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# Energy Based Delay with Link Failure Detection in MANET

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***Abstract- Mobile Ad-hoc network (MANETs) is a network which has "no fixed-establishing network" or self-constructing network. As mobile ad-hoc network consist of portable nodes, it repetitively changes topology of the network. In MANET nodes are also power-constrained and have restricted power. Routing, link breaking and power-failure are the basic problems in this routing network as nodes are not stable and suffer from high mobility; due to which routes rapidly damaged. The most important factor in mobile ad-hoc network is how to examine a constant route which is flexible and unfailing and also to save power of nodes which not only raises system performance but also have longer live transmission. Here we suggested a novel routing metric calculates signal strength of neighboring nodes, so that we can discover which routes can cause link breaking and also discover nodes having high mobility. We also introduces an energy based delay i.e. delay based on remaining energy of the nodes. Benefit of this metric is by choosing a strong and stable route to the destination, by which systems performance improves and network lifetime gets enriched. Simulation results show that SSED-AODV performs better than AODV and our base SE-AODV routing protocol.***

***Keywords- MANET, AODV, Routing, RSSI, Energy, Delay***

## I. INTRODUCTION

An ad-hoc network is a assembly of wireless mobile nodes set up a network lacking the requirement of any central supervision or static network set-up. Mobile ad-hoc networks are self-establishing multi-hop wireless networks [1], in which moving nodes are linked by wireless links to each other. MANET does not want central supervision and lack of fixed-establishing network by which we can setup a impermanent network rapidly at anytime and anywhere essential. There occurs a peer-to-peer association amongst neighbor nodes in mobile ad-hoc network. Each node in MANET can act together as router and host to further nodes [2], seeing as this as a base of ad-hoc networks. Freely moving nodes in mobile ad-hoc networks not restricted to any access point, when they come in range of each other they self-construct themselves and built a network. As MANET is established on the conception of dynamic topology, this leads to link breaking among sender and receiver pair. For communication among non-neighboring nodes a routing protocol is essential. Mostly two types of routing named proactive and reactive routing is used in mobile ad-hoc networks. Proactive routing is the routing in which routing info is kept and periodically updated in routing table. When a node lookup for routing info within their network region, the route already available when a path is desirable. In reactive routing, routing gets reorganized when it is necessary. It is totally unlike from proactive routing since it is built on the conception of "on-demand fashion". When it desires to send the message it examines a route. It also decreases signalling overhead as it creates a route when needed by the sender node [3].

A route in ad-hoc network which do not breakdown for an acceptable period of time is known as a stable route [4]. When mobility does not affects the routes, intermediate nodes considered to be stable. Military battle fields or disaster recovery areas are the applications involves mobile ad-hoc network.

## II. RELATED WORK

Finding a power efficient routing protocol has always been a key challenging issue in mobile ad-hoc networks. Following are the methods to deal with energy conservation to improve networks lifetime.

NitinManjhi and Nilesh Patel [5] suggested a procedure in which strength of signal is calculated and then relates it with RSSI (receiving signal strength indicator) threshold value. Two ray ground models are used to measure RSSI value. If this RSSI value is greater than threshold value then it is accepted otherwise rejected. The benefit of this method is that we can raise the network lifespan though choosing a path to destination. The suggested SSAODV have numerous benefits over AODV.

KrittikaKhator and NitinManjhi [6] recommended a joined method built on signal strength and power of node for routing in MANET. The distances among two successive nodes are calculated based on RSSI and power of node is also calculated. If calculated RSSI and power of node is better than the predefined threshold value then it is accepted otherwise rejects it. This combined technique not only choose path having appropriate energy and signal strength but also increases performance and consumes less power in MANET.

YaserTaj and KarimFaez [7] proposed a novel routing metric known as SSBR which computes signal strength among neighbor nodes by which we can examine nodes having high mobility and can cause link breaking. So that we don't select those nodes as routes.Thus, picking up reliable and stable route for longer live transmission.

ZuhongFeng et.al [8] presents an improved AD-AODV protocol. AODV examines routes with the lack of residual energy and load balancing. Ad-AODV considers a residual energy and load balancing situation of the hosts. It increases the energy efficiency of ad-hoc network and gives better results than AODV routing protocol.

Choi L Sang Hong Lee et.al [9] every single node keeps the RSSI table , RSSI table hold the signal strength value of node's neighbor, with the aid of this RSSI table node calculate that his neighbor node is moving gone from us, after calculating the link failure it executes following steps:

- **Dropping:** If link quality is strictly broken or the link is previously broken, then this scheme drops the packet.
- **Relaying:** Now in this procedure, a node may turn into a relay node when together sender and receiver are in its neighbor table and forward the data amongst source and destination, if the link fails among source and destination.
- **Selective forwarding:** In this method, the packet is dropped by the intermediate node if it originates from bad links.

Ranjan Kumar and Mansi Gupta [10] proposed in order to attain route stability. This protocol chooses the route which fulfils four metrics i.e. Signal Strength, total remaining energy, delay and draining rate and reduces route failure origins due to distance among two communicating node and energy depletion. In order to meet route stability, all the parameters are matched with the pre-defined threshold values, if the intended values fulfil the threshold condition then it forward the route request packet or else it rejects the packet. Proposed RSEA-AODV gives better performance than the current AODV protocol.

F. D. Rango et.al [11] multiple metric like signal strength, queue length, drain rate and delay is used in this protocol to improve the systems performance. In order to overwhelmed congestion, it offers load balancing at node and drain rate. To decrease link breakings due to active topology, this protocol uses signal strength metric to find steady path. Proposed SEQCDR guaranteed quality of service (QOS) and outperforms AODV protocol.

TriptiNema et.al [12] mainly emphasizes on growing the life of node in the network. They suggested a procedure in which , one fixed the minimum energy threshold limit of a portable node, if a node energy level touches the minimum threshold limit then its mode alters to sleep mode, saves energy and survives as time-consuming as possible in the network. This progresses the overall MANETs efficiency.

## III. SE-AODV ROUTING METHODOLOGY

In this paper [6] recommended a joined method built on signal strength and power of node for routing in MANET. The distances among two successive nodes are calculated based on RSSI and power of node is also calculated. If calculated RSSI and power of node is better than the predefined threshold value then it is accepted otherwise rejects it. This combined technique not only choose path having appropriate energy and signal strength but also increases performance and consumes less power in MANET.

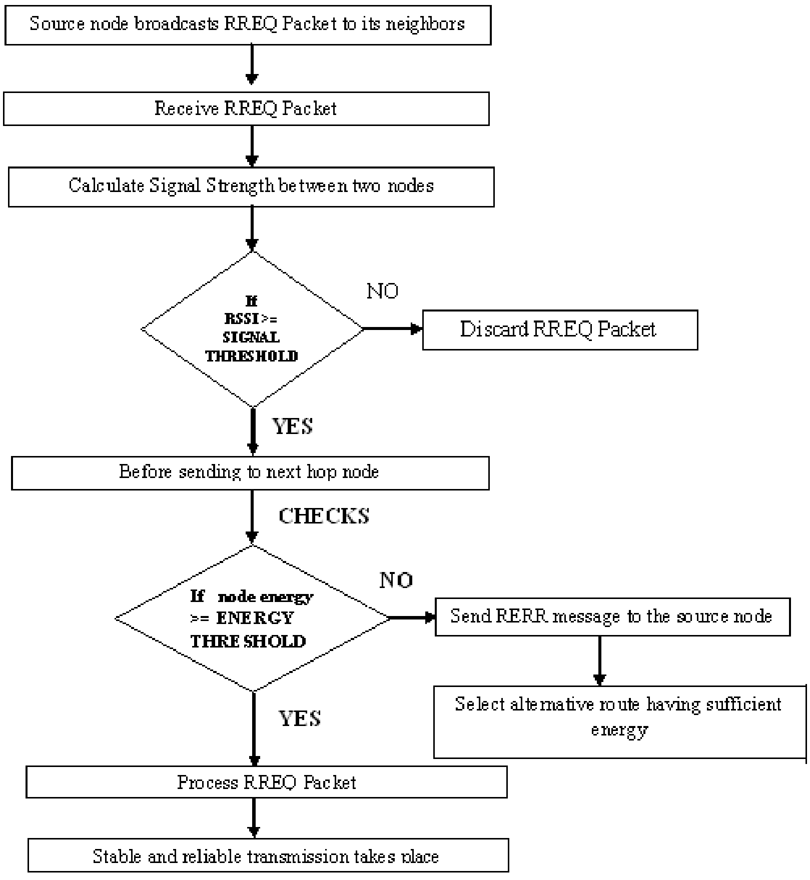


Figure 1 Route Selection in SE-AODV

## IV. SSED-AODV METHODOLOGY

Link breaking and power failure is the major concern in MANET. Link gets quickly broken as the nodes are movable, steady and reliable path is desired in mobile ad-hoc network. A path which does not breakdown for an acceptable period of time is called as stable or steady route. Energy depletion is also another issue in ad-hoc network as nodes are powered and have restricted power. Therefore path also get broken due to less powered nodes. Here we suggested a routing procedure that gives steady routes and an energy survival route for low power nodes. For this we have introduces two criterions: first one is introducing delay based on remaining energy of the nodes and second one is to calculate changes in the neighbor nodes signal strength.

### *A. Delay Model Based on Initial Energy of Nodes*

AODV protocol has been modified in such a way that a powered node which is sending data packets reached a level less than a certain threshold value of its remaining power, if node constantly sending or receiving a data packets it may die quickly. We proposed a method by introducing a delay factor based on the remaining power of nodes.

$$D = 1/(init * 100) \qquad (1)$$

Where D denotes delay and init denotes remaining energy of nodes. As we can see that delay is inversely proportional to remaining energy, more initial energy leads to less delay. Here we define a predefined threshold value which is equal to 1 joule and set an initial energy of node to 10 joule. When remaining energy is more than threshold value then we get minimum delay else maximum i.e. 0.01 sec.

### *B. Evaluation of Signal Strength from Neighbor RSSI Table*

Now, other criterion is to examine steady nodes and reliable path. We need to analysis neighbor nodes received signal strength, as the nodes are movable they can come and go from their neighbor transmission range that leads to route failure in network. Here we suggest a technique in which neighbor RSSI table is maintained. Signal strength of neighbor nodes is stored in neighbor RSSI table in tabular form. With the help of this table changes in signal strength of neighbor nodes are evaluated and previous RSSI value and current RSSI value of node is calculated in routing algorithm. After getting these values following check is performed.

$$check = \left(\frac{currrssi}{prevrssi + currrssi}\right) \qquad (2)$$

Where prevrssi denotes previous RSSI value of a node and currrssi denotes current RSSI value of a node. Now, if the value of check is less than 0.2 then it send an alert message to the source as nodes are moving far and there is a chance of node failure.

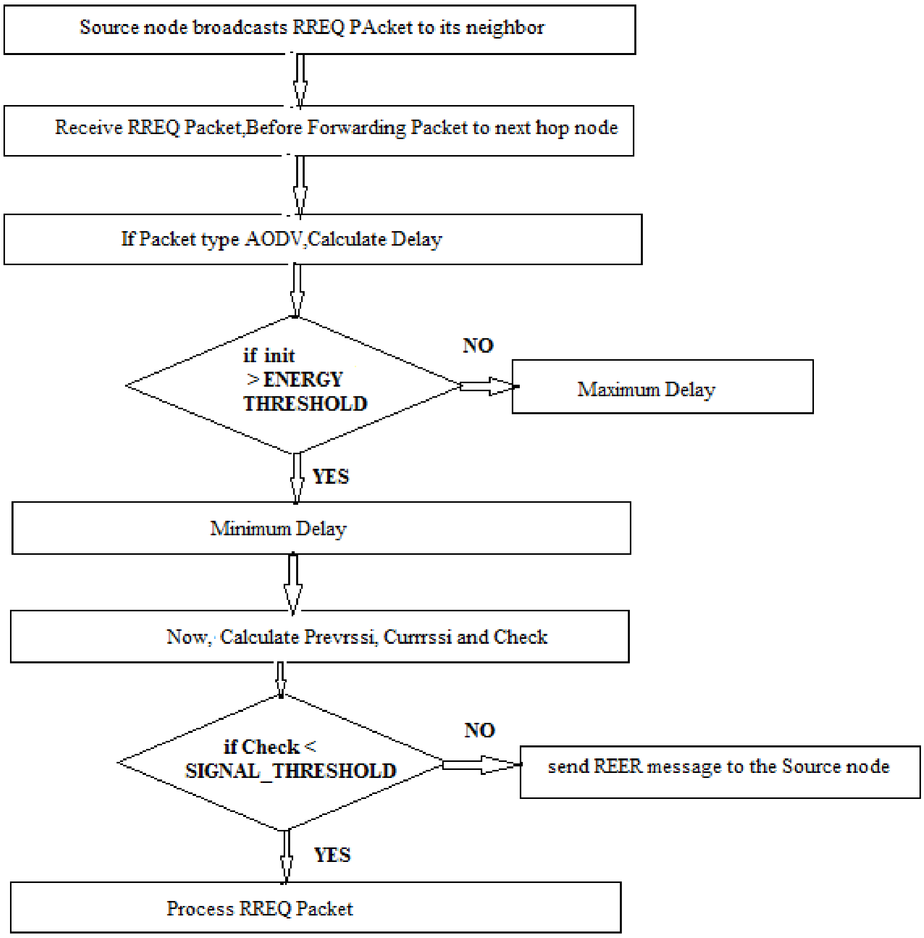


Figure 2 Route Selection in SSED-AODV

## V. PERFORMANCE EVALUATION

To evaluate the performance of our proposed SSED-AODV Routing protocol and the simulation results are compared with AODV protocol, it was tested on NS2. In this section, simulation results are discussed with comparison and simulation environment is **described.**

### *A. Simulation Parameters*

The simulation parameter has shown in Table 1. Network Simulator (NS-2.34) is used to design and implement our test bed, to test the performance of both Routing Protocols. The total simulation time is 100 sec.

Table I: Simulations Parameters

| PARAMETER | VALUES |
|---|---|
| Simulation Duration | 100 sec |
| Topology Area | 1000m x 1000m |
| No. of Nodes | 80/10-150 |
| Mobility Speed | 10 m/s |
| Packet Rate | 4 packet/sec |
| Packet Size | 512 b |
| Routing Protocol | AODV |
| Initial Energy | 10 Joule |
| Traffic Type | CBR |

### *B. Simulation Results*

In this section, the performance of SSED-AODV is evaluated using NS2 and compared with AODV and SE-AODV. Graphical analysis and comparison is done between AODV and SSED-AODV routing protocol and SE-AODV and SSED-AODV. In this scenario we change the no. of nodes.

Figure 3 and Figure 7 shows that as the no. of Nodes increases, the packet delivery ratio will decrease in case of AODV and SE-AODV. SSED-AODV selects the most reliable route as compare to AODV and SE-AODV so the Packet delivery ratio in case of SSED-AODV is better.

Figure 4 and Figure 8 shows that when no. of nodes increases end to end delay in AODV and SE-AODV increases rapidly as compared to SSED-AODV because weak signals are rejected at the routing layer after comparing RSSI with signal threshold. Thus, reducing the end-to-end delay because only selected signals can enter into further phase. Figure 5 and Figure 9 shows the effect of no. of nodes on generated throughput. In general, an increase in the size of the network environment decreased the amount of throughput. The graph represents the generated throughput while network size increases in between AODV, SE-AODV and SSED-AODV.

Figure 6 and Figure 10 shows the average energy consumption of the network when the No. of node increases. Because of No. of nodes, each nodes consumes more energy, if the node increase so energy consumption is minimum for SSED-AODV as compared to AODV and SE-AODV.

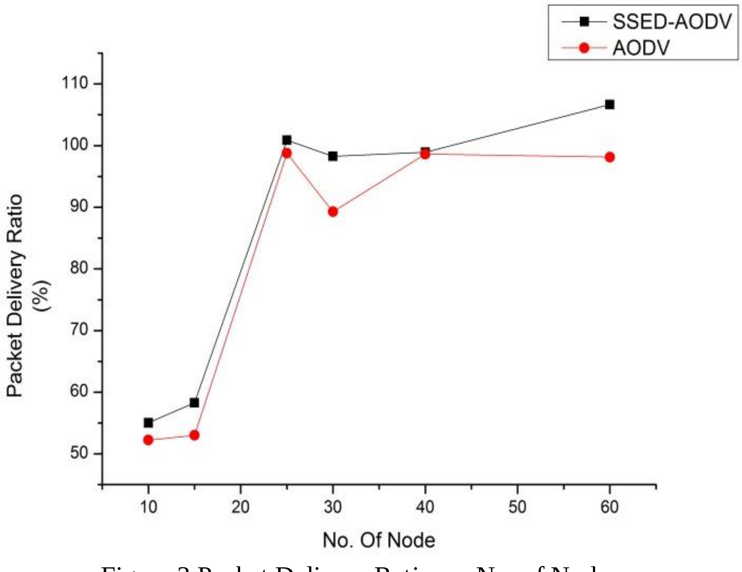


Figure 3 Packet Delivery Ratio vs. No. of Nodes

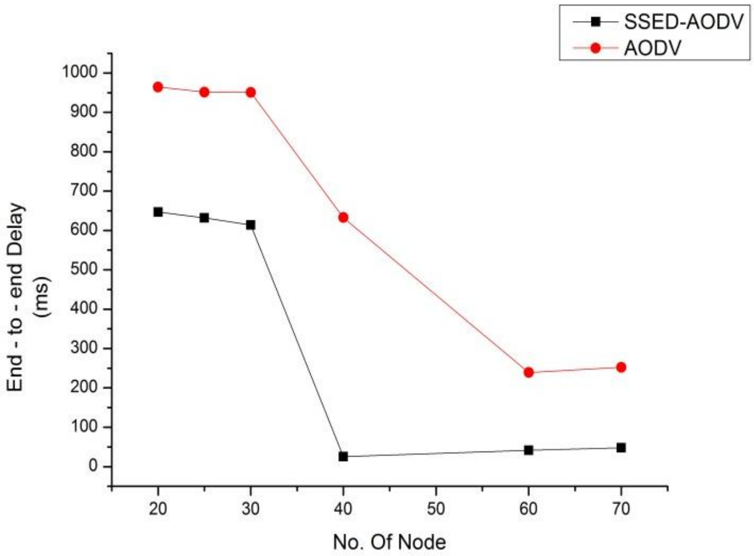


Figure 4 end-to-end delay vs. No. of Nodes

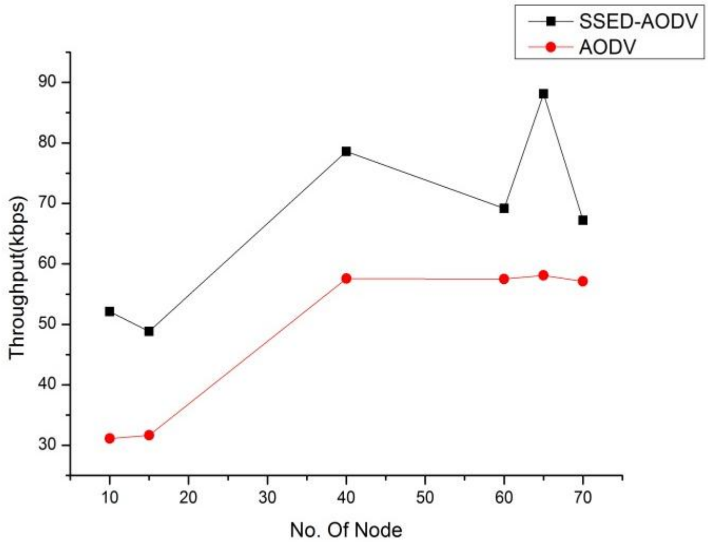


Figure 5 Throughput vs. No. of Nodes

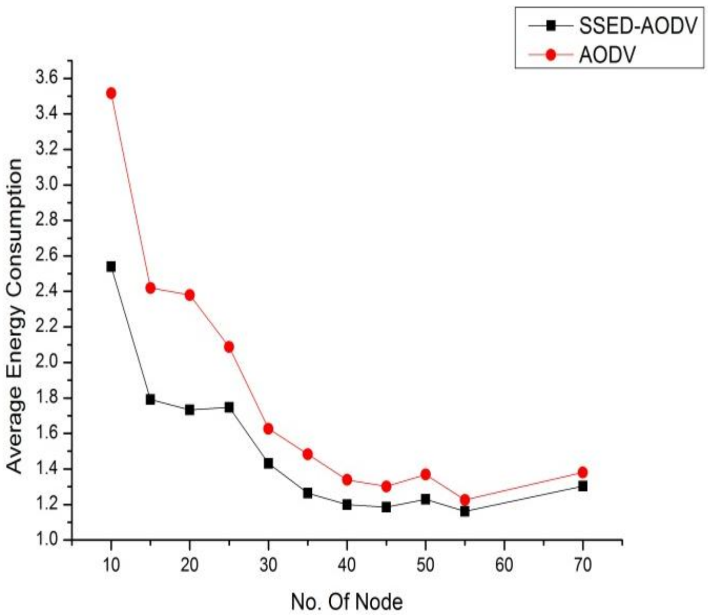


Figure 6 Average Energy Consumption vs. No. of Nodes

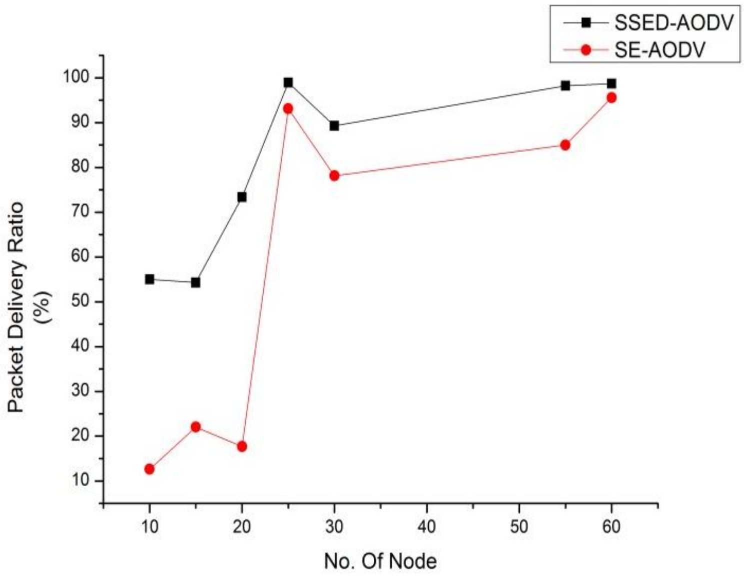


Figure 7 Packet delivery ratio vs. No. of Nodes

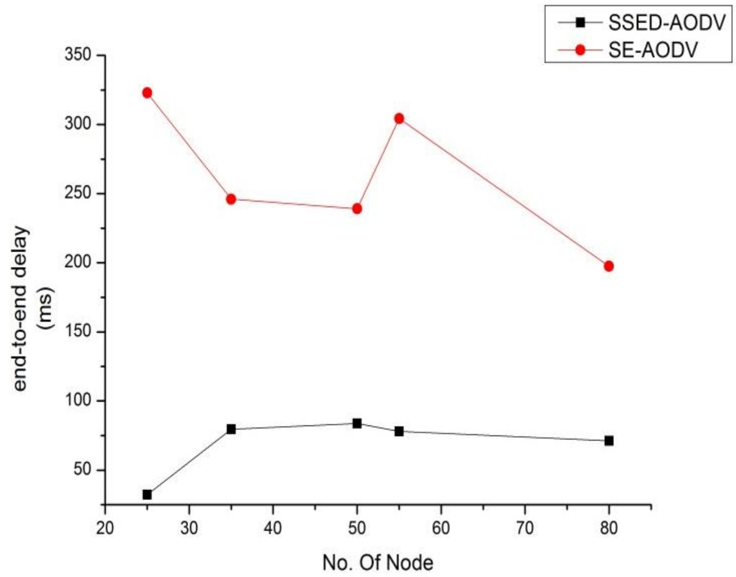


Figure 8 end-to-end delay vs. No. of Nodes

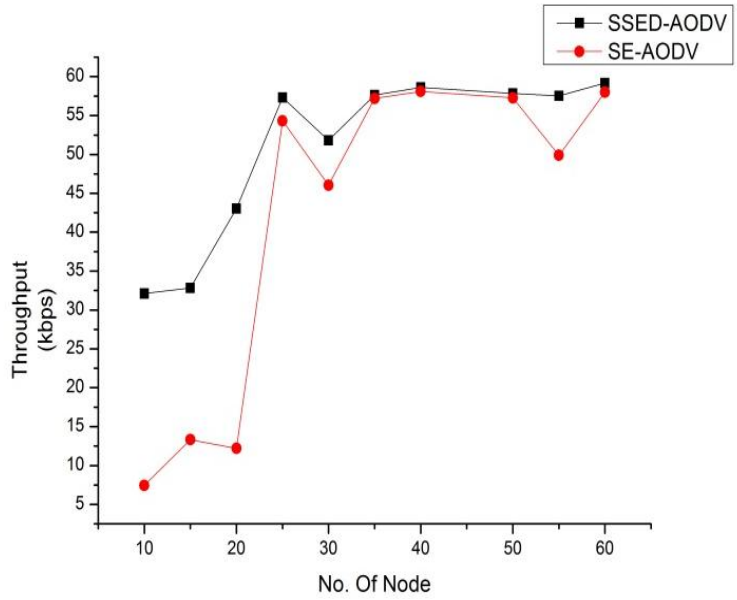


Figure 9 Throughput vs. No. of Nodes

 

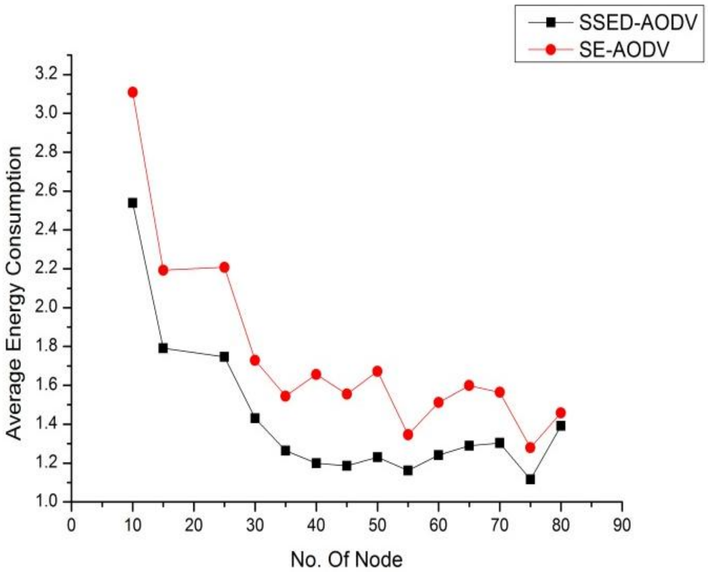


Figure 10 Average Energy Consumption vs. No. of Nodes

## VI. PERFORMANCE EVALUATION

The basic idea of our proposed algorithm is to find a stable and reliable route having maximum energy and signal strength so that it can participate in active communication for longer time and life of nodes can be increase. Our objective is to reduce the link breakage and to maximize network lifetime by using signal strength and energy and to find a longer-lived route. In this approach, a new routing metric is presented. Combining the Signal Strength metric with the Energy based Delay information can increase the overall system throughput even higher than the original AODV and SE-AODV operation.

In comparison to the recently proposed solutions that were performed the newly proposed protocol, built on top of normal AODV routing protocol, achieves an overall good results. It is a good choice for applications where link stability and reliability are the overriding factors. Thus, the proposed metric proves to be more efficient and less power consuming than normal AODV and SE-AODV with an efficient system throughput.

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