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Design of Power Optimized Protocol for Wireless Sensor Networks to Increase Battery Lifetime.

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Abstract: *Designing efficient and reliable communication protocols for wireless sensor networks in indoor monitoring applications is a challenging task, due to the uncertainty and dynamics of the environment. Besides maximizing the lifetime of the sensor node, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to minimize maintenance and maximize overall system performance. The routing protocol has been designed based on the energy efficient techniques. The proposed system uses the distance as the major role to which the power changes adaptive to the distance. The proposed algorithm is AODV when implemented in the wireless sensor networks (WSN) will increase the battery life.*
Keywords*: *AODV, WSN

I. Introduction

Simulation is an important tool in the development of mobile ad hoc networks; it provides an excellent environment to experiment and verify routing protocol correctness. However, simulation does not guarantee that the protocol works in practice, because simulators contain assumptions and simplified models that may not actually reflect real net-work operation.

After a protocol is thoroughly tested in simulation, an implementation is the logical next step. A working implementation is necessary to validate that the routing protocol specification performs under real conditions. Otherwise, assumptions made by the protocol design cannot be verified as correct. Additionally, an implementation can be used to perform and field tests. Eventually it can be used in a deployed system.

Wireless sensor networks (WSN's) have attracted a great deal of research attention due to their idle - range of potential applications. Applications of WSN include battlefield surveillance, biological detection, medical monitoring, home security and inventory tracking. This type of network consists of a group of nodes and each node has limited battery power. There may be many possible routes available between two nodes over which data can flow. Assume that each node generated some information and this information needs to be delivered to a destination node. Any node in the network can easily transmit their data packet to a distance node, if it has enough battery power. If any node is far from its neighbor node then large amount of transmission energy is required to transmit the data to distance node. After every transmission, remaining energy of this node decreases and some amounts of data transmission this node will be eliminated from the network because of empty battery power and in similar situation there will be a condition that no node is available for data transmission and overall lifetime of network will decreases. Whereas network lifetime is define as the time until the first node in the network dies. For maximizing the network lifetime, data should be routed such that energy expenditure is fair among the nodes in proportion to their energy reserved, instead of routing the data to a path that minimize consumed power.

II. Proposed Method

In this work considers the single destination version of the problem. Most of the earlier works on energy efficient routing in wireless sensor network uses the minimum total energy (MTE) routing for data transmission approach in this work to minimize the energy consumption to reach the destination was by sending the traffic to same path but if all the traffic follows the same path then all the nodes of that path will depleted their energy quickly. Instead of trying to minimize the consumed energy the main objective is to maximize the lifetime of the system.

In this works proposed energy efficient routing algorithms such as flow redirection and maximum residual energy path routing. Flow redirection is the redirection based algorithm where some amount of flow is redirected from smallest longest length path to largest longest length path. Where largest longest length path is the path in which has largest capacity in terms of battery power and have less energy consumption per bit transmission.

In this paper, we propose greedy heuristic based routing algorithm to maximize network lifetime in terms of first node death. Proposed approach generates an energy efficient routing path that spans all the sensor nodes. Nodes transmit some amount of data in that path and then energy efficient path is recalculated.

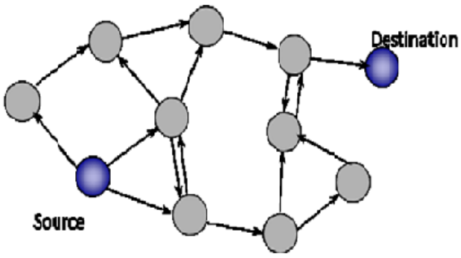

Figure 1: Route Discovery

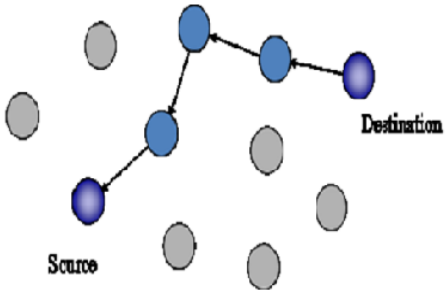

Figure 2: Route Reply

1) Finding the Optimum route based on

The optimum route is determined by using the value of α described in formula (1). The destination node calculates the values of α for received all route information and choose a route that has the largest value of α. That is, the proposed protocol collects routes that have the minimum residual energy of nodes relatively large and have the least hop-count, and then determines a proper route among them, which consumes the minimum network energy compared to any other routes.

$$\alpha = \text{Min-RE} / \text{No. Of hops} \quad (1)$$

Here Min-RE is the minimum residual energy on the route and No-Hops is the hop count of the route between source and destination.

2) Energy Saving Protocol

As the senor nodes are energy constraint nodes, they must take action to save their energy as far as possible. Transmission range adjustment protocol is also executed so that to conserve energy along with the routing process. Two phases are there. 1. Transmission range selection phase 2. Transmission range adjustment phase. At start of the routing process, transmission range selection phase is executed. After route finding, transmission range adjustment phase is executed.

3) Transmission range selection phase:

Higher transmission power will give higher range of communication range. Normally nodes will have the transmission power that provides the coverage to the distance that is much higher than the distance between the node and its extreme neighbour. This leads to the energy wastage which is the main constraint for sensor nodes to operate for long-time. Initially a node will send hello packets to its neighbour and collect the information from the neighbour then find out the distance from it to its neighbours. Then it selects the maximum distance from the calculated distance and set that distance as initial the transmission range.

4) Transmission range adjustment phase:

After some time of communication, energy will be reduced in each node. If the node still uses the initial transmission range, its energy will be completely worn out and it cannot involve in further communication. In order to prevent the node from that, transmission range readjustment phase is executed in which nodes transmission power is reduced. This will lead to i) reduction of transmission range (coverage) ii) Reduction of energy consumption iii) reduction of number of neighbour nodes iv) increase the lifetime of the node in the network. So transmission range must be adjusted based on coverage index required and also based on the remaining energy, duration communication it will involve further.

III. Simulation Results

Network simulator NS2 is used for the simulation of the scenario. Totally 20 nodes are used in the simulation and they are placed in the area of 600X600. Wireless channel is used in the simulation process. Drop Tail queue is used. Mac/802.11 is used and Omni directional antenna is used. Signal propagation uses Two Ray Ground model. UDP is used as transport agent. CBR is used for traffic generation with rate of 1024 bytes per second. The performance is analysed over the wireless sensor network using generated packets, received packets, dropped packets, packet delivery ratio, delay, energy consumption and coverage.

The Packet Delivery Ratio of all three routing protocols provides good Packet delivery in the range of 95-100%. But in Max-Min Energy routing protocol give fluctuation. Fluctuations in the packet delivery ratio are due to the many hops in the routing path.

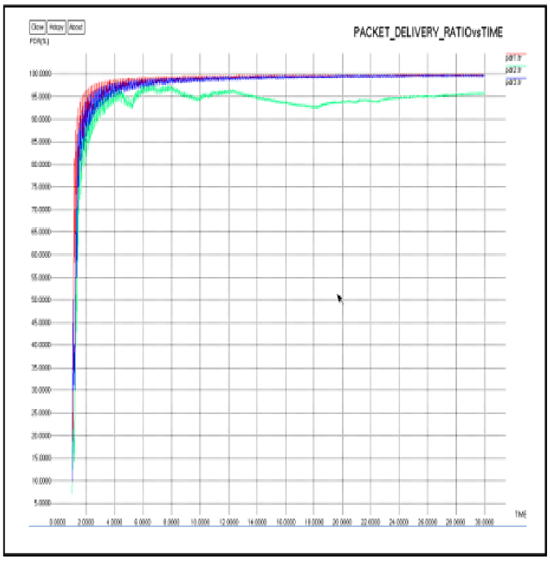

Figure 3: Packet Delivery Ratio versus Time

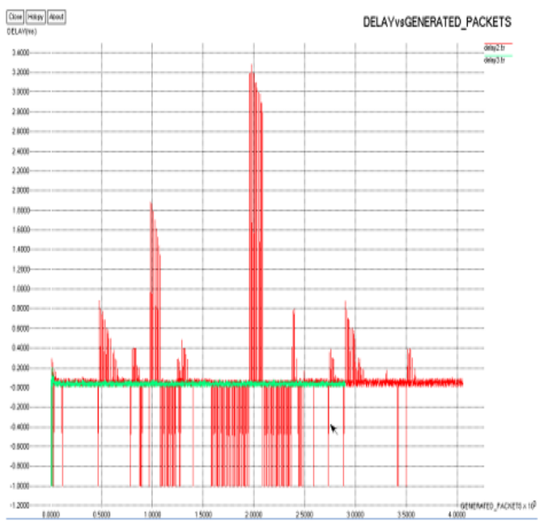

Figure 4: Delay versus Generated Packets

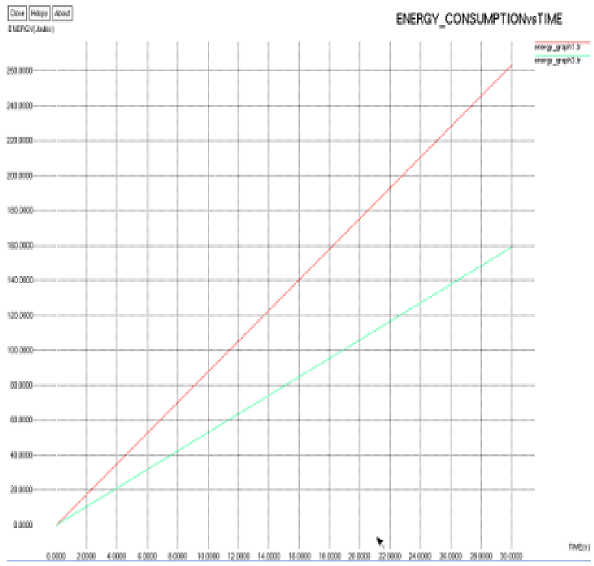

Figure 5: Energy Consumption versus Time

In Figure 3 Red line represents the result of AODV Blue line represents the result of Proposed Protocol. Green line represents the result of Max,min Energy routing protocol. Packet Delivery ratio is almost similar to all the protocols. But Max,min energy routing protocol produces the less packet delivery ratio.

In Figure4 Red line represents the result of Max_Min Energy routing protocol Max_Min Energy routing protocol Green line represents the result of Proposed Protocol. Proposed routing protocol provides lesser delay than the Max_Min energy routing protocol.

In Figure5 Red line represents the result of AODV routing protocol. Green line represents the result of Proposed Protocol. Proposed routing protocol provides lesser energy consumption than the AODV routing protocol.

IV. Conclusion

Proposed protocol achieves the higher energy consumption. This improves the lifetime of the nodes in the network. Quality of Service of the communication network is also improved by achieving the lesser end-to-end delay. Thus proposed routing protocol provides better lifetime and Quality of Service than the AODV and Max_Min energy routing protocol. In the future scope new routing algorithms are needed in order to handle the overhead of mobility and topology changes in such energy constrained environment Other possible future research for routing protocols includes the integration of sensor networks with wired networks .

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