ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

A Survey of Various Routing Algorithms for Mobile Ad-Hoc Networks

[1] P. Roselin, [2] Dr. M. Sivajothi, [3] Dr.T.C. Raja kumar
[1] Research scholar, computer science department, Manonmaniam sundaranar university, Tirunelveli.
[2]Associate professor, computer science department, Sri Parasakthi college for women, Courtallam.
[3]Associate professor, computer science department, St. Xavier's college, Palayamkottai.

Abstract: A Mobile Ad-hoc Network (MANET) is form over wireless media by the various mobile nodes. In other word we can say if various mobile nodes from a network without any infrastructure, such kind of network is known as Mobile Ad-hoc Network. In MANET communication between two mobile devices are performed by routing protocol. This paper presents a coherent survey on routing algorithm of ad hoc mobile networks, with the intent of serving as a quick reference to the current research issues in ad hoc networking. In this survey paper we proved an overview of various routing protocols proposed by various researchers. We will also provide comparative study of all routing protocol to find out the performance of protocol for large MANET.

Keyword: - MANETS, Mobile Ad-Hoc networks

I. INTRODUCTION

In this section we have described about mobile ad-hoc mobile networks. It is a collection of mobile nodes, the nodes are dynamically connected in a arbitrary manner. Ad-hoc mobile networks are self-configuring network there is no any pre-existing infrastructure. There is no designated router on this network and all nodes are able to serve each other as a router and drive the data packets forward. Thus each node act both as host and a router and each node can communicate to other nodes within its transmission range. To communicate with nodes out of its range, a node uses the help from other nodes which play a bridge role to receive and forward messages. These kinds of networks are very flexible and suitable for different situations and applications. For instance, those networks can be applied for military fields, search and rescue operations, and any remote area where is no base station for communications. Due to some mobility of nodes, and infrastructure less environment, routing is significant task in MANETS. Routing protocols are thus responsible for maintaining and reconstructing the routes in timely basis

II. CLASSIFICATION OF ROUTING POTOCOLS

In Ad-Hoc mobile networks, the routing of data packets from source and destination are controlled by routing protocols. Routing protocols designed for MANETs can be broadly classified as position based routing protocols and topology-based routing protocols [1] (also shown in Fig. 1).

III. PROACTIVE OR TABLE DRIVEN ROUTING PROTOCOLS

Proactive Protocols continuously learn the topological information of the network, by periodically broadcast its routing table to its neighbor. These protocols maintain valid routes to all communication mobile nodes all the time, before a route is actually needed. So these protocols have the short response time to determine the route. But due to this periodic broadcasting, it increases the network traffic overhead. And most of the time it is not necessary to have an up-to-date route to all other nodes. some of the Proactive routing protocols are Destination. Sequenced Distance-vector (DSDV)[2] routing protocol, WRP[3], OLSR[4].

IV. ON DEMAND OR REACTIVE ROUTING PROTOCOLS

Reactive Routing Protocols unlike the Proactive ones, it does not attempt to continuously learn the network connectivity. Rather, when the need arises a source node want to send data to the destination the reactive protocols invokes the a procedure to find a route. So there is no need to maintaining routes to each and every node in the network. By using these protocols, it reduces the amount of network traffic overhead and increases the response time. Some of the Reactive routing protocols are AODV [5], DSR [6].

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

V. HYBRID ROUTING PROTOCOLS

Purely proactive or purely reactive protocols works well within limited region of network setting. Hybrid routing protocols combines the advantages of the proactive and reactive approaches. Hybrid routing protocols have less time for route discovery and offer higher scalability[7]. The hybrid algorithm is suitable for MANETs because it has flexibility to change according to change in topology in the network. The common disadvantage of hybrid routing protocols is that the nodes have high level topological information which leads to more memory and power consumption. Some of the Hybrid routing protocols are ZHLS[8], SHARP[9].

VI. ACO BASED ROUTING PROTOCOLS FOR MANET

The ACO(Ant colony optimization) based protocols are specialized to solve routing solutions for MANETs, which are self organizing in nature.ACO

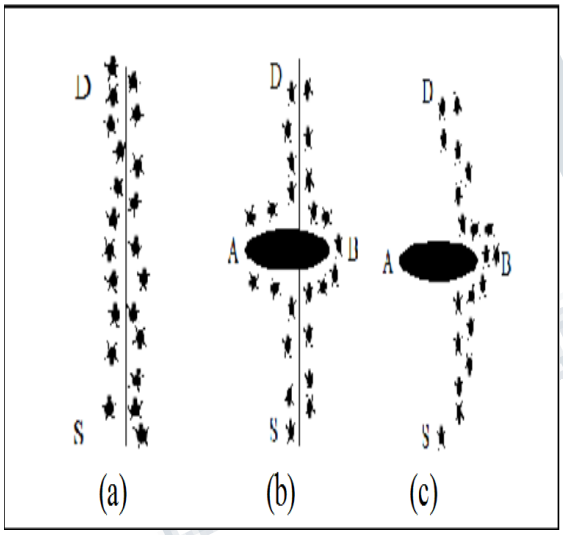

Fig 2. Behavior of ants for searching the food from S to D

is a branch of a newly developed form of Swarm Intelligence. It is based on the study of collective behavior in decentralized, self-organized systems. Swarm is considered as biological insects like ants, bees, wasps, fish etc. ACO has taken the inspiration from real ants to solve the routing problems. Because, there are lots of similarities between mobile ad-hoc networks and the ants[10]. The foraging behavior of the ants has inspired researchers in developing an efficient routing algorithm for MANET. The source of ACO is the pheromone trailing and following behavior of ants which use pheromone as a communication medium.

Pheromone, it is a chemical substance deposited on the ground by ants[11]. While searching the environment for food, the ants deposit pheromone on the ground. When ants fan-out to find food, there are several routes from nest to food source. The ants may find some of them as shown in the figure 2. A lucky ant finds a short route to find a food , then it take a food and come back to the nest in the same way. Since it is attracted by its own pheromone trail, use the same route to take food and come to the nest. Thereby the second pheromone trail was laid down by the lucky ant. The other ant, which choose the longer path, if arrive after the first ant, when trying to make their way back to the nest, there is a good chance for them to be attracted by the shortest route, which was used by the lucky ant. This strengthened the shortest route. concerning the longer path pheromone tend to evaporate after some time so the longer path will be forgotten by the ants. However, over time the shortest route will accumulate greater pheromone concentration and it will be attract more fellow ants.

The basic principle to find the shortest path among several paths is based on pheromone concentration. Which path have the higher pheromone concentration taken by the ant to reach the food source. If a previous short route get blocked or lengthened due to an obstacle on route, the alternate short route get strengthened with higher pheromone content due to shortest end-to-end travel time and move ants more to this route. Representative routing protocols using ant colony for ad-hoc mobile networks include Dynamic Source Routing(DSR), Ant-Based Hybrid Routing Algorithm, for Mobile Ad-Hoc networks(AntHocNet),Ant-Colony Based Routing Algorithm(ARA)[12], Ant-AODV[13], AntHocNet.[14].

A. Ant-Colony Based Routing Algorithm (ARA)

It is one of the representative reactive routing algorithm based on ant-like mobile agents. The source node in a MANET that employs this algorithm broadcast forward ants[12] toward the destination. As each forward ant moves toward the destination, It constructs a route from the visited node to the source node. In ARA, a route is indicated by a positive pheromone value in the intermediate nodes routing tables. Using this algorithm it contains three phases 1. Route Discovery phase 2. Route Maintenance 3. Route Failure Handling. In Route

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

Discovery phase the source node broadcast forward ants (FANT) to the network to find the route to the destination. When the forward ant reaches the destination, it creates the backward ants (BANT) and sends it back to the source node in order to construct there the correct forward route. After the reach of the backward ant the source node start the communication session along that route. ARA does not need any special packets for route maintenance. Route failure handling carried in this situation like, If an intermediate node leaves from the route, while the route is still used in a communication session the node that failed to relay data and sends an error message to the previous node. The previous node checks whether there is alternate route to the destination. If there is one, the previous nodes simply use it. If there is not the previous node asks its neighbors to relay the data packet. If the failure notification reaches the source node, it re- initials the broadcast of the forward ants.

B. AntHocNet

It is a hybrid multipath routing algorithm, designed along the principles of ACO routing. It consists of both proactive and reactive components[14]. It does not maintain routes to all possible destinations at all times, but only sets up paths when they are needed. This is done by reactive route set up phase, where the agents are called reactive forward ants. When a source node wishes to start a communication send data to destination, the source checks whether there is a route from source to destination. When there is exist source simply use it. Otherwise, the source explore reactive forward ant to seek the route. When the forward ant reaches the destination it becomes backward ant and travels back to the source node along the same path.

Even the route is established from source to the destination then the data session started. While the data session is going on the paths are monitored, maintained, and improved proactively using different agents, called proactive forward ants. The algorithm reacts to link failures with either a local

VII. ZONE BASED ROUTING PROTOCOLS FOR MANET

The zone based routing protocols aims to address the problems by combining the advantages of both proactive and reactive approaches[15]. zone based routing protocols can be classed as a hybrid routing protocol. In an Ad-Hoc network , it can be assumed that the largest part of the traffic is directed to nearby nodes. Zone based routing , reduces the proactive scope to a zone centered on each node. In a limited zone, the maintenance of routing information is easier compared to overall network. Nodes that are farther away can reached with reactive routing. Representative zone based routing protocols for ad-hoc mobile networks include Zone Routing Protocol(ZRP)[15], Zone based Hierarchical Link State Routing Protocol(ZHLS)[16], Sharp Hybrid Adaptive Routing Based Protocol(SHARP) [17],HOPNET[18].

A. Zone Routing Protocol(ZRP)

The Zone Routing Protocol, the network is divided into zones. A routing zone is defined for each node separately, and the zones of neighboring nodes overlap)[15]. The size of the zone expressed in the term of radius ρ expressed in hobs. The nodes of the zone divided into peripheral nodes and interior nodes[7]. Peripheral nodes are nodes whose minimum distance to the central node is exactly equal to the zone radius ρ. The node whose minimum distance is less the ρ radius are interior nodes.ZRP refers two types of routing protocol. IntrA-Zone routing protocol(IARP) maintains the routing information within the zone. InEr-zone routing protocol (IERP) maintains routing information between the zones. Instead of broadcasting packets, ZRP uses the concept of Border casting by using Border cast Resolution Protocol(BRA).

Routing in ZRP

When the source node want to send packet to destination first it checks whether the destination is within its local zone by using information provided by IARP. In that case, the packet can be routed proactively. Reactive routing is used if the destination is outside the zone. Reacting routing contains two phases Route Request and route reply. In the route request phase the source sends a route request packet to its peripheral node using BRP. If the receiver of the Route request phase knows the destination, it responds by sending a route reply back to the source. Otherwise it continuous the process by border casting the packet. In ZRP, the knowledge of the local topology can be used for route maintenance. Using ZRP reduces the control traffic produced by periodic flooding of routing information packets and reduces the wastage of bandwidth and overhead compared to reactive schemes. Using ZRP each node have higher level topological information, memory requirements are greater.

B. HOPNET

HOPNET is a hybrid routing algorithm for MANETs based on ACO and zone routing framework[18]. This algorithm is based on ants hopping from one zone to the next, consist of the local proactive route discovery within

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

a nodes neighborhood and reactive communication between the neighborhoods. The algorithm has features extracted for ZRP and DSR protocols. Like ZRP, in HOPNET the network is divided into zones. The size of the zone determined locally by the radius length measured in hobs. The node can be categorized as interior and boundary node. Boundary node are at a distance from the central node all other node less then the radius are interior nodes. All other nodes are exterior nodes(outside the zone). Each node contains two routing tables, IntraZone Routing Table (IntraRT) and InterZone Routing Table(InterRT). IntraRT is proactively maintained so that a node can obtain the path to any node within the zone quickly. The InterRT stores the path to the node beyond the zone. In route discovery phase inside the zone,the ACO algorithm is used to find the shortest or best path from source to destination. Forward and backward ants are used to find the route. Route discovery phase in outside the zone, source node first checks if there is a route is already exist. If there is one the source simply use it. Otherwise the source node broadcast the forward ant to the next zone via the other peripheral nodes within its zone.

The route is proactively maintained by InterRT routing table. If an interzone route is invalid, the upstream node of the broken link will conduct the local repair procedure. If a upstream node successfully find a new route the destination, it will send all buffered packets to the destination via the newly found route meanwhile a notification ant will be send to the source to let the source node know the change of the route. If such an alternate route cannot found, an error ant send to the source node. Then the source node initiates the forward ant to find a route using the route discovery procedure described above.

VIII. POSITION BASED ROUTING PROTOCOLS FOR MANET

In position based routing algorithm it is considered that the node has the aware of its location, the location of its neighbor nodes and the location of the destination. The location of the network can be estimate by the instrument like GPS receivers. To get location information from GPS receivers for MANETS is a difficult one because there are some margins on using GPS. For Indoor work we can't access GPS because there is a problem of GPS range inside the houses or offices. And in smaller wireless devices or sensor nodes it is difficult to install GPS hardware and antenna over it. GPS is very expensive for such small devices or networks. The main aim of position based routing algorithm is to limit and control flooding of route request packets throughout the network.

A. Location-Aided Routing (LAR) in Mobile Ad Hoc Networks.

One of geographical-based routing protocol is location aided routing (LAR) [19]. The main goal of LAR is to limit flooding of routing request packets in a network. LAR contains two zones request zone and expected zone. The area of network in which current location of destination is expected to be is known as "expected zone" and the area through which request packet has to travel is called as "request zone". LAR assumes that each node in the network knows the destination's physical location at time t0 as well as its average traveling speed v. Based on this information, the source node computes the destination's expected zone at time t1 as a circle centered in the destination's last known position and radius r which is computed as follows:

$$r = v \times (t1 - t0) \qquad (1)$$

The request zone is defined as a rectangular area with the following properties: (1) the request zone completely encompasses the expected area, (2) the sides of the rectangle are parallel to the x and y coordinates, and (3) the sides of the rectangle are tangent to the expected zone circle. During the route discovery process only the nodes within the destination's request zone participate in finding the path to destination by re-broadcasting RREQ messages.

B. A Position Based Ant Colony Routing Algorithm for Mobile Ad-Hoc Networks (POSANT)

It is a Reactive routing algorithm. It combines the idea of ant colony optimization and the position of the nodes. Our simulation results, POSANT[20] it reduces the route establishment time while keeping the number of generated ants much smaller in of other ant colony based routing algorithm. In this algorithm it used the concept of zones. For each node s(i.e. s is not necessarily the source node) we partition its neighbors three zones called zone1,zone2,zone3. To start route establishment step, each zone nodes and its outgoing links are initially assigned pheromone values like v1, v2, v3 according to its zone number. Each node maintains two tables, one is related to the value of pheromone trails assigned to its outgoing links for different destinations. Another one is Back Routing(BR) table, which is related to store the path information. To establish a route, source node send n forward ants with unique sequence numbers from each zone at regular time intervals. At each node the forward ant selects the next hob from k neighbors by calculating

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

the probability of pi, it's based on pheromone concentration on each node. When a forward ant reaches the destination it is destroyed and create a backward ant is sent back to the source. The backward ant has the same sequence number corresponding to the forward and use the same path to the source by using the path information stored in the BR table. After receiving the backward ants, for each three zones the source node calculate the average and standard deviations of the delay. From this calculation the source node finds the zone, which has the less delay and shortest path to the destination whose directions are closer to the direction of the destination. Then the source node encourage sending forward ants or data packets, which zone has less delay and short length to the destination. And the sources stops sending forward ants or data packets via other zones.

IX. CLUSTER BASED ROUTING ALGORITHM FOR MANETS

Cluster based routing is an interesting solution to address nodes heterogeneity, and to limit the amount of routing information that propagates inside the network. It also increases network stability, increased the scalability of the system and reduces the network traffic. Different types of Clustering Schemes are available in Mobile Ad hoc Networks. Identifier Neighbour Based Clustering, Mobility Based Clustering, Energy based Clustering, Weight based Clustering, AI(Artificial Intelligence)Based Clustering In a cluster based architecture mobile nodes are grouped into clusters and cluster head is elected for each cluster. These clusters are dynamically rearranged with change in topology of the network.

Three types of nodes are commonly present in the cluster i.e. cluster head, member node, gateway The cluster node is the node which maintains the information about the nodes present in the network. It also use the location information by the use of GPS to find the location of the nodes. normally the cluster based routing protocols are divided into four phases. first phase is cluster formation, second cluster maintenance, third route discovery last phase is route maintenance or route recovery. some of the cluster based routing protocols are CBRP(Cluster based Routing Protocol) [21], LACBER(Location Aided Cluster Based Energy - Efficient Routing) [22], HLRP(Hybrid Location Aided Routing Protocol for GPS Enabled MANET Clusters) [23].

A. HLRP(Hybrid Location Aided Routing Protocol for GPS Enabled MANET Clusters)

This protocol extensively make use of clustering as well as location information. In order to support cluster formation, each node uses it's node value and a neighbour table which stores information about the neighbour node and its node values. The node value which is obtained by using the composite LACBER criterion[23]. The node with high node value with respect to its neighbour table elects itself as cluster head while all the other nodes remain members in the cluster.

Due to the mobility of the nodes the clusters have to be reorganized and reconfigured dynamically. Here, there are three major scenarios in a cluster for reconfiguration. 1. node value of the cluster head lowers. 2. Arrival of new node in a cluster. 3. Mobility of cluster head. The last phase is route discovery in HLRP protocol it is done by using location information. There are two instances of route discovery Intra cluster Routing and Inter cluster Routing.

In Intra cluster Routing, routing within the cluster so all the nodes know about the location of other nodes in its cluster. When a node want to send a packet to a destination, it checks the neighbor table whether the destination node is present in its cluster. if it is present the source node sends packet to the destination. If the destination absent, it follows the procedure of Inter cluster routing. If the destination outside the cluster the source sends the packet to its cluster head. The cluster head contains location information of other cluster heads and sends towards the cluster head which is nearer to the destination node using the location information. On reaching the destination the destination cluster, its cluster head sends back a route reply for the route request.

CONCLUSION

Routing is an essential component of communication protocols in mobile ad hoc networks. This report reviews results in this active research area and presents typical unicast and multicast routing protocols. Although fruitful results have been achieved, the survey shows the fact that no single protocol suits all purposes or is widely accepted by a large community. There also many open questions and just nearly investigated areas in research field of mobile ad hoc routing, such as QoS guarantees, adaptability and robustness improvements, multi-path routing and multicast, etc. New routing schemes are continuously emerging, and at the same time researchers are expending substantial efforts to improve existing routing protocols. It seems that the future success of

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

ubiquitous computing to a large extent will be dependent on the research results in this area. The overall comparison of topology based routing protocol given in Table 1[24].

Routing class	Proactive	Reactive	Hybrid
Routing Structure	Both flat and hierarchical structures are available	Mostly flat	Mostly hierarchical
Availability of route	Always available	Determined when needed	Depends on the location of the destination
Control traffic volume	Usually high	Lower than Global routing	Mostly, lower than proactive and reactive
Periodic updates	Yes	Not requied	Usually used inside each zone. other than zone routing periodic updates done in route maintenance phase.
Storage requirements	High	Usually lower than proactive potocols	Usually depends on the size of the zone may become as large as proactive protocols if zones are big
Delay level	Small routes are predetermined by the use of periodic updates	Higher than proactive	Inside the zone small. outside the zone may be as large as reactive protocols
Scalability	Usually u to 100 nodes	Usually up to few hundred nodes	Designed for up to 1000 or more nodes

REFERENCES

[1] Jain, Sonam, and Sandeep Sahu. Topology vs. Position based Routing Protocols in Mobile Ad hoc Networks: A Survey." International Journal of Engineering Research & Technology (IJERT) 1.3 (2012).

[2] Perkins, Charles E., and Pravin Bhagwat, "Highly dynamic destination-sequenced distance-vector routing (DSDV) for mobile computers", ACM SIGCOMM Computer Communication Review, Vol. 24, No. 4, ACM, 1994.

[3] Murthy, Shree, and Jose Joaquin Garcia-Luna-Aceves, "An efficient routing protocol for wireless networks", Mobile Networks and Applications 1.2 (1996): 183-197.

[4] Jacquet, Philippe, et al., "Optimized link state routing protocol for ad hoc networks", MultiTopic Conference, 2001, IEEE INMIC 2001, Technology for the 21st Century, Proceedings IEEE International, IEEE, 2001.

[5] C. Perkins and E. M. Royer, "Ad Hoc On-Demand Distance Vector Routing", 2nd IEEE Workshop on Mobile Computing Systems andApplications, February 1999.

[6] Johnson, David B., and David A. Maltz, "Dynamic source routing in ad hoc wireless networks", Mobile computing, Springer US, 1996, 153-181.

[7] Raheja, Kanishka, and Sunil Kr Maakar. "A survey on different hybrid routing protocols of MANET." IJCSIT) International Journal of Computer Science and Information Technologies 5 (2014): 5512-5516.

[8] Takahashi, Michito, Masaki Bandai, and Iwao Sasase. "Multilevel zone-based hierarchical link state routing with location search technique applying hierarchical request for mobile ad hoc networks." Electronics and Communications in Japan (Part I: Communications) 88.1 (2005): 44-52.

[9] Ramasubramanian, Venugopalan, Zygmunt J. Haas, and Emin Gün Sirer. "SHARP: A hybrid adaptive routing protocol for mobile ad hoc networks." Proceedings of the 4th ACM international symposium on Mobile ad hoc networking & computing. ACM, 2003.

[10] Mohan, B. Chandra, and R. Baskaran. "A survey: Ant Colony Optimization based recent research and implementation on several engineering domain." Expert Systems with Applications 39.4 (2012): 4618-4627.

[11] Shirkande, Sudarshan D., and Rambabu A. Vatti. "Aco based routing algorithms for ad-hoc network (wsn, manets): A survey."Communication Systems and Network Technologies (CSNT), 2013 International Conference on. IEEE, 2013.

[12] Gunes, Mesut, Udo Sorges, and Imed Bouazizi. ARA-the ant-colony based routing algorithm for MANETs." Parallel Processing Workshops, 2002. Proceedings. International Conference on. IEEE, 2002.

[13] Marwaha, Shivanajay, Chen Khong Tham, and Dipti Srinivasan. "Mobile agents based routing protocol for mobile ad hoc networks." Global Telecommunications Conference, 2002. GLOBECOM'02. IEEE. Vol. 1. IEEE, 2002.

[14] Di Caro, Gianni, Frederick Ducatelle, and Luca Maria Gambardella. "AntHocNet: an ant-based hybrid routing algorithm for mobile ad hoc networks." International Conference on Parallel Problem Solving from Nature. Springer, Berlin, Heidelberg, 2004.

[15] Beijar, Nicklas. "Zone routing protocol (ZRP)." Networking Laboratory, Helsinki University of Technology, Finland 9 (2002): 1-12.

[16] Takahashi, Michito, Masaki Bandai, and Iwao Sasase. "Multilevel zone-based hierarchical link state routing with location search technique applying hierarchical request for mobile ad hoc networks." Electronics and Communications in Japan (Part I: Communications) 88.1 (2005): 44-52.

[17] Ramasubramanian, Venugopalan, Zygmunt J. Haas, and Emin Gün Sirer. "SHARP: A hybrid adaptive routing protocol for mobile ad hoc networks." Proceedings of the 4th ACM international symposium on Mobile ad hoc networking & computing. ACM, 2003.

[18] Wang, Jianping, et al. "HOPNET: A hybrid ant colony optimization routing algorithm for mobile ad hoc network." Ad Hoc Networks 7.4 (2009): 690-705.

[19] Ko, Young-Bae, and Nitin H. Vaidya. "Location-Aided Routing (LAR) in mobile ad hoc networks." Wireless networks 6.4 (2000): 307-321.

[20] Kamali, Shahab, and Jaroslav Opatrny. "Posant: A position based ant colony routing algorithm for mobile ad-hoc networks." Wireless and Mobile Communications, 2007. ICWMC'07. Third International Conference on. IEEE, 2007.

[21] Jiang, Mingliang. "Cluster based routing protocol (CBRP)." IETF Internet-draft (1999).

[22] Deb, Dipankar, Srijita Barman Roy, and Nabendu Chaki. "LACBER: a new location aided routing protocol for GPS scarce MANET." International Journal of Wireless & Mobile Networks (IJWMN) 1.1 (2009): 22-34.

[23] Mangai, S., and A. Tamilarasi. "Hybrid location aided routing protocol for GPS enabled MANET clusters." Communication and Computational Intelligence (INCOCCI), 2010 International Conference on. IEEE, 2010.

[24] Mehran Abolhasan, Tadeusz Wysocki, Eryk Dutkiewicz, " A review of routing protocols for mobile ad hoc networks ",