ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

Energy Efficient Consumption based Performance of AODV, DSR and ZRP Routing Protocol in MANET

Keshav Nayak, Neelesh Gupta
M.Tech student (D.C.), A.P. in E.C.
TIEIT, Bhopal, Madhya Pradesh, India

Abstract*—This Mobile Ad Hoc Networks (MANET) is gaining importance because of their flexibility, mobility and ability to work with a limited infrastructure. In multi-hop wireless network, proper utilization of battery power is very much necessary to maintain network connectivity.In order to overcome the network from inefficient routing problem, this paper presents different energy efficient routing protocols like AODV, DSR and ZRP for mobile ad hoc networks. In this research, efforts is on methods to reduce the power consumption in communications between Ad hoc network nodes. The energy consumption is the critical issue in MANET that's why proposed the compared performance based analysis of three routing protocols i.e. AODV, DSR and ZRP. The different node density scenarios, different velocity scenarios and random velocity scenarious are presented in this research. The energy drain rate and energy cost per packet is also evaluated to scrutinize the performance of these routing protocols. The performance is analyzed by three metrics like PDR, Routing load and Throughput. All the three routing protocols are explained in a deep way with metrics. The different scenarios in different pause time, different mobility, random mobility and different node density are considered. The routing protocols AODV, DSR and ZRP simulation is done through NS-2 simulator. This research analyses that DSR routing protocol is the energy efficient routing protocol in MANET.

***Index Terms*—MANET, Energy, AODV, DSR, AODV, Routing, ns-2.**

I. INTRODUCTION

A mobile ad hoc network (or MANET) [1] is a group of mobile, wireless nodes which cooperatively and spontaneously form a network independent of any fixed infrastructure (e.g., base stations or access points) or centralized administration. A node communicates directly with the nodes within radio range and indirectly with all others using a dynamically-determined multi-hop route. In critical environments such as military or rescue operations, where ad hoc networks will be typically used, conserving of battery power will be vital in order to make the network operational for long durations. Recharging or replacing batteries will often not be possible. This makes the study in energy-aware routing critical.

The challenge in ad hoc networks is that even if a host does not communicate on its own, it still frequently forwards data and routing packets for others, which drains its battery. Switching off a non communicating node to conserve battery power may not be always a good idea, as it may partition the network. Conventional on-demand routing protocols such as AODV [2], DSR [3] and ZRP [4] are energy-unaware. Routing is done based on shortest path, the cost metric either considers number of hops or end-to-end delay at the time when route is established. The protocols do not proactively modify routes until they break. If nodes are energy-constrained, such metrics may have adverse effect on the network lifetime on the whole. For example, a node that lies on several routes will die prematurely and the network may get partitioned. Since recharging or replacing the battery is not feasible in most of the ad hoc network applications, it is imperative to study and design routing protocols which are able to conserve node energy to prevent such premature death.

This work focuses on augmenting the existing Reactive routing protocols like AODV, DSR and Hybrid routing protocol like ZRP making them energy conserving. Reactive DSR protocols are more suitable for this study as they typically have lower routing overhead than proactive, distributed shortest path protocols and thus have a low baseline energy consumption. AODV is used as the base on-demand routing protocol. The techniques implemented are generic in nature and should be applicable to other on-demand routing protocols, such as DSR.

II. ROUTING PROTOCOLS IN MANET

A routing protocol maintains the network topology for a Wireless Ad hoc Network. If a link breaks [5], routing protocols has the responsibility to repair that link in order to maintain the consistency of the network. Different routing protocols have various strategies to repair a broken link. The repair strategy is quite specific to each strategic routing protocol; therefore it is quite hard to analyze the pros and cons of each protocol. The possible way is to find the link break probabilities of different categories of routing protocols since the problem greatly influence the efficiency of a routing protocol. The link break problem will be analyse, the influence of the problem on each categories of routing protocol, and the incurred routing table update to them. The categories of most popular routing protocols, table-driven, on-demand and hybrid routing protocols, are discussed in this article [6, 7].

A. Proactive (Table-Driven)

The pro-active routing protocols are the same as current Internet routing protocols such as the Routing Information Protocol, Distance-Vector, Open Shortest Path First and link-state. They attempt to maintain consistent, up-to-date

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

routing information of the whole network. Each node has to maintain one or more tables to store routing information, and response to changes in network topology by broadcasting and propagating. Some of the existing pro-active ad hoc routing protocols are: Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP).

B. Reactive (Source-Initiated On-Demand Driven)

These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology. When a source requires to a destination, it has to establish a route by route discovery procedure, maintain it by some form of route maintenance procedure until either the route is no longer desired or it becomes inaccessible, and finally tear down it by route deletion procedure. In pro-active routing protocols, routes are always available (regardless of need), with the consumption of signaling traffic and power. Some of reactive routing protocols are Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR).

C. Hybrid protocols

Hybrid protocols combine the features of reactive and proactive protocols. These protocols have the advantage of both proactive and reactive routing protocols to balance the delay which was the disadvantage of Table driven protocols and control overhead (in terms of control packages). Main feature of Hybrid Routing protocol is that the routing is proactive for short distances and reactive for long distances. The common disadvantage of hybrid routing protocols is that the nodes have to maintain high level topological information which leads to more memory and power consumption. Examples: ZRP (Zone Routing Protocol).

III. LITERATURE SURVEY

The previous researches has provides the idea about new researchers in this energy efficient field in MANET. The some latest are mentioned in this section.

This paper [8] combined node lifetime and link lifetime in route lifetime-prediction algorithm, which explores the dynamic nature of mobile nodes such as the energy drain rate of nodes and the relative mobility estimation rate at which adjacent nodes move apart in a route-discovery period that predicts the lifetime of routes that are discovered, and then, the longest lifetime route is selected for data forwarding when making a route decision. Node lifetime routing algorithm depends upon the energy state of nodes, such as residual energy and energy drain rate. This routing algorithm often selects a path consisting of nodes that may survive for the longest time among multiple paths.

A. Drawbacks of this research

1. Only the performance of DSR routing protocol is observed on the basis of performance metrics.
2. The node energy levels graph and the energy cost per packet is not evaluated.
3. The only single DSR protocol performance is observed.

In this paper [9] a new multicast routing protocol called Mobility based Energy Efficient Multicast Protocol (M-EEMC) was introduced, which is a combination of tree and mesh based structures. M-EEMC is a tree-based approach, yet it can preserve the tree branches in high mobility. It can detect broken tree branches rapidly, with the support from the passively participating neighboring nodes around the active branches, and then repair the broken links. M-EEMC achieves less energy dissipation by eliminating the redundant data receptions. This scheme produces a high packet delivery ratio, because all the nodes are continuously relaying all the packets. The performance of M-EEMC is evaluated and compared it with on-demand multicast routing protocol (ODMRP). M-EEMC produces less energy dissipation and provides better packet delivery ratio than ODMRP

In Energy Efficient, Sunil Taneja and Ashwani Kush proposed Secure and Stable Routing Protocol for MANET [10], a routing mechanism that provides energy efficient, secure and stable routes. Here, the Secure Routing done in three steps. Diffie-Hellman Algorithm is used for generation of secret key and hashing to generate subsequent keys over selected route. Here, Encryption and Decryption is performed using XOR operation. The Energy Efficient and Stable Routing is performed by means of a per hop power aware forwarding which is based on some threshold energy value ETh. Even though this protocol gives a Stable and Energy efficient algorithm with best packet delivery ratio which is simple and robust, it should not support large traffic and enhanced TCP connections. Qos is also not ensured and there is no multicast transmission support Gerla et al. [11] described ODMRP-ASYM, which is an extension to ODMRP for asymmetric link support. ODMRP-ASYM is designed to achieve complete route discovery by utilizing unidirectional links. This scheme does not introduce any extra overhead if there is no blocking, i.e., no unidirectional link. ODMRP-ASYM can easily overcome unidirectional links and delivers nearly 100% of the packets when the network is connected. ODMRP-ASYM simply avoids unidirectional links but this scheme would fail when bi-connectivity exists i.e. cannot be implemented via bidirectional paths. Rekha Patil et al. proposed a Link Stability Based on Qos Aware On - Demand Routing for Mobile Ad Hoc Networks [12]. The task of QoS routing is to optimize the network resource consumption while satisfying the application requirements. So, there is no centralized control over links. Further the link quality varies due to mobility of nodes. Existing quality of service based routing protocols have a capacity of not making the changes in link quality once the path is established and cost matrix is set to zero and link quality is not taken in to concern to choose the stable paths. Therefore the performance of such system degrades with high mobility. Hence in this work they stress on incorporating link quality estimation based on mobility prediction of nodes and the primary transmission path is

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

changed in case of a improved route in terms of link quality is obtained. This paper [13] mainly deals with the problem of maximizing the life-time of a wireless ad hoc network, i.e. the time period during which the network is fully working. Presented an original solution called LEAD (Lowest energy Ad hoc network Design algorithm) which is basically an improvement on ANDA (Ad hoc network design algorithm)? After making a brief comparative study of the work, it is analyse that as move on from ANDA to the proposed Algorithm, gradually get an increased network lifetime. From the various graphs and tables, This can be successfully prove that the Algorithm quite outperforms the traditional energy efficient algorithms in an obvious way.

IV. PERFORMANCE OF ENERGY EFFICIENT PROTOCOLS

Aggregate throughput and routing load are key measures of interest when assessing protocol performance. Throughput is directly related to the packet drops. Packet drops typically happen because of network congestion (e.g., buffer overflows) or for lack of a route. Since most dynamic protocols (proactive or reactive) try to keep the latter type (no route) of drops low by being responsive to topology changes, network congestion drops become the dominant factor when judging relative throughput performance. For the same data traffic load, routing protocol efficiency (in terms of control overhead in bytes or packets) determines the relative level of network congestion because both routing control packets and data packets share the same channel bandwidth and buffers.

The performance of three protocols like AODV, DSR and ZRP is simulated in proposed scheme on the basis of:-

1. **Different Pause Time**

In pause time the simulation of AODV, DSR and ZRP protocols are done in case of different time intervals like 20, 40, 60, up to 100.

2. **Different Node Mobility.**

In different mobility case the protocols performance in done in case of 5 m/s, 10 m/s, 20 m/s, 25 m/s and maximum speed of 30m/s.

3. **Random Mobility**

The case of random mobility is every node in network moves in surrounding area in different mobility speed and the maximum mobility speed is 30 m/s.

4. **Different Node Density**

The node density is increase in network to observe the performance of routing protocols in case of more senders and receivers and also analyses the effect of dense network on energy consumption.

The whole performance of network is measurers through Performance Metrics like throughput, routing load, energy consumption per packet and energy drain rate.

The maximize the lifetime of network nodes and hence the network operation as a whole. The main goals of the algorithm are fair energy conservation via:

- ✓ Rotating sleep periods equally among network nodes thus giving nodes equal opportunity for reducing energy consumption
- ✓ Assisting routing algorithms in making routing decisions based on energy fairness
- ✓ Little impact on network operation, for example, introduces slight or no additional traffic or energy cost.
- ✓ The proposed energy based algorithm for AODV, DSR and ZRP protocol is:-

A. Description of Proposed Algorithm.

Proposed Connection Establishment Algorithm

Initial energy = E // set randomly in network
Routing Protocol = AODV, DSR, ZRP.
The energy consumption parameters mention in simulation parameters table 5.1.
Set mobile Node = N; //Mobile Nodes
Sender Nodes = S; // S € N ;
Destination Nodes = D; // D € N;
Set Simulation Time = T
Set Radio Range = RR;// Initialize Radio Range
AODV_RREQ_B (S , D , RR)

1) If {(**E** > 0) && (radio range from source to next hop < 550m) && (next hop == destination)}
{Forward connection confirmation through receiver;
Establish connection from source to destination;
Started data delivery in network;
}
Else if
{
Increment hop count by one & Go to **step 1**
}

DSR Connection Procedure

DSR_RREQ_B (S , D , RR)

1) If {(**E** > 0) && (radio range from source to next hop < 550m) && (next hop == destination)}
{
If (Route Information in Cache = = True)
{
No required to establish connection;
Start data delivery;
}
Else
{Establishment Connection in S to D}
Else if
{
Increment hop count by one & Go to **step 1**
}
Else
{
Destination Not found}
}

ZRP Routing Procedure

ZRP_RREQ_B (S , D , RR)
Set Zone Radius (ZR) = 200m

1) If {(**E** > 0) && (radio range from source to next hop < 550m) && (next hop == destination)}
{
Divide the Network in according to ZR;

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

Routing Done In the Zone (IZRP) and Outside the Zone (OZRP);
Forward connection confirmation through receiver;
Establish connection from source to destination;
Started data delivery in network;
}
Else if
{
Increment hop count by one In the Zone or Outside the Zone & Go to **step 1**
}
{Destination not found}
}

Routing Load in network depends on route discovery latency, additional delays at each hop (comprising of queuing, channel access and transmission delays), and the number of hops. At low loads, queuing and channel access delays do not contribute much to the overall delay. In this regime, proactive protocols, by virtue of finding optimal routes between all nodes pairs, are likely to have better delay performance. However, at moderate to high loads, queuing and channel access delays become significant enough to exceed route discovery latency. So, like in the case of throughput, routing protocol overhead again becomes key factor in determining relative delay performance.

V. PERFORMANCE EVALUATION

NS or the network simulator (also popularly called NS-2 [14], in reference to its current generation) is a discrete event network simulator. NS is used in the simulation of routing protocols, among others, and is heavily used in ad-hoc networking research. Ever since, several revolutions and revisions have marked the growing maturity of the tool, thanks to substantial contributions from the players in the field. Among these are the University of California and Cornell University who developed the REAL network simulator, the foundation which NS is based on. Since 1995 the Defense Advanced Research Projects Agency (DARPA) supported development of NS through the Virtual Inter Network Testbed (VINT) project.2 Currently the National Science Foundation (NSF) has joined the ride in development. Last but not the least, the group of researchers and developers in the community are constantly working to keep NS2 strong and versatile. The traffic sources are Constant Bit Rate (CBR). The source destination pairs are spread randomly over the network. The mobility model uses 'random waypoint model' in a rectangular field of 1000m x 1000m with 20, 40, 50 and 60 nodes. Different network scenarios for different number of nodes for 5 connections to 10 connections are generated. In Table 1, summarized the model parameters that have been used for these experiments. In this research, following four performance metrics to compare the three routing protocol. Then get Simulator Parameter like Number of nodes, Dimension, Routing protocol, traffic etc. According to below table 1 Network is Simulated. The simulation results are evaluated in case of pause time. The mobility and pause time analysis is done in case of 50 nodes not in case of 20, 40, and 60 nodes but the nodes variation is considered in case of random mobility and 100 simulation time.

Table .1 Simulation Parameter for Analysis

Number of nodes	20, 40, 50, 60
Dimension of simulated area	800×600
Pause time	20, 30, 40, 60, 80,100
Routing Protocol	AODV, DSR, ZRP
ZRP Radius	200 meters
Radio Range	550 meters
Pause time (seconds)	20, 40, 60, 80, 100
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	512, 3pkt /sec.
Nodes mobility (m/s)	5, 10, 15, 20, 25, 30
Random mobility scenario	Consider with maximum mobility of 30 (m/s)
Transmit Energy	1.5
Receiving Energy	1.0
Idle Energy	.017
Sense Energy	.470
Sleep Energy	.07

A. Performance Metrics

The performances of routing protocols are measured on the basis of performance metrics.

1. Average End-to-End Delay:

It is defined as the average time taken by the data packets to propagate from source to destination across a MANET. This includes all possible delays caused by buffering during routing discovery latency, queuing at the interface queue, and retransmission delays at the MAC, propagation and transfer times.

2. Normalized Routing Load (NRL):

The number of routing packets transmitted per data packet delivered at the destination.

3. Packet Delivery Fraction (PDF):

This is the ratio of the number of data packets successfully delivered to the destinations to those generated by sources. Packet Delivery Fraction = received packets/sent packets * 100

4. Throughput:

It is the rate of successfully transmitted data packets in a unit time in the network during the simulation.

5. Energy cost:

The energy cost is calculated per packet and total energy consumption in network.

VI. SIMULATION RESULTS

The simulation results are evaluated in case of Energy based AODV, DSR and ZRP protocols. The energy is the life of nodes in network and minimum energy consumption routing protocol is the best for routing in network.

A. The results are evaluated in case of Pause time with Radom Mobility

The simulation result in case of pause time is evaluated in this section. The performance of Energy DSR is better as compare to Energy AODV and Energy ZRP.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

1. *Throughput Analysis in Pause Time*

The throughput parameter measures the unit time information in network of data packets. The throughput enhancement is shows the better energy utilization. This Graph shows Through Put Vs Pause Time. Through Put is in Y axis where as Pause Time is in X axis. This Graph Shows that as Pause Time increases the Through Put of DSR was greater than AODV & ZRP. Whereas DSR having greater Throughput among the three. The DSR protocol is more energy efficient then other routing protocol in term of energy consumption. The route cache information is advantages in route break due to link expiration and request time out in network. The throughput difference in different pause time also increases among these energy based protocols.

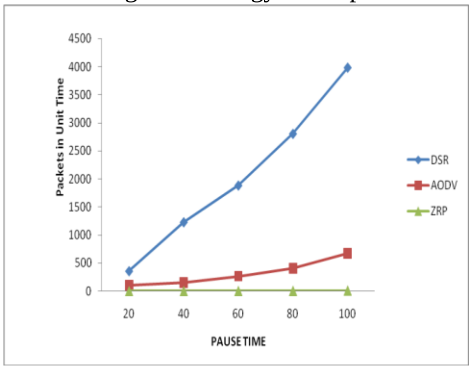

Fig. 1 Pause Time Throughput Analysis

2. *Routing Load Analysis in Pause Time*

The control packets are finding the destination in network by that the communication in between sender and receiver is initiated. The route establishment packets is confirm the destination and after that the data deliver is started. This Graph shows Routing Load Vs Pause Time analysis of AODV, DSR and ZRP protocol. Routing load is in Y axis where as Pause Time is in X axis.This Graph Shows that as Pause Time increases the Routing Load of ZRP was greater than AODV &DSR. Whereas DSR having least Routing Load among the three. The minimum routing overhead reason in DSR is to maintaining the strong connectivity due to their routing mechanism. The AODV is completely destroyed the routing information by that the again routing is deliver in network for sending same destination in network. In ZRP the zone is created and the communication with other zone possible to enhance routing overhead.

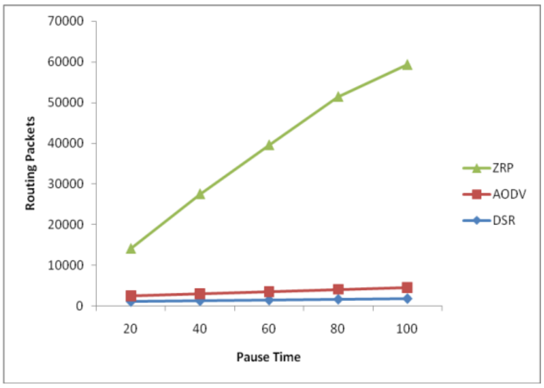

Fig.2 Pause Time Routing Load Analysis

3. *Packet Delivery Ratio (PDR) Analysis in Pause Time*

The packet percentage ratio or Packet Delivery Ratio (PDR) is completely depending on the ratio of receiving and sending. If the difference in in between sending and receiving is more than in the PDR value is also degrades in network. This Graph shows Packet Delivery Ratio Vs Pause Time. Packet Delivery Ratio is in Y axis where as Pause Time is in X axis. This Graph Shows that as Pause Time increases the Packet Delivery Ratio of DSR was greater than AODV &ZRP. Whereas DSR having greater Packet Delivery Ratio among the three. The time about 80 seconds the PDR of AODV and DSR is equal but after that, at time 100 DSR protocol again obtain the lead in performance. In dynamic network the ZRP performance is degrades +due ti find the destination in other zones i.e. beyond the 200 meters radius and due to that the energy consumption is also more in network.

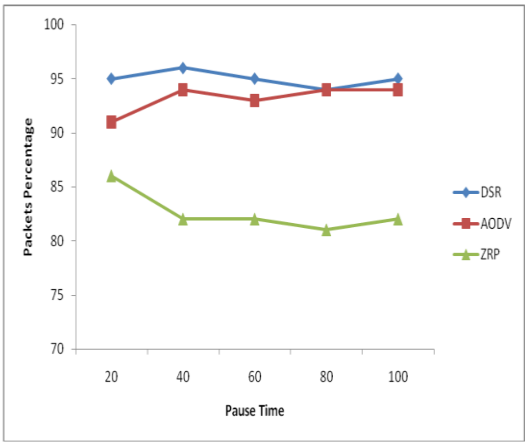

Fig. 3 Pause Time PDR Analysis

4. *Average Energy Cost per Packet in Pause Time*

The energy cost per packet analysis is required to observe the average per packet energy consumption in network. The packet transmission is the major source of energy consumption in network. The energy cost is evaluated in network on the basis of the total energy consumption of mobile nodes in a given simulation.

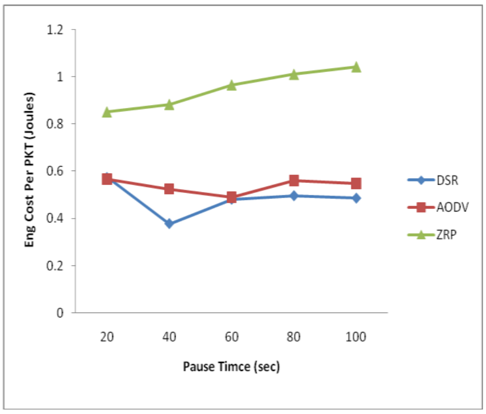

Fig. 4 Energy Consumption per Packet in Pause Time

This Graph shows Energy Cost per Packet Vs Pause Time. Energy cost per Pkt is in Y axis where as Pause Time

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

is in X axis. This Graph Shows that as Pause Time increases the Eng Cost per pkt of ZRP was greater than AODV &DSR. Whereas DSR having least Energy cost per pkt as compared to rest of two protocols in network. That proves that the DSR routing consume less amount of energy. The ZRP is consumes higher energy that degrades the life of network.

5. *Energy Drain Rate in Pause Time*

The energy drain rate is evaluated in network by measure the energy consumption per second in network. The energy consumption in measured in a unit time is also called drain rate. This Graph shows Energy Drain Rate Vs Pause Time. Energy Drain Rate is in Y axis where as Pause Time is in X axis .This Graph shows that as Pause Time increases the Energy Drain Rate of ZRP was greater than AODV & DSR. Whereas DSR having least Energy drain rate as compare to AODV and ZRP. The simulation pause time at uniform interval is measured with drain rate. The AODV is the second least energy consumption protocol and ZRP is the highest due to that zonal routing behavior. The energy drain rate reduces to consume less amount of energy in a unit time for routing i.e. possible with DSR.

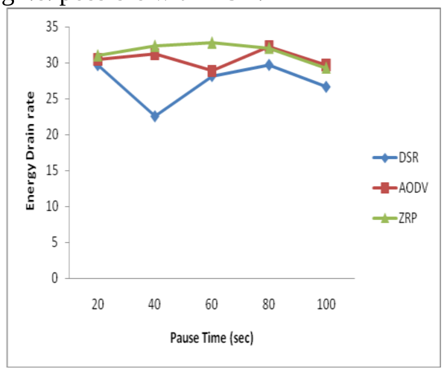

Fig. 5 Energy Drain Rate in Pause Time

B. *Results Evaluated in Different Mobility*

The simulation results are evaluated in case of different mobility like 5, 10, 20, 25 and 30 in case of 50 nodes. The different mobility scenarios are clear the performance of routing protocols and provides the best energy efficient protocol.

1. *Throughput Analysis in Diverse Mobility*

This Graph shows Through Put Vs Mobility in simulation time of 100 seconds. Throughput is in Y axis where as Mobility is in X axis. This Graph shows that as mobility increases the Throughput or packets in unit time of DSR was greater than AODV & ZRP. Whereas DSR has greater throughput as compare to AODV and ZRP. The maximum mobility is considered here of 30 m/s of mobile nodes. Now the dynamic topology that changes frequently is the major cause of the energy loss in network but in case of DSR protocol the throughput is better and highest at 20m/s and 25m/s in network. The throughput of AODV is also improves as compare to ZRP but less than DSR. The ZRP protocol is showing as usual performance at all mobility cases so that it can also be predicted that in higher mobility the ZRP is showing same result.

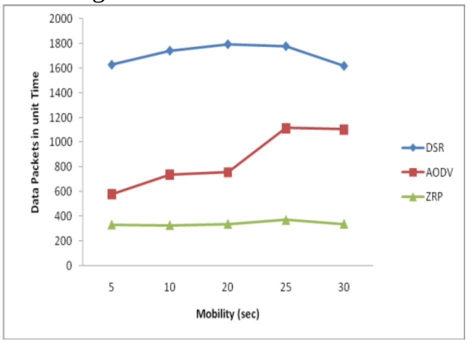

Fig.6 Throughput Analysis in Diverse Mobility

2. *Routing Load Analysis in Diverse Mobility*

The routing packets performance in case of different mobility is evaluated to scrutinize the effect of mobility on routing packets delivery in network. The mobility of 30 m/s is showing the little enhancement in routing packets in all routing protocols. This Graph shows Routing Load Vs Mobility. Routing load is in Y axis where as Mobility is in X axis. This Graph shows that as mobility increases the Routing Load of ZRP was greater than AODV & DSR. Routing load of DSR again not as much of as compare to AODF and ZRP. The ZRP routing load is exceptionally high due to finding the destination in different zones. The DSR reduces the energy consumption because the routing packets are also required energy for data sending and receiving. The routing strategy of DSR is also energy efficient and improves the network performance to minimize routing load.

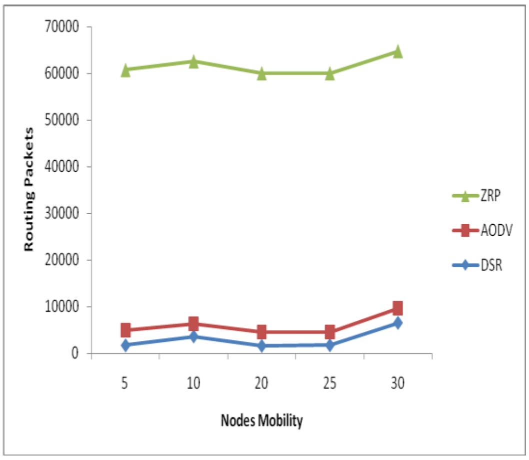

Fig. 7 Routing Load in Diverse Mobility

3. *Packet Delivery Ratio (PDR) Analysis in Different Mobility*

The PDR performance in different mobility is evaluated to identify the energy utilization in percentage of data delivery in MANET. This Graph shows Packet Delivery Ratio Vs Mobility. Packet Delivery Ratio is in Y axis where as Mobility is in X axis. This Graph shows that as Mobility increases the Packet Delivery Ratio of DSR is greater than AODV & ZRP. The data receiving of DSR is high as compare to AODV but the percentage ratio of sending and receiving in AODV and DSR is almost same due to that the PDR is performance is also very little fluctuate. The ZRP performance is as usually satisfactory not much better. The energy efficient routing is only possible through DSR protocol by sending and receiving maximum number of packets in network.

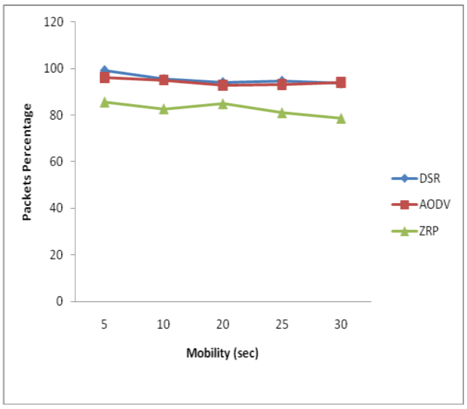

Fig. 8 PDR Analysis in Diverse Mobility

4. Energy Cost per Packet in Different Mobility

The energy consumption per packet is again evaluated in different analysis like mobility in network. This Graph shows Energy cost per packet Vs Mobility. Energy cost per packet is in Y axis where as Mobility is in X axis. The energy calculations are in joules. This Graph shows that as mobility increases the Energy Cost per packet of ZRP was greater than AODV & DSR that consumes more energy. Whereas DSR having least energy cost per packet among the three routing protocols. The mobility enhancement reduces the possibility of link breakage by that the data loss in network and also the energy is loss for sending loss data again network. Here the DSR again maintaining the lead in performance and provides minimum energy consumption of packet in network. The ZRP per packet cost is more because of less number of packets received and sending.

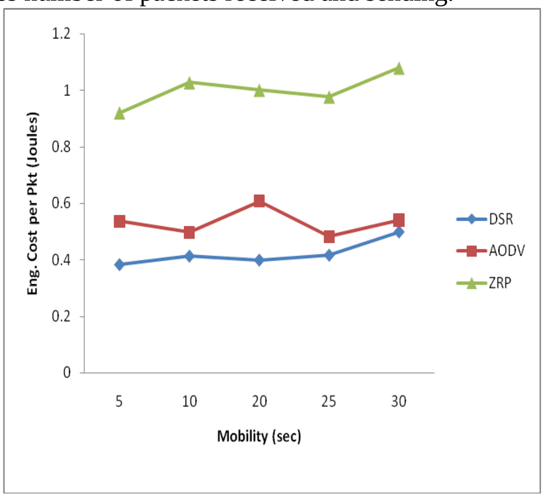

Fig.9 Energy Cost Analysis in Diverse Mobility

5. Energy Drain Rate in Different Mobility

The energy drain rate is again evaluated in network for identifying the energy consumption per unit of time in network. The energy drain rate is also evaluated in joules. This Graph shows Energy Drain Rate Vs Mobility. Energy Drain Rate is in Y axis where as Mobility is in X axis. This Graph shows that as mobility increases the Energy Drain Rate of ZRP was greater than AODV &DSR. Whereas DSR having least Energy Drain Rate among the three protocols. The routing performance of DSR is consumes less amount of energy for complete the whole procedure of communication from the routing initiation to successful data delivery and connection releasing at the end. The energy drain rate of in DSR is provides minimum by that the life of network maximizes.

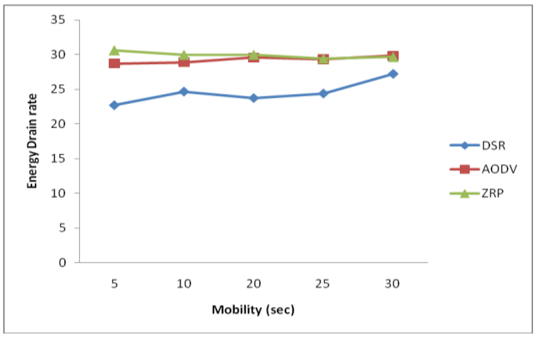

Fig. 10 Energy Drain Rate Analysis in Diverse Mobility

C. Results Evaluated in Different Node Density but in Random Mobility

The Results in case of different node density with random mobility is evaluated to compute the energy based routing protocols performance. This is the real MANET scenario all the mobile nodes are moving with different mobility speed.

1. Throughput Analysis in Random Mobility

The throughput is again evaluated in the same dynamic network but here the nodes mobility are random and the node densities are varying in a simulation time of 100 seconds in MANET. Throughput or packets in unit time is in Y axis where as Node density is in X axis. This Graph shows that as for increasing the node density increases the throughput in network and after all the throughput performance is greater than AODV & ZRP. Whereas DSR has greater throughput as compare to AODV and ZRP it means that utilized the energy consumption. The node density 30 throughput performance is highest of DSR but in case of 40 and 50 performance degrades due to enhancement of senders and receives also the random mobility is used by that the unpredictable the motion of nodes.

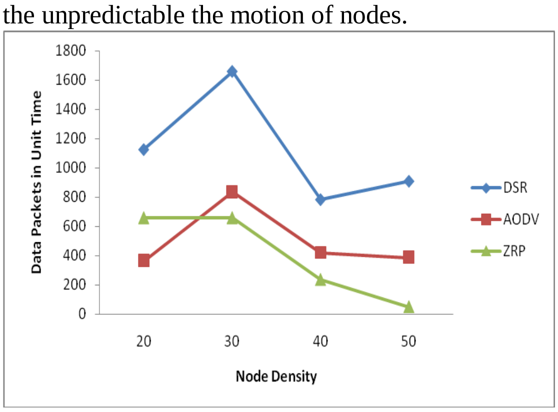

Fig. 11 Throughput Analysis in Random Mobility

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

2. *Routing Load Analysis in Random Mobility*

The routing packets or connection establishment packets are flooded by sender by that the communication between sender and receiver agents is possible. The route establishments packets are confirm the destination and after that the data deliver is started. This Graph shows Routing Load Vs Node density analysis of AODV, DSR and ZRP protocol in random mobility. Routing load is in Y axis where as Node density is in X axis. This Graph shows that as node density increases the Routing Load of ZRP was greater than AODV & DSR. The routing over head in ransom mobility of 40 node density is greater after that in it less reaches down to AODV. In ZRP the zone is created and the communication with other zone possible to enhance routing overhead but in 50 nodes the difference is reduces.

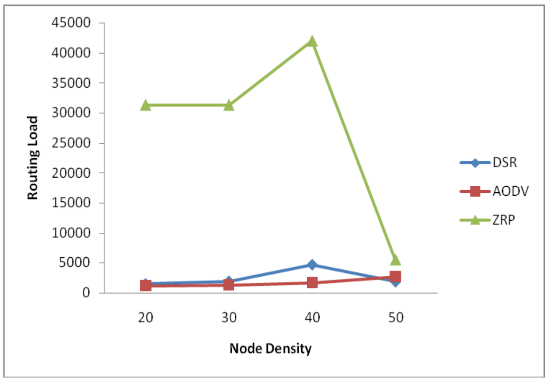

Fig. 12 Routing Load Analysis in Random Mobility

3. *Packet Delivery Ratio (PDR) Analysis in Random Mobility*

The PDR performance at that time evaluated in case of different node densities. The energy consumption efficiently reduces packet loss by that PDR progressed. Percentage of packets (PDR) is in Y axis where as Node density is in X axis. This Graph shows that as node density increases the PDR of DSR is also more as compare to rest of the was AODV & ZRP routing protocols. Whereas DSR has greater PDR as compare to AODV and ZRP.

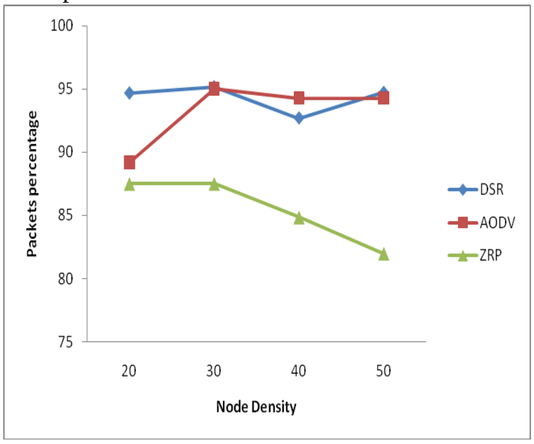

Fig. 13 PDR Analysis in Random Mobility

In this scenario only the node density is varying but the actual environment is of random mobility of MANET is used in a fixed simulation time of 100 seconds. The DSR performance is also maintaining the lead but in case of 40 node density the performance percentage is degrades but it doesn't mean that the packets receiving is reduces energy is wasted and also improves at 50 node density.

4. *Energy Cost per Packet in Random Mobility*

The energy consumption per packet is evaluated in random mobility and node density in network. This Graph shows Energy cost per packet in joules Vs Node density. Energy cost per packet is in Y axis where as Mobility is in X axis. The energy calculations are in joules. This Graph shows that the node density is increases Energy Cost per packet of ZRP were greater than AODV & DSR that consumes more energy because of increasing the zones in MANET. Whereas DSR having least energy cost per packet among the three routing protocols. The node density enhancement reduces the possibility of link breakage by that the data loss in network and also the energy is loss for retransmission in network. Here the DSR again showing the better performance and provides minimum energy consumption of packet in network. The ZRP is required more energy consumption by that life of network reduced.

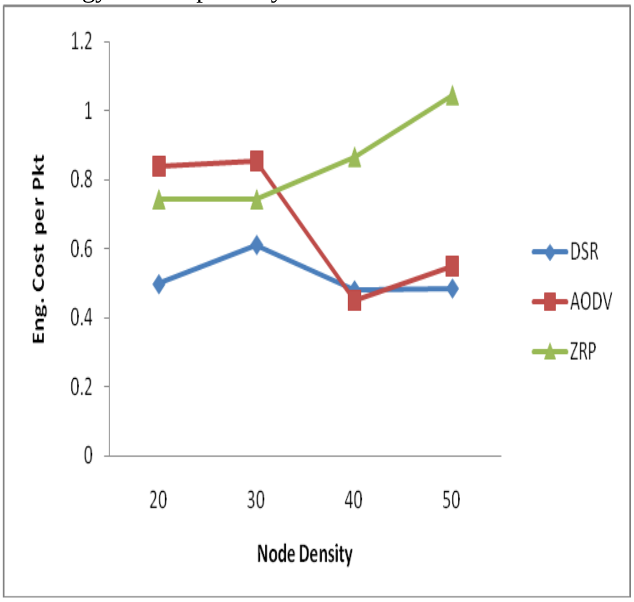

Fig. 14 Energy Cost Analysis in Random Mobility

5. *Energy Drain Rate in Random Mobility*

The energy drain rate is evaluated in network for identifying here in case of random mobility of mobile nodes in network. The energy drain rate is also evaluated in joules. This Graph shows Energy Drain Rate Vs Mobility. Energy Drain Rate is in Y axis where as Node density is in X axis. This Graph shows that as node density increases the Energy Drain Rate of ZRP was greater than AODV & DSR. Whereas DSR having least Energy Drain Rate among the three protocols. The DSR consumes less amount of energy and DSR routing procedure provides better routing and less energy consumption as compare to a smaller amount nodes density. The energy drain rate of in DSR is provides minimum by that the life of network maximizes.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 11, May 2015

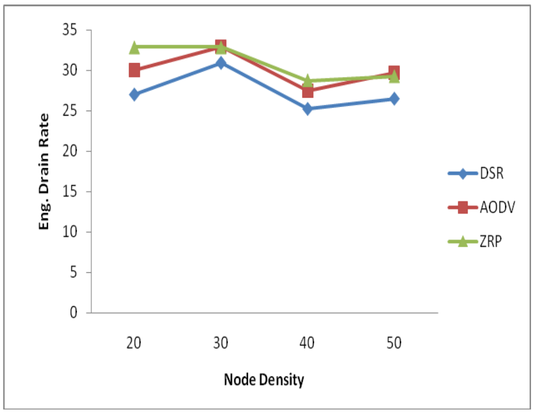

Fig. 15 Energy Drain Rate Analysis in Random Mobility

VII. CONCLUSION AND FUTURE WORK

This strategy mainly optimizes the power depletion and maintains a more or less uniform power usage among all the nodes in the network while maintaining effective throughput. In the simulation, it is observe that a sharp performance and power usage gains using the considered AODV, DSR and ZRP protocol performances. If the battery of a node is drained out, then it cannot communicate with other nodes and the number of nodes that more participating in routing their energy is depleted early in network. The energy based routing is done with AODV, DSR and ZRP performance has been studied via simulations. Simulation results have indicated that the DSR routing technique provides robustness to mobility and enhances protocol performance. However, this routing performance may perform well under different pause time, energy consumption, Node mobility, random mobility and different node density. Its performance has been found much better than other existing protocols in dense medium as probability of finding active routes increases. The energy consumption per packet in DSR protocol is less. The comparison analysis will be carrying out about these protocols and in the last the conclusion is that the DSR is the more energy efficient protocol for routing and for energy based routing DSR routing protocol is the best one for mobile ad hoc networks. In future this concept can be apply with all different MANET protocol like MPDSR, MAODV and OLSR. In future various energy depletion parameters can be used and simulate the work so in future rectified result get from the proposed module.

REFERENCES

[1] Macker and S. Corson. Mobile ad hoc networks (MANET). http://www .ietf.org/ html.charters/manet-charter .html, 1997. IETF Working Group Charter.

[2] Charles Perkins, Elizabeth Royer, and Samir R. Das. Ad hoc on demand distance vector (AODV) routing", IETF Internet Draft , 2003

[3] D. Johnson and D. Maltz. Dynamic source routing in ad hoc wireless networks. In T. Imielinski and H. Korth, editors, Mobile computing, chapter 5. Kluwer Academic, 1996.

[4] Z. J. Haas and M. R. Pearlman, "ZRP: A Hybrid Framework for Routing in Ad Hoc Networks", pp. 221.253, 2001.

[5] Vassileva, N. and Barcelo-Arroyo, F. "A Survey of Routing Protocols for Energy Constrained Ad Hoc Wireless Networks", in IEEE Future Generation Communication and Networking, Dec. 2007, pp. 522-527.

[6] Anuj K. Gupta, Harsh Sadawarti, & Anil k. Verma, (2011) "Review of various Routing Protocols for MANETs," International Journal of Information and Electrical Engineering, ISSN: 1109-2742, Vol. 1 No. 3, pp. – 251-259.

[7] Anuj K. Gupta, Harsh Sadawarti, and Anil K. Verma "A Review of Routing Protocols for Mobile Ad hoc Networks" ACM Journal on WSEAS Transactions on Communications, ISSN: 1109-2742, Volume 10 Issue11, pp. 331-340, 2011, November 2011.

[8] Mrs.C.Priyadharshini and Ms.K.Thamarai Rubini "Predicting Route Lifetime for Maximizing Network Lifetime in MANET" IEEE International Conference on Computing, Electronics and Electrical Technologies (ICCEET), pp 792-797, 2012

[9] N.Fareena, A.Shunmuga Priya Mala, "Mobility based energy efficient multicast protocol for MANET", Elsevier Ltd Proceeding Engineering 38,pp- 2473 – 2483, ICMOC 2012.

[10] Sunil Taneja and Ashwani Kush, "Energy Efficient, Secure and Stable Routing Protocol for MANET," Global Journal of Computer Science and Technology, Vol. 12, May 2012

[11] Gerla M., Lee Y. Z., Joon-Sang Park, Yi. Y, "On demand multicast routing with unidirectional links" IEEE Conference on Communication and Networking , pp. 2162-2167,13-17 March, 2005.

[12] Rekha Patil, Megha Rani.R and Rajkumar Bainoor," Link Stability Based On Qos Aware On - Demand Routing In Mobile Ad Hoc Networks," IOSR Journal of Computer Engineering (IOSRJCE) ,ISSN: 2278-0661, ISBN: 2278-8727 Volume 5, Issue 3 (Sep-Oct. 2012), PP 52-57.

[13] Subhankar Mishra1, Sudhansu Mohan Satpathy," energy efficiency in ad hoc networks", International Journal of Ad hoc, Sensor & Ubiquitous Computing" (IJASUC) Vol.2, No.1, March 2011,pp-139-145.

[14] The Vint Project: The ns-2 Manual (formerly ns Notes and Documentation), Available on link http://www.isi.edu/nsnam/ns/doc. Last visit on 15 October 2014.