Angle Based-Unicast Routing Protocol

Mehvish Minhaj*, Vandana Dubey**

Amity School of Engineering & Technology
Amity University, Lucknow Campus, U. P., India
* mehvishminhaj022@gmail.com, **vdubey@lko.amity.edu

***Abstract*- A Mobile Ad-hoc Network (MANET) is self-configuring network made out of portable nodes with no altered foundation. In a MANETs, there are no distinction between a host node and a router so that all nodes can be source and forwarders of movement. Among all the different protocols unicast will be a standout amongst the most critical application in MANETs which manage the exchange of message from single source to single destination hence this sorts of protocol are extremely powerful and mainstream these days. We have proposed a unicast Routing Protocol for MANETs which consolidate the directional forwarding along largest distance from the single source to single destination, named as AB-URP. The fundamental point of this protocol is low system postponement, accomplishing lessened packet overhead and high adaptability in the system.**

***Index Terms*-** MANETs, Angle based protocol, Unicasting routing protocol, Directional Routing

I. Introduction

Mobile Ad-Hoc Networks (MANETs) are included mobile nodes (MNs) that are self-arranging and agreeable to guarantee proficient and exact packet routing in the middle of nodes (conceivably, base stations). There are no particular routers, servers, access focuses for MANETs. On account of its quick and simple of organization, power, and minimal effort, Typical MANETs applications could be find in the accompanying territories like Military applications (i.e. a transitory system in the front line), Search and salvage operations, Temporary networks inside of meeting rooms, air terminals, Vehicle-to-vehicle correspondence in brilliant transportation, Personal Area Networks joining portable gadgets like cellular telephones, portable workstations, shrew watches, and other adaptable PCs and so on. Configuration issue for creating a routing protocol for remote environment with portability is altogether different and more unpredictable than those for wired network with static nodes [1].

Primary issues in mobile ad hoc network are Limited transmission capacity and oftentimes change in the topology. Even Though there are plenty of routing protocols that can be utilized for unicast correspondence inside of the Mobile Ad hoc systems, it watches that any one protocol can't fit in all the diverse situations, diverse topologies and activity examples of Mobile Ad-Hoc Networks applications.

For example, proactive routing protocols are exceptionally helpful for a small scale MANETs with high versatility, while reactive routing protocols are extremely helpful for an extensive scale, MANETs with moderate or less topology changes. Hybrid routing protocol endeavors to strike harmony between the two, for example proactive for neighborhood, responsive for far away [2].

Most applications in the MANET are based upon unicast correspondence. Hence, the most essential operation in the IP layer of the MANET is to effectively transmit information packets from one source to one destination. The sending system is exceptionally basic in itself: with the routing table, the rely node just uses the destination address in the information packet to find it in the routing table. In the unicast routing protocol one different duplicate sends to every collector from the source node. Information packet is repeated at the sender node and afterward conveyed to each destination node. By this procedure we can undoubtedly see that transmission capacity is devoured by the excess information packets. The off chance that the longest coordinating destination location is found in the table, the packet is sent to the relating next hop. The issue that emerges is the way the steering table is constructed in the nodes in the MANET.

Unicast routing protocol are divided into three part i.e. Proactive, Reactive and Hybrid unicast routing protocol. Which can be better understood by the diagram.

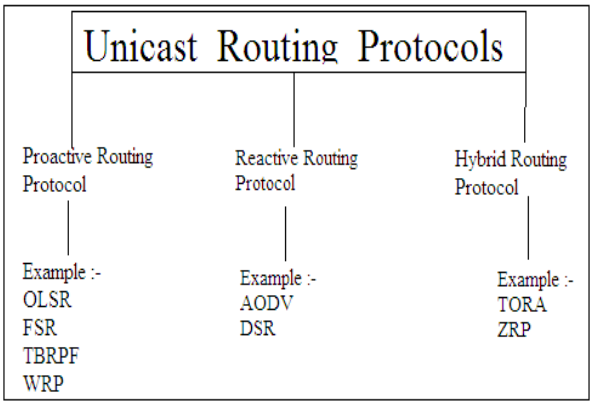

Fig1: Classification of Unicast Routing Protocol

By making use of geographical information available at each node routing is optimized in position based protocol. Position based protocols are broadly classified into two categories:- 1.Greedy forwarding 2.Restricted flooding.

In Greedy Forwarding source node selects the node with the best progress towards the destination based on the location

information of the destination node. The location information of the destination is further inserted in their data packets and unicast to the selected node. After receiving the unicast data packet, the selected node selects the finest node among its neighbor and this process continues until the data packet reaches its specific destination. Greedy Forwarding works specifically in topology as stated in and several work proposed recovery techniques to run-over voids [3, 4, and 5].

Restricted Flooding can be implemented where by limited nodes participate in the flooding and not network-wide participation, with location information. In Restricted Flooding the packet is broadcasted by the nodes that are located nearer to the destination or in a forwarding zone. The operation towards the destination is determined by the distance and forwarding zone information that are computed at the respective nodes. These nodes in-turn broadcast the packet and the process is repeated at each intermitted node until it reaches the destination.

Complex mathematical computation is required by the routing protocol so far. These computation accured further processing downtime in the current node .besides this position based protocol needs local topology updates via periodic beaconing among the neighbor [5, 6].

II. BACKGROUND

Routing is one of the important issues which are having a significant impact on network performance. Different measures which are matters with the Quality of Service are like pause time end to end delay, control overhead, packet delivery ratio, routing overhead, and distance in between source and destination pair.

Different optimization techniques can be used to find out an available optimal path from source to destination. Generally, there are two different stages in routing;

- Route discovery
- Data forwarding.

In route discovery, route to a destination will be discovered by broadcasting the query. Then, once the route has been established, data forwarding will be initiated and sent via the routes that have been resolved. Through broadcasting, all nodes that receive the query will broadcast to all neighbors and hence, large number of control messages is transmitted.

A. Proactive Unicast Routing Protocols:

Traditional routing protocols, for example, Optimized connection state (OLSR), The Fisheye State Routing (FSR), And Topology Broadcast Based on Reverse-Path forwarding Routing Protocol (TBRPF) are proactive unicast routing protocol. Periodic broadcast of network topology update (e.g., distance vector or link state data) is important to register the shortest path from the source to each destination, which devours a considerable measure of bandwidth. Despite the fact that they are generally utilized as part of the Internet backbone. They can't be utilized as a part of the MANET straightforwardly due to the contrasts between the hardwired network furthermore, the MANET. In Table 1 gives the Characteristic examination of proactive Unicast Routing Protocol.

1. Optimized Link State Routing Protocol (OLSR):

Optimized link state routing protocol (OLSR) is a proactive (table-driven) routing protocol for MANETs. A route of routing protocol between sources to destination is accessible quickly when required. OLSR is taking into account link-state algorithm. Generally, every single remote nodes flood neighbor data in a network, yet not in OLSR node. It is publicizing data just about links with neighbor who is in its multipoint hand-off selector set. Its decrease size of control packets diminishes flooding by utilizing just multipoint hand-off nodes to send data in the network and decrease number of control packets by diminishing duplicate transmission. This protocol does not anticipate dependable exchange, since upgrades are sent intermittently. OLSR utilized hop by hop routing. Routes are in light of element table passages kept up at moderate nodes. The protocol is outline to work in disseminated way and consequently does not depend up on the focal substance. The conventions therefore bolster a nodal versatility that can be followed through its nearby control message, which depends up on the recurrence of these messages. Point of preference of OLSR is having the routes accessible inside of the standard routing table can be helpful for a few frameworks and network applications as there is no route revelation deferral connected with discovering another route. Greater overhead and need more power are primary hindrance of this convention [7].

2. Fisheye State Routing Protocol (FSR):

The Fisheye State Routing (FSR) is a table driven unicast routing protocol for Mobile Ad hoc Networks taking into account Link State routing calculation in actuality with lessened overhead to keep network topology data. As demonstrated in its name, FSR uses a function like a fish eye. The eyes of fishes catch the pixels close to the central with high detail, and the subtle element diminishes as the separation from the point of convergence increments. Like fish eyes, FSR keeps up the precise distance and way quality information about the quick neighboring nodes, and dynamically lessens detail as the distance increments. Point of preference of this convention is that it has possibility to bolster various way directing and QoS routing yet detriment of FSR is that it has high storage complexity [8].

3. Topology Broadcast Based on Reverse-Path Forwarding Routing Protocol (TBRPF):

Topology Broadcast Based on Reverse-Path Forwarding routing Protocol (TBRPF) was proposed in. TBRPF goes for the Mobile Ad hoc Network with at generally a few several mobility nodes or high portability of nodes. Each node in the remote system keeps halfway worldwide topology data. At the point when a node needs the briefest way to each other node, a minimum spanning rooted established at itself is processed utilizing adjusted Dijkstra's calculation. TBRPF transmits just the

contrasts between the past network state and the present system state. Correspondingly, routing messages are littler, and can therefore be sent all the more oftentimes. This implies that nodes routing Tables are all the more breakthrough [9].

TABLE 1: Attributes of Proactive Unicast Routing Protocol

	OLSR	FSR	TBRPF
Scope	Large and dense MANETs	Large scale MANETs with high mobility	MANETs with hundreds of nodes and high mobility
Organization Of the Network	Flat	Hierarchical	Flat
Neighbor Detection Method	Periodical HELLO messages	Periodical link state updates	Differential HELLO messages
Optimized Broadcast	Multipoint relaying	Combined with neighbor Detection	Combined with HELLO Messages
Broadcast Information	MPR selector list	Link state update	(Partial) Spanning tree
Route Freshness	Up-to-date	Maybe not up-to-date	Up-to-date

B. Reactive Unicast Routing Protocols:

Because of the as often as possible changing topology of the Mobile Ad hoc Network, the worldwide topology data put away at every node needs to be upgraded often, this expends heaps of bandwidth. Notwithstanding, this utilization now and again is a misuse of bandwidth, in light of the fact that the link state upgrades gotten lapse before the route in the middle of itself and another node is required. To minimizing the wastage of transfer speed, the idea of On Demand or reactive routing protocol is proposed. In On Demand protocols; the routing is isolated into the accompanying two stages: initial one is route disclosure and second one is route maintenance. The most unmistakable On Demand unicast routing protocols are Dynamic Source Routing protocol (DSR), Ad Hoc On demand distance Vector Routing routing(AODV) and Temporally Ordered Routing Algorithm and so forth. In Table 2 gives the Characteristic examination of Reactive Unicast routing Protocols [10].

1. Dynamic Source Routing Protocol (DSR):

Dynamic Source Routing (DSR) is an On Demand unicast routing protocol that uses source routing algorithm. In source routing algorithm, every data packet contains complete routing information to achieve its dispersal. Moreover, in DSR every node employments caching technology to keep up route information that it has found. Case in point, the intermediate nodes cache the route towards the destination and backward to the source. Moreover, in light of the fact that the information packet contains the source route in the header, the catching nodes are capable to cache the route in its steering store [11].

2 .The Ad Hoc On-demand Distance Vector Routing Protocol (AODV):

The Ad Hoc On-demand Distance Vector Routing (AODV) protocol is a reactive unicast routing protocol for mobile ad hoc networks. In a reactive routing protocol, AODV just needs to keep up the routing information about the dynamic ways. In AODV route information is kept up in routing tables at nodes. Each mobile node keeps a next-hop routing table, which includes the destinations to which it as of now has a route. In a routing table, sections lapses in the event that it has not been utilized or reactivated for a prespecified ending time. Also, AODV hold the destination sequence number procedure utilized by DSDV in an on-demand way [12].

3. Temporally Ordered Routing Algorithm:

Temporally Ordered Routing Algorithm (TORA) is an On Demand routing algorithm taking into account the idea of joins inversion. This Routing protocol enhances the fractional join inversion technique by identifying partitions and ceasing non-gainful connection transposition. TORA can be utilized for exceedingly progressive mobile ad hoc networks. TORA has three fundamental steps: route construction, route preservation and route deletion. In TORA the DAG gives the capacity that numerous nodes can send packets to a given destination and ensures that all routes are without circle. On account of node portability the DAG in TORA may be separated. In this way, route maintenance step is an imperative part of TORA. This routing protocol has the distinctive attribute that control messages are localized into a small set of nodes near the topology changes occurred [13, 14].

TABLE II: Characteristic of Reactive Unicast Routing Protocol

	DSR	AODV	TORA
Updating of Destination at	Source	Source	Neighbors
Multicast Capability	No	Yes	No
Control Hello Message Requirement	No	No	Yes
Design Structure	Flat	Flat	Flat
Unidirectional link	Yes	No	Yes
Multiple Route	Yes	Yes	Yes

C .Hybrid Unicast Routing Protocols:

Hybrid routing protocol endeavors to find equalization between the two, for example, proactive for neighborhood, reactive for far away. In light of proactive and reactive routing protocols, some

hybrid routing protocols are suggest to join their favorable circumstances. The most unmistakable hybrid routing protocol is Zone Routing Protocol.

1. Zone Routing Protocol (ZRP):

Zone Routing Protocol (ZRP) [4] is a hybrid routing protocol for mobile ad hoc networks. The hybrid protocols are proposed to diminish the control overhead of proactive routing methodologies and decline the inertness brought on by route look operations in reactive routing methodologies.

Zone Routing Protocol (ZRP) is a structure of hybrid routing protocol suites, which is made up the accompanying modules: First one is Intra-zone Routing Protocol, second one is Inter-zone Routing Protocol, and last one is Broadcast Resolution Protocol [15].

ZRP alludes to the mainly proactive routing segment as the Intra-zone Routing Protocol (IARP). The invariably reactive routing segment is named Inter-zone Routing Protocol (IERP). IERP and IARP are not particular routing protocols. Rather, IARP is a group of limited depth, proactive link-state routing protocol. IARP keeps up routing information for nodes that are inside of the routing zone of the node. Correspondingly, IERP is a group of reactive routing protocol that offer upgraded route discovery and maintenance support administrations in view of nearby integration observed by IARP [16] [17].

III.PROPOSED UNICAST ROUTING PROTOCOL

A. Basic Strategy:

AB-URP is a proficient unicast routing protocol which incorporates the choice of angle for mobile nodes to forward packet in two unique headings in light of the biggest distance in the middle of sender and recipient nodes. The establishment of route having biggest separation from source serves taking after focal points:

- It brings down the quantity of Hop Counts.
- Decreases the dormancy in the system.
- Decreases the aggregate number of packets in the system.
- Control the congestion in the system.

Routes in the network are manufactured and kept up utilizing reply and request messages. At the point when an intermediate node gets a message from a source node, the node first confirmed that the message that was send by other node is received for the first time or not. In the event that it was received for the first time, the node angle forward that message utilizing the same rakish methodology, else it drops the message. Every sending message is stamped by the source with a special sequence number. The duplication can be identified by putting away a record of source and sequence number for beforehand got messages. Source +Sequence number in the route demand message characterizes the character of the message.

B. Methodology :

Above all else, source distinguishes its neighboring nodes with the assistance of an echo packet. In the wake of getting the reply from every one of its neighbors, source sends route ask for RREQ message in two distinct bearings in angle of points and biggest distance to diverse neighboring nodes for the foundation of routes. The message is sent and the source and sequence number is put away so as to filter the future copies and structures the unicast gathering utilizing the reply along opposite path. It is not important to have Location information on all nodes.

The far nodes in the network cover more new network space than closer nodes, accordingly hold latencies down for far-away nodes. This makes our protocol more powerful than others.

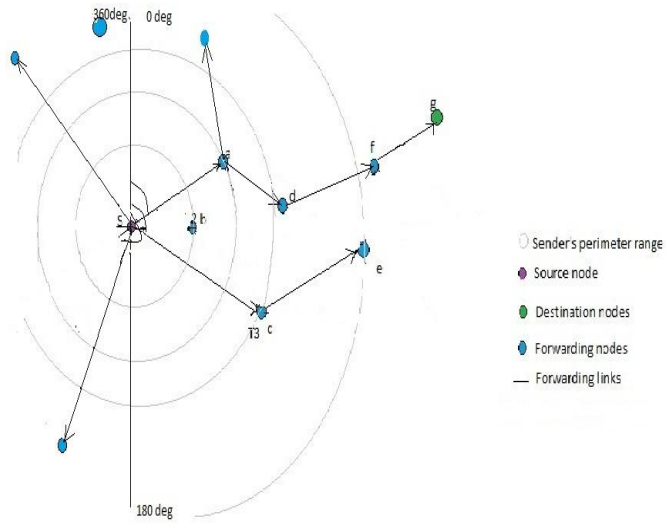

Fig1.Descreption of protocol

The request packet is redirected in two directions by calculating the angle as follows:

1. Y=X2-X1,X=Y2-Y1
   ANGLE=180 – atan(y/x)*180/pi

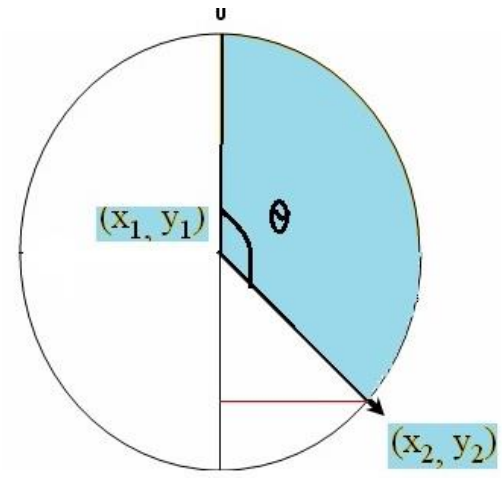

Fig2: Calculation of angle $<180^0$

2. Y=X1-X2, X=Y1-Y2
ANGLE=360-atan(y/x)*180/pi

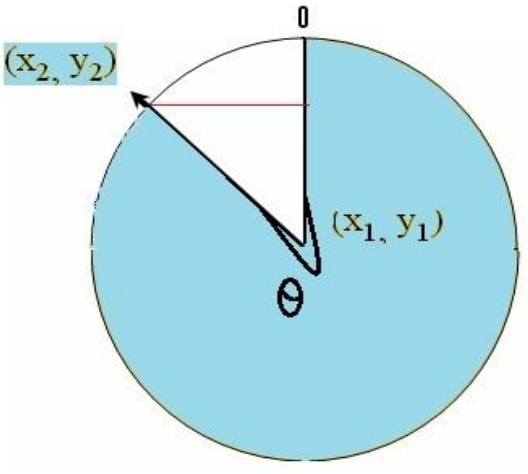

Fig3: Calculation of angle $>180^0$

Here,

- For knowing the location coordinates all the nodes should be equipped with GPS.
- atan(y/x) is the inverse tangent or arc tangent function, which is used to compute the angle between positive y-axis of a plane and a point (x, y) on it.

C. Route Creation:

For each Unicast transmission of packets in the ad hoc network, a route from the source is made. The unicast route is framed utilizing the replies along reverse path. Location information is not complitly needed on all nodes. The source sends a REQUEST to neighbouring nodes in two directions. After one-hop, request is further sent to node in just one bearing, leaving the course from which the request came. A REQUEST packet is remarkably distinguished by the comparing (source, sequence) match that is put away in the forwarding cache. As the REQUEST packet is spread to other node, reverse route passages are made at every intermediate node. Subsequent to getting the REQUEST message from source nodes, the comparing nodes reply with the REPLY messages to build up the route.

Each node in the network maintains a Forwarding Table which is updated after sending or receiving request and reply messages. The format of the Forwarding Table is as follows:

Table III: Forwarding Table Format

Sequence No.	Previous Hop	Next Hop	Node coordinate	Request id
1	S	a, b, c	(x1, y1)	S

IV. ALGORITHM

Calculation for route foundation: AB-URP
Start
At the point when a source node S sends a route request packet RREQ to a unicast destination UD
1. Find the neighboring nodes which act as Forwarders FG utilizing echo packet
2. Maintain the Forwarding Table (FTI) at every node
3. Compute the ANGLE with every member node
4. Append the Sequence no., Source Address, Destination location and FTI to RREQ
5. Select the route having largest distance .
6. Broadcast RREQ to every neighboring node N in two directions
At the point when an Intermediate node Ii gets RREQ,
7. If Ii is an member of UD, then
a. Get UD and show warning of stop to different nodes
8. Else If Ii is an individual from N, then
a. dentify new arrangement of neighboring nodes N'
b. Broadcast RREQ to all new neighboring nodes N'
9. End if
10. End if
11. Send RREP along chose route utilizing information as a part of FTI

V. CONCLUSION

AB-URP is a productive technique utilized for unicast directing as a part of mobile ad hoc networks. It impressively decreases the packet overhead when density of nodes is higher. Due to its directional forwarding methodology, the protocol has the capacity safeguard the potential timing of sending packets under sensible limits and viably diminishes packet overhead. ED-URP gives various advantages due to its single destination, geographic area consideration of nodes, controlled directional sending of packets towards group individuals in the network. The protocol utilizes directional forwarding of the data packets outside the zone towards the objective. These outcomes in impressive reduction in packet preparing accordingly minimize the utilization of energy and transmission capacity.

Toward the end, we got to the meaningful part from my reenactment consider that the execution of our directing convention shifts with the density of nodes.

ACKNOWLEDGMENT

The authors are thankful to Mr. Aseem Chauhan (Additional President RBEF, Chancellor AUR), Maj. General K. K. Ohri, AVSM (Retd.), Pro Vice Chancellor, AUUP, Lucknow Campus, Wing Cd (Dr) Anil Kumar Tiwari (Director ASET), Brig. Umesh K. Chopra (Director, AIIT, & Dy.corrdinator, ASET) and Prof. (Dr.) Deepak Arora (Head CSE & IT Department) for their cooperation, motivation and suggestive guidance.

REFERENCES

[1] Murthy, S. and J.J. Garcia-Luna-Aceves, "An Efficient Routing Protocol for Wireless Networks", *ACM Mobile Networks and App. J., Special Issue on Routing in Mobile Communication Networks*, Oct.1996, pp. 183-97.

[2] M. Ismail. "Routing Protocols for Ad Hoc Wireless Networks", *M.Sc (ISS) project, Carleton University, Ontario, Canada,* August2001.
[3] Stojmenovic, I. Position-based Routing in Ad Hoc Networks. *IEEE Communications Magazine*. July 2002.40(7). 128-134.
[4] Oh, H., Bahn, H. and Chae, K-J. An Energy Efficient Sensor Routing Scheme for Home Automation Networks. *IEEE Transactions on Consumer Electronics,* Vol.31 (3). August 2005.
[5] Chakeres, I. D. and Royer, E.M. AODV Routing Protocol Implementation Design. *Proceedings of 24th WWAN 2004.* 23-24 March 2004. Tokyo. 2004. 698-703.
[6] Chakeres, I. D. and Royer, E. M. AODV Implementation Design and Performance Evaluation. *International Journal ofWireless and Mobile Computing.* 2(3). 2005.
[7] P. Jacquet, P. Muhlethaler, and A. Qayyum, "Optimized Link State Routing Protocol", *IETF MANET, Internet draft*, 1998.
[8] Mario Gerla, Xiaoyan Hong, and Guangyu Pei, "Fisheye State Routing Protocol (FSR) for Ad Hoc Networks", *draft-ietf-manet-fsr-03.txt*, June, 2002.
[9] Richard G. Ogier, Fred L. Templin, Bhargav Bellur, and Mark G.Lewis, "Topology Broadcast Based on Reverse-Path Forwarding (TBRPF)", *draft-ietf-manet-tbrpf-05.txt*, March 2002.
[10] David B. Johnson, "Routing in Ad Hoc Networks of Mobile Hosts", *Proceedings of the IEEE workshop on Mobile Computing Systems and Applications,* December 1994.
[11] D. Johnson, D. A. Maltz, "Dynamic source routing in ad hoc wireless networks", *in Mobile Computing (T. Imielinski and H. Korth, eds.),* Kluwer Acad. Publ., 1996.
[12] C.E. Perkins and E.M. Royer, "Ad hoc on demand Distance Vector routing", *mobile computing systems and applications, 1999. Proceedings. WMCSA '99. Second IEEE Workshop on,* 1999, p90 - p100.
[13] V. Park, and S. Corson, "Temporally-Ordered Routing Algorithm (TORA)", *Version 1 Functional Specification. IETF Internet draft*, 1997.
[14] V. D. Park and M. S. Corson. "A highly adaptive distributed routing algorithm for mobile wireless networks", *INFOCOM '97, Sixteenth Annual Joint Conference of the IEEE Computer and Communications Societies. Driving the Information Revolution, Proceedings IEEE, Volume: 3,* 1997 Page(s): 1405 -1413 vol.3.
[15] Z. J. Haas and M.R Pearlman, "The Zone Routing Protocol (ZRP) for ad hoc networks", *IETF Internet draft*, August 1998.
[16] Haas, Zygmunt J., Pearlman, Marc R., Samar, P.: "Intrazone Routing Protocol (IARP)", *IETF Internet Draft, draft-ietf-manet-iarp-01.txt,* June 2001.
[17] Haas, Zygmunt J., Pearlman, Marc R., Samar, P.: Interzone Routing Protocol (IERP), *IETF Internet Draft, draft-ietf-manet-ierp-01.txt*, June 2001.

AUTHORS

First Author – Ms. Mehvish Minhaj is currently pursuing M.Tech in the field of Computer Science and Engineering from Amity University, Lucknow, (U.P.), India. Her area of interest is Computer Networks and the dissertation work complied by her includes improving the efficiency of Unicast Routing Protocol.
Email id: mehvishminhaj022@gmail.com

Second Author – Ms. Vandana Dubey is pursuing Ph.D. in the field of Reversible Circuit Designing. Her area of interest is Computer Architecture and Organisation. She is currently working as Assistant Professor at Amity University, Lucknow (U.P.), India.
Email id: vdubey@lko.amity.edu