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Modified WBIP Multicast Routing Protocol for Wireless Sensor Networks

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ABSTRACT

Most of the commercially available nodes of wireless sensor networks like motes are smart dust driven by battery sensing, processing and communication are the three major functions performed by energy nodes in the network. The power required for all these are delivered by the battery i.e. present in each nodes. as the energy level of the battery decreases, the life time of that particular node also decreases.

Energy optimization is a crucial challenge of WSN.Enormous solutions have been proposed to meet this challenge. In this paper, a residual energy based multicast routing is proposed. Energy consumption required to construct the fully connected graph is considered as the key objective of this paper. A fully connected graph links all the nodes in the deployment area, forming the minimum spanning tree. The proposed routing protocol retains the multicast advantage property and extends the lifetime of the network. Two routing algorithms namely Prim and Broadcast Incremental Power (BIP) are constructed which results in establishing a fully connected network. Initial simulation results shows that BIP outscores Prim. Node based approach have been implemented in the BIP algorithm called Weighted BIP and in this WBIP A complete Energy model has been adapted. The energy model includes transmit and Receive modes and the results provide the accurate.

KEY WORDS: *Sensor nodes, BIP, MWBIP, Multicast Routing, Routing Algorithms, Performance Analysis, Simulations*

1. INTRODUCTION

Motivation: Due to the broadcast nature of wireless medium for omni directional antenna, a unit of message sent to a receiver at the boundary of the transmission range reaches every node within the range for “free.” Wieselthier et al. [1] coined a term “*Wireless (multicast advantage*” for this property. This property is incorporated and a new algorithm called Broadcast Incremental Power (BIP) is formulated. In this paper we are trying to provide the accurate results by means of adding transmion and receive power in the route selection. Among the solutions that have been proposed to lessen the problem of energy consumption, many are “link-based solutions”, while “node-based solutions” can offer better results. to make it as a node based approach one, Residual energy of the battery is taken as a one of the cost function. Which in turn while it selects the routing path this will take in to account. In this paper we are trying to provide the accurate results by means of adding transmion and receive power in the route selection.

The rest of paper is organized as follows in the next section we give literature survey of the paper. The section 3 deals with communication and network model. Section 4 discusses the overview of the related work. Section 5 deals with the power analysis on weighted Broadcast Incremental Power algorithm. Section 6 describes about the simulation results and finally this paper concludes with future direction of work.

RADIO MODEL FOR SENSOR MODEL:

Different assumptions about the radio characteristics includes energy dissipation in the transmit and receive modes that change the advantage of different protocols. In this work we assume a node dissipates E_{elec} =50 nanojoules/bit to run the transmitter or receiver circuitry and $\in_{amp}$ =100 picojoules/bit/m2 for the transmit amplifier to achieve an acceptable Eb/No.which results in d2 energy loss due to channel transmission.

To transmit a N-Bit message a distance D using the radio model,it spends

$$E_{TX}(N,d) = E_{TX\text{-}Elec}(N) + E_{Tx-Amp}(k,d)$$

$$E_{TX}(N,d) = E_{elec} * N + E_{Amp} * N * d^2$$

and to receive same amount of Message, the Radio spends

$$E_{Rx}(N) = E_{Elec * N}$$

This protocol should try to minimize not only the transmit distance but also the number of transmit and receive operations.

MODIFIED BROADCAST INCREMENTAL POWER ALGORITHM:

BIP exploits the wireless multicast advantage in the construction of the broadcast tree. BIP has similar in principle to Prim's algorithm for the formation of MinimumSpanningTrees(MSTs), that new nodes are added to the tree one at a time (on a minimum-cost basis) until all nodes are included in the tree. In fact, the implementation of this algorithm is based on the standard Prim algorithm, with one fundamental difference. The inputs to Prim's algorithm are the link costs *Pij* (which remain unchanged throughout the execution of the algorithm), whereas BIP must dynamically update the costs at each step (i.e., whenever a new node is added to the tree) to reflect the fact that the cost of adding new nodes to a transmitting node's list of neighbors is the incremental cost. Consider an example in which node *i* is already in the tree (it may be either a transmitting node or a leaf node), and node *j* is not yet in the tree. For all such Nodes i (i.e., all nodes already in the tree), and Nodes *j* (i.e., nodes not yet in the tree), the following is evaluated:

$$P'_{ij} = P_{ij} - P(i),$$

Where

- P_{ij} is the link-based cost of a transmission between Node *i* and Node *j* (i.e., it is d^{α}_{ij}
- *P (i)* is the power level at which Node *i* is already transmitting (prior to the addition of Node *j;* if Node *i* is currently a leaf node, *P (i)* = 0*)*.

The quantity *P'ij* represents the incremental cost associated with adding node *j* to the set of nodes to which node *i* already transmits. The pair *{i, j}* results in the minimum value of *P'ij* is selected, i.e., Node *i* transmits at a power level sufficient to reach Node *j.* Thus, one new node is added to the tree at every step of the algorithm.

Power Aware Analysis on Weighted Broadcast incremental Power Algorithm:

In this study, we denote the earliest time that a sensor node is depleted of energy as the network lifetime. The node that trained out first usually the node that transmits at the maximum power level or the node that transmits often. In order to maximize the network lifetime, the maximum energy consumption among all nodes must be minimized.

To extend the life time further, it is evident to incorporate the residual battery energy in to route selection criteria. We need to modify the Original Broadcast Incremental power algorithm. In order to incorporate the Residual energy the incremental cost function is multiplied with the additional weighting factor Wi before constructing the total cost function. Where Wi is a time dependent function, which includes energy dissipation in the transmit and receive modes.

$$T_{wbip} \cong \arg\min_{T \in G(N,A)} \sum_{(i,j) \in T} W_i \Delta p_{ij}$$

$$W_i = E_{Total} / (E_{Total} - \sum_{E=0}^{n} E_{ik})$$

Where Etotal is the Initial battery Energy of the node i

If i is the Transmitting node Then Ei = Etx

Else if the node i is Receiving node

Then Ei=Erx

Notice here that the weighting factor *Wi* is initially set to unity (i.e., BIP) and as time progresses and more energy is consumed, *Wi* is monotonically increasing (i.e., $Wi \geq 1$). The cost metric $Cij = Wi\ \Delta Pij$ (WBIP) includes both node-based cost and link-based cost. The more a node has remaining energy, the less *Wi* is and, therefore, there is a greater chance for this node with large battery capacity to be included in the route.

VI SIMULATION RESULTS

The Simulation Results are carried out in MATLAB7.5.in the simulation setup nodes are placed in a 10X10 grid. Both random as well as regular scenarios have been tested. in case of random deployment, nodes are uniformly distributed between the intervals [0-1] and it is multiplied by a scaling factor so that all the nodes can be deployed in the 10X10 grid. In this case the path loss exponent (α) is considered as 2. The simulation results are for the static network topology without node mobility and no restriction on the maximum available transmission power $P\max = \infty$ is imposed.

Figure 2 shows the performance comparison between BIP algorithm and Prim algorithm. Number of nodes and their corresponding power expenditure are taken as a parameters. the overall power required to construct the tree is increased. More also the Result shows that BIP requires minimum power to construct the tree compared to prim. Figure 3 shows that performance comparison between Prim and MWBIP with respect to lifetime.

figure shows that network lifetime of MWBIP is increased approximately 33%over Prim.

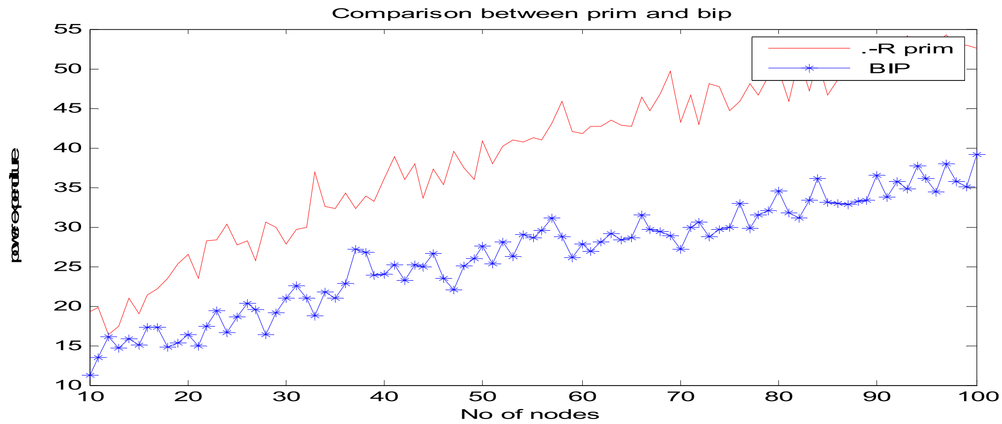

Figure 2 Performance comparisons between Prim and BIP

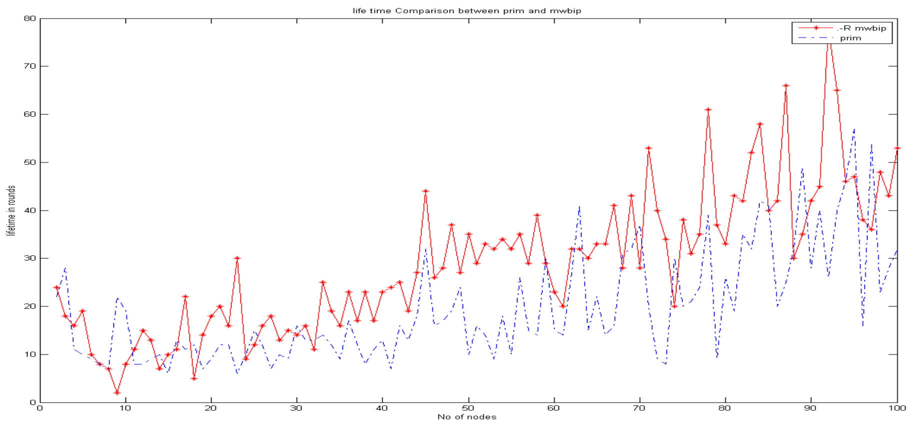

Figure 3. Performance comparison between PRIM and MWBIP with respect to lifetime

Figure 4 shows the Result of Initial energy of the battery in each node is assumed to be .5 J of energy. and the broadcast tree is updated at every specified update interval (Δt) , IT presents a 10×10 grid with α = 2 for 15 nodes in the regular using power analysis based weighted Broadcast Incremental Power routing solution at different instance.

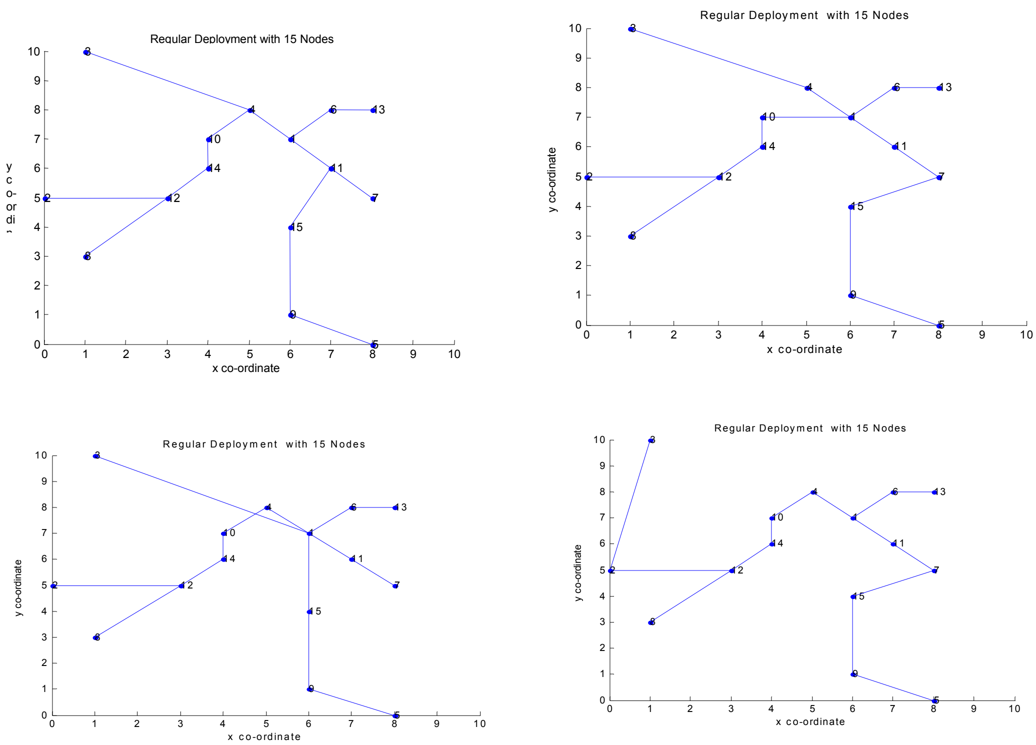

Figure 4. Routing Tree at different instance

VII Conclusions and Future Work

In this approach, the network lifetime is extended in the sensor networks by using BIP algorithm. The network life time further extended by the proposed modifiedWBIP. Modified WBIP showed the accurate results because of inclusive of transmit and receive power. The Results shows that the total transmissions and energy utilization is much better than the earlier proposed BIP and WBIP algorithms.

Future work

The BIP and WBIP algorithms show that, the entire information exchanges with all the nodes. It increases the number of transmissions and overhead. In the Future work the nodes are divided into Clusters based on their positions and Cluster Heads are elected based on their energy level. And try to make the proposed algorithm as a localized one .so that the information need not be exchanged with all the nodes rather it can exchange with in its clusters.

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