VCD< DIST (J_{PV} , LPV))
ELSEIF
LOCAL OPTIMUM
SET NN_ADDR=0 // indicates that packet is buffered
ENDIF

V. ENHANCED GREEDY ALGORITHM

Every vehicular node creates and maintains a location table that indicates the information of neighbors. As the request packet send, the source uses the location information of the destination carried and selects one of the neighbors in the location table as the next relay hop. In this, the packet is transmitted in geographical area. The current GeoAdhoc router looks over all the entries in its location table (LocT) and finds the vehicle closest to the destination (VCD). The algorithm has been shown that the how the heavy vehicle scheme been applied in the greedy forwarding algorithm:
i) First of all, the current node that has a data packet to be forwarded finds the closest neighbor (the closest heavy vehicle to the destination and closest small vehicle to the destination) from the location table (LocTE). The distance of heavy vehicle from the destination known as VCD_H and distance of small vehicle from the destination is known as VCD_S.
ii) In second step, compare the two distances VCD_H and VCD_S. The difference between VCD_H and VCD_S is known as DIST_diff.
iii) In third step, a parameter Threshold is defined as which is the difference between a heavy vehicle's theoretical communication range and small vehicle's maximum communication range.

GP-- is the packet to be forwarded
VCD-_H--is the Heavy vehicle closest to the destination
VCD_S--is the Small vehicle closest to the Destination
J--is the J-th LocTE
NN—is the location of next hop
LPV—is the local position vector
D_{PV}– is the destination position vector in the packet to be forwarded
D-Threshold- is the difference between the maximum transmission ranges of a Heavy vehicle and a Small Vehicle
Jpv --is the position vector of the J-th LocTE
NN_H-- is the location of heavy vehicle closest to the destination
NN_S-- is the location of small vehicle closest to the destination

VCD_H=VCD_S= DIST (J_{PV}, LPV) // Initialize VCD
FOR (J€ LocT)
IF (J.Is_NEIGHBOUR) THEN // location J is neighbor
IF (J.IS_HEAVY) THEN
IF (DIST(D_{PV} ,J_{PV})< VCD_H) THEN
NN_H← J
VCD_H ← DIST (D_{PV}, J_{pv})
ENDIF
ENDIF
ELSEIF (J.IS_SMALL) THEN
IF (DIST (DPV, JPV)< VCD_S) THEN
NN_S← J
VCD_S ← DIST (D_{PV} ,J_{PV})
END IF
ENDIF
ENDFOR
IF (VCD_S< VCD_H) THEN
IF (VCD_H- VCD_S < D_ Threshold && VCD_H < DIST (D_{PV},LPV)) THEN
SET NN_ADDR= NN_H
ELSE IF (VCD_H- VCD_S > D_ Threshold && VCD_H >DIST (D_{PV},LPV))
SET NN_ADDR = NN_S
ENDIF
ENDIF
IF (VCD_H < DIST (D_{PV} , LPV) THEN
SET NN_ADDR= NN_H
ELSEIF
(VCD_H> DIST (D_{PV} , LPV)) // indicates that forwarder is at local optimum
LOCAL OPTIMUM

VI. CONCLUSION

VANET network is a collection of vehicular nodes which are self-organized and self-maintained in nature. VANETs are expected to be highly dynamic and distributed resulting in significant reliability issues for the communication protocols. So, on comparing and investigating various routing techniques, greedy routing technique is taken into consideration. In greedy algorithm, call for information about the physical position of the participating nodes. This position is made available to the direct neighbors via periodic transmissions from beacons. In proposed greedy algorithm, the source node will send packet to the heavy vehicles because of their received signal strength and coverage area of heavy vehicles is more effective than small vehicles. If we compare the greedy algorithm and heavy vehicle greedy algorithm, on the basis of number of hops between sender and receiver the proposed greedy algorithm will be beneficial in terms of hop count because source node will choose the heavy vehicle. So, the packet will send from heavy vehicle to heavy vehicle and the number of hops between sender and receiver will be decreased. In future, vehicles speed in the network could be considered and then the position of other vehicles could be predicted by the vehicle act as the local GeoAdhoc router. In this way, the source/forwarders may know which neighboring vehicle will be nearer to the destination after a time interval, and select it as the next relay hop.

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