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PEGASIS: Energy Harvesting in Sensor Networks

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ABSTRACT

To collect the valuable information, we use sensor web which consists of nodes with limited battery power and wireless communication. This problem in sensor network is managing energy in an efficient manner. This paper proposes a new power efficient protocol named PEGASIS. This protocol works with neighboring nodes, which sense the data and randomly chosen nodes will take its turn to communicate with Base station. It assumes that BS is establishing from the sensor node at far distance. All nodes information has maintained by database, which stores the location of all other nodes. This makes the protocol robust to failures. We have compared the Energy Efficient level from existing mechanism to proposed mechanism. Finally our system is minimizing energy consumption and further to prolong network life and to achieve energy efficiency.

Keywords: PEGASIS, Energy Harvesting, Data Collection, Chain Formation

1. INTRODUCTION

WSN is an improving technology which plays a major application in military, industrial, agriculture and in aerospace. All the wireless sensors collect and process the data. PEGASIS is a protocol, which is use the optimal chain based technology. The technique used to collect all the data's from the node sand transmitted to close neighbors. Then it acts as a leader for transmission of data to BS. This method shares equal amount of energy among the sensor nodes. The node randomly forms a chain using greedy algorithm. In another way, BS divides this chain and broadcasts it to all the nodes. In PEGASIS, each node receives and transmits one packet in each round and is the leader at least once in n rounds (n are no of nodes). PEGASIS overcome on LEACH by saving energy on succeeding stages. First, in the gathering of local address, the far of the transmitting node is less than as LEACH. Second, from the neighbor node, receiver can receive two but not in LEACH protocol. Finally, one node transmits the message to the BS in each round of communication. PEGASIS protocol has its solicitations in environment monitoring. The nodes sense various environmental influences such as temperature, humidity, pressure, etc. Each node fuses its sensed data with the adjacent node. The CH (cluster head) finally has all the sensed data, and the sensed data's send to the BS.

In chapter 2 we discussed about the papers referred to get knowledge about the energy harvesting and the efficiency and in the chapter 3 we gone through the system model include the modules and the architecture diagram. And finally in chapter 4 we implemented the algorithm technique as PEGASIS.

2. LITERATURE SURVEY

O. Orhan *et al* [1] propose a fading channel concept for energy harvesting. They deployed "directional glue torrential" is a technique which deploys offline transmission method. And they have proved the convex

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optimization for the offline optimization problem. V. Sharma *et al* [2] is deliberated the greedy policy in low SNR rule which reduce throughput optimal and the mean delay. Lost region can be recovered if we spontaneously use the energy harvesting before storing in a buffer. J. Yang *et al* [3] are considering the time deprecation for transmission finalization problem in energy harvesting and they considered two scenarios for this problem. Packets had been arrived before the transmission starts and second scheme is packet has arrived during the transmission. So they used a single user communication channel with energy harvesting transmitter. And they have developed an algorithm which obtains a good lower bound and the transmission power obtained is globally optimal. J. Lei *et al* [4] had examined about the energy efficient renewable sensor networks. They have constructed a continuous time Markov chain process and develop a threshold based energy-aware transmission method. K. Tutuncuoglu *et al* [5] said have considered the problem as the short term throughput of energy harvesting, in this the energy harvesting battery has finite energy storage capacity. Here they have considered about two things, first is energy storage constraint and causality constraint. Here they followed the technique is the solution of the former is identical to that of the latter. Here they have find the optimal power allocation. O. Ozel *et al* [6] his measured the transmission time minimization trouble in an M-user broadcast channel. In this work the transmitter harvest the energy from the natural source and save the energy in the battery. Cut-off power is calculated by between the strong and the weak user. And finally they used optimality algorithm and cut off policy method for filling the water in battery.

3. SYSTEM MODEL

3.1. Analysis of Nodes

This module used to find the information about nodes. The source node wants to select the next transmission node, for sending data with high quality. Source node analyze, the next node is Secure or not and check the reliability of the neighbor nodes. These modules analyze all the nodes in network. Using this analysis we find routing path and nodes in network.

3.2. Communication Node Phase

Only the sensor node which is in its sensing range will be explored by a target. From the other sensor node it can perform the functions of transferring or receiving data within its network coverage. Basically, the radio transmission range is much larger compared to the sensing range. Once a target is produced, the base station receives the sensory information from the sensor nodes within it are during period D. To transmit or to receive bits, a sensor node has the consumption of battery as its energy. If the energy of the battery gets exhausted, then the function of the sensor node stops.

3.3. Offline Scheduling

If battery size is infinite then it will make sensing scheduling decisions, and then directed to statuses of battery in sensor, which are accessible by the FC. We have considered the Time slotted system. Here ‘t’ as time slot and ‘Ct’ mention as sensor subset which is elected for sense the environment and their information have forwarded to FC. Few amount of energy is needed to sense the environment and transmitting the information is mentioned as each slot [7].

3.4. Online Scheduling

This kind of node could not know about the battery size which is accessible the power during the online scheduling. Here *K* orthogonal channels are being allocated by the access point, which is carry to K out of the N nodes in network media. The similar problem in maximization of the throughput are stated as POMDP and express to Round-Robin based myopic policy in optimization that put down the *K* nodes under different system models with the largest estimation to increase the energy.

3.5. Chain Construction Phase

Number of nodes, initial energy and the location information of BS is determined. Chain construction starts. The complete network is broadcasts by BS and will obtain the network information through sending the hello message. End node is chosen by farthest node from Base Station, first the chain gets join and is stated as node 1. The chain node will measure the distance information between itself. Other nodes did not make the chain until now, and it will found the nearest node for join the chain, set as 'i'. That chain is representing by 'i^{th}' node. During Chain formation each node will communicate with their neighbor node and then it get distribute to the Base Station. This chain formation is maintained by an algorithm called greedy algorithm.

'I' is represent as chain node it will be get by the distance information between itself and i-1 nodes is sited on the chain, which is discover the nearest node for join the chain, which is mentioned as 'j' and it will directly connects with chain node. End of node will be find by far node from BS, as 'i^{th}' node. Finally it will get the chain as i, i+1, i+2, i+3….i^{th} node to until get all sensor node join on the chain then it will make the branching of the chain.

3.6. Elect the Leader node

This method elect the leader node through weighing technique, which is include both residual energy and distance from leader node to Base Station. New Leader node will be selected by IEEPB organization through calculating of weight in each phase.

Sensor node did not have more knowledge about their terrestrial location. That node can calculate the distance between the nodes via obtained signal strength, which is received from another end. Base station can broadcast the information to the all the network and 'n' node can calculate the distance by BS through obtained signal strength. We can choose the leader node by combination of energy and weight of each node. Here, we calculate the energy and weight of each node. Based on their parameters we can choose the leader node, and then compare the minimum weight of each phase.

3.7. Data Transmission Phase

After the completion of above process, information will transmit to end of the chain node. We can formulated the chain by joining of 'n' nodes, each node can forwarded the sensed information to their neighbor node

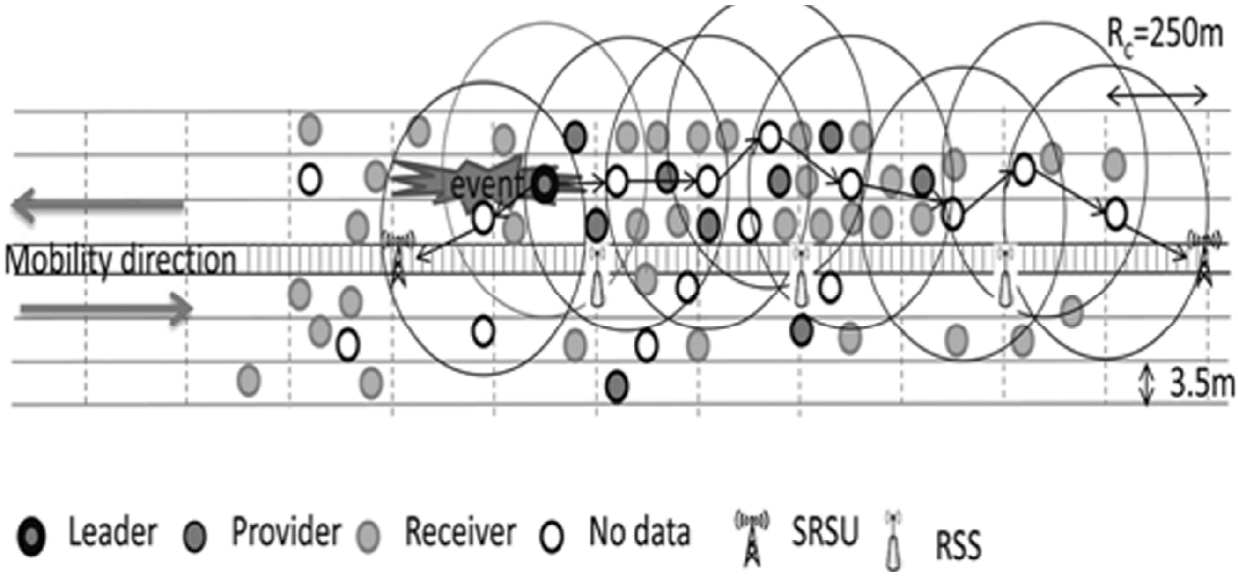

Figure 1: Selection of next Leader

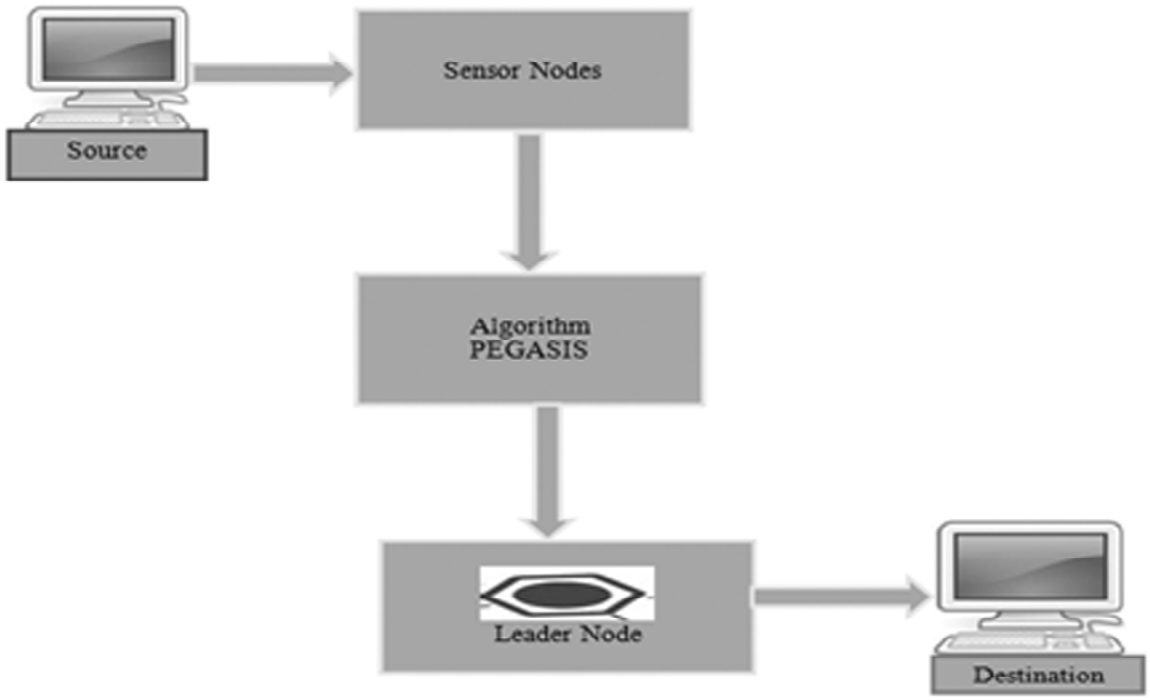

Figure 2: System Architecture

and their time slots is distributed by TDMA method. The neighbor node integrate with own data and forwarding data. That node will forward to their neighbor node. One trip will complete until BS can receives the data from the leader node [8, 9].

4. ALGORITHM TECHNIQUE

PEGASIS is a protocol, which is used to find the optimal solution based on routing protocol. Its function is creating a chain among the sensor nodes. Each and every node will receive and forwarded the packet to their neighbor node and it will form a group node. It is measured as the leader for transmission of data to BS which allocates the energy load evenly among the sensor nodes [16, 17]. The nodes are randomly located and organize them in to a chain using greedy algorithm. Otherwise, BS multiplies this chain and broadcasts it to all the nodes. Node 0 and node 1 will be connected to the node 3, node2 and node 3 will be connected to the node 1 and node 1 connected to node1. When node is drop in the chain manner, that node is called as dead node. The constant elasticity enhances the selection of leader node and their technique can be usable to all network circumstances.

In information gathering, each node receives the data from one neighbor, passions its data and transmits it to the next node in the chain. In given round a simple token passing technique initiates the leader to start the data transmission from the ends of the chain. Here the cost is very less because the size of the token is very small [10-13].

Figure 4 shows that the node C2 as the leader and it passes the token to C0 and then the C0 sends its data to C1. C1 wraths its data with C0's data and sends it to the leader C2. C2 then transmits the token to C4. C4 sends its data to C3. C3 fuses its data with C4's data and then transmits it to leader C2. C2 waits to accept data from both the neighbors and then it wraths its data to neighbor's data. The leader then transmits only one message to the BS. In PEGASIS, each node obtains and communicates one packet in each round and is the leader at least once in n rounds. PEGASIS overcame the LEACH by equivalent energy at subsequent stages. First, in the local gathering, the distance that most of the nodes transmits is comparatively less than the CH in LEACH. Second, the leader obtains only two messages from the neighbors which are not in the

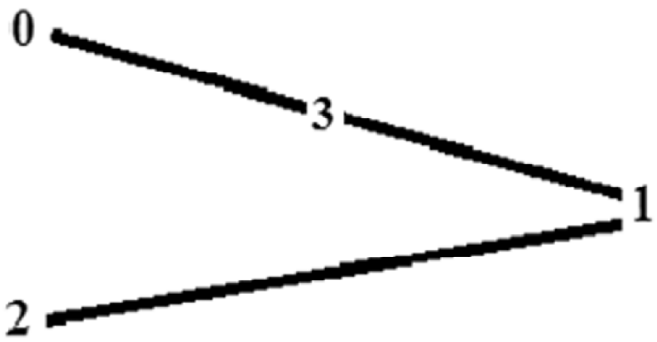

Figure 3: Nodes connectivity

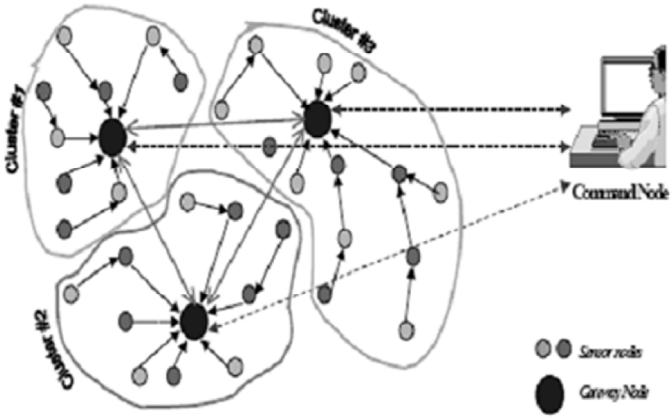

Figure 4: Token transmission

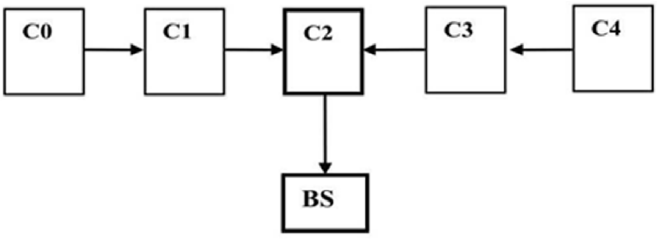

Figure 5: Leader selection

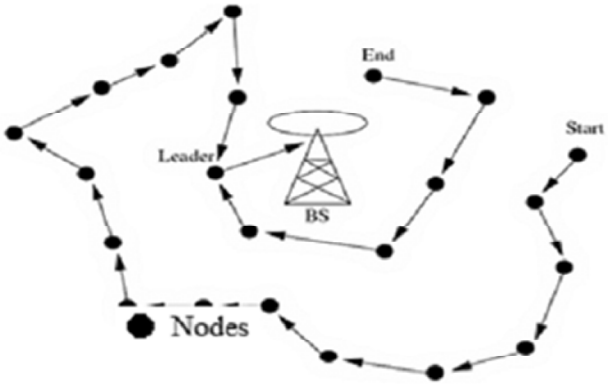

Figure 6: PEGASIS Process

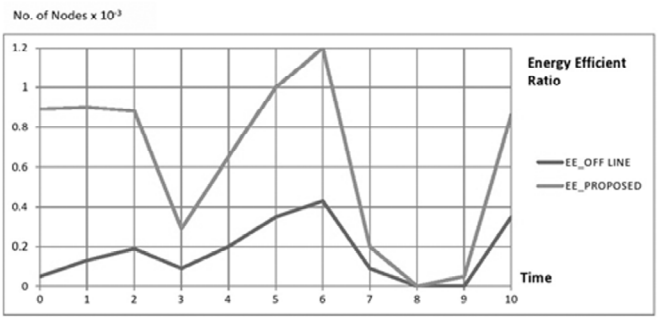

Figure 7: EE_Comparison between EE_Off Line and EE_Proposed

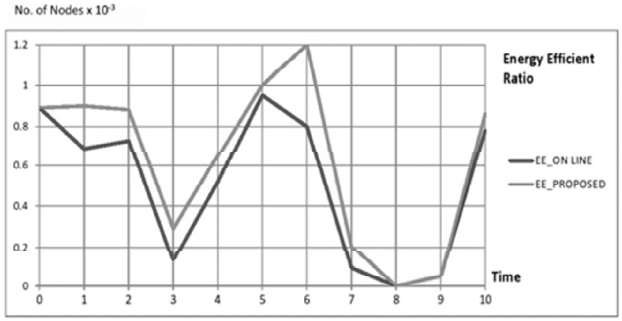

Figure 8: EE_Comparison between EE_On line and EE_Proposed

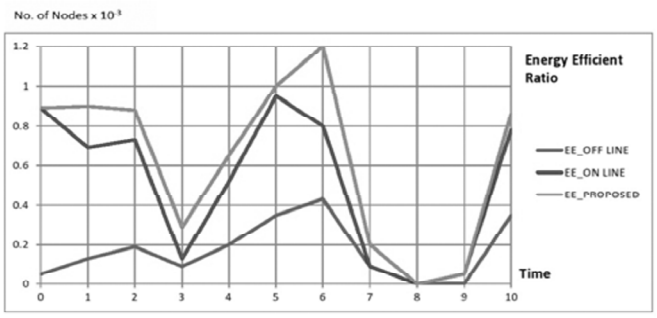

Figure 9: Energy Efficient Comparison between Existing and Proposed

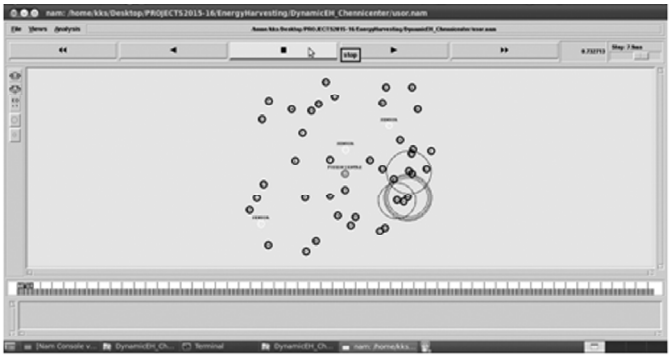

Figure 10: Fusion center and sensors in wireless sensor network

case of LEACH. The leader node takes the responsibility to communicate to the base station behalf of all other nodes in the network. In the local gathering area energy can be saved [14, 15, 19].

The leader will receive minimum number of messages in the network boundary. At this point energy can be saved. Natural light energy gives more amount of energy than any other energy harvesting resources.

5. CONCLUSION AND FUTURE WORK

Optimal scheduling method is considered in a sensor network. The main intention of work is calculate the energy efficient in both offline and online manner and calculate the time average utility, which generated by sensors nodes. Consider the offline scheduling, we have identify the majorization method is noted first then we have propose the algorithm with is identify the structure of ordering nodes. Consider the online scheduling we have proved the time average utility which is generated by sensor nodes. We can satisfy these scheduling methods by randomized myopic method. Finally we use PEGASIS algorithm, which is used to minimize energy consumption in wireless sensor network and use the energy efficiently.

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