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# Energy Efficient Modified AODV for Wireless Sensor Network

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***Abstract*—** Wireless sensor network are gathering of number of mobile nodes which are associated wirelessly with each other to carry out some tasks. Wireless sensor network are self-configured, infrastructure less network. In a WSN an effective utilization of resources is a vital issue because nodes in the network depend on limited resources like battery power. Hence, energy efficient routing for this network is essential which will provide better performance with the restricted resources. The purpose of this paper is to design energy aware routing protocol; here we consider classical AODV and Modified AODV (M-AODV). This protocol based on remaining energy of each node which will help to lengthen the life of network. Network Simulator NS-3.20 determined for simulation between AODV and M-AODV.

***Keywords*—** Wireless Sensor Networks, AODV, M-AODV, Energy Efficiency

## I. INTRODUCTION

A wireless sensor network is a group of mobile nodes. Each node has three basic components: A sensing subsystem for data acquisition from the physical surrounding environment, a processing subsystem for local data processing and storage, a wireless communication subsystem for data transmission [1]. WSN characteristics are dynamic topological structure, no fixed infrastructure, limited energy resources, and unstable links. But in spite of WSN inherent characteristics it's popular in numerous areas some of them are: military applications, disaster habitat, emergency operations etc. A serious requirement in wireless sensor networks is to reach energy efficiency throughout the routing as the sensor nodes have restricted energy resources. Various dedicated routing protocols have been proposed for wireless sensor networks. In wireless sensor network routing protocols could be generally classified into three main classifications Proactive routing protocol, Reactive routing protocol and Hybrid routing protocol based on the routing information update method [2]. Proactive protocols are table driven all routes are calculated before they really required. Whenever there is need of route the information will be available instantly in route table. Due to dynamic topology, maintaining the network not easy, while in reactive protocols routes are computed on demand basis. A route discovery task appeals a route-determination process and which dismisses when either a route is established or there is no possible route accessible. They do not require repeated communication of topological information of the network. Hybrid protocol is the combination of proactive and reactive routing protocols. A reactive routing protocol has minimum routing overhead compared with proactive routing protocol as well as reactive routing protocol has improved scalability than proactive routing. On the other hand, in reactive routing source nodes may suffer with extended delays for route discovery. Reactive protocols have extended more importance as they decrease routing overhead and use less energy [3]. Reactive routing protocol ad hoc on-demand distance vector routing is appreciated for wireless sensor networks. In WSN energy is the limited resource. So it is essential that routing protocol aimed for WSN consider an energy constraint. It's a superior choice to consider only maximum remaining energy nodes for routing the path. AODV is proposing to find a particular path between source and destination. Intention of this work is to identify an energy responsive routing protocol for wireless sensor network. Based on nodes remaining energy concept, and originate from the most recognized routing protocol: Ad-hoc on demand Distance Vector (AODV) and Modified Energy Ad-hoc on demand Distance Vector (M-AODV) improves the network lifespan simply using energy responsive routing metric.

Rest of the paper is organized as follows, Section I contains the introduction of wireless sensor network and different types of protocol, Section II contains related work of energy efficient protocol, Section III existing protocol, Section IV contains proposed modified protocol, Section V contains performance evaluation of the work and Section VI contains conclusion of the research work.

 

## II. LITERATURE REVIEW

In [4] Modified AODV with Energy Metrics for Wireless Sensor Network. This paper proposes modified AODV with energy metric, M-AODV that studies the energy factor and node life time on the path for discovering the optimal path between source and destination pair. M-AODV take part two energy metrics into AODV in an efficient way so that the Ad hoc sensor network has a greater lifetime and energy consumption of each node across the network is reduced.

In [5] MCEB-AODV: A Modified Energy Constrained Based Protocol for Mobile Ad hoc Networks. This protocol proposed which taking into account the nodes remaining energy; researcher changed this scenario by using concept of remaining maximum energy of nodes. When a source node wants to connect with destination then if route discovery process the route request packet will be sent to that node which has maximum remaining energy so that the path set up will have that maximum energy and can last for a longer time.

In [6] this paper address the problem of energy efficient routing to increase the lifetime of the network, paper focusing on three major ways of increasing the life of a node are efficient battery management. The scheme has been proposed to reduce the energy consumption at the nodes, thus maximizing the network lifetime. Transmission power control method is used to adjust the power levels at node. Common power levels are used during Route Discovery. New power levels are calculated between every pair of nodes based on distance.

In [7] this paper present a new protocol Secure and Energy Aware Routing Protocol (ETARP) considered for energy efficiency and security for wireless sensor network. The significant part of the routing protocol is route selection based on utility theory. The idea of utility is a novel approach to simultaneously factor energy efficiency and trustworthiness of routes in the routing protocol. ETARP determines and chooses rules on the basis of maximum utility with incurring additional cost in overhead compared to the common AODV

## III. AODV

The AODV is a reactive routing protocol, which determines routes on the demand [8]. AODV works with two steps: route discovery and route maintenance. Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs) are the message types defined by AODV [9]. Route Requests (RREQs) which are used to start the route discovery process. Route Replies (RREPs) which are used to confirm the routes. Route Errors (RERRs) which are used to inform the network of a link breakage in an active route. AODV has to keep the routing information about the working routes. Routing information in AODV is kept in routing tables at nodes. Each node preserves a next hop routing table that has the destination to which it has an active route. Routing table entries fall dead if not used or restarted for a predefined termination time.

## IV. PROPOSED MODIFIED AODV

In AODV, when a source node desires to communicate with destination node, it starts the route discovery process and broadcasts the route request packets (RREQ). When an intermediate node receives the call for route request, in proposed protocol added one step that it must check the remaining energy of node with given threshold values before sending the packets, if it finds node having maximum remaining energy then only it rebroadcasts the request. In other case, the node concludes that its remaining energy is not sufficient any longer to route the other packets and node discards the RREQ packets and rejects the request. This proposed routing protocol uses the concept of to choose only maximum remaining energy nodes for routing. So, when source node requires transferring data packets to destination. The route discovery procedure will find the path which having maximum remaining energy nodes. Certainly such path can persist for a longer time.

Algorithm:
Energy Threshold - ET,
Current Remaining Energy - CRE
Energy Node Validity - ENV
Nodes - N
Each n € N
**Start**
**Step1**: Initialize the nodes
**Step2**: Neighboring nodes discovery
**Step3**: Energy Monitor Agent

```
If CRE > ET
        ENV[n] = valid;
Else
        ENV[n] = invalid;
```

**Step4**: Select the valid node for routing.
**Step5**: Else repeat the step 2, 3 and 4 till the destination node.
**End**

## V. PERFORMANCE EVALUATION

Simulation research tool is used to evaluate the performance of the network with given metrics. Many more network simulators are available. Here for this work Network Simulator (NS3) had been taken consider. NS3 is widely used network simulator for wireless sensor networks. The most important reasons using NS3 is supporting energy mode.

### *A. Simulation Parameter*

Network Simulator (NS3) is used to evaluate AODV and M-AODV. Simulation considered 50 mobile nodes which are using Random Waypoint mobility scenario. WiFiRadioEnergy model is considered for nodes energy.

 

Table1. The Parameters used for the simulation

| Parameters | Values |
|---|---|
| Network Simulator | NS3 |
| Protocol Studied | AODV, M-AODV |
| Network Type | Mobile |
| Node movement model | Random waypoint |
| Energy model | WifiRadioEnergy model |
| Packet Size | 1 |
| Simulation Time | 40,60,80,100ms |
| Connection Type | UDP |
| Simulation area | 500*500m |
| Number of Nodes | 50 |
| Pause Time | 0 sec |
| Nodes Speed | 20ms |

### *B. Result Analysis*

Simulation carried out on the wireless sensor network using energy constraints. Ad hoc on demand distance vector (AODV) and Modified ad hoc on demand distance vector (M-AODV) are used for the simulation

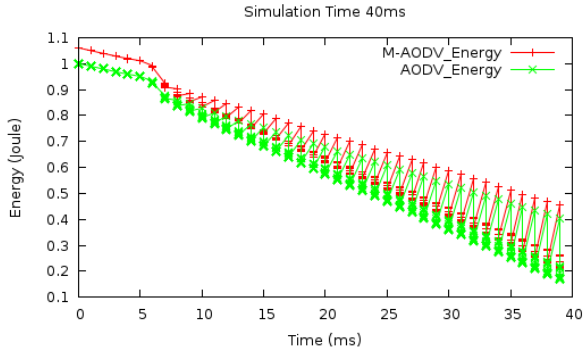


Figure 1. Energy Graph

Above graph shows Energy (Joule) verses Time (ms), considered 50 mobile nodes and 40ms simulation time. M-AODV performs well than AODV.

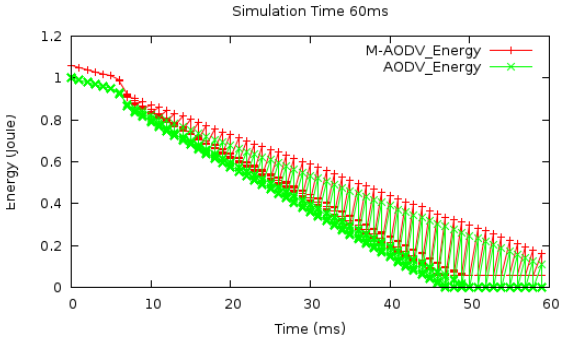


Figure 2. Energy Graph

Above graph shows Energy (J) verse Time (ms), considered 50 mobile nodes and 60ms simulation time. This senario clearly shows that M-AODV performs well though simulation time increases while in AODV after sometime network goes in zero state.

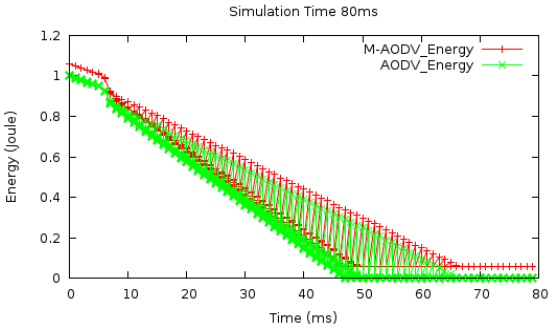


Figure 3. Energy Graph

Above graph shows Energy (J) verses Time (ms), considered 50 mobile nodes and 80ms simulation time. In this scenario M-AODV performs well than AODV.

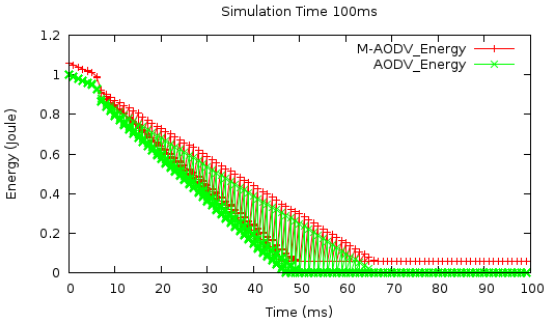


Figure 4. Energy Graph

Above graph shows Energy (J) verses Time (ms), considered 50 mobile nodes and 100ms simulation time. Simulation result of all above graphs shows that M-AODV performs very well. M-AODV gives best performance than AODV.

## VI. CONCLUSION

To design an energy efficient protocol has been one of the key issues in wireless sensor network. The goal of proposed work is to provide an energy efficient routing scheme for WSN. Simulation result between classical ad hoc on demand distance vector (AODV) and modified ad hoc on demand distance vector (M-AODV) shows that M-AODV properly manage energy all over the network. In AODV effective node energy consumption is not possible, all above scenarios shows if simulation time gets increases after sometime nodes goes to

 

dead condition and whole network gets breakdown due to nodes energy gets drain. Comparing with M-AODV which considers only those nodes which having maximum remaining energy for routing and it's clearly shows that although increasing in simulation time M-AODV not goes in zero position. M-AODV excellently apply energy all over the network which help to prolong the existence of the network. M-AODV shows greater performance than AODV in terms of energy consumption as well as it's improving the lifespan of network.

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