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GLOBAL ENERGY BALANCE IN EXTENDING THE LIFETIME OF WIRELESS SENSOR NETWORK

Dr. ANURADHA M.S[1], REKHA[2]

[1,2]Depertment of Electronics and Communication Engineering, Guru Nanak Dev Engineering College, Bidar, Karnataka, India

Abstract: **In the wireless sensor network the main issue are energy efficient and reliability. WSN has been widely used for monitoring and control applications in our daily life due to its promising features, such as low costs, low power, easy implementation and easy maintenance. However, most of sensor nodes are equipped with limited non rechargeable battery power. Energy saving optimization, therefore becomes one of major concern in the WSN routing protocol design GTEB routing protocol is proposed to solve the problem of Energy balance and increase network lifetime by balancing traffic load at two levels, over regions and at the nodes in these regions. The energy balance at the region is achieved using EGT while that at the node level is achieved using CGT. This project shows use of EGT and CGT in designing a protocol that offers significant improvement over existing protocols in extending network lifetime.**

Keywords**: Energy balance geographical routing protocol, game theory, GTEB, Random-Random routing protocol.**

1. INTRODUCTION

As technology is increasing the demand for wireless network is also increasing. Wireless network utilizes HF radio waves in place of cables for communication among nodes. By the time technology advancing in the world wired and wireless networking has become the necessity. In WSN, the sensor nodes have a circumscribed transmitted range and their processing and storage capacities as well as their energy resources are also circumscribed. Routing protocol for wireless sensor network are responsible for maintaining the routes in the network and have to guarantee dependable multi-hop communication below these condition.

The main issue in the WSN is the energy efficiency and network lifetime. There are many protocols that were developed to increase in the network lifetime and efficiency but all they could not balance the energy. Geographical routing protocol together with game theory is proposed to balance the energy levels of all the sensor nodes in the network leading to increased network lifetime, GTEB resolves the Energy balance problem in the region level as well as at the node level using EGT.

2. RELATED WORK

Network lifetime be able to be increased using various techniques by designing the power aware routing protocol, distribute traffic loads amongst least protocol paths and altering the transmission power.

In RTLD (real-time load balance distribution protocol) that is a quadrant based directional forwarding task to a quadrant of the forwarding nodes.

One of the familiar issue in WSN, the excess use of nodes covering the sinks is solved by modifying the transmission energy of a nodes for by-passing the inclined nodes all-round the sink then transmitting directly to the sink with certain probability it is shown in “Energy balanced data propagation in wireless sensor networks”

In Real-time power aware routing protocol (RPAR) by adjusting the transmission power showed the balance between energy absorption as well as end-to-end delay.

For various problems related to relay selection, task allocation, network congestion and end-to-end delay, CGT can be used in GRPs.

In game theoretic heterogeneous balanced data routing (HBDR) algorithm network lifetime is maximized by constructing a network for supplying a load balanced tree using CGT.

In game theoretic approach in routing protocol for wireless sensor network, routing overhead is reduced by choosing selecting forwarding nodes to offer connection with no partitioning of network.

The packet forwarding problem is solved in Evolution of cooperation in multi-class WSN by implementing EGT.

3. PROPOSED SYSTEM

Game Theoretic Energy Balance (GTEB) Routing Protocol

Within the wireless sensor network there are different protocols which are proposed to expand the lifetime of the sensor network. GTEB is the mainly notorious concept that balances the wireless sensor network globally. The main reason for the reduced network lifetime the energy or the power of the sensor nodes. The power control problem can be overcome by using game theory which helps to provide the energy conservation. The nodes in the network are considered to be the players as game theory is nothing but a research conflict and the cooperation between a set of players. The non cooperative GT approach gets used where the nodes are considered to be independent in decision making. Each player in a network must be capable to make the network more efficient by choosing the best strategy.

GTEB is a combination of Evolutionary game theory (EGT) and Classical game theory (CGT). Load balance issue is solved together at region level and the node level. Region level employs EGT and nodes level employs CGT. Both EGT and CGT are used at the same time in geographical routing for energy balance to prolong the network lifetime.

3.1 sub-region selection in GTEB

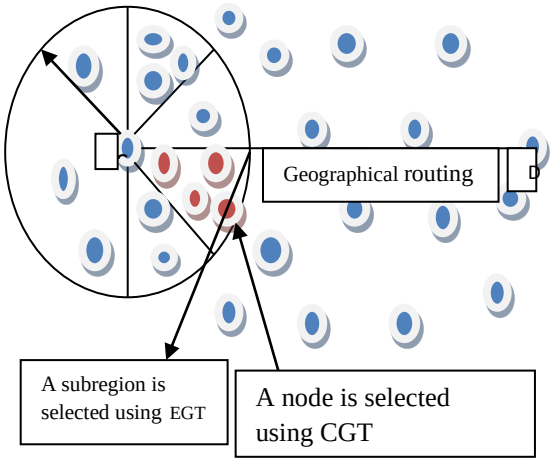


Fig 1: Sub-region and node selection

Fig 1. shows the how the energy is balanced in the wireless sensor network, in WSN any node can be source node and any node can be destination node. The GTEB protocol proposed for balancing the energy of all the nodes in the network. As shown in fig the transmission range is “r” and the primary energy of each node is “E” J. Nodes capable of reporting the actions regularly or by the time it occurs. Nodes have an idea of its position and position of the destination node. Energy balance issue is settled at the region and the node levels. As shown in the fig. the nodes create the sub-regions till it reaches the destination, and in each sub-region one best potential node is selected as the forwarder node. RLEB is at the sub-region and the energy balance in these sub-regions is achieved using EGT. NLEB is inside the sub-region and the energy balance is at the node level is achieved using CGT.

3.2 GTEB's Functional diagram

Fig below shows the functional diagram of GTEB. The node's neighbor discovery is performed by the time of deployment of network to enable the nodes study the number of single hop neighbors. Depending upon the neighbor information, forwarding region is determined when node receives a fresh packet from any of the neighbors. When node region is not equal to the forwarding region or a packet have been already forwarded then the packet is dropped. If the node region is equal to the forwarding region it plays EGT for RLEB. In RLEB a sender node evaluates the energy levels of all the sub-regions in a network using EGT. Once the sub-region is selected, within the sub-region NLEB plays CGT. In the node level, the CGT plays non-cooperative game and selects the best forwarding node. In this way the energies of all the nodes are balanced and the packet is forwarded.

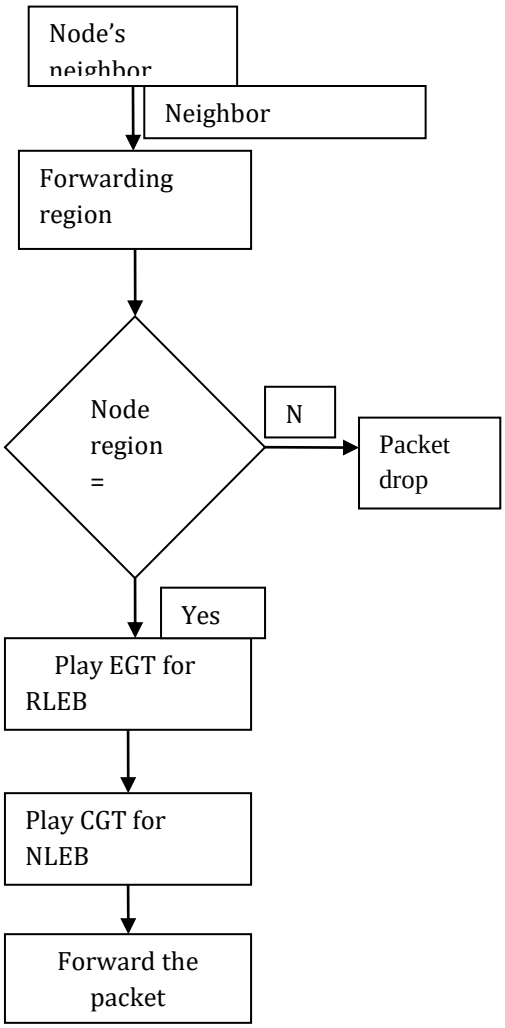


Fig. 2: GTEB's functional diagram

3.3 Algorithm for GTEB

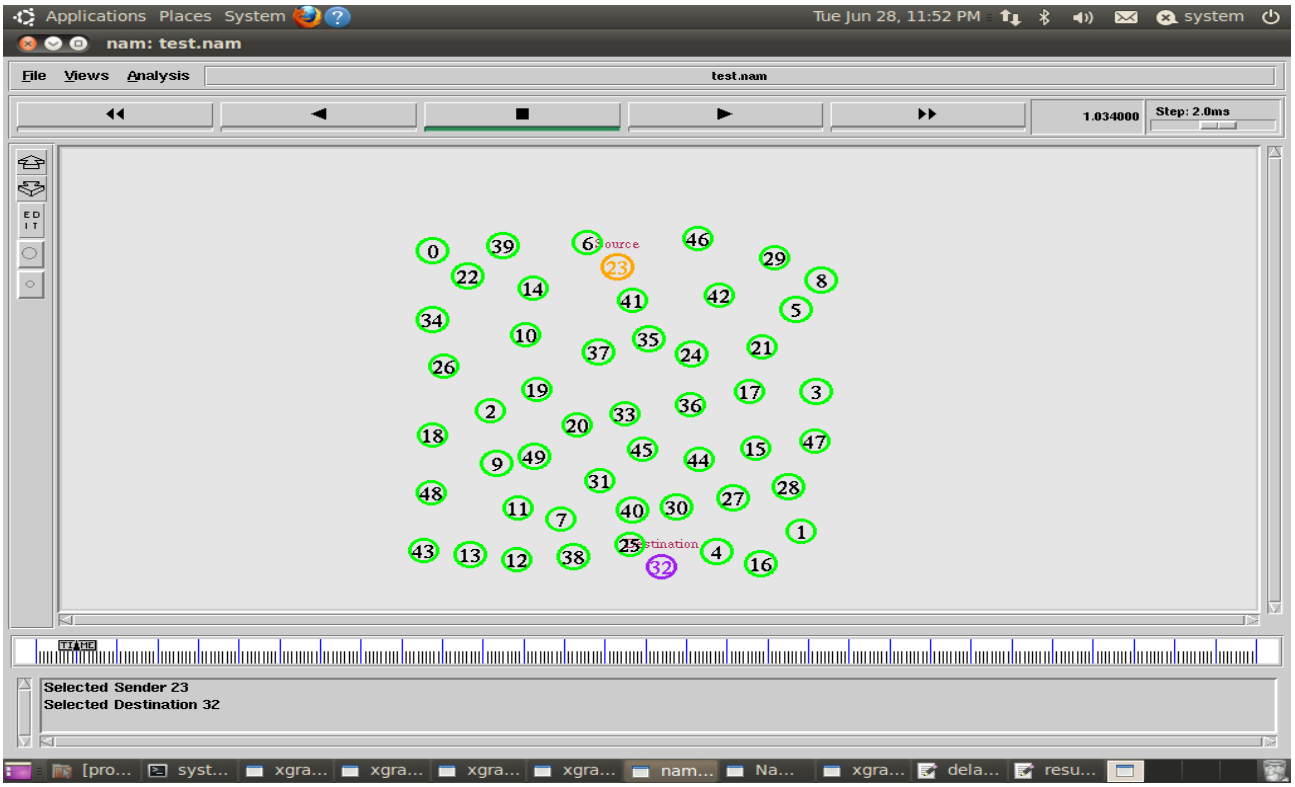
STEPS

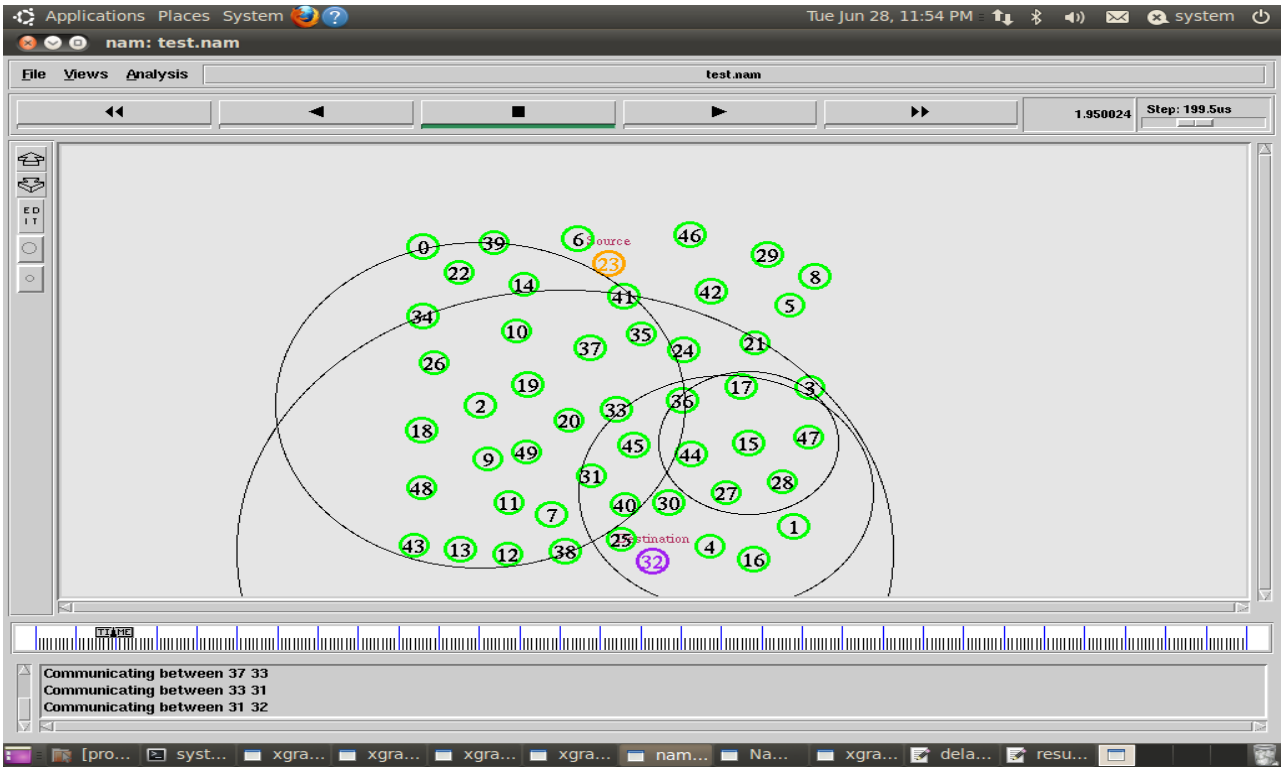
1 : Initialize network topology.
2 : Give source node.
3 : Give destination node.
4 : **RLEB** employed by **EGT** selects
5 : The nodes placed between source to destination based on energy.
6 : **NLEB** employed by **CGT** selects the high energy node among the RLEB selected Nodes.
7 : Maximize the hop count between the transmissions.

8 : Energy extended and energy used efficiently.

4. SIMULATION RESULTS

In this section, the set of simulation experiment were conducted. The simulation are obtained using Network Simulator 2.34 simulator based on UBUNTU platform. The simulation environment assumes a monitoring area of 100m X 100m and 50 sensor nodes that are randomly deployed over a field. Any of the node can be a source any node can be a destination in a network.





5. PERFORMANCE ANALYSIS

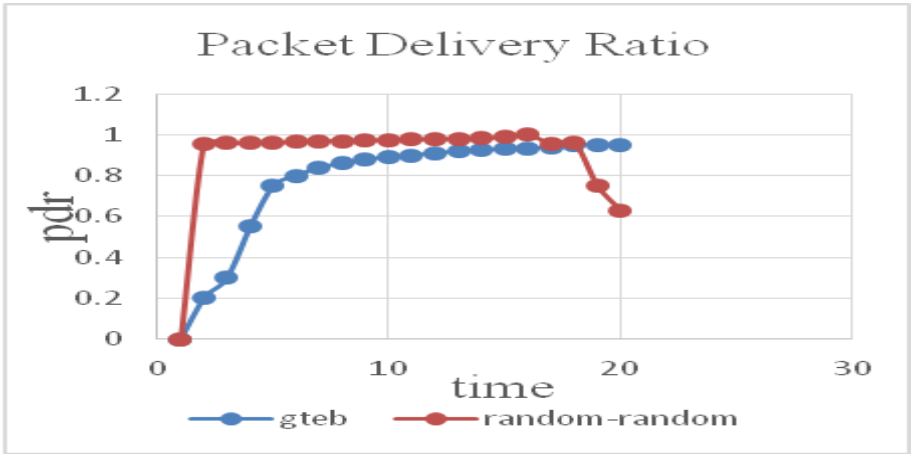


Fig a. Packet Delivery Ratio

Fig a. describes the packet delivery ratio as a function of time. In this figure GTEB shows better packet delivery rate compared to Random-Random protocol despite of increasing traffic load in the network. Energy in a network is balanced using ECG and CGT in the region level and at the node level in order to achieve energy balanced network.

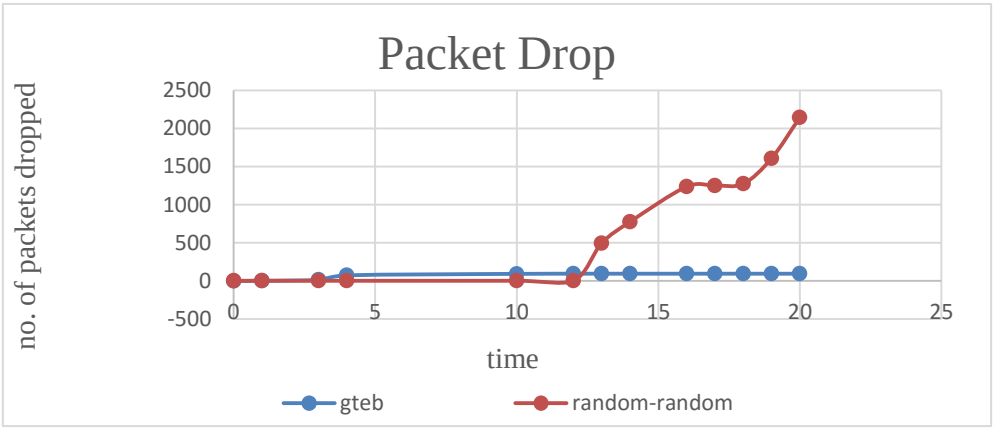


Fig b. Packet drop

From fig b. it is shown that packet drop as a function of time, the number of packet drop in GTEB is less when compared with the Random-Random. GTEB uses EGT and CGT in the region level and node level respectively to select the appropriate packet to transmit the data which leads to less number of packet drops where as in Random-Random nodes are randomly selected in the region level and node level without knowing the energy status of the forwarding node leading to the more number of packet drops. GTEB there by increases the throughput.

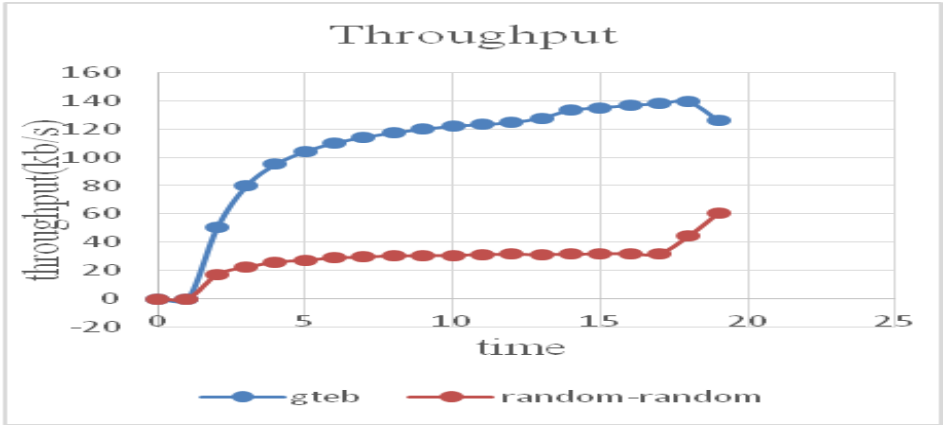


Fig c. Throughput

As shown in above fig c. throughput is described as a function of time, the data sent by source is equal to the data received at the particular period of time. The throughput of GTEB is more than the Random-Random algorithm; due to the less packet drops in GTEB.

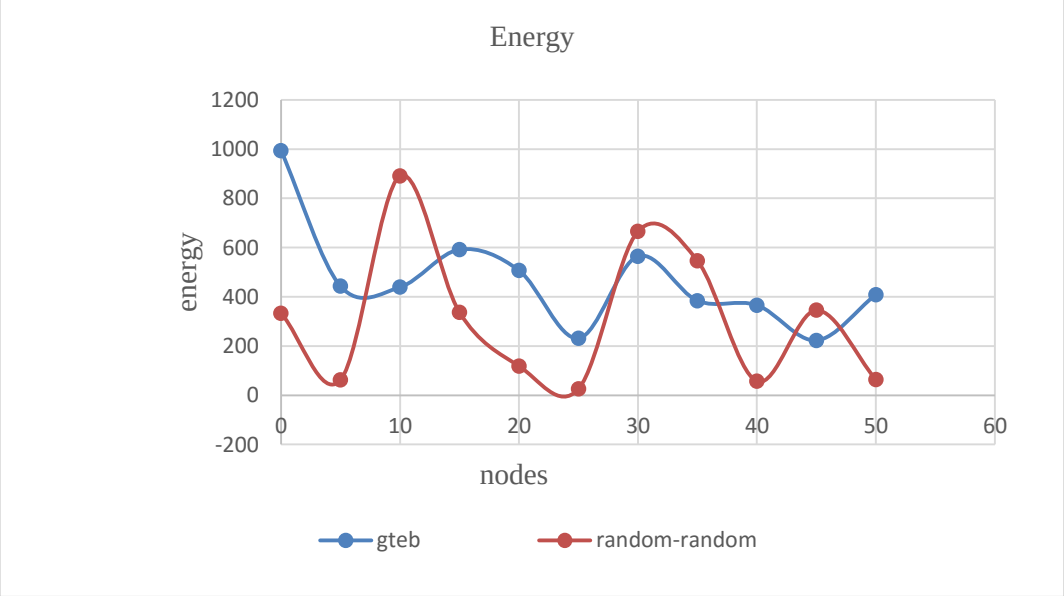


Fig d. Node energy

Fig. d shows the energy of the node as a function of time. GTEB with EGT and CGT utilizes the energy of only those nodes which are in the transmission process the remaining nodes energies will be in the idle mode due to which the whole energy of the network is balanced achieving longer network life.

6. CONCLUSIONS

In this project the energy problem in the wireless sensor network is solved by using game theory energy balance which is a routing protocol. Design of routing and broadcasting of packets are being studied, using the GTEB protocol for minimizing energy consumption, thereby increasing network lifetime. GTEB utilizes evolutionary game theory at the region level that to balance the traffic load in the available sub-region and classical game theory at the node level to choose the finest node for balancing the load in the chosen sub-region. The GTEB routing theory is used to virtually optimize network energy efficiency by considering both distance to destination as well as residual energy of each node. Which in turn prolong the network lifetime. Therefore the main objective for energy-efficient strategy guarantees minimum power cost. Simulation results and test bed results demonstrates GTEB significantly improves energy saving and network partition as matched with existing routing algorithm.

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