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Comparative Analysis of Throughput and Dropped rate for Location-Aided

Phân tích so sánh thông lượng và tỷ lệ mất gói tin trong Giao Thức Định

## Routing Protocol

### I. Introduction

There are two categories of ad hoc networks: Mobile ad hoc network and Wireless LAN. Mobile ad hoc network works as higher level while wireless LAN work as a low level. WI-FI" protocol or wireless LAN is capable of providing ad- hoc network facilities at low level, when no access point is available. However in this case, the nodes are limited to send and receive information but do not route anything across the network. Mobile ad-hoc networks can operate in a standalone fashion or could possibly be connected to a larger network such as the Internet [1].

The Bluetooth technique is available in some mobile. This technique introduced a new type of wireless systems known as mobile ad-hoc networks. Mobile ad-hoc networks or "short live" networks operate in the absence of fixed infrastructure. Mobile ad-hoc network is an autonomous system of mobile nodes connected by wireless links. Nodes in mobile ad-hoc network are free to move and organize themselves in an arbitrary fashion. Each user is free to roam about while communication with others [1].

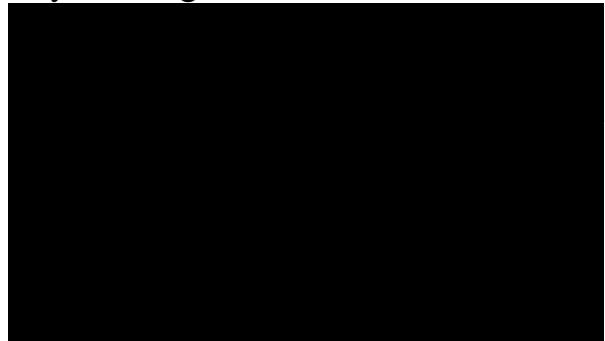
A mobile ad-hoc network is a collection of mobile nodes forming an ad-hoc network without the assistance of any centralized structures. These networks introduced a new art of network establishment and can be well suited for an environment where either the infrastructure is lost or where

## Tuyến Hỗ Trợ Vị Trí

### I.Giới thiệu

Có hai loại mạng tùy biến: Mạng tùy biến do động và LAN không dây. Mạng tùy biến di động hoạt động ở mức cao trong khi mạng LAN không dây hoạt động ở mức thấp. Giao thức WIFI hoặc LAN không dây có thể cung cấp công cụ cho mạng tùy biến ở mức thấp, khi không có sẵn điểm truy cập. Tuy nhiên trong trường hợp này, các nút chỉ giới hạn ở việc gửi và nhận thông tin mà không định tuyến bất kỳ đối tượng nào trên mạng. Các mạng tùy biến di động có thể hoạt động đơn độc hoặc kết nối với một mạng lớn hơn chẳng hạn như Internet [1].

Trong mạng di động có thể sử dụng kỹ thuật Bluetooth. Kỹ thuật này đưa vào một loại hệ thống không dây mới được gọi là mạng tùy biến di động. Mạng tùy biến di động hoặc mạng có thời gian sống ngắn hoạt động khi không có cơ sở hạ tầng cố định. Mạng tùy biến di động là một hệ các nút di động tự hành kết nối với nhau qua các liên kết không dây. Các nút trong mạng tùy biến di động có thể tự do di chuyển và tự tổ chức theo kiểu tùy ý. Mỗi người dùng có thể tự do di chuyển trong quá trình truyền thông với nhau [1].



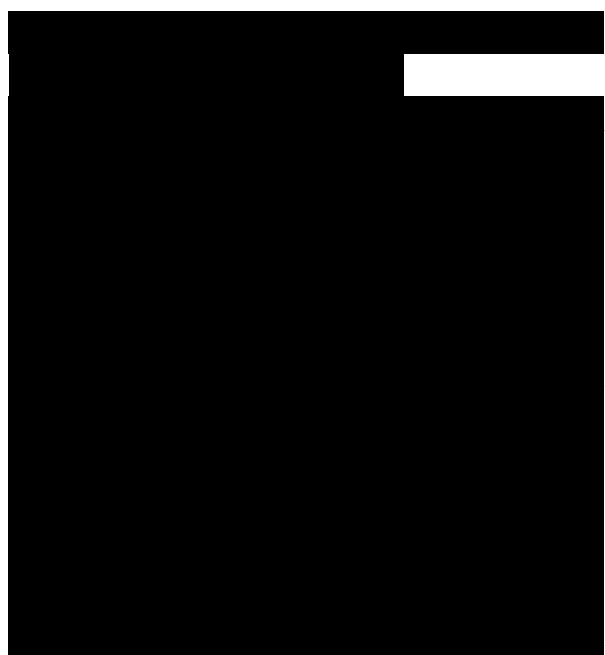
deploy an infrastructure is not very cost effective [2]. Wireless mobile ad hoc networks consist of mobile nodes which can communicate with each other in a peer-to-peer fashion (over single hop or multiple hops) without any fixed infrastructure such as access point or base station. In a multi-hop ad hoc wireless network, which changes its topology dynamically, efficient resource allocation, energy management, routing and end-to-end throughput performance can be achieved through adaptive clustering of the mobile nodes [3].

The remaining section of this paper is organized as follows. Previous Work of LAR and DSR are discussed in section 2, proposed work is discussed in section 3, simulation described in section 4, results discussed in section 5 and finally conclusion in section 6.

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### Location-Aided Routing (LAR) in mobile ad hoc networks

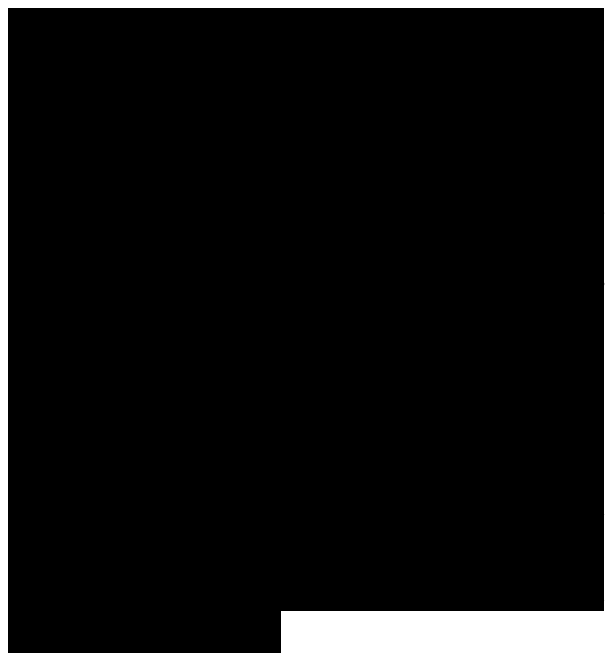
Mobile ad hoc networks consist of wireless mobile hosts that communicate with each other, in the absence of a fixed infrastructure. Routes between two hosts in a Mobile Ad hoc Network (MANET) may consist of hops through other hosts in the network [7]. Host mobility can cause frequent unpredictable topology changes. Therefore, the task of finding and maintaining routes in MANET is nontrivial. Many protocols have been



proposed for mobile ad hoc networks, with the goal of achieving efficient routing [6,9,11,13,16,18-20,23,28,30,31,33,35]. These algorithms differ in the approach used for searching a new route and/or modifying a known route, when hosts move.

In this paper, we suggest an approach to decrease over-head of route discovery by utilizing location information for mobile hosts. Such location information may be obtained using the global positioning system (GPS) [10,29]. We demonstrate how location information may be used by means of two Location-Aided Routing (LAR) protocols [19,20,22] for route discovery. The LAR protocols use location information (which may be out of date, by the time it is used) to reduce the search space for a desired route. Limiting the search space results in fewer route discovery messages.

This paper is organized as follows. Section 2 discusses some related work. In section 3, we describe proposed approach for using location information for route discovery in MANET. Performance evaluation of our protocols is presented in section 4, and several optimizations to our basic approach are described in section 5. Finally, section 6 presents conclusions.



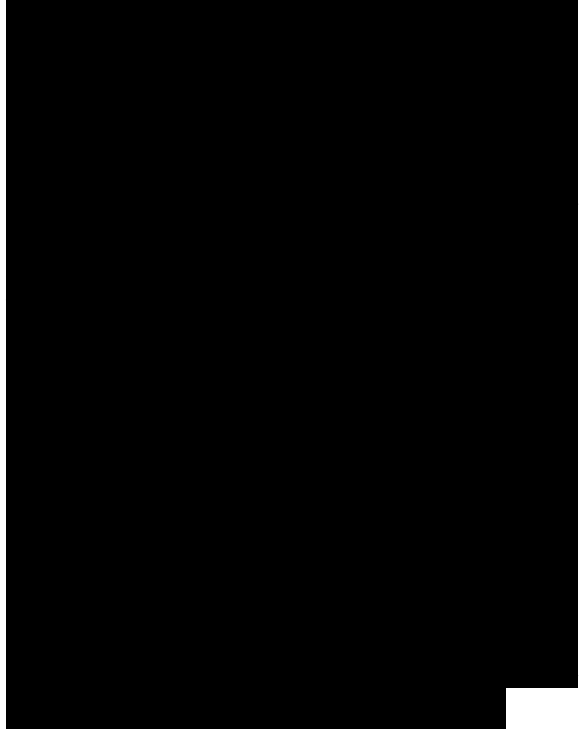
Comparative Analysis of Throughput and Dropped rate for Location-Aided Routing Protocol checked

II. Previous Work

A. Location Aided Routing Protocol  
Young Bae. Ko and Nitin H. Vaidya [4] described how location information may be used to reduce the routing overhead in ad hoc networks. They present two LAR protocols, namely, LAR scheme 1 (LAR-1) and LAR scheme 2 (LAR-2). Results indicate that using location information results in significantly lower routing overhead, as compared to an algorithm, which does not use location information. They also suggested several optimizations on the basic LAR schemes that may improve performance.

Li et al. [5] presented a modified version of the LAR protocol; it was called LAKER (location aided knowledge extraction routing) protocol for MANETs. It was a combination of caching strategy in DSR and limited flooding in LAR protocols. LAKER gradually learns of the topological characteristics of the network, such as node density, during the route discovery process and uses this information to enhance the network performance. Simulations showed that LAKER can save up to 30% broadcast messages compared LAR, while achieving better delivery ratio and almost the same delay.

Vyas and Mahgoub [6] presented a



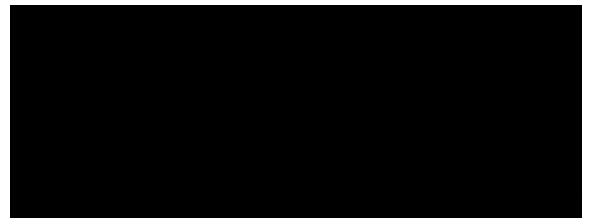
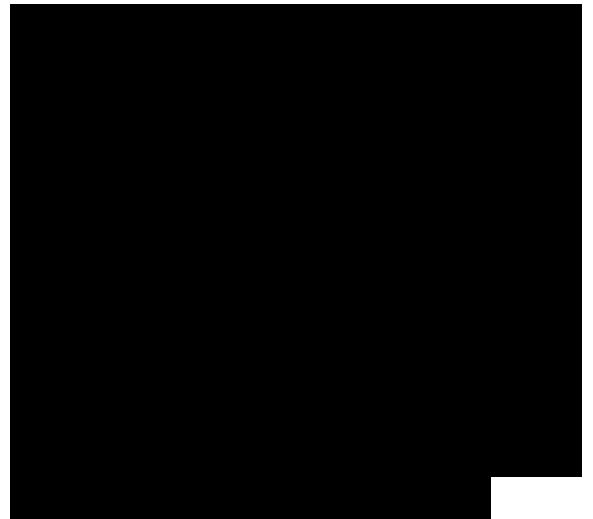
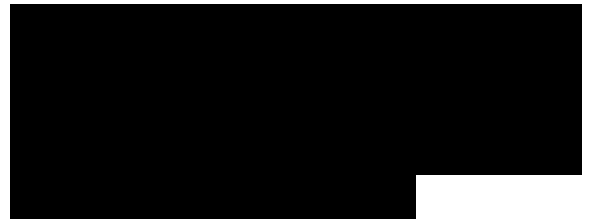
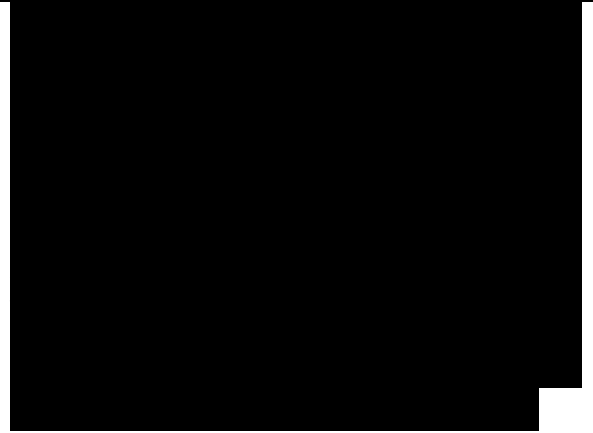
location and mobility pattern based routing algorithm for MANET. The proposed algorithm was an enhancement of the LAR algorithm that utilizes both location information as well as mobility pattern of mobile hosts to further reduce route discovery overhead. The results showed reduction in the routing messages when the information of predictable mobility pattern of the mobile hosts is utilized.

H. Al-Bahadili [7] extended the work to accommodate a dynamic retransmission probability. The simulation results obtained demonstrated an excellent enhancement in the performance of the LAR-1P algorithm.

Bolena and Camp [8] combined location information and mobility feedback to create an innovative MANET routing protocol. They developed a hybrid MANET routing protocol which adapts between two MANET routing protocols in order to combine the strengths of both component protocols while avoiding their weaknesses. This protocol achieved data packet delivery ratios above 80% in very demanding network mobility conditions.

In more stable networks, their protocol achieved data packet delivery ratios above 90%.

Zeng et. al [9] proposed geography based ad hoc on demand disjoint multipath (GAODM) routing protocol to be used instead of pure flooding in wireless ad hoc networks. In this



protocol, an informed and independent unicast decision is made by each node so that the traffic flow for the route discovery is efficiently directed towards the destination. The simulation result showed that (1) GAODM has better ability of finding more disjoint paths than AOMDV, especially when nodes are further apart; (2) GAODM finds shorter paths, and incurs much less route discovery overhead, than AODV and AOMDV.

H. Al-Bahadili et. al [31] developed and evaluated the performance of a new flooding optimization algorithm, namely, the LAR-1P algorithm, which utilizes two well-known flooding optimization algorithms, the location-aided routing scheme 1 (LAR-1), and the probabilistic algorithms. In this algorithm, when receiving a broadcast route request (RREQ) message, a node within the requested zone rebroadcasts the request message with predefined transmission probability and each node is allowed to broadcast the received RREQ message only once.

#### B. Location Aided Routing Algorithm

LAR algorithms make use of location information to reduce routing overhead. Location information used in LAR protocols may be provided by a Global Positioning System (GPS) [4]. There are basically two LAR algorithms, namely, LAR-1 and LAR-2. They differ in the manner they use to determine the request zone. However,

in this work, we mainly concern with the LAR-1 scheme. The LAR-1 scheme uses a request zone that is rectangular in shape [4]. It is assumed that source node (S) knows that destination node (D) was at location  $(X_d, Y_d)$  at time  $t_0$ . At time  $t_1$ , node S initiates a new route discovery for D. It is also assumed that node S knows the speed  $u$  with which D can move. Using this, node S defines the expected zone at time  $t_1$  to be the circle of radius  $R_e = u(t_1 - t_0)$  centered at location  $(X_d, Y_d)$ . Instead of the average node speed,  $u$  may be chosen to be the maximum speed or some other function of the speed distribution. In LAR-1, the request zone is defined as the smallest rectangle that includes current location of S and the expected zone (the circular region defined above), such that the sides of the rectangle are parallel to the X and Y axes. When the source node is outside the expected zone, the request zone is the rectangle whose corners are S, A, B and C, whereas when the source node is within the expected zone, the rectangle has corners at A, B, C and G. The current location of node S is denoted as  $(X_s, Y_s)$ . The source node S can determine the four corners of the request zone. S includes their coordinates with the RREQ packet transmitted when initiating route discovery. When a node receives a RREQ, it discards the request if the node is not within the rectangle specified by the four corners included in the RREQ. For instance, if node  $i$  receives the route request from another



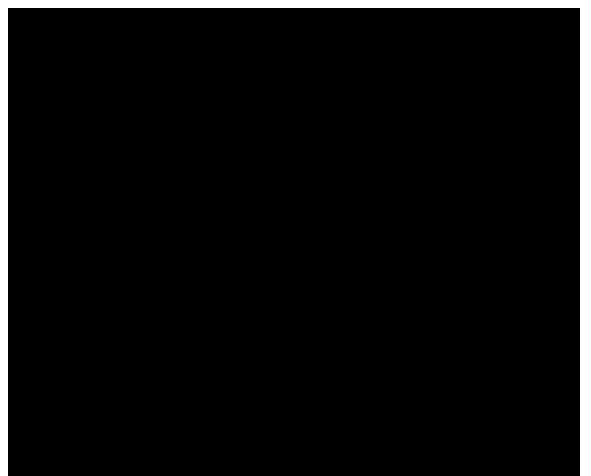
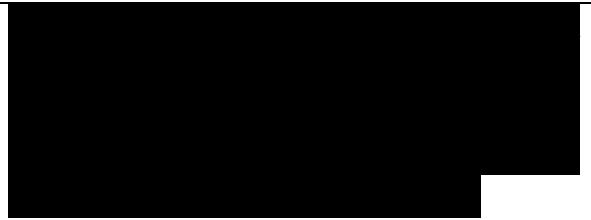
node, node i forwards the request to its neighbours, because i determines that it is within the rectangular request zone. However, when node j receives the RREQ, node j discards the request, as node j is not within the request zone.

### C. Dynamic Source Routing

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration [10].

The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use.

The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example for use in load balancing or for increased robustness. Other advantages of the DSR protocol include easily guaranteed loop-free routing, support for use in networks containing unidirectional links, use of only "soft state" in routing, and very rapid recovery when



routes in the network change. The DSR protocol is designed mainly for mobile ad hoc networks of up to about two hundred nodes, and is designed to work well with even very high rates of mobility [10].

### III. Proposed Work

The proposed algorithm increase probability to search node for one place. This work has proposed algorithm for expected zone of LAR protocol. The expected zone is circular region where destination may be move from the point of view source node. This region is divided into four segments because it does not cause interference.

In the proposed system

1) Each host still has a unique ID (such as IP address or MAC address).

2) To be location-aware, each mobile host is equipped with a positioning device such as a GPS receiver from which it can read its current location.

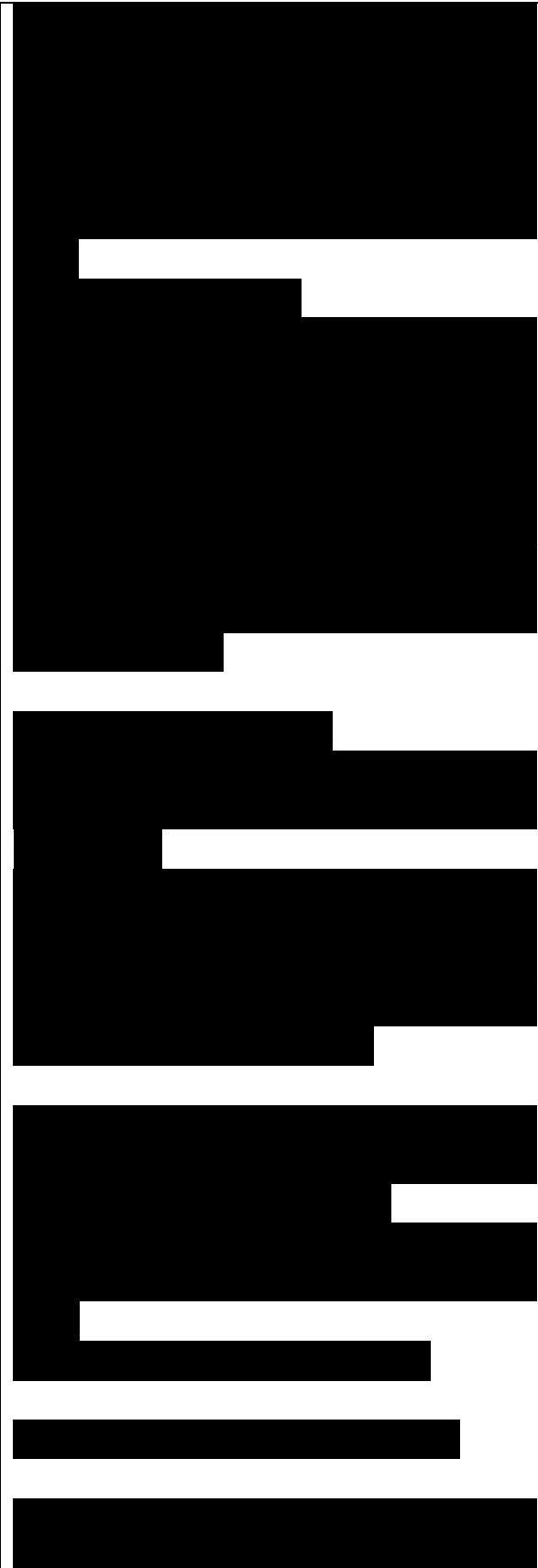
3) Each node knows their maximum distance for communication, according to their transmitter power.

Let a node S has to transmit the packet to destination D, now two possibilities arrives

1) The S knows the coordinates of D. or

2) The S doesn't know the coordinates of D.

The S will transmit the RREQ packet with (source address, source location,



destination address, destination location, Padd, Ploc) in above mentioned case 2 it will transmit the zero filled data for destination location. The following step is required for proposed work:

Step 1: Consider that source node S wants to transmit packet to the destination node D.

Step 2: The source node selects the destination which has to be transmitted the packet during transmission.

Step 3: If source node knows the location of destination, it sends the RREQ message with Address and Location of D, Otherwise.

Step 4: It sends the RREQ with Address of D.

Step 5: The intermediate node P receives this RREQ packet.

Step 6: If transmitting range of P is greater than distance between P and S it will drop the packet otherwise.

Step 7: The intermediate node P forwards the RREQ packet to the destination node with max PDF.

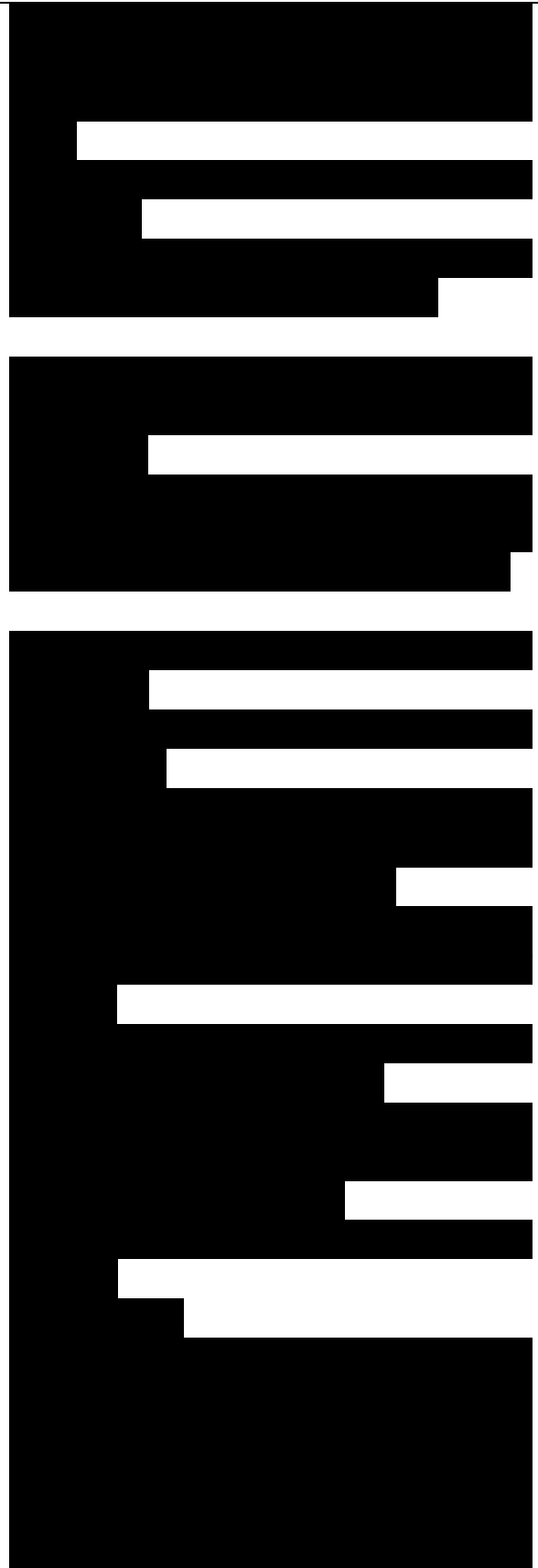
Step 8: The process is continued till the destination node D found.

The above step is repeated until destination node received the RREQ packet and then process is completed.

Fig. 1. Showing the flow chart of proposed work.

#### IV. Simulation

Network simulation provides a means of testing proposed changes prior to placing them into effect, performing what- if analysis concerning the reliability of key components in a network and the effects of losing a



component, planning for future growth, and initial design of a proposed network. The costs associated with the building and operating of a network make simulation a viable option in making choices in the building, modification, and performance analysis of a network.

To implement this paper, the most popular network simulation software OPNET Modeler is used to simulate LAR, DSR and LAR (using PDF) routing protocol of the mobile ad hoc network and compare performance.

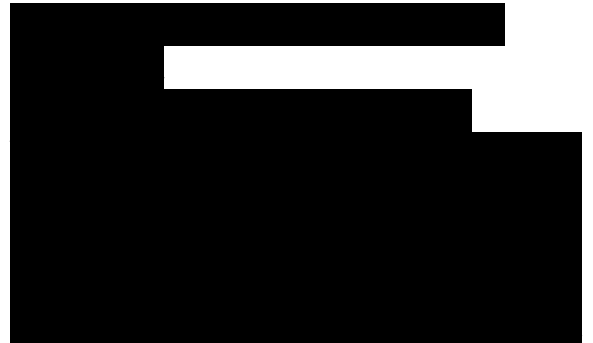
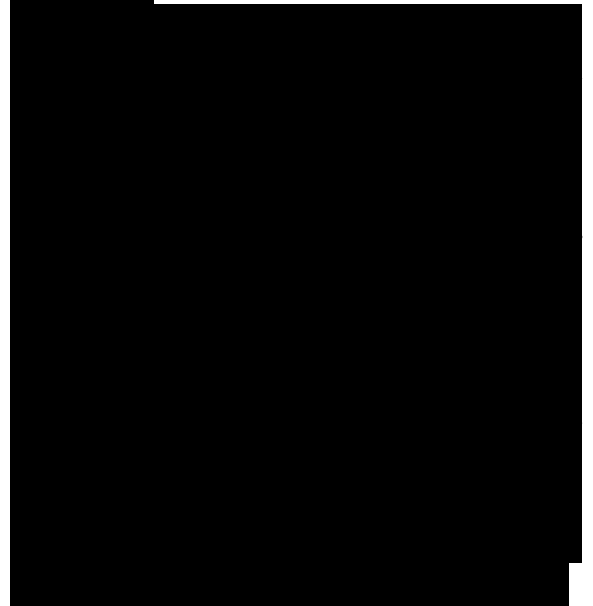
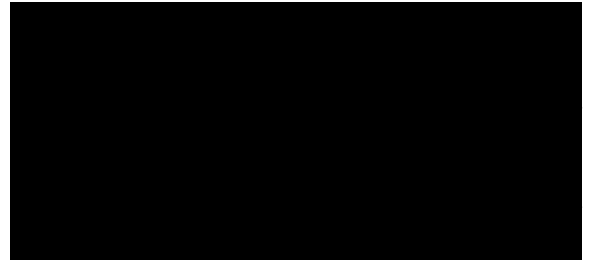
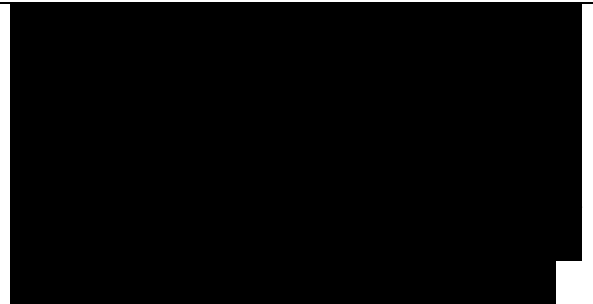
The simulation environment setting used in experiment is shown in table I. The simulation duration is 30 minutes and the network area is 1 km x 1 km that includes variable number of mobile nodes ranging from 5 to 10. A Constant Bit Rate (CBR) is generated as a data traffic pattern at a rate of 1 packet per second, and 100% of the mobile nodes are selected randomly as CBR sources. The scenario of nodes mobility is generated randomly based on random way point model where a mobile node moves to a new position and pauses there for time period between 1 seconds, then it move to another position.

Table 1 - OPNET simulation settings.

## V. Results

### A. Load versus simulation time

It represents all control packets sent by the nodes in the network for the discovering and maintaining the route during the emulation. Loading ability can be used to compare the scalability,



efficiency as well as the competence of adapting network congestion in different networks. Routing protocols with large loading capability have more probability of packet collision and delay.

Fig. 2: Load in wireless LAN for 9 nodes.

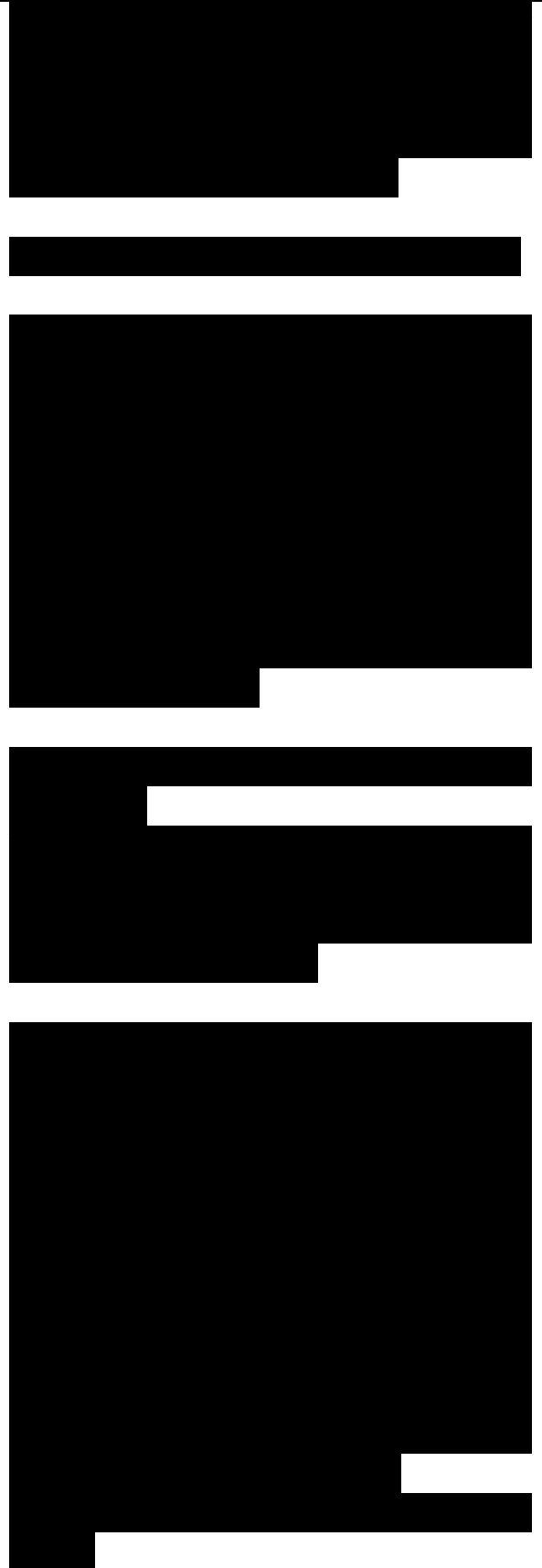
Figure 2 and 3 illustrates that data packet load for each node is constant after a moment in DSR protocol. Data load is increasing in LAR protocol when numbers of node are less in wireless LAN. While nodes are increasing in network, data load is decreased in LAR protocol. LAR proposed Protocol has constant data load for both cases.

#### B. Retransmission Attempts versus Simulation time

The source node sends the packet to the destination node if packets are lost or dropped during transmission. This graph shows the comparison for different scenarios.

A figure 4 and 5 show that packets retransmission attempt in DSR protocol is lower than LAR and LAR proposed protocol. Packets retransmission attempt is varying between from 1.2 to 1.4 in LAR proposed protocol. While packet retransmission attempt in LAR protocol is higher than both protocol i.e. DSR and LAR protocol. It means that DSR does not forward packets to neighbor node if transmission is failure.

#### C. Throughput versus Simulation time



Throughput is given as Actual amount of data is being transmitted in a given time.

Fig. 6: Retransmission attempts for 9 nodes.

Wireless LAN Retransmission Attempts (packets)

Figure 4: Throughput in wireless LAN for 9 nodes.

Figure 5: Throughput in wireless LAN for 18 nodes

Fig. 7: Retransmission attempts for 18 nodes.

Figure 6 and 7 shows that while increasing the number of nodes in wireless LAN, throughput of LAR proposed protocol is also increased as compare to DSR and LAR protocol. The both figure 1 and 2 shows that DSR protocol has decreased throughput while number of nodes are increased in wireless LAN. Therefore, LAR proposed protocol is suitable for wireless LAN.

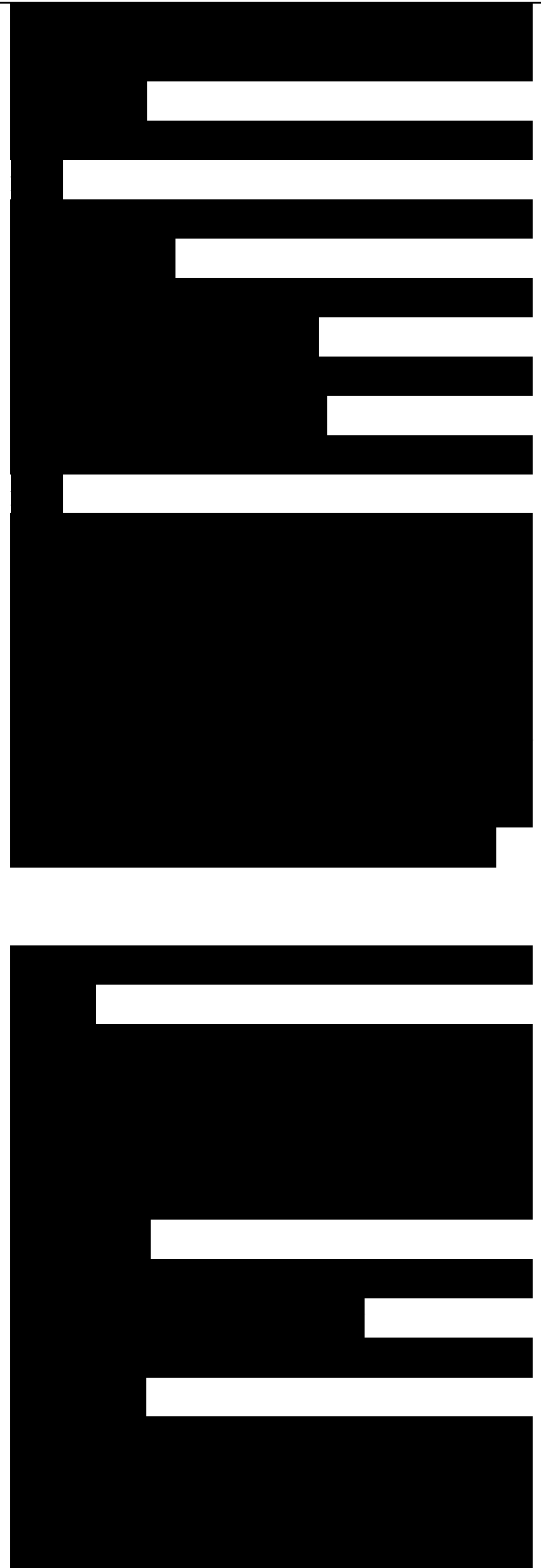
D. Data dropped versus simulation time

If the packet is received but the input buffer capacity has been exhausted, the frames may be dropped by the network. The OPNET has option of keeping track of this occurrence in the network operation.

Table 2: Performance comparison for 9 nodes in wireless LAN

Fig. 8: Data dropped in wireless LAN for 9 nodes.

Figure 8 and 9 shows that data dropped rate for 9 nodes are rising and falling in DSR and LAR routing protocol. While increasing the number of node in



wireless LAN Data dropped has maximum for LAR routing protocol as compare to DSR protocol. In both cases, number of nodes is increasing in Wireless LAN data never dropped in LAR proposed protocol. The blue line shows graph for DSR, the red line shows graph for LAR protocol and the green line shows the graph for LAR proposed protocol.

#### E. Performance Comparison for different scenarios in Wireless LAN

The thesis work has compared two different scenarios for Wireless LAN with DSR, LAR and Proposed LAR Protocol on basis of simulation parameter. The first table presents comparison of three protocols for 9 nodes. This table shows that number of nodes is less in Wireless LAN for changing effect.

The second table represents performance comparison for 18 nodes in wireless LAN.

#### VI. CONCLUSION

The paper has implemented three routing protocols, DSR, LAR and LAR proposed for different scenarios in for Wireless LAN using the OPNET simulator. It found that DSR, LAR is not better for high density network like Wireless LAN. While number of nodes is less in Wireless LAN, DSR and LAR are good for transmission of packet. Whenever increasing the number of nodes in Ad Hoc network, DSR and LAR protocol does not get well results. We have analyzed various parameters



for DSR, LAR and proposed LAR protocol in wireless LAN. For all parameter proposed LAR protocol. In addition, simulation results show that data dropped rate is maximum in case of LAR protocol as compare to DSR because it does not search the location of destination node. Therefore, packet is always dropped during transmission. In DSR, data dropped rate is medium because it broadcasts the packet to all node which in network and it ensures that packets are reached to the destination. Likewise load will always maximum and medium in case of DSR and LAR. Retransmission of packets results show that DSR does not retransmit data while LAR has maximum possibility to retransmission. Actual amount of data is successfully transmitted by proposed LAR protocol i.e. throughput will increase in LAR and proposed LAR protocol. In overall performance of different scenarios in wireless LAN, proposed LAR protocol is achieved better results for all parameters which are used in simulation. The proposed LAR protocol is better for low and high density network.

