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Improved Aodv Routing In Wireless Sensor Networks Using Shortest Path Routing.

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ABSTRACT**:** *Recent advances in wireless networks have prompted much research attention in the area of wireless sensor network (WSN). Sensor network consists of hundreds to thousands of low power multifunctioning sensor nodes operating in hostile environment with limited computational and sensing capabilities. In WSN it is critical to collect the information in an efficient manner. In order to avoid this problem we propose a new technique of improved AODV routing using least cost path. It provides energy aware, data gathering routing structure in wireless sensor networks. It can avoid network congestion and fast consumption of energy of individual node. Then it can prolong the life cycle of the whole network. The main goal is to maintain the maximum lifetime of the network, during data transmission in an efficient manner. This paper defines implementation of WSN and comparison of its performance with AODV routing protocol based on the least cost path. The implementation is done in NS2.*

Keywords:- *Shortest path, AODV, wireless sensor networks, NS2.*

I. INTRODUCTION

Due to the advances in low power wireless communications, the development of low power wireless sensors has received recently an important attention.

Wireless sensor networks have critical applications in the scientific, medical, commercial and military domain. Examples of these include environmental monitoring smart homes and office surveillance and intelligent transport systems. It also has significant usage in biomedical field. Although sensor networks are used in many applications they have several limitations including limited energy supply and limited computing capabilities.

The use of mobile sink can improve the performance of wireless sensor network; the mobile sinks are mounted on some people or animals moving randomly to collect information of interest sensed by the sensor nodes where the sink trajectories are random. The path constrained sink mobility is used to improve the energy efficiency of the network. This paper focuses on improving the AODV routing by selecting the least cost path, thus calculating the distance between the neighboring node including its trust and the threshold energy level. The mobile sink collects data from sensor nodes while moving close to them. According to the communication range of M, the monitored region can be divided into two parts, the direct communication area (DCA), and the multihop communication area (MCA) for far-off sensors. Sensor nodes within the DCA, called subsinks, can directly transmit data to the mobile sink due to their closer proximity of the trajectory. On the other hand, sensors within the MCA, called members, must first relay data to the subsinks which complete the final data transmission to the mobile sink. The communication time (or duration) between each subsink and the mobile sink is assumed to be fixed due to the fixed movement path and constant speed of M. The throughput of the WSN is dependent on the relationship between the upper bound on the data collected and the number of members belonging to each subsink. The main challenge here is to find an efficient assignment of members to the subsinks that improves the data delivery performance as well as reduces energy consumption.

II. AODV [AD-HOC ON-DEMAND DISTANCE VECTOR]

AODV is a method of routing messages between mobile computers. It allows these mobile computers, or nodes, to pass messages through their neighbors to nodes with which they cannot directly communicate. AODV does this by discovering the routes along which messages can be passed. AODV makes sure these routes do not contain loops and tries to find the shortest route possible [1]. AODV is also able to handle changes in routes and can create new routes if there is an error. The diagram to the left shows a set up of four nodes on a wireless network. The circles illustrate the range of communication for each node. Because of the limited range, each node can only communicate with the nodes next to it [6].

AODV is one of the most efficient routing protocols in terms of establishing the shortest path and lowest power consumption. It is mainly used for ad-hoc networks but also in wireless sensor networks. It uses the concepts of path discovery and maintenance. However, AODV builds routes between nodes on-demand i.e. only as needed. So, AODVs' primary objectives are:

1. To broadcast discovery packets only when necessary,
2. 2. To distinguish between local connectivity management (neighborhood detection) and general topology maintenance,
3. To disseminate information about changes in local connectivity to those neighboring mobiles nodes that are likely to need the information.
4. Error Message: The significant characteristic of AODV is that it maintains time base category for individual routing tables of each node. When a route error message (RERR) is received by node, all the routes are checked by it that contains dreadful nodes and routing table of node. AODV maintain routes by the route error message and warns to each node when error message arise

AODV Characteristics

1. Will find routes only as needed.
2. Use of Sequence numbers to track accuracy of information.
3. Only keeps track of next hop for a route instead of the entire route.
4. Use of periodic HELLO messages to track Neighbors.

Pros

The AODV routing protocol does not need any central administrative system to control the routing process.

Reactive protocols like AODV tend to reduce the control traffic messages overhead at the cost of increased latency in finding new routes.

Cons

It is possible that a valid route is expired.

The performance of the AODV protocol without any misbehaving nodes is poor in larger networks

III. PROBLEM FORMULATION

Let n sensor nodes be deployed randomly and let l1s nodes close to the trajectory of the mobile sink be chosen as subsinks. The other 11m nodes away from the mobile sink choose different subsinks as their destinations. The mobile sink moves along a fixed path periodically with constant speed to collect data. Assume that the mobile sink has unlimited energy, memory, computing resources and has enough storage to buffer data. Each sensor node continuously collects data and transmits them either directly to the mobile sinks or to one of the subsinks which finally delivers the data to the mobile sink. The members within the multihop communication area need to choose one and only one subs ink as its destination. A highly dense sensor network is considered, in which all members can reach the subsinks through single-hop or multihop communication.

IV. PROBLEM SOLUTION

The proposed solution focuses efficient data collection and network lifetime maximization of wireless sensor networks. Here the predictable mobile sink path is considered. The objective is to improve the energy efficiency for data gathering, which minimizes the energy consumption of entire network under the condition of maximizing the total amount of data collected by the mobile sink. Network life time can be improved by optimal subsink selection which depends on the residual energy of the nodes. The problem is solved by finding the least cost path and determining the smallest route to the destination. A novel routing approach using Improved AODV algorithm is proposed for Wireless Sensor Networks consisting path constrained mobile sink.

V. SIMULATION TOOL

NS-2 is an object based tool which encapsulates independent objects linked to each other within a system hierarchy. [7] Network simulators are very important and efficient analyzing tool used for routing in network and different protocols used for wired and wireless networks.[6] Network simulator use TCL to configure the topology, the nodes, the channels, schedules the events etc. C++ language is used to implements the protocols. [8] ns-2 is often used network simulator and is one of the most popular simulators for the researchers. ns-2 is extended to the wireless sensor network and its protocols. ns-2 uses object oriented design for implementation of different modules of a sensor network

VI. SIMULATION PARAMETERS

(I) Packet Delivery Fraction (PDF): Packet Delivery Fraction is the ratio of the number of data packets successfully delivered to the destination nodes and number of data packets produced by source nodes. [9] (II) End-to-End Delay: The term End-to-End delay refers to the time taken by a packet to be transmitted across a network from source node to destination node which includes retransmission delays at the MAC, transfer and propagation times and all possible delays at route discovery and route maintenance. [11] The queuing time can be caused by the network congestion or unavailability of valid routes. [17]

(III) Throughput: The term throughput refers the number of packet arriving at the sink per ms. Throughput is also refers to the amount of data transfer from source mode to destination in a specified amount of time. The goal is to calculate maximum throughput of IEEE 802.11 technologies in the MAC layer for different parameters such as packet size. [10]

VII. PROPOSED ALGORITHM

The improved AODV protocol is proposed to establish the least cost path that can satisfy the source node's requirements including energy, trust, and route length. To establish a route to the destination node D, the source node S broadcasts RREQ packet and waits for RREP packet. The source node embeds its requirements in the RREQ packet, and the nodes that can satisfy these requirements broadcast the packet. The destination node establishes the shortest route that can satisfy the source node's requirements. The rationale of the improved AODV protocol is that the node that satisfies the source node's requirements is trusted enough to act as a relay. The protocol is useful to establish a route that avoids the low-trusted nodes and high energy consumption routes. Energy values of node are declared as numerical value such as {1,2,3,4..etc},threshold of energy is assigned as 2, thus the route is taken in such a way that, node should have energy value of less than or equal to 1.

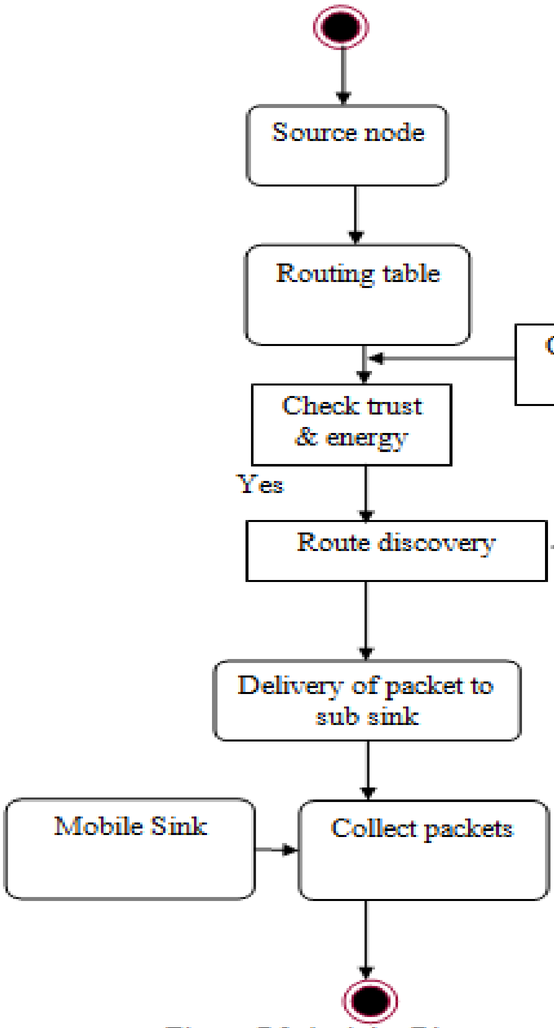

Figure 7.1 Activity Diagram

VII. SIMULATION SETUP

In this paper, we investigated AODV protocol with a scenario where a total of 5,10,15,20,28 nodes are used with the maximum connection number 10; CBR connection; transfer rate is taken as 256 packets per second i.e. the send rate of 0.01 and the pause time is varied starting from 0 s., 20 s., 40 s., 60 s., 80 s., and 100 s. (i.e. in the steps of 20 s.) implemented respectively in a 1000 m. x 1000 m. and 2000 m. x 2000 m. terrain areas. The simulation time was taken as 900 seconds and keeping the speed constant. The details of general simulation parameter used are depicted in Table 1.

Sr. No	Parameters	Values
1.	Radio Model	Two ray round
2	MAC type	802_11
3.	Antenna	Omni Antenna
4.	Max packet in ifq	50
5.	Number of nodes	5,10,15,20,28
6.	Routing protocol	AODV
7.	Dimension of topography	1000x1000 2000x2000
8.	Time of simulation	900 seconds
9.	Packet size	512
10.	Traffic type	CBR
11.	Max Speed	100

Table no 8.1 Simulation Parameters

IX. RESULTS AND DISCUSSIONS

The investigations were performed on Parameters using AODV routing protocol such as Packet Delivery Fraction [%] (PDF), Average End-to-End Delay [in ms], Average Throughput [in kbps], and Packet Loss [%].

Comparison of 5, 10, 15, 20 and 28 nodes scenario is shown.

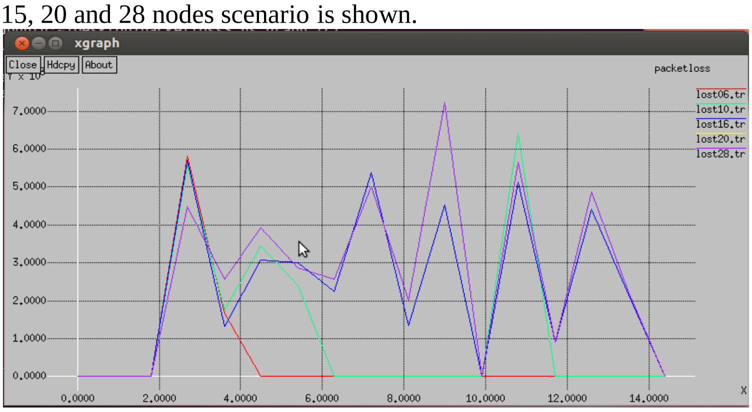

Fig.9.1 Comparison graph of packetloss for 5, 10, 15, 20 and 28 nodes

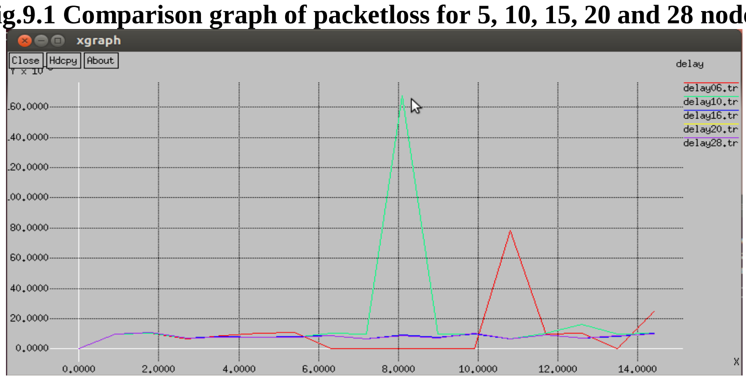

Fig 9.2 Comparison graph of delay for 5, 10, 15, 20 and 28 nodes

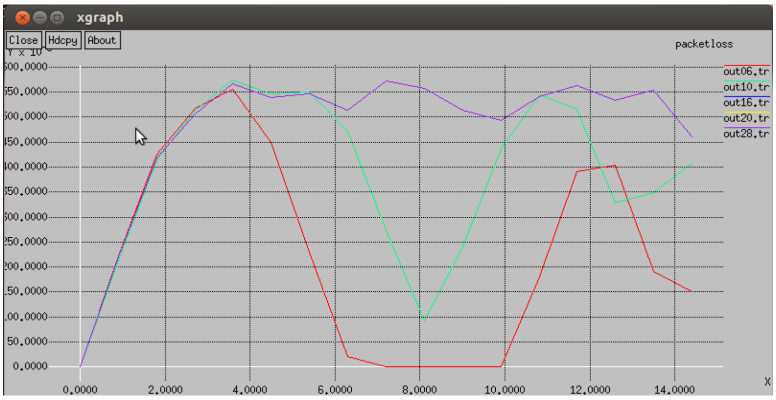

Fig. 9.3 Comparison graph of throughput for 5, 10, 15, 20 and 28 nodes

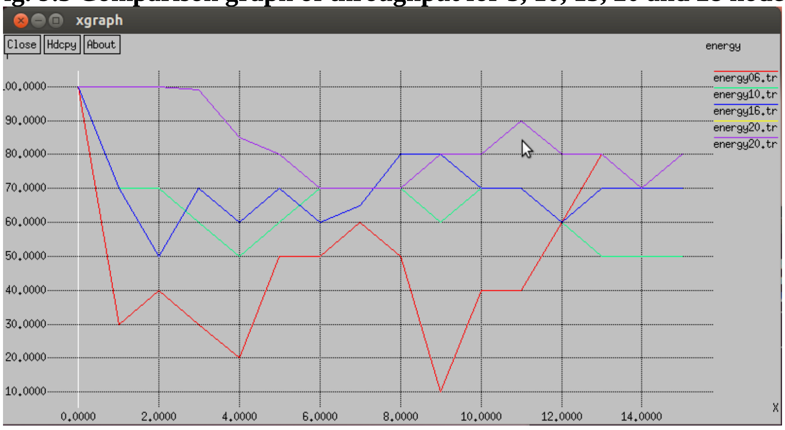

Fig. 9.4 Comparison graph of energy consumption for 5, 10, 15, 20 and 28 nodes

X. RESULTS FOR (SRR) PROTOCOL

	NUMBER OF NODES				
	5	10	15	20	28
Packet loss	0	6	5.5	7	7
Delay	80	160	10.8	10.8	10.8
Throughput	550	555	555	600	600
Energy	80	50	70	80	80

Table 10.1 Results of SRR Protocol

10.1 Results for (AODV) Protocol

	NUMBER OF NODES				
	5	10	15	20	28
Packet loss	0	250	140	250	250
Delay	33	140	120	120	120
Throughput	350	350	350	350	350
Energy	70	50	60	70	70

Table 10.2 Results of AODV Routing

Hence from the above results we can say that Shortest reliable routing protocol gives a better performance than AODV routing by finding the shortest route to the destination and thus consuming less energy and increasing the network lifetime of the network.

XI. CONCLUSION

The performance of the proposed data collection scheme using shortest reliable routing using ant colony optimization is implemented in NS2. Initial energy of each node including the sink, subsink and sensor nodes are set and the mobile sink moves with a constant speed. Three zones are created each having 9 nodes where 1,2 and 3 are subsinks and 0 is the sink. From the energy file low value energy nodes are selected for routing path and one hop neighbours are identified. For the packet loss it is observed that the loss is consistent throughout the network and it is high for a 28 node network at time around 9.A zero packet loss is observed for a 5 node network since it consists of less number of nodes, hence the packet delivery to the destination is efficient for less number of nodes. The delay of the packets to the destination is observed high for a 10 nodes network at time 8. Where as a minimum and consistent delay is observed for all the other scenarios using SRR. The throughput of the network is high and consistent for 28 and 20 node network. But certain fluctuations are observed for a 5 and 10 node network. Due to the use of a mobile sink in SRR routing, the energy consumed by the network is much less as compared to the other AODV protocols. The initial energy being observed as 100 is found to be highly consistent for all the scenarios.The SRR routing can be further implemented for a larger number of nodes. Also some additional components like GPS modules can be connected so as to improve the network efficiency by consuming less energy. More number of mobile sinks can be implemented to collect the data more efficiently. Path controllable mobile sink can be implemented to visit each node to collect the data.

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