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Energy Efficient Routing Protocol in MANET Using NS-2

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ABSTRACT

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less* network *of mobile devices connected* without wires. *Geographic routing (also called georouting or position-based routing) is a* routing *principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. One of the major challenges in mobile ad hoc networks (MANETs) is link failures due to mobility. Ad hoc On-Demand Distance Vector Routing(AODV) and Dynamic source routing(DSR) Routing is a routing protocol for mobile ad hoc networks (MANETs) and other wireless ad hoc networks. The AODV Routing Protocol uses an on-demand approach for finding routes that is a route is established only when it is required by a source node for transmitting data packets. The major difference between AODV and Dynamic Source Routing (DSR) stems from the fact that DSR uses source routing in which a data packet carries the complete path to be traversed. However, in AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission. Dynamic Source Routing (DSR) is a routing protocol for networks. This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. Dynamic source routing (DSR) protocol is more efficient than AODV protocol because Dynamic source routing (DSR) protocol supports high mobility environment than AODV protocol.

Index Terms— MANET, AODV, DSR Protocol, Geographic routing.

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INTRODUCTION

A mobile ad hoc network (MANET) is a wireless network that uses multi-hop peer-to-peer routing instead of static network infrastructure to provide network connectivity. A MANET is a collection of self-organized wireless mobile hosts forming a network without the aid of any established infrastructure or centralized administration stations. Ad-hoc is a Latin phrase which means for this purpose. It generally signifies a solution designed for a specific problem or task. MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links .Ad-Hoc networks are mobile wireless networks that have no fixed infrastructure. There are no fixed routers instead each node acts as router and forwards traffic from other nodes. MANET is a type of ad-hoc network with rapidly changing topology. Since the nodes in a MANET are highly mobile, the topology changes frequently and the nodes are dynamically connected in an arbitrary manner. In order To facilitate communication with the network, a routing protocol is used to discover the routes between nodes.

Mobile Ad Hoc Networks (MANETs) consist of nodes that change position frequently. To accommodate the changing topology special routing algorithms are needed. For relatively small networks flat routing protocols may be sufficient. However, in larger networks either hierarchical or geographic routing protocols are needed. There is no single protocol that fits all networks perfectly. The protocols have to be chosen according to network characteristics, such as density, size and the mobility of the nodes. Wireless local area network based on IEEE 802.11 technology is the most prevalent infra-structured mobile network, where a mobile node communicates with a fixed base station, and thus a wireless link is limited to one hop between the node and the base station maintaining an optimized lifetime of a routing path in a network is a very challenging task because the power or energy of the nodes depends on the size, model, property, and capacity of the battery. Energy in batteries continuously deplete due to node activities such as transmission, reception and overhearing. Depletion of energy in nodes especially the intermediate ones disrupt communication and results in changes to the network topology. However disruption can be minimized through an efficient selection of intermediate nodes. Such selection criteria must be the first step in any route selection process in order to maintain a stable routing of data between the end nodes.

Mobile Ad-Hoc Networks (MANETs) are collections of mobile nodes, dynamically forming a temporary network without preexisting network infrastructure or centralized administration.

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Fig. 1. An example of a Mobile Ad hoc Network (MANET)

- Mobile nodes can be arbitrarily located and are free to move randomly at any given time.
- No dedicated routers, each node in a MANET network acts as a router and is responsible for discovering and maintaining routes to other nodes.
- The primary goal of the MANET routing protocol is correct and efficient route establishment to facilitate communication within the network between arbitrary nodes.

Geographic routing (also called Geo-routing or position-based routing) is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. The idea of using position information for routing was first proposed in the 1980s in the area of packet radio networks and interconnection networks. Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery. Geographic routing scheme that uses the physical positions of each node, geographic routing algorithms have also been applied to networks in which each node is associated with a point in a virtual space, unrelated to its physical position

DSR (Dynamic Source Routing) is on-demand, simple and efficient routing protocol for multi-hop wireless ad-hoc networks of mobile nodes. DSR uses source routing and protocol composed of two main mechanisms-'Route Discovery' and 'Route Maintenance', which works together entirely, on-demand. The protocol allows multiple routes to destination, loop-free routing, support for unidirectional links, use of only 'soft state' in routing, rapid discovery when routes in the network change, designed for mobile ad hoc networks of up to about two hundred nodes and to work well even with high rates of mobility.

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AODV (Ad hoc on-demand distance vector) enables dynamic, self-starting, multi-hop on-demand routing for mobile wireless ad hoc networks. AODV discovers paths without source routing and maintains table instead of route cache. It is loop free using destination sequence numbers and mobile nodes to respond to link breakages, changes in network topology in a timely manner. It maintains active routes only while they are in use and delete unused routes.

2.RELATED WORKS

Routing protocols in mobile ad hoc networks are classified into two classes: table-driven and on-demand. The table-driven, or proactive, method is used for alternate updating links and can use both the distance vectors and link statuses used in fixed networks. In the on-demand method with reactions, other nodes do not update the route and the routes are determined at the origin of the request. Therefore, there is the possibility of using a caching mechanism. The advantage of this method is that both energy and bandwidth are used effectively. In this chapter, the table-driven and the on-demand protocols are explained and then compared with different parameters.

2.1 Table-Driven Protocols

In this group of protocols, each node maintains one or more tables that include routing information to other nodes of the network. All nodes update their tables to preserve compatibility and to give upgraded viewpoints of the network. When the topology of the network changes, the nodes distribute update messages across the network. Some identifying aspects of this class of routing protocols include the ways in which information is distributed, the ways the topology is changed and the number of table's necessary for routing.

2.2 On-Demand Routing Protocol

Some of the better known MANET protocols are AODV, TORA, DSR, TBRPF and OLSR. Each protocol has evolved over time to better suit the particular requirements of various types of mobile ad hoc networks.
These protocols are classified broadly into two categories.
1. Proactive
2. Reactive.

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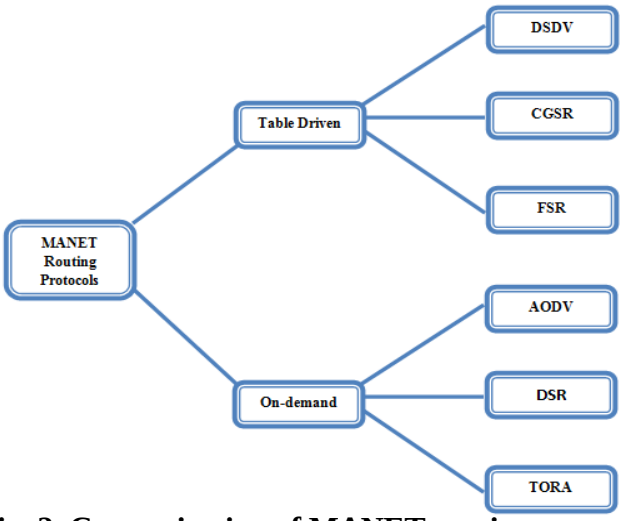

Fig. 2. Categorization of MANET routing protocols

Proactive Protocols:-

Periodic topology updates a node always possesses the latest routing information.

Proactive MANET protocols update routing information in a proactive manner by exchanging route information at periodic intervals. The exchange of table-based route information is evenly distributed across the wireless network. As a result, routes are established prior to being needed, providing a wireless network that is low in latency, at the expense of increased overhead. The well-known proactive routing protocols are TBRPF, DSDV.

Reactive protocols:-

Rather than distribute all route information across the entire network, On-demand MANET protocols perform route maintenance only when required. On-demand protocols create fewer networks overhead since the exchange of routing information is localized rather than evenly distributed. The result is a network with less overhead, at the expense of increased latency due to the route discovery process.

Energy management in MANETs is the basis on which routing protocols are improved to attain energy efficiency. The choice of the routing protocol affects each of the dimensions along which energy is consumed, such as transmission, battery, device and processor energy. These dimensions are discussed in detail in the remainder of the section. Along with these schemes there is also a description of the energy cost metrics which measure the amount of energy saved by using different path selection schemes.

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2.3 Ad Hoc On-Demand Distance Vector (AODV)

Ad Hoc On-Demand Distance Vector Routing discovers routes on an as needed basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers.

An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves.

2.4 Dynamic Source Routing (DSR)

Dynamic Source Routing The key distinguishing feature of DSR is the use of source routing. That is, the sender knows the complete hop -by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network. The RREP routes itself back to the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for future use. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes any route using this link from its cache. A new route discovery process must be initiated by the source if this route is still needed. DSR makes very aggressive use of source routing and route caching.

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III. Need of Energy Consumption

Energy efficient protocols are introduced to enhance energy level of nodes. Some nodes may have limited battery power. With decrease in power they become incapable to forward packets. These protocols are made to enhance this energy level among nodes. Whenever packets are transmitted via intermediate node, its energy is consumed every time. Asymmetric power configuration of adjacent nodes is affected. There are many ways to efficiently utilize energy in MANETs. The performance differentials are analyzed using varying network load, mobility and network size. also compare the AODV & DSR with the help of the packet delivery ratio, end-to-end delay, throughput, not considered the energy consumption in the mobile ad-hoc network. In the MANET considered two routing protocol i.e. AODV & DSR. Both are on demand routing protocols.

IV. Software

Network Simulator (NS2) is an object–oriented, discrete event simulator for networking research. NS provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks. The simulator is a result of an ongoing effort of research and developed. Even though there is a considerable confidence in NS, it is not a polished product yet and bugs are being discovered and corrected continuously.

NS is written in C++, with an OTCL1 interpreter as a command and configuration interface. The C++ part, which is fast to run but slower to change, is used for detailed protocol implementation. The OTCL part, on the other hand, which runs much slower but can be changed very fast quickly, is used for simulation configuration. One of the advantages of this split-language program approach is that it allows for fast generation of large scenarios. To simply use the simulator, it is sufficient to know OTCL. On the other hand, one disadvantage is that modifying and extending the simulator requires programming and debugging in both languages.

NS can simulate the following:

1. Topology: Wired, wireless
2. Scheduling Algorithms: RED, Drop Tail,
3. Transport Protocols: TCP, UDP
4. Routing: Static and dynamic routing
5. Application :FTP, HTTP, Telnet, Traffic generators

4.1 Simulation SCENARIO :-

Steps:-

When user goes for execution of simulation in NS2, following steps should be followed

1. Write TCL script with correct flow containing all required modules.

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2. Now run the simulation from terminal window of Linux system by giving proper path of directory and execute .tcl file using ns command
3. After execution of ns command source and destination nodes to be fixed by the user by entering node no.s
4. After finishing simulation it will show animation window i.e. .nam file
5. View animation and correct tcl script if any error occurs
6. Now write AWK script to extract required data from trace file
7. Generate xgraph file from extracted data
8. Run this xgraph file either along with tcl file or separately in terminal window
9. Analyze and compare the results for further development.

4.2 Simulation environment:-

1. Channel	2. Wireless
3. Propagation	4. Two Ray Ground
5. Antenna	6. Omni direction
7. Link layer type	8. LL
9. Interface queue	10. CMUPriqueue
11. Ifq length	12. 1024
13. Routing protocol	14. DSR
15. No. of Nodes	16. 48
17. X value	18. 1300
19. Y value	20. 900
21. Energy	22. 30/60/100 unit

4.3 Node creation

In simulation, mobile nodes are randomly placed in a region of size 1300 m *900 m. User can take no of nodes, here we take 48 nodes. The radio range for each node is assumed to be 250 meters. Here Constant Bit Rate (CBR) traffic source is used with each source generating four packets per second. before creating the node we have to define its position in the form of X &Y co-ordinates.

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4.4 Beacon update

In MANET there is no fixed communication infrastructure. Each node is free to move in an arbitrary manner. Hence it's necessary for nodes to maintain updated position information with the immediate neighbor. Also there will be frequent changes in the topology of the mobile nodes. each node is needed to maintain its location information with the neighbor nodes. For this purpose they transmit the beacon packet periodically. which is not fair in terms of update cost and performances in term of routing decision. To overcome this we introduce the Efficient Beacon scheme based on mobility of node which uses two principles. 1) A node transmits its next beacon if the deviation in its predicted value with its actual location is more than the acceptable error range. 2) When a node overhears a data packet transmission it transmit beacon as a response to it.

4.5 Node mobility

MANET is a mobile ad-hoc network in which all nodes movable. we assigning the variable position for each node in the network.in this every node changes its position at every time instant with velocity 'V'. speed is allocated to every node which is different.

4.6 Neighbour node calculation

For successful transmission and reception we must know the distance between each node and its neighbor node.

Distance formula –

$$D=\sqrt{(x1-x2)^2+(y1-y2)^2}$$

4.7 Finish procedure

In this procedure we call the .awk files, trace files and some xgraphs generate with the help of these files we can generate the name file and different graphs as we expected.

V. SIMULATION RESULTS

We are performing this project on the three different parameters which are,

Performance Parameters

1. Energy Consumption:

Energy efficient protocols are introduced to enhance energy level of nodes. Some nodes may have limited battery power. With decrease in power they become incapable to forward packets. These protocols are made to enhance this energy level among nodes. Energy can be calculated,

Total Energy – Residual Energy

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2. Packet delivery ratio: -

The fraction of the data packets delivered to the destination nodes to those sent by the source nodes.

Packet Delivery Ratio (PDR) = {(sent-recv) / sent }

3. Throughput:-

It is the average rate of successful message delivery over a communication channel.

Throughput= (Bytes*8) / (Finish time – Start time)

Energy consumption

We observe energy consumption by allocating different energy to the nodes in units, and observed following graphs.

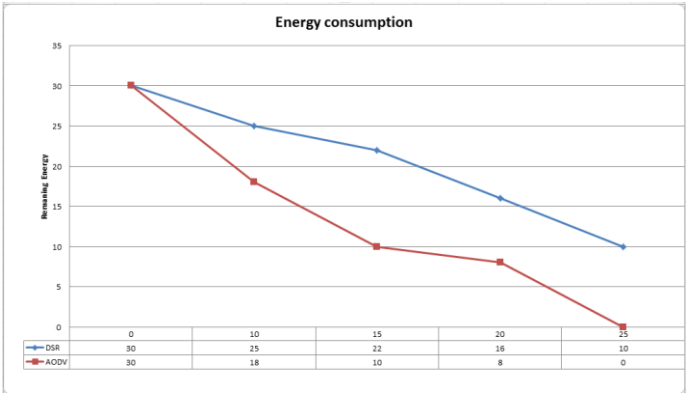

Fig.3- energy at 30 units

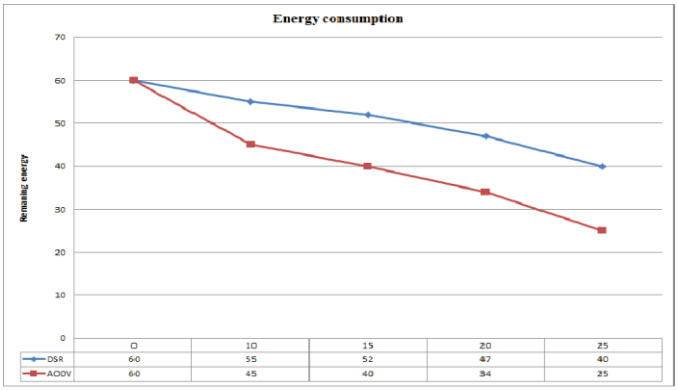

Fig 4-energy at 60 units

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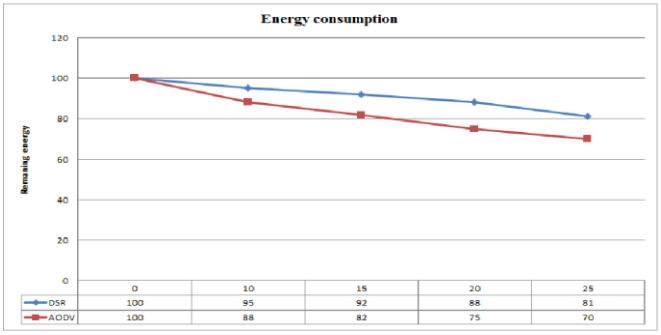

Fig 5-energy at 100 units

1. Packet delivery ratio (PDR):-

Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources. Mathematically, it can be defined as:

PDR= *S1÷ S2*

Where, S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source. Graphs show the fraction of data packets that are successfully delivered during simulations time versus the number of nodes. Performance of the DSDV is reducing regularly while the PDR is increasing in the case of DSR and AODV. AODV is better among the three protocols.

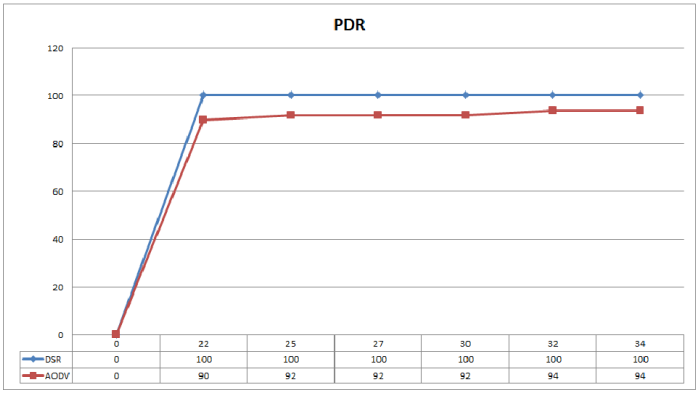

Fig 6-Packet delivery ratio

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2. Throughput:-

It is defined as the total number of packets delivered over the total simulation time. The throughput comparison shows that the algorithms performance margins are very close under traffic load of 48 nodes in MANET scenario and have large margins when number of nodes increases to 200. Mathematically, it can be defined as: Throughput= N/1000 Where N is the number of bits received successfully by all destinations.

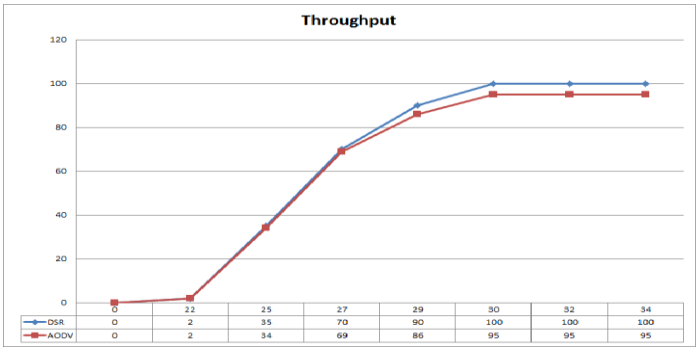

Fig 7- Throughput

***A.* Evaluation of all network parameters:-**

In this we measure the number of sent and received packets, packet delivery ratio, throughput and amount of energy consumed during data transmission; also we can calculate no. of dropped packets, average energy consumption for each node. These all information about data transmission is given in the single awk file.

These awk file is applied to trace file to achieve following results.

```
rohit@ubuntu:~/Documents/final sample$ awk -f energy_wireless.awk Trace.tr
No of pkts send                 521
No of pkts recv                 521
Pkt_delivery_ratio:             100
Control_overhead:               94
Normalized_routing_overheads:   0.180422
Delay:                          0.011022
Throughput:                     24364.8
Jitter:                         0.0549844
No of Pkts Dropped              0
Dropping_Ratio:                 0
Total_Energy_Consumption:       582.597
Avg_Energy_Consumption:         12.3957
Overall Residual Energy:        4034.3
Avg Residual Energy:            85.8362
rohit@ubuntu:~/Documents/final sample$
```

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VI. CONCLUSION

The energy consumption behavior of various routing protocols is being analyzed. With energy optimization proper delivery of packets with optimum cost is also concerned. This project analyzes the performance of AODV and DSR routing protocols for ad hoc networks using ns-2 simulations. DSR perform better under high mobility simulations than AODV. DSR protocol can support high mobility network and while data transmission minimum energy consumed consumed. By using DSR protocol we minimize the required energy and studied the Packet delivery ratio, throughput and energy graphs at different units.

REFERENCES

[1] L. Blazevic, S. Giordano, and J.-Y. LeBoudec, "A Location Based Routing Method for Mobile Ad Hoc Networks," IEEE Trans. Mobile Computing, Vol. 4, No. 2, pp. 97-110, MARCH 2005.

[2] B. Karp and H.T. Kung, "DSR: Greedy Perimeter Stateless Routing for Wireless Networks," Proc. ACM MobiCom, pp. 243-254, AUGUST 2000.

[3] Juan A. Sanchez and N.H. Vaidya, "Location-Aided Routing (LAR) in Mobile Ad Hoc Networks," ACM/Baltzer Wireless Networks, Vol. 6, No. 4, 307-321, SEPTEMBER 2002.

[4] Y. Cai, W. Lou, M. Li, and X.-Y. Li, "Energy Efficient Target Oriented Scheduling in Directional Sensor Networks," IEEE Trans. Computers, vol. 58, no. 9, pp. 1259-1274, Sept. 2009.

[5] W. Wu, J. Cao, J. Yang, and M. Raynal, "Design and Performance Evaluation of Efficient Consensus Protocols for Mobile Ad Hoc Networks," IEEE Trans. Computers, vol. 56, no. 8, pp. 1055-1070 , Aug. 2007.

[6] C. Perkins, E.M. Royer, and S. Das, "Ad Hoc On-Demand Distance Vector (AODV) Routing," IETF RFC 3561, July 2003.

[7] Quanjun Chen, Salil S. Kanhere and Mahbub Hassan, "Adaptive Position Update for Geographic Routing in Mobile Ad Hoc Networks", IEEE Transactions On Mobile Computing, Vol. 12, No. 3, MARCH 2013.