BACK BONE ASSISTANCE FOR VANETs USING HOP GREEDY ROUTING

Goutam Budha[1], Ramesh Patil[2]

[1] M.Tech Student, Electronics and Communication, Guru Nanak Dev Engineering College Bidar, Karnataka, India
[2]HOD, Computer Science, Guru Nanak Dev Engineering College Bidar, Karnataka, India

Abstract: **Advancements in wireless technologies have made vehicular ad hoc networks (VANETs) viable for their applications, such as navigation, driver safety, multimedia content sharing, infotainment, etc. distribution of information is constrained by fast movement of nodes and frequent disconnections in VANETs. Currently geographic routing protocols are employed for VANETs and these routing protocols work well as they don't require route construction and route maintenance phases and reliable delivery is concerned when connectivity is taken as the parameter. To get target vehicle position some of protocols use flooding system which can be harmful in city environments. As the city streets and highly connected road segments have numerous intersections, the geographical routing protocols yield routing paths with higher hop counts. In this paper, a hop greedy routing scheme is introduced that yields a routing path with minimum number of intermediate intersections so as to attain minimum hops to reach out to destination and when connectivity is considered as an issue, backbone node is introduced which tracks the movement of source and destination. As the vehicles are considered the highly mobile nodes, the backbone forwards the packet to a proper forwarding node to destine the data. If it doesn't find the proper node, it stores the data till a proper forwarding intermediate node is found. Simulation results signify high packet delivery ratio and shorter end-to-end delay.**

Keywords: **Destination discovery, greedy routing, unicast routing, vehicular ad hoc network (VANET).**

I. INTRODUCTION

The automotive industry is currently undergoing a phase of revolution. Today, a vehicle is not just a thermo mechanical machine with few electronic devices; rather, recent advancement in wireless communication technologies has brought a major transition of vehicles from a simple moving engine to an intelligent system carrier. Wireless communication among moving vehicles is increasingly the focus of research in both of the academic community and automobile industry, driven by the vision that exchange of information among vehicles can be exploited to improve the safety and comfort of drivers and passengers [1]. Recent trends swing toward advertisement, marketing, and business of services and products on wheels [3]. Several technical problems need to be solved before installing vehicular networks; in the near future, large scale vehicular networks will be available to provide people with more conveniences in their driving experience. For example, through such networks, people can query the price and services provided by gas stations in a certain region. Driver can even download a real time traffic image and connect to access points of parking lots to enquire the number of available parking lots.

Routing has been a challenge in VANETs because of the rapid movement of vehicles and frequent changes in the topology of VANETs. From these weaknesses, greedy routing protocols are known to be more suitable and useful to VANETs. Finding the routing path is key challenge to routing protocol. Greedy forwarding is one of the most suitable solutions for routing in VANETs because it maintains only the local information of neighbors instead of per-destination routing entries. Greedy routing algorithms needs the physical position information of the available nodes which are participating in transmission of packets and this position helps neighbors in periodic transmission. A sender can request the position of a receiver by means of a location service. The routing protocol takes the routing decision based on the destinations position and the position of the forwarding nodes neighbors. Greedy routing protocols [2] use the geographic position of vehicles to determine the direction for forwarding a data packet. Traditional greedy routing protocols use beacon messages: each vehicle announces its address and geographic position to all of its neighbors via a radio broadcast. Whenever a vehicle receives such a beacon message from a neighbor, it stores the address and position of that vehicle in its neighbor table. When a vehicle has to forward a packet, it uses the table to determine the neighbor the packet should be forwarded to in order to make progress toward the final destination.

II. BACK BONE ASSISTANCE FOR VANETs

A. Related work:

Several routing protocols were designed for mobile ad hoc networks and which later enhanced to suit the VANET scenarios GPSR, DSR, AODV. The position based routing protocol GPSR [7] is based on the location service to acquire the position information of the destination. Greedy perimeter stateless routing (GPSR) [7] is the best known greedy routing protocol for VANETs. GPSR [7] makes greedy forwarding decisions using only information about a routers immediate neighbors in the network topology. GPSR [7] consists of two methods for forwarding packets: greedy forwarding and perimeter forwarding. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. GPSR [7] uses greedy forwarding to forward packets to nodes that are always progressively closer to the destination. This process repeats at each intermediate node until the intended destination of the packet is reached. Since GPSR [7] only maintains location information of all of its 1-hop neighbours, it is nearly stateless and leads to better scalability in a per router state than shortest path ad hoc routing protocols. GPSR may increase the possibility of getting a local maximum and link breakage because of the high mobility of vehicles and the road specifics in urban areas. GPSR [7] may also suffer from link breakage with some stale neighbour nodes in the greedy mode because of the high node mobility and rapidly changing network topology. The local maximum and link breakage can be recovered in perimeter mode forwarding, but packet loss and delay time may occur because the number of hops increases in perimeter mode forwarding. These characteristics of greedy forwarding decrease VANET reliability.

In GPCR, [8] packets are forwarded by applying a restricted greedy forwarding procedure. GPCR [8] consists of two parts: a restricted greedy forwarding procedure and a repair strategy and junctions. Therefore it does not need a graph planarization algorithm. In the restricted greedy forwarding of GPCR, [8] junctions are the only places where actual routing decisions are made. Therefore, packets should always be forwarded to a node on a junction rather than being forwarded across a junction. A coordinator broadcasts its role along with its position information. If the forwarding node is located on a street and not on a junction the packet is forwarded along the street towards the next junction. During the selection of a forwarding node, a junction node termed as the coordinator node is preferred over a non-junction node. Note that the coordinator node is not necessarily the closest node to the destination. However, the recovery strategy in GPCR [8] remains the same as GPSR [7].

B. Existing system:

In existing system GPSR protocol is used, in which a node finds its nearest node to the destination to send the data using greedy forwarding method if it does not find such a node. Since GPSR only maintains location information of all of its 1-hop neighbors, it is nearly state less and leads to better scalability. GPSR may increase the possibility of getting a link breakage because of the high mobility of vehicles. The link breakage can be recovered in perimeter mode forwarding, but packet loss and delay time may occur because the number of hops increases in perimeter mode forwarding.

C. Problem formulation and motivation:

- ***Searching nodes at intersections:***

Intersections in city environments play crucial roles for data communications. The probability of change of direction is high as the intersection region is small and it will be risky to choose unstable nodes as forwarding node. This happens when a vehicle speeds up after sending its beacon packet. When a vehicle crosses the intersection without having another vehicle arrive at the intersection, a disconnection may occur. This situation arises when number of vehicles crosses the intersection before any vehicles arrives at an intersection. Although CAR addresses connectivity issues, it could be affected as the average connectivity does not ensure connectivity in individual road segments in a routing path. Protocols such as GPSR, GPCR, and GSR do not ensure connectivity, and hence, the foregoing problem can have a serious impact on their performances.

- ***Requirement of location service to obtain destination position:***

The position-based routing protocols are aware of the destination position through location services. As the information has to be forwarded to other nodes, it needs to travel through many numbers of hops and due to this fetching destination position is also impossible. The location service is no longer needed for the nodes that do not take part in communication. Protocols like GPSR and GPCR take the aid of proactive location services like hierarchical location service (HLS) [15] and grid location service (GLS). Sensors are deployed at the intersections to provide the actual position information of the destination. Gathering of information and distribution throughout the network leads to communication and computational overheads. For every minor movement of the destination, there is a need for the computation of a new path to the destination from the intermediate intersection. As a result, the hop count may be increased.

- ***Packet Swinging in Greedy Forwarding:***

In greedy forwarding, a sender chooses a forwarding node that is closest to the destination. Normally, in cities, the distance between two intersections is far less. Further, plenty of intersections are located in a small area. In such a case, the destination may move across many intersections while a data packet is on the way. Assuming that a location service provides real-time position information of the destination, the forwarding node selection depends on the updated position information of the destination. Apparently, new routing paths are computed at every hop. Hence, the packets keep on moving in search of the destination. We term this phenomenon as packet swinging in greedy forwarding.

D. Proposed system:

In proposed system, a back-bone mechanism is introduced, in which some specialized nodes perform functions such as tracking the movement of end nodes, detecting void regions on road segments, storing packets on unavailability of forwarding nodes, and selecting the most suitable intersection node as the forwarding node. Since the routing algorithm selects a path using destination position, we employ a unicast request-reply-based destination probing mechanism. As the position of each boundary intersection is known, the uni-cast request messages initiated by the source can be easily sent to each boundary intersection. The back-bone nodes stationed at boundary intersections then take the responsibility to spread the request messages within the respective zones. The fact that unicast packets do not provide burst traffic and is shielded by request to send/clear to send (RTS/CTS) hand-shake is the basic motivation to adopt unicast to carry out all control packet transmissions. Once the destination receives the request message, it finds a suitable path to the source and sends the reply. On receiving the reply message, the source forwards data on a routing path computed by the hop greedy routing algorithm.

Advantages of proposed system:

- Crucial problems such as unreliable location service, intersection node probing problem, etc., experienced by VANET routing protocols are explored.
- A hop greedy routing protocol is introduced, that aims to reduce the end-to-end delay by yielding a routing path that includes the minimum number of intermediate intersections.
- To address connectivity issues such as void regions and unavailability of forwarders, the concept of back-bone node is introduced.

E. System design:

By literature review, to reduce end to end delay and also to find best possible path in terms of hop count and connectivity a new routing protocol is introduced i.e. hop greedy routing protocol. Furthermore, it improves packet delivery ratio, reduces end to end delay, ut as compared to other ad-hoc routing protocol.

Data Flow Diagrams:

Data Flow Diagrams are a way of representing function-oriented systems where each round-edged rectangle in the data flow represents a data function that implements some data transformation, and each arrow represents a data item that is processed by the function.

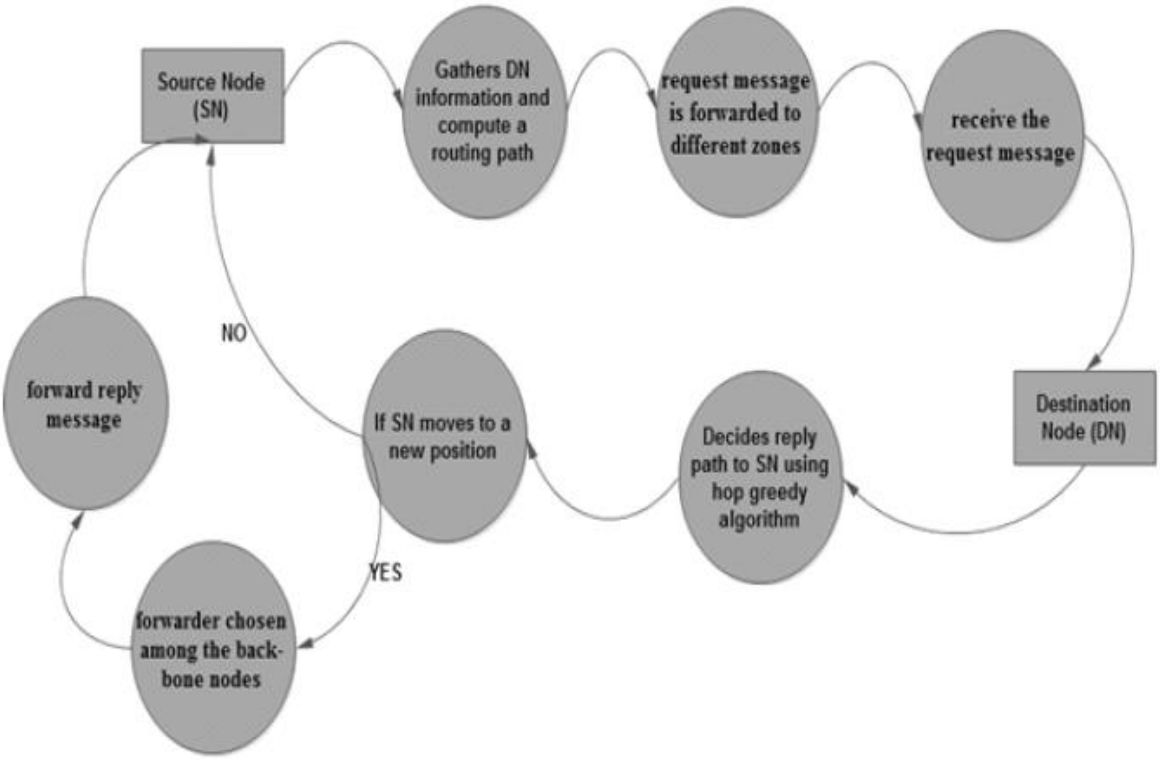


Figure: Data Flow Diagram

First of all, as shown in Figure, the sender node broadcasts the location request message. If it finds the location of the destination, it predicts the position of the node. And if it finds that the destination is within the range, it transmits data, otherwise predicts the position. The destination sends location reply to the source and source transmits data to destination through forwarding node.

F. CASE DIAGRAM:

Case diagram for proposed system:

Case diagrams represent the functionality of the system from user's point of view. Use cases are used during requirements elicitation and analysis to represent the functionality of the system. Use cases focus on the behavior of the system from external point of view as shown in Figure.

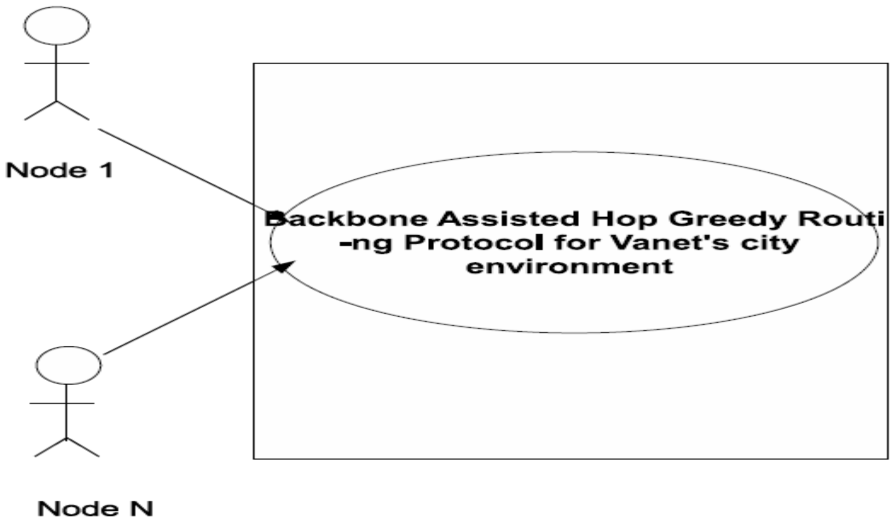


Figure: Case diagram for proposed system

Case diagram for system functionality of proposed system:

Clearly use case diagram in figure depicts how source node member broadcast request packet using hop greedy process of proposed system. The sender node gathers the geographic information. This is broadcasted as message to receiver node through hop greedy route, which is shortest distance path from source to destination node. once the receiver receives the message it sends reply to the sender through same path while sending or receiving the message the source or destination may change its position and move to different direction at that time the backbone nodes, which are main part of the proposed protocol maintains the connectivity and stores the message until it finds suitable path to the destination to forward the message.

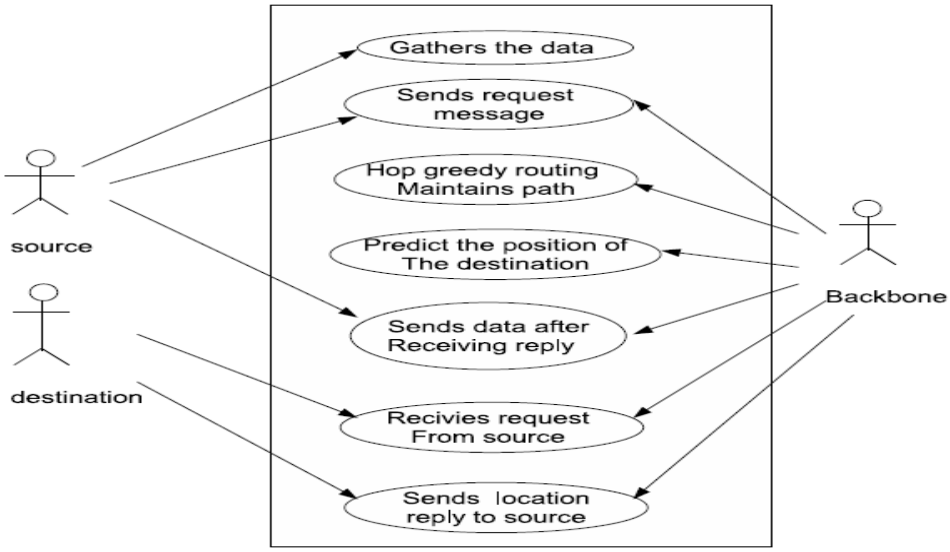
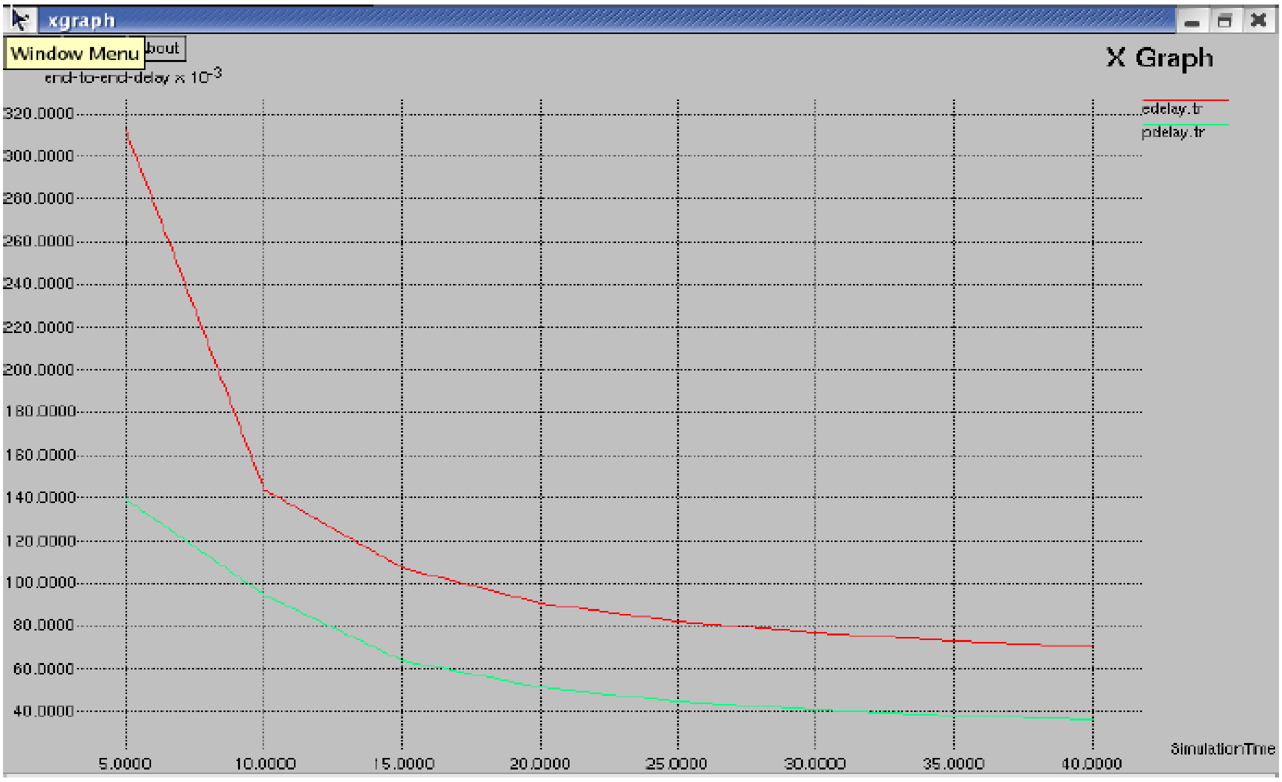


Figure: Case diagram for system function of proposed

G. Performance Analysis

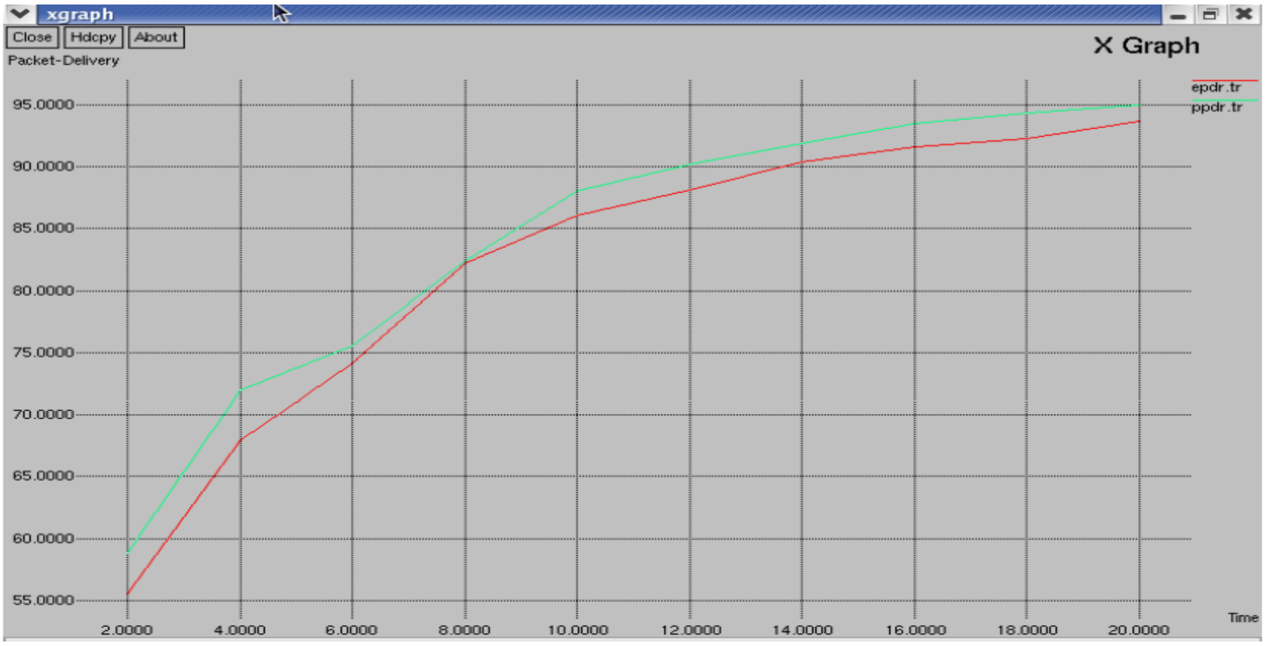
Performance Analysis for End to End Delay against time:



Graph: End to end delay versus simulation time

Analysis: Above graph shows the performance of the end to end delay with time. The delay is more for GPSR protocol when compared to proposed protocol because the packets generated at source are not reached to destination due to link breakage. The link breakage occurs due to high mobility of vehicle and packets are losses due to this reason and hop counts are increases. Delay is less for proposed protocol because of short routing path and less hop counts**.**

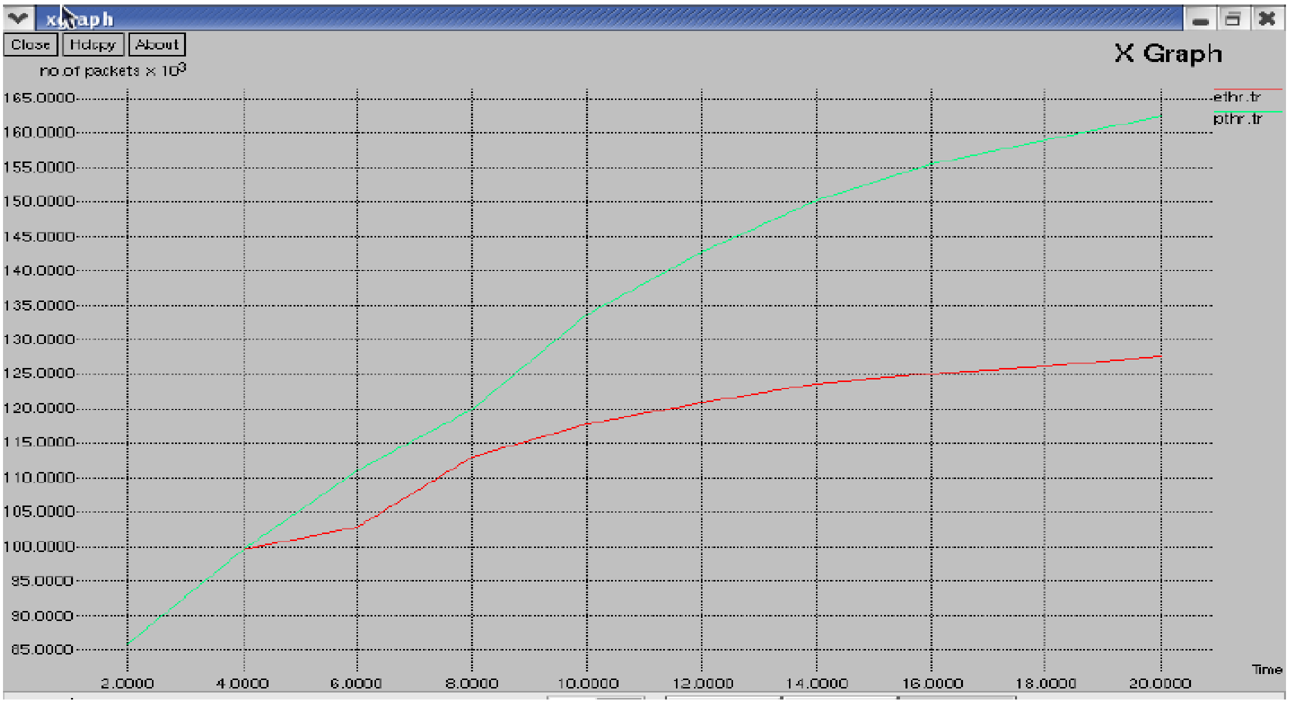
Performance Analysis for Packet Delivery Ratio against time:



Graph: Packet Delivery Ratio against time

Analysis: Above graph shows the performance of the packet delivery ratio with time. As shown above, the delivery ratio is for both existing and proposed protocols are similar for some time, and then it starts increasing for proposed protocol because of the presence of backbone nodes. Backbone nodes store the data on the unavailability proper forwarding node for reliable transmission of data to destination. It is decreasing in existing because of link breakage.

Performance Analysis for throughput by taking no. of packets against time:



Graph: no. of packets against time

Analysis: The above graph shows the performance of the throughput with time. The throughput is defined as the number of packet delivered to the destination per second. The network throughput increases with increase in no of packets with time. Because the link quality of every hop in BAHG is better than that of GPSR, BAHG achieves a slightly larger network throughput than GPSR.

III. CONCLUSION

In this paper a hop greedy routing protocol is introduced which finds the best possible path to destination in terms of both hop count and connectivity. A unicast request messages are forwarded to intended destination. For connectivity issues the concept of backbone node is introduced which tracks the movement of both source and destination and forwards the data in the changed direction by choosing a proper intermediate forwarding node to destination. The hop greedy routing also helps to reduce congestion, packet loss while broadcasting the message. The results of GPSR with BAHG in terms of packet delivery ratio and end to end delay are compared.

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