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A Novel ODSR Algorithm In Wireless Sensor Network For The Unswerving Routing

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Abstract

A novel Option-DSR (ODSR) algorithm is proposed in this paper. This algorithm is implemented in both hardware and software. The existing independent routing and other node characteristics have not been taken up for decision making in the routing process. This happens to be the drawback of the existing dynamic source routing. Our approach is considered as innovative. It is designed to utilize the parameters in the shortest hop. Analysis of results vindicates our conclusion of efficiency of our proposed option-DSR.

Keywords: adhoc network, dsr, energy consumption, network life time , wsn

Introduction

WSN plays an appreciable role in wireless network technology. This WSN network refers to a group of nodes communicating with a, through intermediate nodes within the group of network without a base station. The nodes in the WSN network consist of three units. The WSN node has a group of sensors on it for environmental and physical condition monitoring. The processor organized in the node is meant to collect data from the sensors. The communicating unit is meant to transmit and receive the collected data over the nodes. The WSN network finds application in many areas including military operations, rescue operations and agriculture monitoring. This is due to its advanced technology, miniature size, (reduction) saving in cable cost and ease in forming a network. There are disadvantages too. Some of them are: shorter lifetime, absorption of high quantum of power. There is also energy loss due to collusion occurring among data while the node receives a large number of packets at one point of time random movement of the nodes. Network partition is the main issue faced by the wireless sensor network. It is also due to the energy loss of the nodes. In WSN network a group of nodes are accessed by a single intermediate node. In that case when that node drains off due to lack of power those group of nodes get separated from the network. The other problem faced by WSN network due to the energy loss occurring at the node is decrease in the transmitting and receiving radius of the nodes. There is also a packet loss that occurs due to the reduced strength of the nodes.

Related Works

Much research work is being done (resulting in desirable developments) in the designing of a wireless sensor network sensor with the objective of increasing survival time, nothing on the power supply being based on a limited energy battery. In the energy efficient network, the node is taken to sleep mode while not in use. This is meant to improve the lifetime of the network [1]. This helps in economy is power consumption in the sleep mode as compared to use in the idle mode. In [2], conjunction occurring is the main cause of power draining problem. Conjunction means node receiving two or more packets at a time particle swarm optimization algorithm is used. To solve this problem using particle swarm optimization may increase the efficiency of the node up to 40%.

The other method used by the research to increase the node life period is [3] Round Robin Cluster Header research. RRCH recommends to choose rotational head selection. This method results in the selection of the third node despite the source and destination being near to each other. This selection is found to be unnecessary. There is wastage of transmission energy in the absence of the mode, when data is sent directly to it. An automatic repeat request is the method used for reducing this wastage. The method involves a request being sent for checking the availability of the node done before sending the packet directly. Data packets are sent subsequently. This results in reduction in power wastage of the lost node.

In "*TCP computational energy cost within wireless Mobile Ad Hoc Network*" the authors have submitted a detailed measured result on energy computational cost of the TCP variant of different types. These measurements are taken when the TCP variant is used by a mobile ad hoc network. Hybrid methods of the measurement are done using simulation and emulation. The emulation tool is named SEDLANE. Packets losses are studied using different routing protocols of the ad hoc network [4].

In "*Sensors Lifetime Enhancement Techniques*
In Wireless Sensor Networks - A Survey [5]" the authors discuss different state-of-art protocols. There were discussions on the enhancement of the lifetime of the network. Routing domains were proposed for the WSNs. There are three generalized categories in the WSNs routing protocols. They are data centric, hierarchical and location based. The first two categories alone are focused by WSN analysts who focus on design in the protocol. They are energy conservation methods using routing protocol and architecture design issue in WSNs.

In "Efficient Algorithm for prolonging Net work lifetime of wireless sensor Net Works", the authors point out to challenges in maximizing the network survival time involved in WSN design. The sensor node located close to the communication node gets itself involved heavily on the network, resulting in a big drain of most of the power. The authors suggest a rely node in the network to overcome this problem. For reducing the method on the heavily involved node, a particle swarm optimization based algorithm is used.

The development of the micro electro mechanical system has found a solution for the problems of low power consumption and low cost sensor natural development. But energy consumption continues to be the main problem faced by the network node. The clustering based routing algorithm protocol developed by researchers helps in solving the problem. This algorithm has several advantages like minimal control, bandwidth reusability and power control. But, still there are some grey areas in QOS and transmission efficiency. The paper “Energy efficient wireless Sensor Networks based on QOS enhanced base station controller Dynamic clustering protocol” suggest the implementation of a modified QOS enhanced base station controlled dynamic clustering [7] for overcoming these problems.

The paper “polytope codes against Adversaries in Network” suggest the polytope method to eliminate possibility of eavesdropping of information sent over the network by intruders or adversaries. In this method, each packet is divided into several small packets each of which is sent to the destination one after another via different intermediate nodes. This eliminates the possibility of getting complete information by the intruder note. However, the ploytope code can be implemented only in small scale networks and not in large scale areas.

Data aggregation is the best method for reduction of power consumption. Considering that energy consumption is the main problem in WSNs. In this paper [9] an energy-efficient, secure, highly accurate scalable scheme for data aggregation is proposed. The main theme of the EESSDA is secured channeling data aggregation with slicing technology. Saving in power consumption becomes possible due to the elimination of the need for encryption and decryption operations.

The paper [10] reports the study of popular trust and reputation for WSN. The main challenge faced by routing data are accuracy, scalability and power consumption. The life time of the network is based on the power consumed by the network node. Here the authors present the average path length, average accuracy and average consumption rate for the several proposed trust and reputation modules. Power consumption with respect to network lifetime is measured by teleosB mote in [11]. High Bandwidth and low latency are achieved by combining spread spectrum and local coordination with the approach of a collision less energy efficient method.

A point of interest based on saving range variation has been proposed (Note: scholar: please check the accuracy ensure no change in the meaning for have in mind). The variation being based in the utility factor. Mathematical like [13] such as step and exponential functions. Paper [14] suggests online distributed algorithms that feature algebraic communication links and calculation of maximal flows of particular patch.

Methodology

A. OPTIMIZATION

All nodes of WSNs use protocols of some type which could be proactive, reactive, hybrid, clustering or hierarchical, each with different features and deficiencies. Earlier papers had proposed proactive routing protocols in each of which every node contributing in the networks shares information on the presence or absence of its adjacent nodes with other nodes, flooding the information to all nodes in the network. It floods its information to all nodes in the network. Upon receiving the status information each sensor nodes updates its own routing table and floods again. This update messages have periodically shared among entire network. This method adds more traffic to the network. Some of recent papers proposed the use of some hybrid protocols, but it includes the drawbacks of heavy traffic to the network. Our proposed paper implements the optimized energy aware dynamic source routing, which results more reliability, efficiency than earlier methods.

The DSR protocol, is used to find the shortest among all available paths. In DSR, the source floods route request throughout the network and the destination node responds by route reply messages to all route requests it receives from the various paths. The redundant route request adds traffic and hence it consumes more power. In order to follow the shortest path, the source might use similar nodes for entire packet transmission. A multiple source node may find similar nodes as the best and shortest path that would cause failure of network at an early stage.

In our proposed Optimized-DSR, the nodes with high energy alone respond to route request and hence the number of route request accumulated at destination will be highly reduced. Our optimized protocol uses the best energy path among the available minimum hop counts. If the network offers two or more paths able at a similar hop count, it prefers the path at which an immediate neighbor has high residual energy. But existing shortest path algorithms such as DSR, the always prefer the path, which carries earlier reply. Route selection is done by the first route reply basis. Our proposed method seeks the best and suitable energy path at every next incremental hop path in any case where a lower hop count path does not contain adequate battery power. Even with such prediction (?), it adopts for an incremental hop path. It may even allow one or more additional hops which may not be the shortest path(scholar : please check accuracy-does it have the meaning intended by you). Thus the adjustability between the best energy path and available shortest path shapes our protocol and is more suitable for wireless sensor network and hence named Optimized Energy Aware DSR.

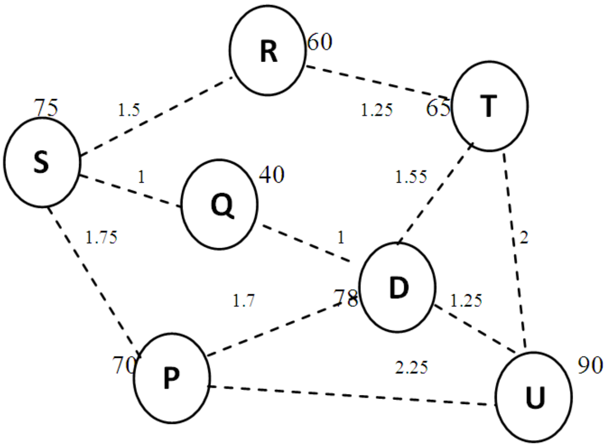

Figure 1.1: Opt-EDSR Routing

Fig 1.1 shows the network deployment and lines makes demonstrate the accessibility of adjacent nodes. Nodes not interconnected by the lines affirm that they are not in coverage range. The values mentioned over the link specify the distance between nodes and the values over each node indicates the residual energy in it.

As per DSR routing, source S floods request to all neighbors in order to communicate to D. Obviously it receives the earliest reply from node Q since it reaches destiny sooner than other available routes. So, in DSR it selects the path S-Q-D. But it has very low power and dies earlier. Our proposed Opt-EDSR uses S-P-D since it is found as long living node even it offers few excessive delay in delivery of packets. After sometime the node P would dry up below certain level. Now both single hop path not affordable for communication. Our method allows selection of increased hop path, when the minimum hop path is unavailable in sufficient energy level. It demands S-R-T-D path to communicate with destiny. This method keeps all nodes to sustain their energy above some level. At the same time, if the request is intended for accessing its own data then particular node would respond to request since it could not be avoided and no node could provide the data of it.

B. Hardware Implementation

The figure 1.2 shows the hardware implementation of nodes and figure 1.3 shows the master nodes. Every single node unit built by PIC16F controller, has Zigbee freescale module, attached battery MAX level converter module, sensor units. PIC 16F877a is a 8 bit micro controller developed by microchip. It uses Harvard architecture. It possess as a high performance RISC CPU and internal memory upto 8k x 14 words of flash memory for program debugging and data memory (RAM) upto 368 x 8 bytes and EEPROM upto 256 x 8 bytes. All nodes are programmed to work with our proposed protocol.

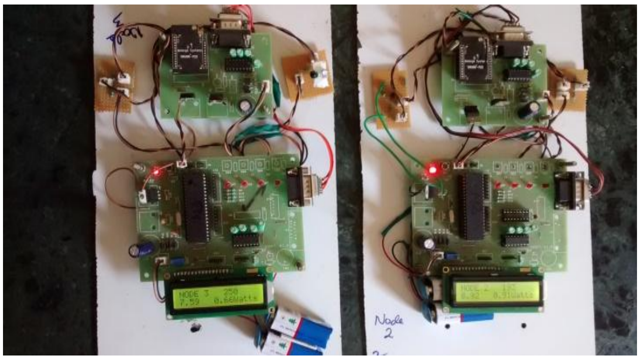

Figure 1.2: WSN Nodes Hardware Setup

Figure 1.3: Mater Node Hardware Setup

Each node communicates through a freescale. This freescale communicates at 2.4 GHZ ISM band. A transponder unit MCI322x of Freescale is used. This module operates in the IEEE frequency band of 2.4 to 2.4835Ghz. It operates in both Net and Mesh type features. It affords 16 channels for communication. These nodes send out and receive data serially. Serial to parallel and its inverse will be performed at each controller. Similarly the analog sensor values measured at each node is subjected to ADC conversion since the controller processes digital inputs. The battery power has to be measured at each node. We have used a 12V battery for node. The direct measures of battery could not be given to the controller directly since the over voltage could affect the node.

A voltage divider circuit has been used and the analog voltage feeds in analog channel of controller. This value renders battery level to the protocol. When a node receives a request packet it checks for source address, sink address and the number of nodes it has of travelled via and replies with data for the request if it is sink. If not so, it checks for battery power and further floods request packet if it consists sufficient voltage level. Because the destiny clearly knows about what are the intermediate nodes involved in that packet transmission and hence the destiny chooses the same path as per the incoming request.

For every inlet and outlet transmission, the node is in a position to route to various neighbor nodes. It causes the node to change its destination address, not the sink address in packets. In order to modify its destination address every time node runs AT (Attention) commands to change the destination address and channels. Based on the content in received packets, each node would modify the destination address. The controller takes care of the switching between the command mode and the transmission mode to enable configuration changes.

Opt-EDSR Algorithm:
1. If destination address RREQ packet = node My address?
Send RREP to neighbor node x-1.
2. Else if check battery power of node > Min?. power
Add its identity no to newly request packet at position b(n) and Forward RREQ to x+s
3. Else No Reply to RREQ
4. If Data received at node x, check destination address in packets, id dest addr is x_n-1 or x_n+1 Forward packet to d.
5. Or else check b(n-1) and b(n+1) in packet and forward data to node address mentioned in b(n-1)
Step 1 to 5 continues for each newly arrived request. If the data servicing for past requests step 2 to 5 continues.

Results and Discussions

A. Simulation Parameters

This protocol has been designed and implemented to ensure simulation of results. The physical layer is configured as 802.11 and transmitting power, receiving power, idle power and initial energy are configured as in table 1.1. the nodes deployment and transmission are verified from the network animator window.

Table 1.1: Simulation Parameters

Number of nodes	10
Area Size	1000 x 1000
Mobility model	Random Way Point
Traffic's type	CBR
Channel capacity	2 Mbps
Transmit Power	0.3 J
Receive power	0.1 J
Idle power	0.01 J
Initial energy	11 J
Communication system	MAC IEEE 802.11g
Routing protocol	Opt-EDSR

The Energy drain calculated. From the trace file, the algorithm discussed earlier has been used in designing our proposed Opt-EDSR.

B. Network Lifetime

Network life time is sometimes referred to as the duration for the low power device sustaining in the network. It is further classified based on whether it is idle or carrying traffic. When traffic is handled, it depends on the traffic size and consumption has to be calculated. Power consumption for sensing is very low during idle time. This means reduced energy drain and increase in network lifetime. The idle case network life time has plotted against the time in Figure 1.4.when handling heavy traffic, it dries earlier than in the case of other nodes. This paper seeks to indentify are alternative path when the node dries up beyond a certain level and sustains the node for stability to prove the network life time is higher than with other nodes. Here, the network lifetime is referred to as non functional during idle time and as functional during idle time and as functional during traffic handling.

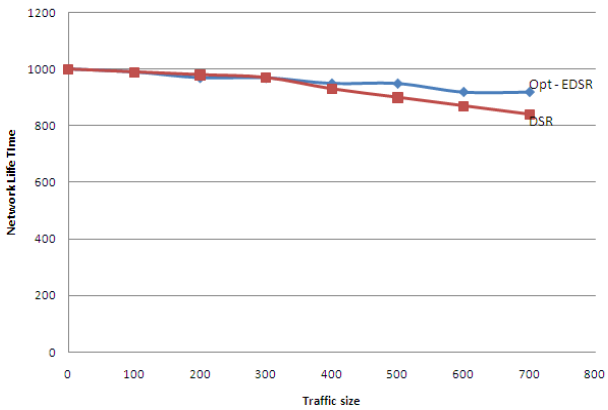

Figure 1.4: Network life as function of Traffic size

C. Packet Delivery Ratio

In existing methods in shortest hop routing algorithm prefers only the node offers the shortest hop. In head selection based routing all nodes accept one node as head among it and send packets through it. Due to the accumulated utilization of a set of nodes, those nodes transmit packets at low energy level. The data are unable able to reach its appropriate destiny results in packet loss. This paper focuses on effective delivery of packets and renders a more reliable network than other methodologies. This is shown in Figure 1.4. The residual energy maintenance has achieved and the residual energy of a node beyond certain level has maintained constant as shown in Figure 1.5. It is calculated by assuming the request is not intended for the node drain outs of energy. As per our protocol each intermediate node adds its own identity number as header with the packets received and forwards the newly modified packet to neighboring nodes. Nodes in communication might be having insufficient power or have making no contribution moved away from network. The Fig 1.6 shows the Residual energy and no of packets.

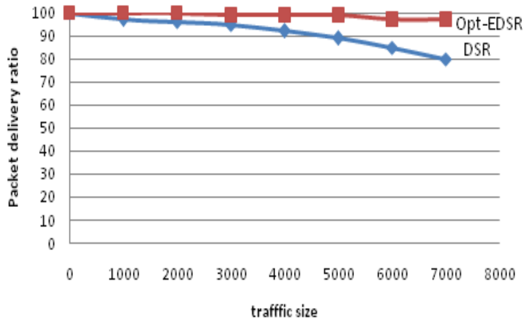

Figure 1.5: Packet delivery Ratio Vs traffic size

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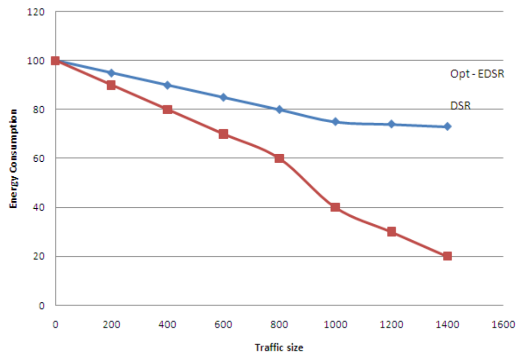

Figure 1.6: Residual energy Vs no of packets

During the conversation between two nodes between themselves, source, destination and all other intermediate nodes can predict what are all the nodes that have power in the network, since this protocol uses only the high power nodes as intermediate nodes.

In real time our proposed protocol has implemented in hardware. In Optimized DSR, in each packet the entire data transmission path is carried out along with data. Power drain is calculated through variation of traffic size. In transmitting packets node derives 0.005504A i.e. 0.55mA and 12v battery provides power. When the traffic size varies a similar reflection in power consumption also is acquired as mentioned in following table 1.2. A variation from the initial packet type would depends on the intermediate hop counts

Table 1.2: Power consumption

No of Packets (Size in bits)	Battery power Consumed (In Micro Watts)
256	2.145
274	2.149
512	6.724
560	6.735
1024	11.435
1040	11.452

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