International Journal of Advance Research in Science and Engineering
Volume No.06, Special Issue No.(01), December 2017
www.ijarse.com
IJARSE
ISSN: 2319-8354

PEGASIS Routing Protocol Strength Coherent With Different Environment for WSN Scenarios

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ABSTRACT

Wireless sensor networks have attained increasing attention from both the research industry and academia. Wireless Sensor Networks consist of small wireless nodes which are capable of sensing, computation and wireless communication capabilities, this paper consist a systematic evaluation of a PEGASIS routing protocol for WSN based on the well-known Power Efficient Gathering in Sensor Information System (PEGASIS) is compared with AODV, AOMDV and PEGASIS routing protocol. This work evaluates the protocols on a range of WSN with various node densities with comparison metrics i.e. Packet Delivery Ratio (PDR), Residual Energy and Throughput.

Keywords: - WSN, AODV, AOMDV and PEGASIS

I.INTRODUCTION

Wireless Sensor Networks [1], with the characteristics of low energy consumption, low cost, distributed and self-organization; have brought a revolution to the information perception [2]. The wireless sensor network is composed of hundreds of thousands of the sensor nodes that can sense conditions of surrounding environment such as illumination, humidity, and temperature. Each sensor node collects data such as illumination, humidity, and temperature of the area. Each sensor node is deployed and transmits data to base station (BS). The wireless sensor network can be applied to variable fields. For example, the wireless sensor network can be used to monitor at the hostile environments for the use of military applications, to detect forest fires for prevention of disasters, or to study the phenomenon of the typhoon for a variety of academic purposes.

These sensor nodes can self-organize to form a network and can communicate with each other using their wireless interfaces. Energy efficient self-organization and initialization protocols are developed in [3], [4]. Each node has transmitted power control and an Omni-directional antenna, and therefore can adjust the area of coverage with its wireless transmission. Typically, sensor nodes collect audio, seismic, and other types of data and collaborate to perform a high-level task in a sensor web. For example, a sensor network can be used for detecting the presence of potential threats in a military conflict. Most of battery energy is consumed by receiving and transmitting data. If all sensor nodes transmit data directly to the BS, the furthest node from BS will die early. On the other hand, among sensor nodes transmitting data through

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ISSN: 2319-8354

multiple hops, node closest to the BS tends to die early, leaving some network areas completely unmonitored and causing network partition. In order to maximize the lifetime of WSN, it is necessary for communication protocols to prolong sensor nodes' lifetime by minimizing transmission energy consumption, sending data via paths that can avoid sensor nodes with low energy and minimizing the total transmission power.

II. ARCHITECTURE OF WIRELESS SENSOR NETWORK

Figure.1 shows a typical schematic of a wireless sensor network (WSN). After the initial deployment (typically ad hoc), sensor nodes are responsible for self-organizing an appropriate network infrastructure, often with multi-hop connections between sensor nodes [5] The onboard sensors then start collecting acoustic, seismic, infrared or magnetic information about the environment, using either continuous or event driven working modes. Location and positioning information can also be obtained through the global positioning system (GPS) or local positioning algorithms. This information can be gathered from across the network and appropriately processed to construct a global view of the monitoring phenomena or objects.

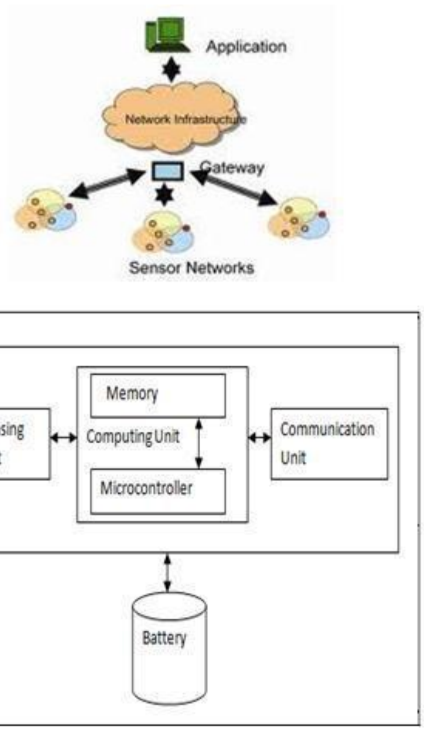

Fig. 1 Schematic of a Wireless Sensor Network Architecture

III. PROTOCOLS OF WSN

A. Ad-hoc on Demand Distance Vector Routing Protocol (AODV)

The AODV routing protocol is an on demand routing protocol [8]. Therefore, routes are created only when the requirement is generated [2]. "Hello Messages" may be used to detect and monitor neighbors. Periodically nodes broadcast the "Hello Message" to determine the activeness of neighbor nodes [6]-[9].

This technique is used to know the status of active nodes for data transfer. It broadcasts a "Route Request" (RREQ) to each intermediate node. If the receiving node does not receive RREQ and there is no route to the destination rebroadcasts the RREQ. If the receiving node is the destination or has a current route to the destination, it generates a Route Reply (RREP).

- Advantages

1. The searching of paths is done when the requirement is generated.

- Disadvantages

1. Multiple route replies are generated for the same route request.
2. Time to time "hello" message is generated; which is wastage of resources like battery consumption.

B. Ad-hoc on demand multipath distance vector routing protocol (AOMDV)

The motivation for designing AOMDV is to compute multiple loop free and link Disjoint paths in highly dynamic ad hoc networks where the link breakage occurs repeatedly[17] It is the extension of AODV routing protocol [2] [10] [16]. AOMDV maintains a routing table for each node containing a list of the next-hops and its associated hop counts. Every next hop has similar sequence number for maintaining of a route. To send route advertisements, each node maintains the advertised hop count of the destination. If any node's hop count is less than the advertised hop count, then loop freshness is guaranteed for that node by receiving alternate paths to destination. In the case of a route failure, AOMDV uses alternate routes [2]. In AODV routing protocol, a route discovery procedure is needed for each link failure. Performing such procedure causes more overhead and latency also [17]. In the case of AOMDV, new route discovery process is required only when all the routes fail[10][16]. In AOMDV, a source initiates a route discovery process if it needs a communication route to a destination. The source broadcasts a route request (RREQ) along a unique sequence number so that duplicate requests can be discarded. After receiving the request, an intermediate node record previous hop. If it has a valid and fresh route entry to the destination in its routing table, then it sends a reply (RREP) back to the source. If it has no valid and fresh route entry, it rebroadcast the RREQ. The nodes on reverse route towards source update their routing information by establishing multiple reverse paths. Duplicate RREP on reverse path is only forwarded if it contains either a larger destination sequence number or a shorter route found [10] [16].

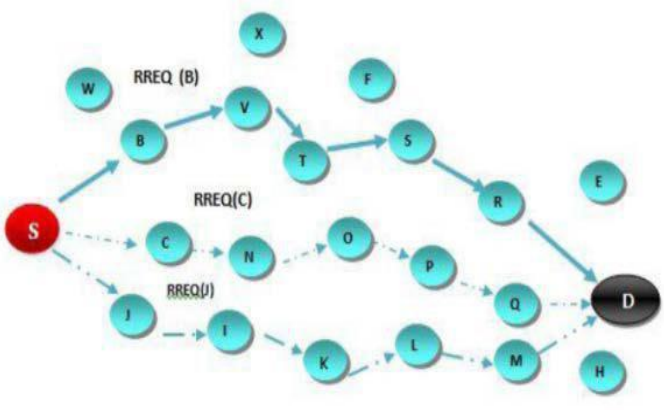

Fig. 2 Route Discovery Procedures in AOMDV

C. Power efficient gathering in Sensor information System (PEGASIS)

The PEGASIS protocol forms a chain of the sensor nodes and the chain is formed using a greedy approach, starting from the node farthest to the sink node. The nearest node sends data to the neighboring node. This procedure continues until all the nodes are included in the chain.

We used random node network for our simulation. For a 4000m x 800m area, here before passing the information to the adjacent neighbor data aggregation takes place.

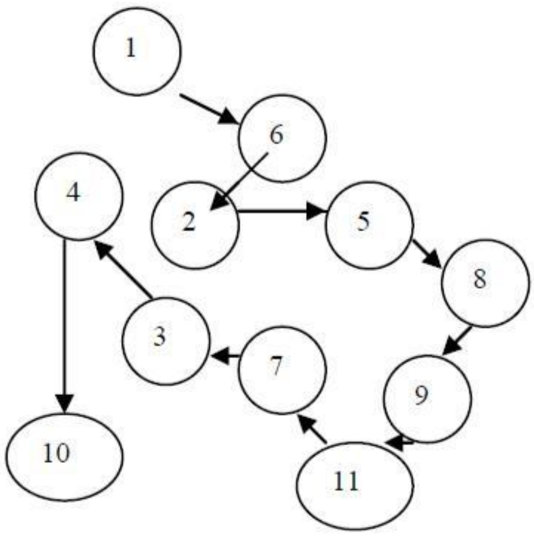

Fig. 3 Chain Construction using Greedy Algorithm

For constructing the chain, we assume that all nodes have global knowledge of the network and employ the greedy algorithm. To construct the chain, we start with the furthest node in the base station. We begin with this node in order to make sure that nodes farther from the base station have close neighbor's, as in the greedy algorithm the neighbor distances will increase gradually since nodes already on the chain cannot be revisited. In Figure 2 chain is constructed between the nodes and finally node 10 is selected to pass the data to sink node. Figure 2 shows node1 connecting to node 6, node 6 connecting to node 2, and node 2 connecting to node 5, node 5 connecting to node 8, and node 8 connecting to node 9, node 9 connecting to node 11, and node 11 connecting to node 7, node 7 connecting to node 3, and node 3 connecting to node 4, node 4 connecting to node 10. When a node dies, the chain is reconstructed in the same manner to bypass the dead node.

IV. IMPLEMENTATION & RESULTS

In this paper implemented work i.e. performance evaluation of WSN Scenario for PEGASIS routing protocol on ns2 platform with comparison and to analyze Different routing protocols with the use of various performance matrices Like Packet* Delivery Ratio, Residual Energy, Throughput and End to End delay.

Simulation Parameters:-

Simulation Tool	Network Simulator2.35
IEEE Scenario	802_15_4
Mobility Model	Two Ray Ground
No. Of Nodes	25, 50, 70, 90, 120, 170, 200
Traffic Type	TCP
Antenna	Omni Directional Antenna
MAC Layer	IEEE 802_15_4
Routing Protocols	AODV, AOMDV, PEGASIS
Queue Limit	50 packets
Simulation Area(in meter)	4000*800
Queue type	Droptail
Channel	Wireless Channel
Simulation Time	100 sec

Performance Matrices:-

This work have used WSN scenario with varying node density i.e. 20nodes, 50nodes, 70nodes, 90nodes, 120nodes, 170nodes and 200nodes under static scenario using three routing protocols. We have reached to the results with the help of various performance matrices for now we have used following performance matrices.

- Packet Delivery Ratio
- Residual Energy
- Throughput
- End to End Delay

Packet Delivery Ratio: - Packet delay ratio is the ratio that is used to calculate the number of data packet transmitted by the source node and no. of data received by the destination node. It is used to calculate the loss rate of data packets while during data transmission in network. It evaluates the loss rate and measures up both the correctness and efficiency of ad-hoc routing protocols. A higher packet delivery ratio is hoped in any network.

Packet Delay Ratio = ∑ Number of packet receive / ∑ Number of packet send

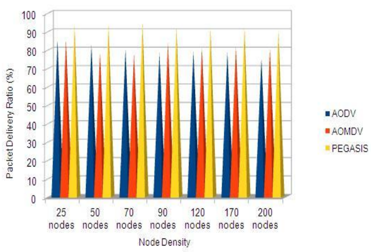

Fig. 4 Packet Delivery Ratio for various node Density

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ISSN: 2319-8354

Residual Energy: - It is the total amount of remaining energy by the nodes after the completion of Communication or simulation. If a node is having 100% energy initially and having 70% energy after the simulation than the energy consumption by that node is 30%.The unit of it will be in Joules.

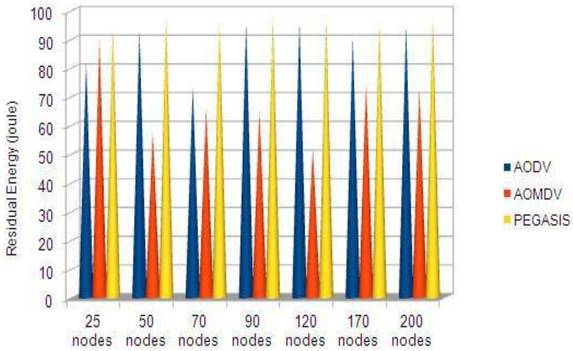

Fig. 5 Residual Energy for various node Density

Throughput: - Throughput or network throughput is the rate of successful message delivery over a communication channel. The data these messages belong to may be delivered over a physical or logical link, or it can pass through a certain network node, throughput is usually measured in bits per second (kbps).

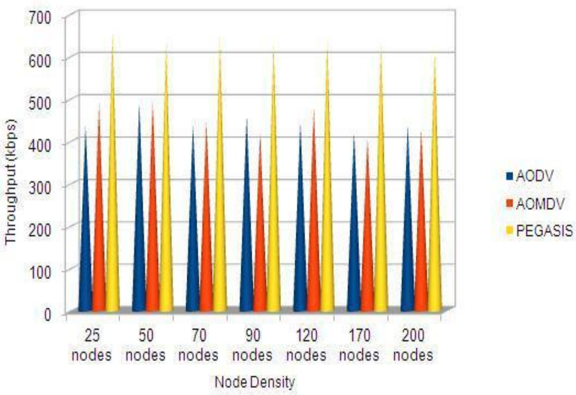

Fig. 6 Throughput for various node Density

V. CONCLUSION

WSN has the ability to deploy a network where a traditional network infrastructure environment cannot possibly be deployed. Energy efficient routing protocol for WSN is one of the important features for its deployment, the energy consumption in the network as a challenging task. In this work analyzed the effect of energy consumption and other matrices in the performance of AODV, AOMDV protocol and compare it to the PEGASIS routing protocol. The simulation has been done using the network simulator (NS-2.35). The performance metrics like packet delivery ratio, Residual energy and throughput has been measured and analyzed with the variable node density. From the simulation results it is clear that when the PEGASIS routing protocol work in the network with high residual energy, packet delivery ratio and throughput exists in the network as compare to AODV and AOMDV routing protocol.

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