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ENERGY DEPLETON AWARE ROUTING PROTOCOL FOR WSN

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Abstract— Energy is an important criterion in wireless sensor networks. In order to use energy available at sensor nodes efficiently, most of the existing routing schemes attempt to find the minimum energy path to the sink. In a network, nodes closer to the sink tend to deplete their energy faster than the others as it needs to relay more number of packets than nodes away from sink. This uneven energy depletion dramatically reduces the network lifetime and leads to network partition. If the sensor nodes consume their energy more evenly, the connectivity between the nodes and the sink can be maintained for a longer time, thus postponing the network partition. Therefore energy should be balanced for efficient routing of packets in a network. This problem can be overcome by using EDARP (Energy Depletion Aware Routing Protocol). The basic approach of this algorithm is to make the packets to move towards higher energy nodes when energy depletion at current relay node is detected. Although numerous energy-aware routing protocols have been proposed, most of them focus only on energy efficiency. EDARP not only aim for energy efficiency, but also for balancing energy consumption. By this we can minimize energy depletion at nodes and maximize the network lifetime.

***Index Terms*—— Wireless sensor networks,Balancing energy consumption,Energy-efficient routing,potential field.**

I.INTRODUCTION

A WSN can be generally described as a network of nodes that cooperatively sense and may control the environment enabling interaction between persons or computers and the surrounding environment. A sensor is a hardware device that produces measurable response signal to a change in a physical condition such as temperature, pressure, humidity etc. The sensed data can be collected by few sink nodes which have access to infrastructure networks. The main features of WSNs are: scalability with respect to the number of nodes in the network, self-organization, self-healing, energy efficiency, a sufficient degree of connectivity among nodes, low-complexity, low cost and size of nodes. WSNs enable new applications and thus new possible markets; on the other hand, the design is affected by several constraints that call for new paradigms.

Wireless Sensor Networks have been used to enable better data collection and data processing in many areas like scientific laboratories, military defences, and monitor factory machinery. All of these uses depend on the ability to collect data such as light, vibration, moisture, temperature, and more as well as the ability to communicate with each other. A type of wireless networking which is comprised on number of numerous sensors and they are interlinked or connected with each other for performing the same function collectively or cooperatively for the sake of checking and balancing the environmental factors. This type of networking is called as Wireless sensor networking. Basically wireless sensor networking is used for monitoring the physical conditions such as weather conditions, regularity of temperature, different kinds of vibrations and also deals in the field of technology related to sound.

II.WORKING OF WSN

The WSN consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

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III.ENERGY DEPLETION AWARE ROUTING PROTOCOL(EDARP)

In Wireless Sensor networks, when a node transmits the packets which it receives from a source node it consumes some amount of its energy for transmission. Due to increased transmission, the energy of the node may decrease and this may affect the network lifetime. Thus, for battery-powered WSNs, energy is one of the most critical resources and energy efficiency becomes one of the basic tenets in WSN protocol design. For routing protocol design in WSNs, the energy balance and energy efficiency should be two different technical goals, since they will lead to routing algorithms with different attributes. An energy efficient routing protocol tries to extend the network lifetime through minimizing the energy consumption, whereas an energy-balanced routing protocol intends to prolong the network lifetime through uniform energy consumption.

Although numerous energy-aware routing protocols have been proposed, most of them focus only on energy efficiency, namely finding the optimal path to minimize energy consumption. In our opinion, an energy-aware routing protocol should not only aim for energy efficiency, but also for balancing energy consumption balance. Energy Depletion Aware Routing Protocol (EDARP) is proposed to solve this problem, by taking into account both energy efficiency and energy balance. EDARP is aware of the residual energy of each sensor nodes and updates its routing table. Based on this information, the routing is performed to select the node with higher energy. Dynamic switching of different paths takes place depending on the available local information, such as residual energy, depth, and energy density.

IV.OPERATION OF EDARP

Consider a wireless sensor network with number of sensor nodes surrounding a sink. Assume node1 needs to transmit data to sink. Like most existing energy-efficient routing protocols EDARP initially choose the shortest path. During the transmission node N2 sends its data through node N6 through which node N1also sends. Due to increase in packet transmission N6 suffers energy depletion. When this energy depletion increases N6 may get partitioned from the network.

To avoid this network partition the nodes N1 and N3 uses EDARP to find the nearby higher energy nodes. The source nodes maintain a routing table which updates the residual energy, depth and energy density of each node for every transmission. To avoid the worst case the nodes check the threshold level of every node below which no node is allowed to get depleted. During transmission while N6 nears the threshold it informs the source nodes N1 and N3 about its energy depletion. On receiving this information N1 and N3 finds a node with high energy level to relay the packets. Thus the energy of relay nodes are conserved and depletion of energy is minimized. Ultimately preventing network partition and improving networks lifetime.

V.SIMULATION RESULTS

The NAM output display represents the randomly placed sensor nodes forming a wireless sensor network. The nodes 0 and 17 are taken as transmitting source nodes, named as N1 and N2 respectively. The nodes 4 is considered as sink node, which gathers various data transmitted by the nodes in its range.

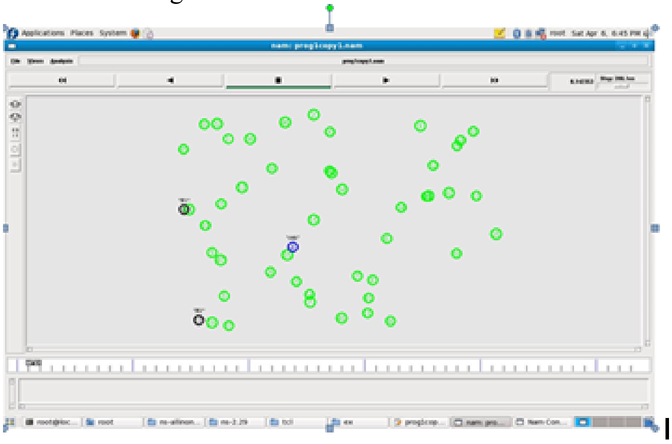

FIGURE 1.Displays the source nodes and sink

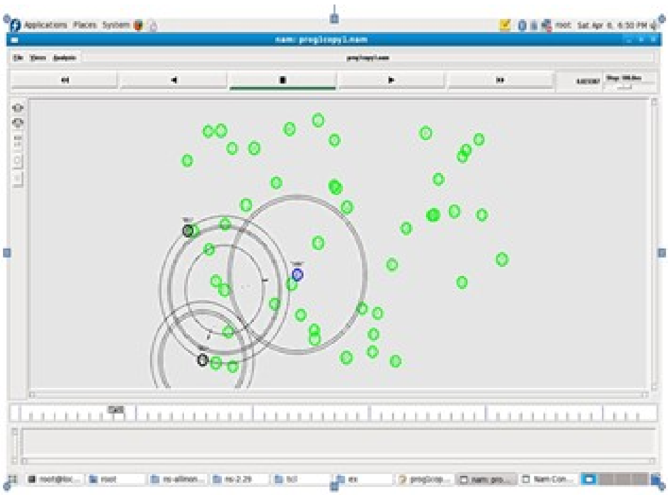

FIGURE 2.Displays the transmission of N2 to sink

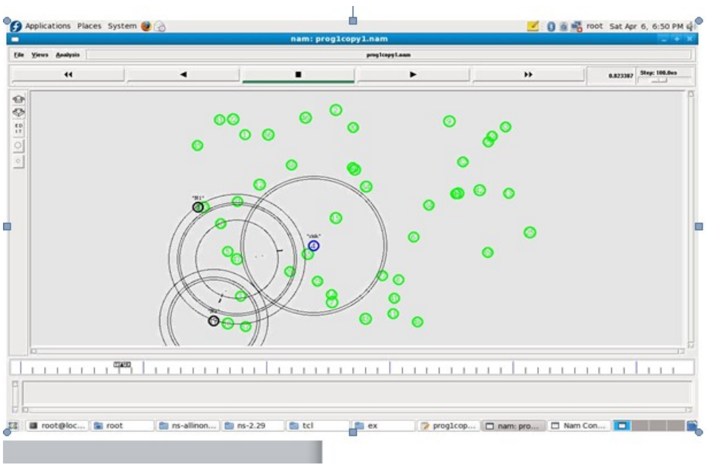

FIGURE 3.Displays the transmission of N1to sink

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FIGURE 4.Displays the transmission of packets from node N1 to sink through node 47

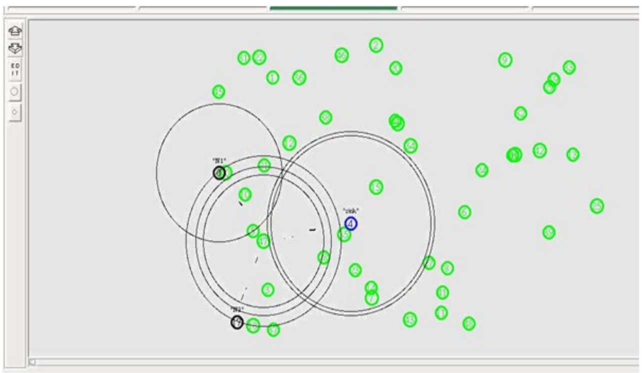

FIGURE 5.Packet transmission of N1and N2 through node 47

The above output displays the transmission of packets by N1 and N2, simultaneously through same node 47. Since the node 47 relays more packets its energy starts decreasing than other nodes. Hence it is necessary to protect the energy of node 47 in order to improve network as well as node lifetime.

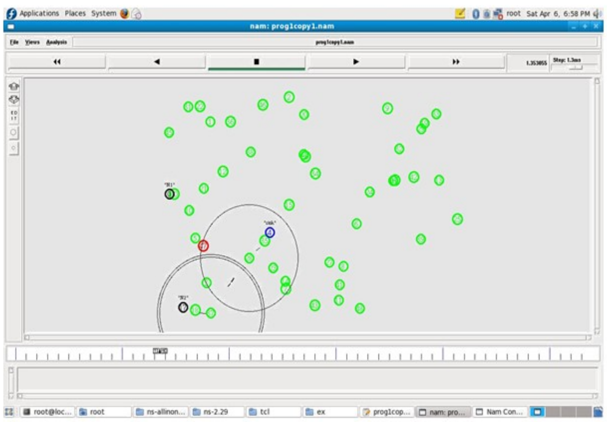

FIGURE 6.Path change by N2 due to energy depletion at relay node

The above output figure 6 displays the path change by the node N2 to transmit packets towards sink due to energy depletion at node 47. The node N2 changes its transmission path to node 37, as it is determined to have higher energy than any other nodes.

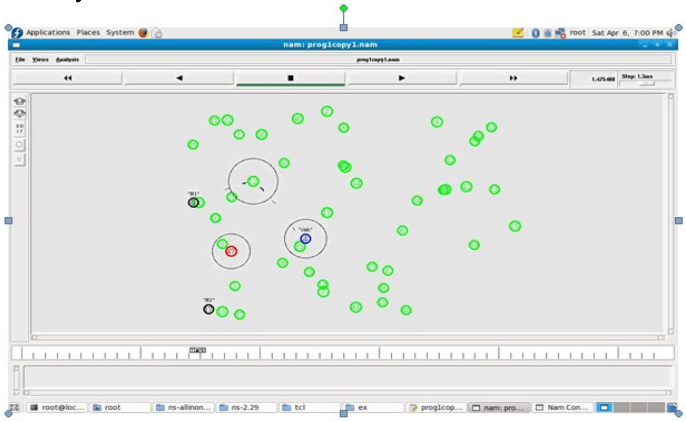

FIGURE 7.Displays path change by N1

The output shown above displays the path change in the transmission of packets from node N1 to the sink due to the energy depletion of the relay node 47. Hence reducing further depletion of energy at node 47 and prolonging its lifetime.

VI.GRAPH

The below graph represents the plot of throughput against time. Here we can see that the throughput increases gradually with respect to time. During the time of energy depletion there is a drop in throughput. To avoid further decrease in throughput due to energy depletion the packets are transmitted through denser path. Thus the network gains throughput.

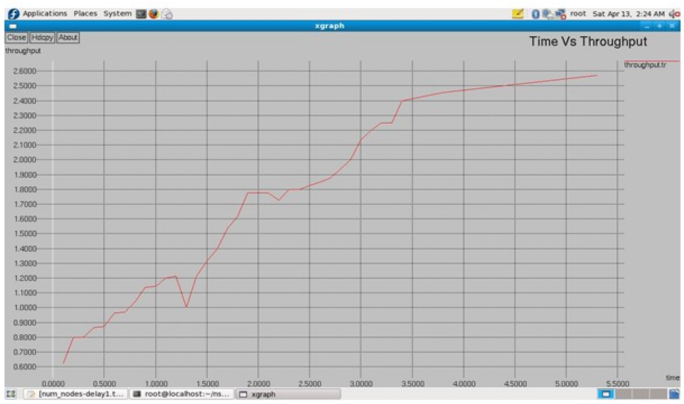

FIGURE 8.TIME VS THROUGHPUT

The below graph represents the plot of delay against number of nodes. Here we can see that the delay decreases gradually with increase in number of nodes. In EDARP when number of nodes increases there is a possibility of increased number of different routes. So, the receiving node gets the data with minimum delay.

The delay will be decreases with respect to the number of nodes increases.Using EDARP the receiving node will receive the data with less delay.Figure 9 represents the number of nodes vs delay.

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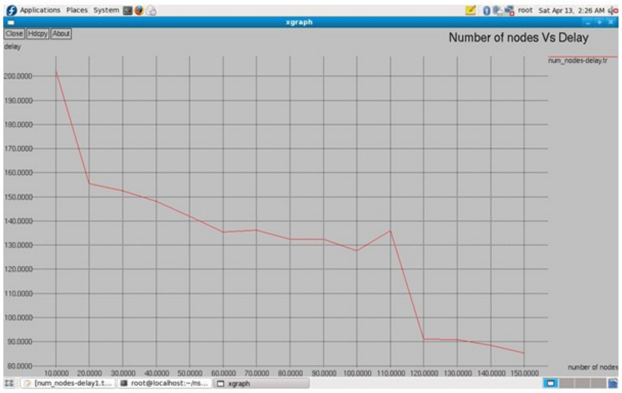

FIGURE 9.NUMBER OF NODES VS DELAY

VII.CONCLUSION

Thus implemented the Energy Depletion Aware Routing Protocol to effectively prolong network lifetime. This protocol focuses on routing that also balances the energy consumption. In our experimental simulation, nodes N1 and N2 transmit data through a same relay node 47 which increases energy depletion in that node. This may affect the network connectivity of node 47. This problem is effectively dealt using EDARP which selects a path with higher energy density and transmits. Thus improving energy consumption balance and network lifetime.

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