International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 8 Issue 11 Series. I || November 2019 || PP 17-26

Performance Evaluation of Enhanced Energy Efficient Multipath Routing Protocol in Wireless Sensor Networks

D.Srinivasa Rao[1], Kadari Rasagnya[2]
[1](Electronics and Communication Engineering, JNTUH College of Engineering, India)
[2](Electronics and Communication Engineering,JNTUH College of Engineering, India)
Corresponding Author: D.Srinivasa Rao

Abstract: *The wireless sensor systems comprises of various sensor nodes which has restricted limited resource. The sensor nodes are working through the battery, energy sparing ends up which is a basic issue in WSNs. Energy consumption is the significant factor to decide the life expectancy of sensor network. Designing protocols and applications for such systems must be energy aware so as to expand the lifetime of the system, on the grounds that the substitution of the batteries turns out to be extremely troublesome once these sensors have been introduced. One of the major trusted area in WSNs is energy effective routing.Energy effective routing algorithms give energy sparing without influencing the Quality of Service Parameters. Improved EEEMRP is a change of a current AOMDV convention. EEEMRP is likewise uses distance vector idea and hop by-hop routing methodology. Notwithstanding the AOMDV, bit of leeway of EEEMRP to choose the best path among multiple paths utilizing cuckoo search algorithm and endeavors to make the information move solid with less energy utilization. EEEMRP is implemented using NS2 simulator and compared with AOMDV and AODV routing protocol utilizing Quality of Service Parameters like Delay, Throughput, Average Energy Consumption, Control Overhead and Average Remaining Energy.*

***KEYWORDS** -AODV, AOMDV, EEEMRP, Wireless Sensor Networks (WSNs)*

Date of Submission: 26-10-2019 Date of acceptance: 11-11-2019

I. INTRODUCTION

Recent progressions in integrated circuits have cultivated the development of a fresh out of the box new age of pretty much nothing, modest low power sensors. Due to their monetary and machine practicability, a system of hundreds of sensors has the potential for shifted applications in common and military applications like battle field reconnaissance, disaster management and security. These detecting gadgets are utilized to gauge various conditions, for example, temperature, pressure, movement and so on. The sheer scope of those gadgets and their specially appointed planning inside the space of intrigue gets changed difficulties systems administration and the board of those frameworks. The plan, execution, and activity of a remote sensor system needs the conjunction of the numerous controls, just as signal processing, systems administration and protocols, installed frameworks, data the executives and diverse appropriated calculations. Such systems are conveyed in asset compelled conditions, with battery worked hubs. These prerequisites deal with that remote sensor compose issues are best moved nearer in a hostile manner, by considering the physical, systems administration, and application layers together and making genuine structure tradeoffs over the layers.

A wireless sensor network consists of large number of sensor nodes which are organized into a cooperative network.

A wireless sensor system comprises of huge number of sensor nodes which are sorted out into a helpful network.

A sensor node is comprises of four essential parts as appeared in Fig.1

1. Sensing unit: It comprises of subunits: analog to digital converters sensors. The analog signals transferred by the sensors are changed over to digital signals by the ADC[2], and afterward bolstered as contribution to the processing unit.

2. Processing unit: Every sensor node comprises of at least one microcontrollers, DSP chips or CPUs, and may contain different sorts of memory (flash memories, information and program). The preparing unit is utilized to convey one sensor node with different nodes to complete the allotted sensing tasks.

3.Transceiver unit: It is utilized to interface the sensor node to the system. A RF transceiver (as a rule with a solitary Omni-directional antenna wire), suit different sensors and actuators.

4.Power unit:It is the most significant part of a sensor node. Power units can be upheld by sunlight based cells.

It has application subordinate extra parts, for example, a position discovering framework, a mobilizer and a power generator. Sensing units are which generally made out of subunits: analogue to digital converters and sensors

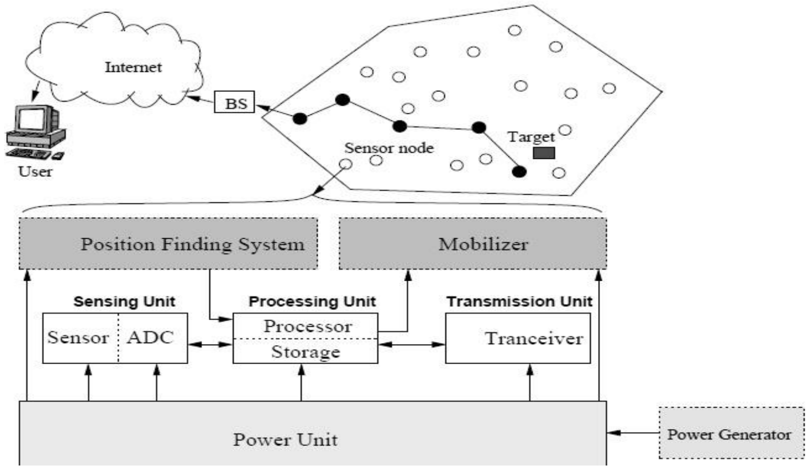

Fig.1 Basic components of a WSN node

II. ON DEMAND ROUTING PROTOCOLS

2.1 AODV - Ad Hoc On-demand Distance Vector Protocol

The AODV routing protocol is an on-demand routing protocol; all paths are found just when required, and are kept up just as long as they are being utilized. Paths are found through a course disclosure cycle, whereby the system hubs are questioned looking for a course to the goal node[3]. In AODV, on off chance that source node need to transmit information to the target node, at that point source node communicate route demand packets(RREQ) to the nearest nodes, if the neighboring nodes have way to target node, again these nodes communicate RREQ packets to their neighboring nodes. In this event that nodes have a path to the goal, that path is accounted back to the source node. On the off chance that any connection between nodes breaks in the chose path, the middle nodes both advises the end nodes about the way break by sending path reply packet with count of hop considered as infinity(8). Favorable circumstances of AODV are Establish on request, Destination sequences are utilized to locate the most recent way to target, and association arrangement deferral is less in organize. Hindrance of AODV Intermediate node can prompt conflicting path, Beacon-base, heavy control overhead and more energy utilization it there is a way break.

2.2 Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV)

AOMDV protocol is an augmentation to the AODV protocol for registering various link disjoint and loop free paths[4]. The routing sections for every target node contain a rundown of next-nodes alongside the relating hop counts. All the following hops have a similar sequence number and this aides in monitoring a path for information transmission. A hub keeps up the publicized hop counts for every target node, which is characterized as the maximum count of hops for every one of the paths. It is utilized for sending path advertisements to the target hub. Each copy path advertisement got by a hub characterizes a substitute way to the goal hub. Loop freedom is guaranteed for a node by tolerating substitute ways for information transmission to target hub in the event that it has a less hop count. Since the most extreme hop count is utilized for information transmission from source hub to target hub, the advertised hop count consequently doesn't change for a similar sequence number. In the event that a target hub gets a path advertisement with a larger sequence number, the following hop list and the advertised hop count are reinitialized for information transmission from source to target. AOMDV routing protocol[7] can be utilized to identify hub disjoint paths.

2.3 Enhanced Energy Efficient Multipath Routing Protocol In Wireless Sensor Networks

EEEMRP is an alteration of a current AOMDV protocol[6]. AOMDV has been created from a single path on-demand routing protocol AODV. The AOMDV protocol finds various paths[5]. The proposed EEEMRP is an augmentation of AOMDV. EEEMRP is likewise uses distance vector area and hop-by-hop routing approach. EEEMRP likewise utilizes a route discovery procedure to discover the on demand paths. The RREQ communicated among source and target. EEEMRP additionally offers intermediate hubs with interchange ways which will be valuable in reducing the route discovery rate.The fundamental goal of the EEEMRP protocol is to find the various path with loop free and disjoints utilizing flood-based path discovery. On off chance that a relating RREP has not been gotten inside the time, the entry is erased, this is given by Entry expiration time. The routing table section is adjusted for the upkeep of the numerous entries and various loop free routes.

Notwithstanding the AOMDV, bit of leeway of EEEMRP to choose the best way among the various ways gave between sources to target and endeavors to make the information move dependable with less energy utilization.

III. Simulation Scenario

Simulation Parameter	Value
Network Simulator	NS-2.35
Simulation Area	1000m*500m
Number of Nodes	10 to 100
Interface Queue Type	Droptail / Priqueue
Traffic Type	CBR
Packet Size	1024 Bytes
Energy	100 to 1000 Joules
Stop Time	20 sec
Routing Protocol	AODV, AOMDV,EEEMRP
No. of CBR connection	1 to 5
Speed of Node	5 to 30 m/sec

Table 1: Simulation Parameters

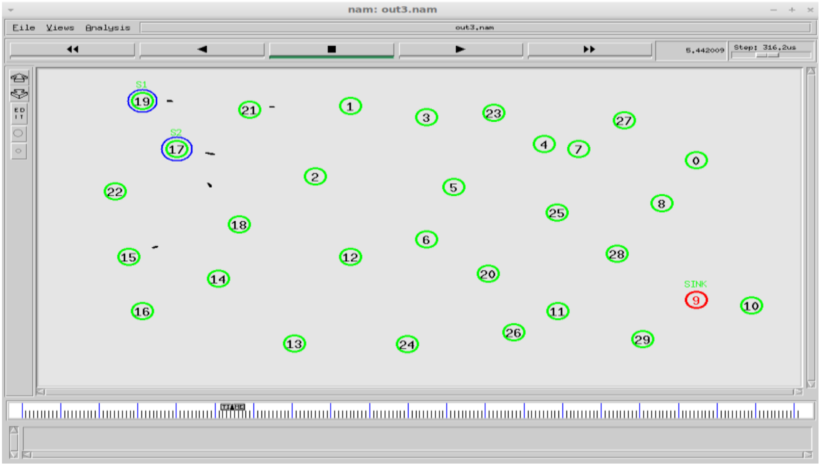

Fig 2: Execution of AODV routing protocol

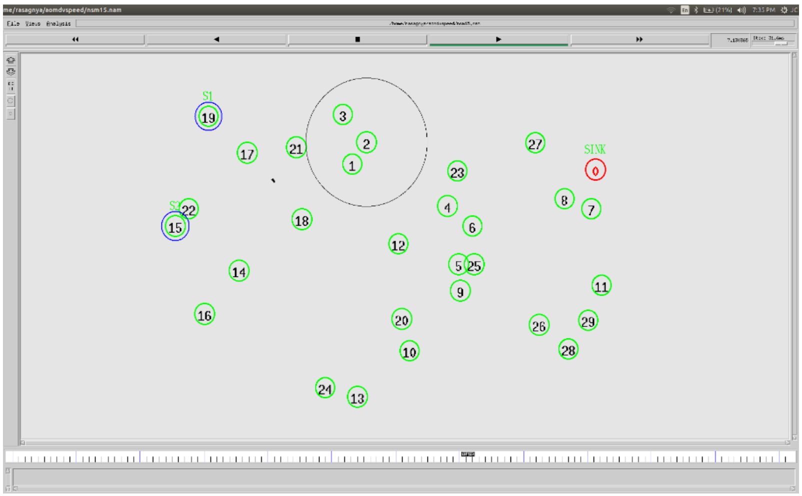

Fig 3: Execution of AOMDV routing protocol

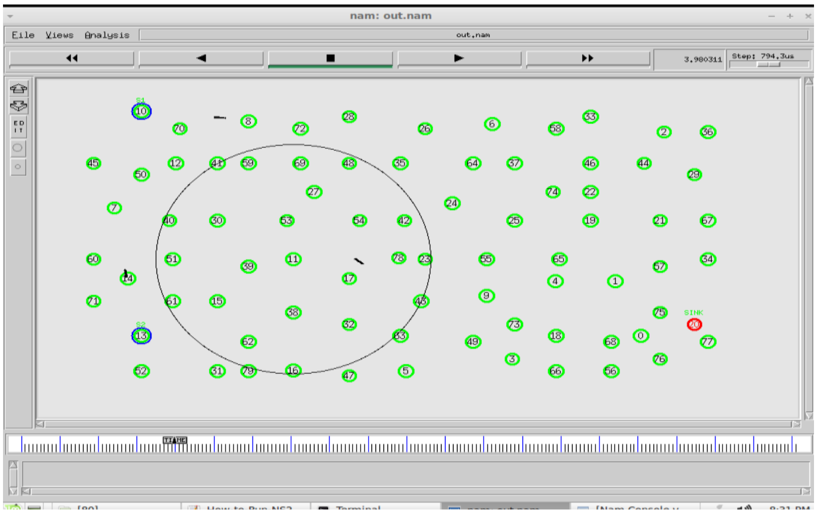

Fig 4: Execution of EEEMRP

IV. Results

4.1 Throughput

It is characterized as the total number of packets transferred effectively per unit time.

4.1.1Throughput obtained by changing number of nodes

With the expansion in number of hubs, number of moderate hubs increments among source and target which will increment in packet drops so throughput diminishes. Average throughput of EEEMRP is more than AOMDV and AODV.

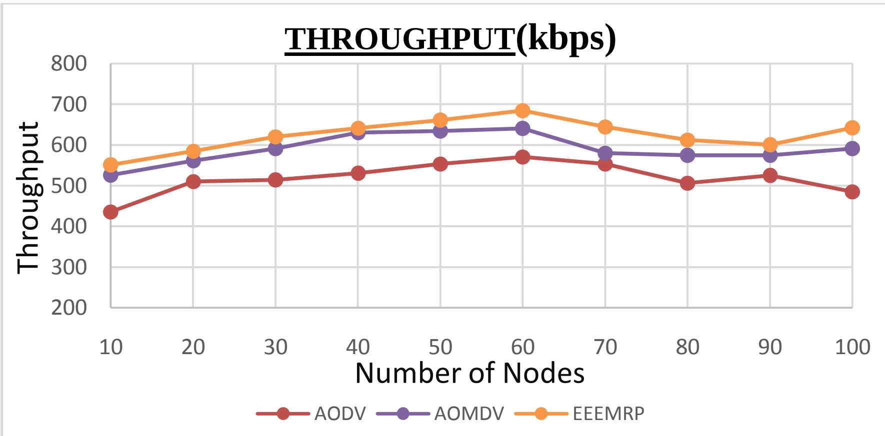

Fig 5: Graph for Throughput by varying number of nodes

4.1.2Throughput obtained by varying speed of the node

With the expansion in speed of the hub, throughput is diminished. Because of Link breaks and route breaks, packet loss increments accordingly throughput is diminished. Throughput for EEEMRP is more than AOMDV and AODV.

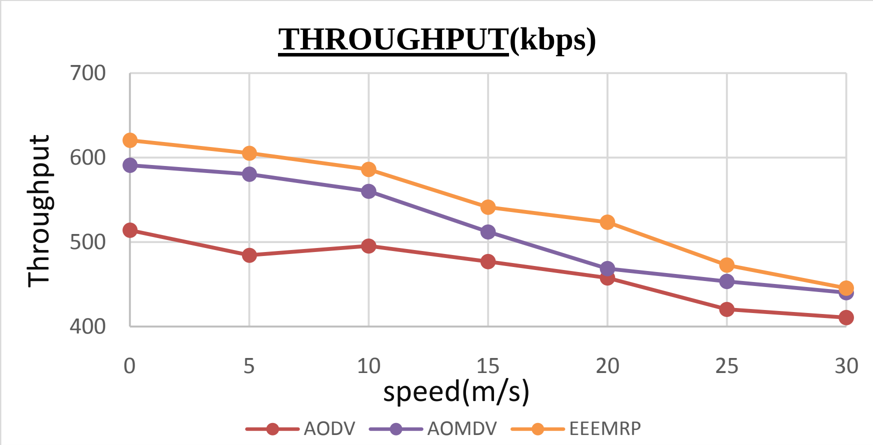

Fig 6: Graph for Throughput by varying speed of the node

4.1.3Throughput obtained by varying number of sources

With the expansion in number of sources, throughput is increased. Throughput for EEEMRP is more than AOMDV and AODV.

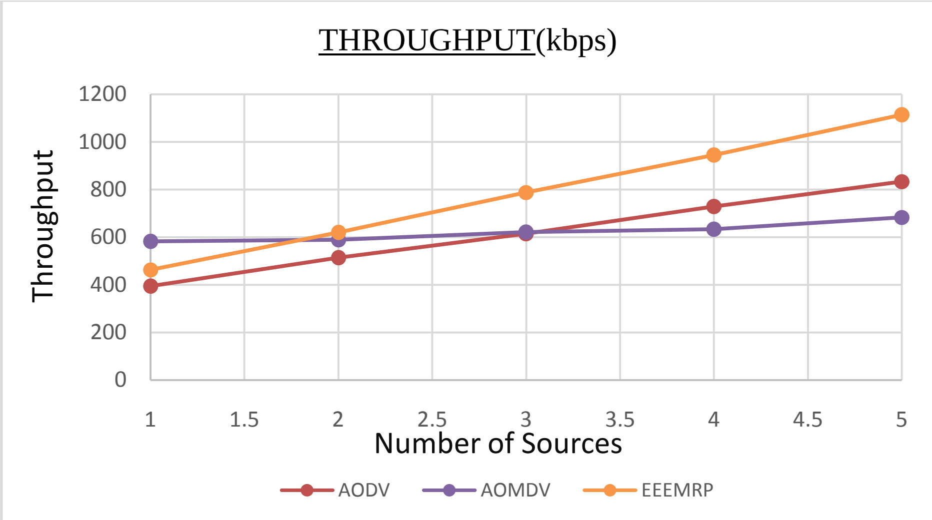

Fig 7: Graph for Throughput by varying number of sources

4.2 Control overhead

It is the proportion between the quantity of routing packets required to build up connection and the quantity of information packets sent to the target.

4.2.1 Control overhead obtained by varying number of nodes

With the expansion in number of hubs, retransmission of routing packets increments because of packet drops so control overhead is expanded. Control Overhead for EEEMRP is not greater than AOMDV and AODV.

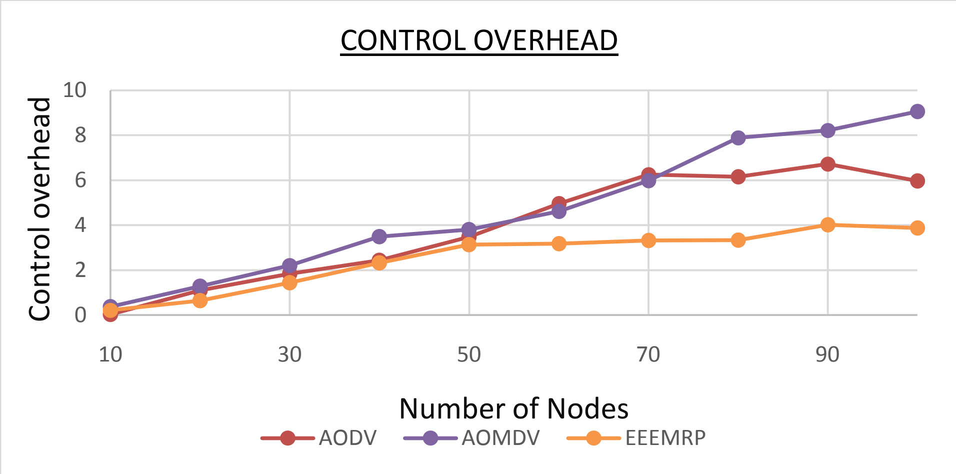

Fig 8: Graph for Control overhead by varying number of nodes

4.2.2 Control overhead obtained by varying speed of the node

With the expansion in speed of the hub, control overhead is expanded. Because of Link breaks and route breaks number of retransmissions increments. Additionally path discovery procedure to be started once more, which results in expanded control overhead. Control overhead of EEEMRP is not greater than AOMDV and AODV.

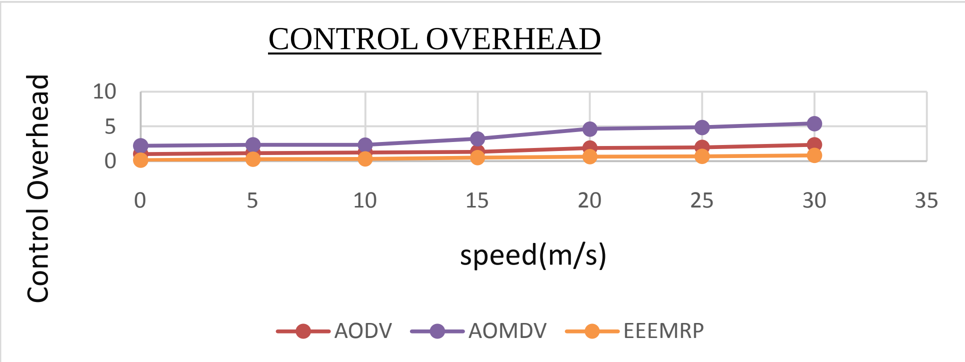

Fig 9: Graph for Control overhead by varying speed of the node

4.2.3 Control overhead obtained by varying number of sources

With the expansion in speed of the hub, control overhead is expanded. Because of Link breaks and path breaks number of retransmissions increments. Likewise path discovery procedure to be started once more, which results in expanded control overhead. Control overhead of EEEMRP is not exactly AOMDV and AODV.

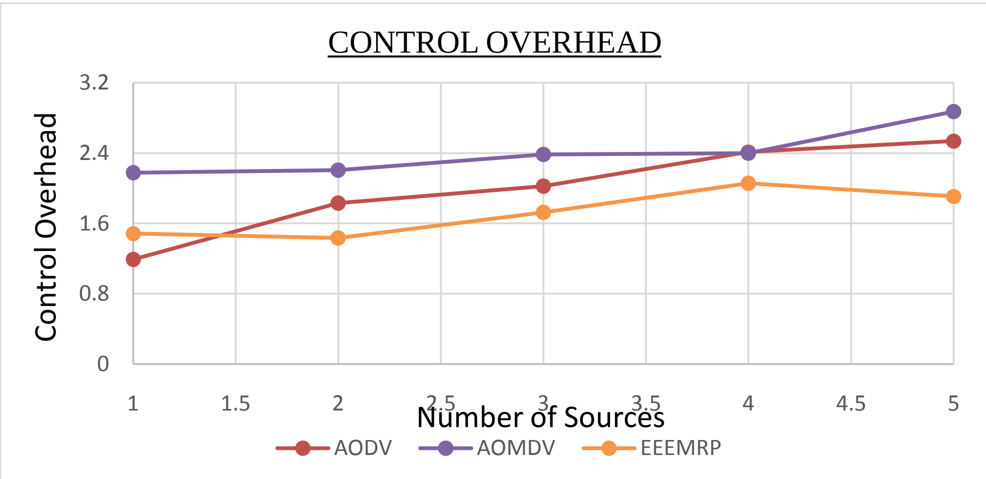

Fig 10: Graph for Control overhead by varying number of sources

4.3 Energy Consumption

It is the energy or power devoured by the sensor hubs in detecting, gathering and transmitting the information to the base station.

4.3.1 Energy Consumption obtained by varying number of nodes

With the increase in number of Nodes, Energy Consumption is increased.Energy Consumption of EEEMRP is less than AOMDV and AODV.

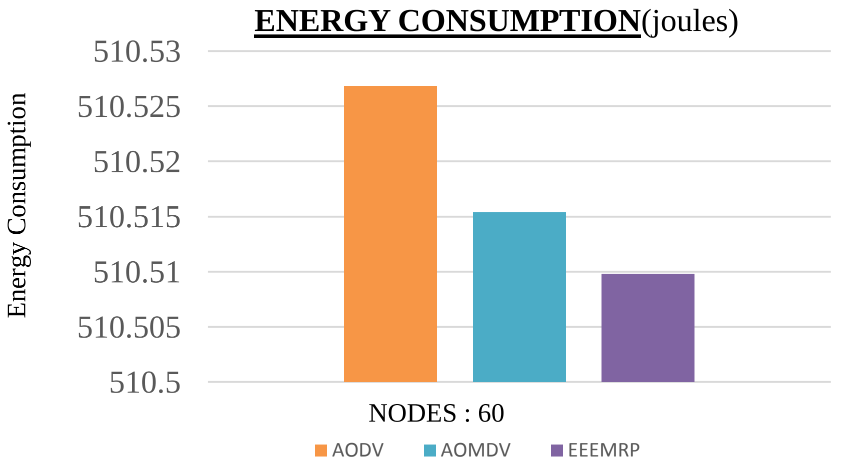

Fig 11: Graph for Energy Consumption by varying number of nodes

4.3.2Energy Consumption obtained by varying speed of the node

With the expansion in speed of the hub, Energy Consumption is expanded. Because of Link breaks and path breaks number of retransmissions increments . Likewise route discovery procedure to be started once more, which results in expanded vitality utilization Energy Consumption for EEEMRP, is not exactly AOMDV and AODV.

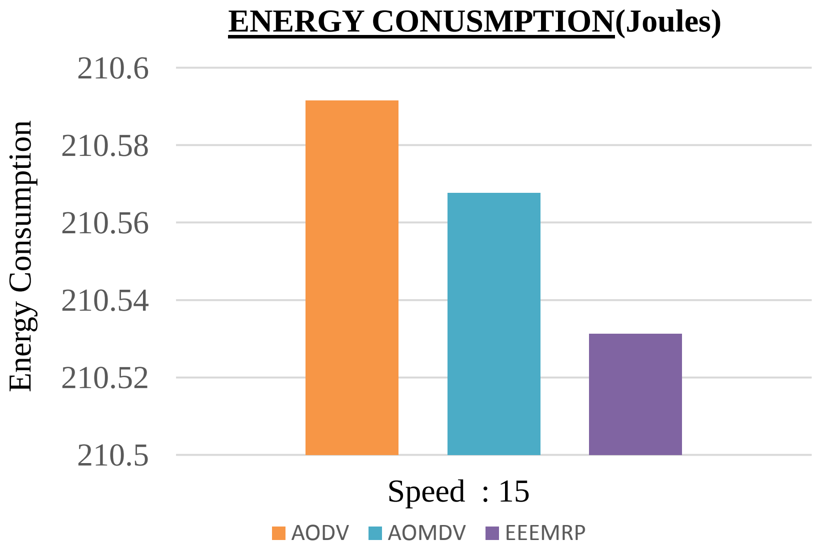

Fig 12: Graph for Energy Consumption by varying speed of the node

4.3.3Energy Consumption obtained by varying number of sources

With the increase in number of sources, Energy Consumption is increased. Energy Consumption of EEEMRP is less than AOMDV and AODV.

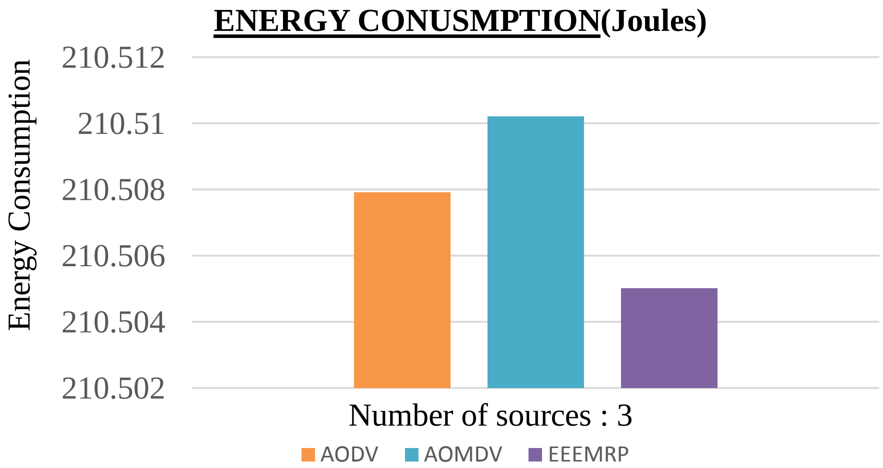

Fig 13: Graph for Energy Consumption by varying number of sources

4.4 Average Remaining Energy

4.4.1 Average Remaining Energy obtained by varying number of nodes

With increase of number of nodes, intermediate nodes between source and destination increases so remaining energy decreases.Remaining energy of EEEMRP is more than AOMDV and AODV.

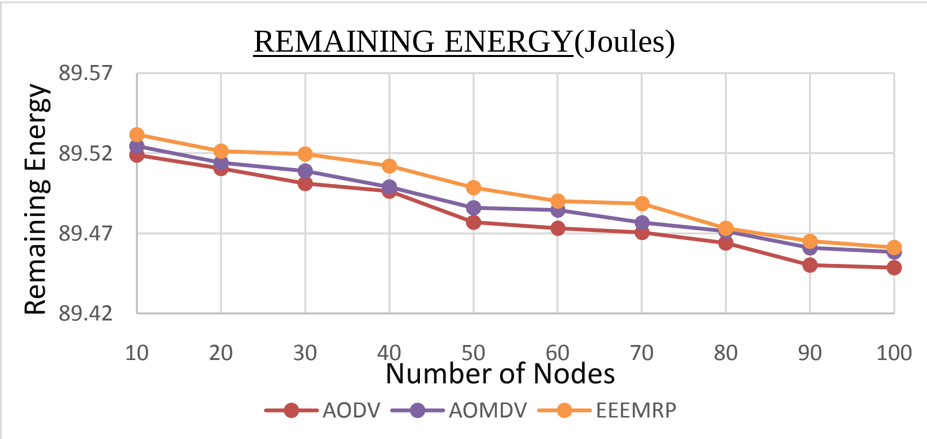

Fig 14: Graph for Remaining Energy by varying number of nodes

4.4.2Average Remaining Energy obtained by varying speed of the node

With the increase in speed of the node, remaining energy is decreased. Due to Link breaks and path breaksnumber of retransmissions increases . Also route discovery process to be initiated again, which results in decreased remaining energy.Remaining Energy for EEEMRP is more than AOMDV and AODV.

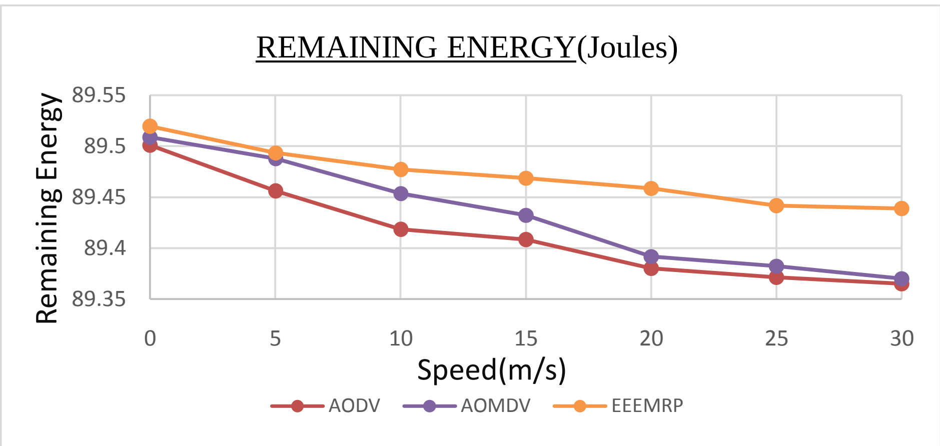

Fig 15: Graph for Energy Consumption by varying speed of the node

4.4.3Average Remaining Energy obtained by varying number of sources

With the increase in number of sources, remaining energy is decreased.Remaining energy of EEEMRP is more than AOMDV and AODV.

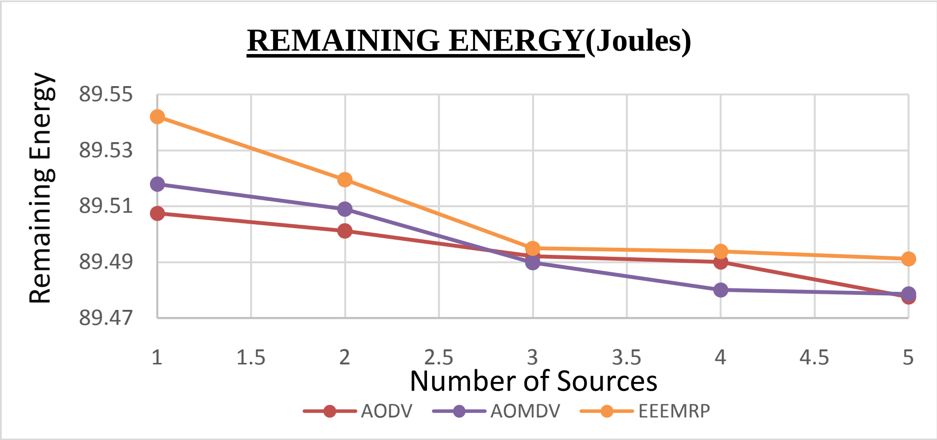

Fig 16: Graph for Energy Consumption by varying number of sources

4.5 Delay

The average time taken by information packets in effectively transmitting information packets over the system from source to target.

4.5.1 Delay obtained by varying number of nodes

At the point when number of hubs expands, delay increments because of increment in number of intermediate hubs among source and target. Delay of EEEMRP is more than AOMDV and AODV.

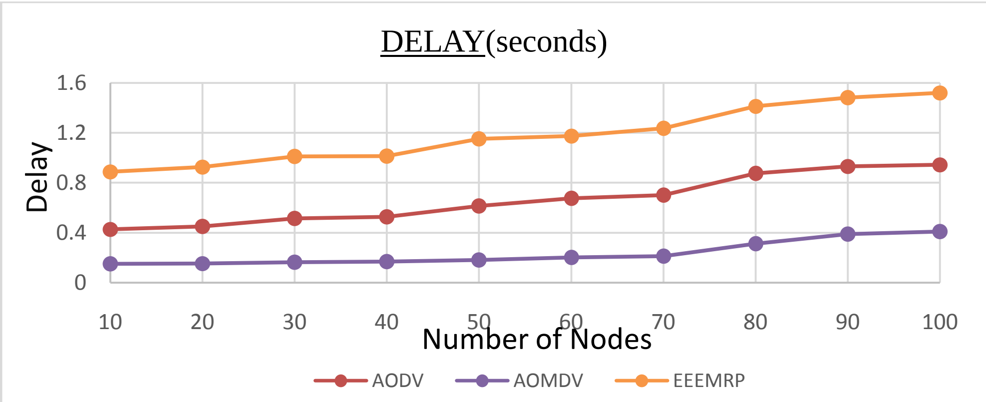

Fig 17: Graph for Delay by varying number of nodes

4.5.2Delay obtained by varying speed of the node

With the expand in speed of the node, delay is expanded. Because to Link breaks and routebreaks route discovery procedure to be started again which results in increments of end to end delay.

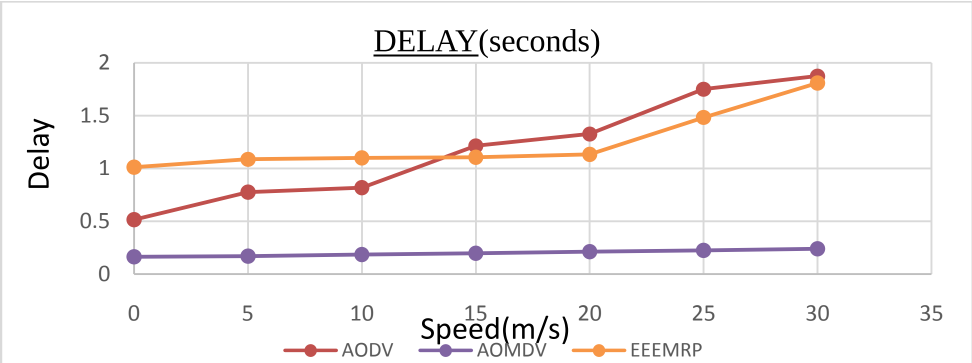

Fig 18: Graph for Delay by varying speed of the node

4.5.3Delay obtained by varying number of sources

With the expand in number of sources, queuing length expands so delay is expanded. Delay for EEEMRP is greater compared to AOMDV and AODV.

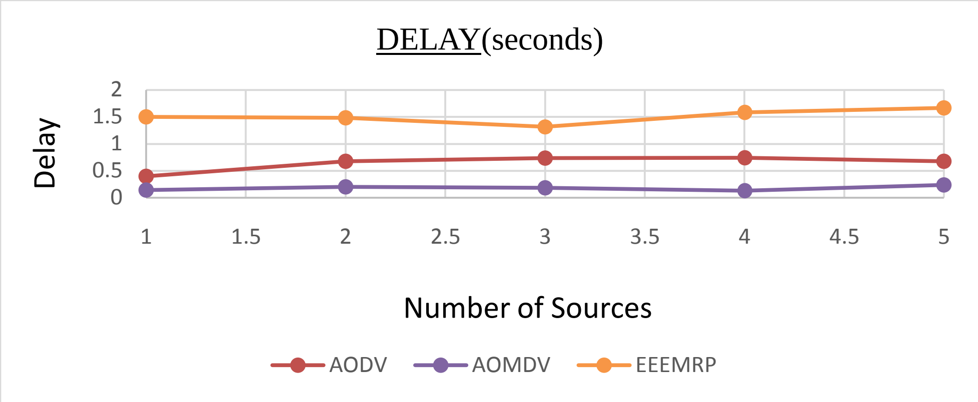

Fig 19: Graph for Delay by varying number of sources

V. CONCLUSION

Performance of EEEMRP is evaluated and compared with AOMDV and AODVusing Quality of Service Parameters likeDelay, Throughput, Average Energy Consumed, Remaining Energy and Control Overhead in different scenario by changing the number of nodes, changing the number of sources and varying the speed of hub. NS2 is used to simulate the network in which the hops are randomly distributed in 1000 X 500 areas. The type of traffic is CBR and the packet size is 1024 bytes.Performance analysis and simulation results explain that EEEMRP is more effective in terms of Throughput, Energy Consumed and Control Overhead as compared to AOMDV and AODV protocols. This indicates the lifetime of the network in extended a little with respect to EEEMRP. The ease of deployment, energy conservation and extension of network lifetime make EEEMRP a remarkable and robust protocol for wireless sensor networks.

Delay of EEEMRP is more than AOMDV and AODV.EEEMRP has only few percentage of improvement, while comparing with AOMDV and AODV.The project can be implemented by increasing the number of nodes to more than hundred, by increasing the maximum speed, by increasing the size of packet.It can be modified with help of advanced algorithm to decrease delay, extend the lifetime and the performance level of the Wireless Sensor Communication Networks.

Acknowledgements

This project work is supported in part by the AICTE funded project, Titled ‘’Development of Early Warning System for Landslide Prediction’’ under research promotion scheme (RPS), during 2017-2020.

REFERENCES

[1]. Aritra Dhar, Pinaki Sarkar,"Full Communication in a Wireless Sensor Network by Merging Blocks of a Key Pre distribution using Reed Solomon Code", CCSEA 2011, CS & IT 02, pp . 389–400, 2011.

[2]. Jamal N. Al-Karaki, The Hashmite University Ahmed E. Kamal, Lowa state University, “Routing Techniques in WSN: A survey”, IEEE Wireless communication, 2004.

[3]. S. Archana and C. Shiva Ram Murthy,“A Survey of protocols and Algorithms for Wireless Sensor Networks” Technical Report, Department of Computer Science and Engineering, Indian Institute of Technology , Madras, India, July 2003.

[4]. V.C.Patil, Rajashree, V.Biradar, R.R. Mudholkar, S.R.Sawant, “On-Demand Multipath Routing Protocols for Mobile Ad Hoc Networks Issues and Comparison”, International Journal of Wireless Communication and Simulation, 2010, Vol. 2(1), pp. 21-38.

[5]. R.L.Lagendijik, J.F.C.M.de Jongh, “Multipath Routing in Mobile Ad Hoc Networks”, Traineeship Report, Version 1.2, TU-Delft/TNO, 2003.

[6]. Raj DAA, Sumathi P (2016) Analysis and comparison of EEEMR protocol with the flat routing protocols of wireless sensor networks. 2016 International Conference on Computer Communication and Informatics (ICCCI -2016), Coimbatore, India.

[7]. Manveen Singh Chadha, Rambir Joon, Sandeep,"Simulation and Comparison of AODV, DSR and AOMDV Routing Protocols in MANETs ", International Journal of Soft Computing and Engineering (IJSCE), vol. 2, Issue.3, July 2012. pp. 375-381.

D.Srinivasa Rao" Performance Evaluation of Enhanced Energy Efficient Multipath Routing Protocol in Wireless Sensor Networks"International Journal of Engineering Science Invention (IJESI), Vol. 08, No.11, 2019, PP 17-26