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A Review on Routing and Scheduling Algorithm in Wireless Sensor Network

Sukrati Dixit[1], Vimlesh Kumar[2]

Research Scholar, School of Information & Communication Technology,

Gautam Buddha University, Greater Noida, U.P. India[1]

Research Associate, School of Information & Communication Technology

Gautam Buddha University, Greater Noida, U.P. India [2]

Abstract: Wireless sensor network is a collection of distributed sensor nodes, which can sense the environment by collecting, processing and transmitting the data to sink node. The main drawback of wireless sensor networks since most sensors are connected by non-rechargeable batteries. The lifetime of a sensor network can be increased by jointly applying different techniques of routing and scheduling schemes also brings great challenges to the design of efficient distributed routing protocols for multi-hop wireless sensor networks. In scheduling algorithms, the nodes are organized in sleep state when they are not required. The scheduling algorithms is applied to diminish resource starvation and to make honesty amongst the parties using the resources. The main impetus of routing algorithm is applied to wireless sensor networks for minimizing energy consumption due to retransmissions and dynamically bypass of different sensor nodes with less energy. This paper gives a review on the latest progress in scheduling and routing schemes that are used in the WSN and compare their strengths and weakness.

Index: wireless sensor network, sensor nodes, routing, scheduling, energy constraint, duty cycle.

I. INTRODUCTION

The most prominent objective of a wireless sensor network is to collect desired information from raw data obtained by the different sensors. This data is merging to form single unit and processed to get the predictable foresees result. For getting a logical result it should be necessary that there should be find a reliable time period to figure out the collection points which can be easily differentiate from each other. For an example, in a target tracking scenario, an object can be find out by different sensors at different point in time when the targeted object come in to the range of each sensor. Sensor reading like time period (indicating the time at which the object was sensed) are passed through a central point in order to fusion of such readings from various sensors will add up to form a global result, e.g. direction and speed of the object [1].

The advancement of wireless sensor networks was induce by military applications like as battlefield observation; now a day's such networks are required in many industrial and consumer applications, like industrial growth monitoring and control, machine health monitoring, and so on. An unstructured WSN is a huge collection of sensor nodes disseminate in the sensor field; it's much snag to manage valiancy between the nodes and to find about the failure of nodes. Wireless sensor networks pretence different technical defiance in data processing, communication, sensor management, ad hoc network discovery, network control and routing, collaborative signal and information processing, querying, tasking, and security. Each sensor node has a sensing Unit, a processing Unit, memory and a power source.

Fig. 1 shows the components of a typical sensor node.

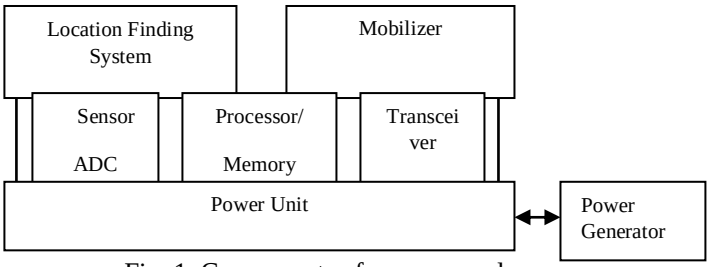

Fig. 1. Components of a sensor node.

II. DUTY CYCLING

Sensor nodes are detected resource obligate devices and mostly run on a non-replenish able energy source. It is aspired that a node should run as long as possible and the life time of a node is equal to its energy source. Probably the best idea is to decrease the energy requirements of a node is duty-cycling [2]. A node is keep into a low power sleep-mode by keeping switch-off the radio transceiver and other energy intensive components. However, a node should active at periodic intervals to perform its allotted function.

Duty cycle is defined as the number of time count nodes is to be in active or listen state in the period of network lifetime. It is mainly depend on the network system. Whenever communication is not in need, the radio transceiver or nodes are to be go to (low-power) sleep mode for energy conservation in the network. A sleep/wakeup scheduling algorithm, join with any duty cycling scheme, typically a distributed algorithm based on

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which, a sensor nodes decide when to transition from active to dominant, and back. It allows neighboring nodes to be kept weak up at the same time, making packet exchange feasible even when nodes process with a low duty cycle.

Duty cycling, where a node is periodically placed into the dominant mode, is an effective method of reducing energy profligacy in wireless sensor networks. The minimum the duty cycle, the longer nodes can sleep and the large energy they will save, whereas the transmission latency is increased because the fewer nodes are available to get involve in data routing at any given time period.

III. LITERATURE REVIEW

A. A Load Balanced aggregation Scheduling for Duty Cycled Wireless Sensor Network.

Z.Chen, G. Yang, L.Chen, J.Xu and H.Wang write about their algorithm, called the *Latency Minimized and Load-Balanced assignment Algorithm* (LAMBA) that just about solves the problem of parent-children assignment. They also show resemblances between their LAMBA algorithms with *Balanced Shortest Path Tree* (BSPT).The arbitrary parent-children assignment of BSPT may occur larger sleep latency of each hop in SPT that's because LAMBA algorithm gives the better result than BSPT. LAMBA algorithm shows the performance is less to a small extent than *Minimal Sleep Latency scheduling algorithm* (MSL), because it suffers from some latency performance to get load-balance. In this paper, introduced a load-balanced and effective latency data aggregation scheduling for duty-cycled WSNs. As is well known, the effectiveness of data aggregation is mainly determined by the routing structure. A Shortest Path Tree (SPT) in which each node has the least hop count path to the sink is used as the routing structure for data aggregation scheduling in this paper. The reason is that sensors can save relatively high computational costs for maintaining routing tables if sensors route packets based on a tree [3], on the other hand, shorter path usually has shorter delay [4].

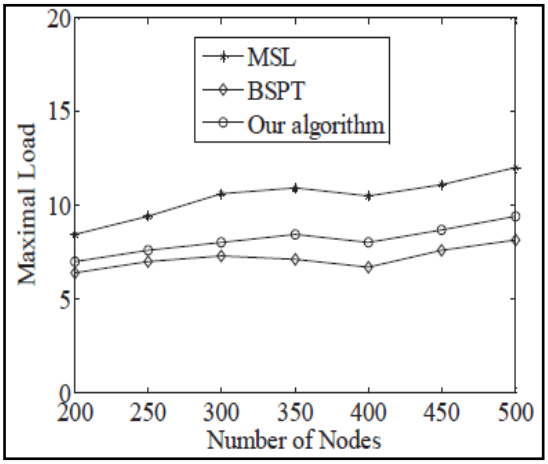

Fig. 2. Maximal load with different no. of nodes.

In SPT, we design a parent-children assignment algorithm in which assign nodes from level h +1 to the parents at level such that every parent has a balanced load, *i.e.*, nodes at the same number of hops away from the sink should have the same number of children, while reducing the sleep latency which is a time period for a sender to wait for its parent to be active. Fig. 2 shows the maximal load of each algorithm with different no. of nodes.

B. Energy Efficient Routing Protocol for Wireless sensor Network.

G. Kaur, S. Bansal and R. K. Bansal gave the comparison of LEACH and M-GEAR Protocol with the process of cluster head selection upgrade by introducing efficient cluster head replacement scheme and the amplification energy levels are varied at inters intra and CH to BS communication. Performance of the proposed protocol is well identified in terms of network lifetime, energy consumption, and throughput. [5]

Deployment

- A rechargeable gateway node is broadcast at the centre of the network
- The deployment of BS is done far off from the sensing field
- Sensor nodes, gateway node and BS are static after deployment
- The homogeneous sensor nodes with same computational and sensing capabilities are used
- Each sensor node is assigned with an egregious analyzer.

After collecting all information of nodes, sink separated the nodes into four logical regions. Nodes that are nearer to the sink and gateway node use the direct communication, while in other two regions clustering technique like LEACH is used.

- Network lifetime

It is the time periods from the start of the network operation till the last node expire. The graph shows that proposed protocol has the longer Lifetime than M-GEAR and LEACH protocol, Fig. 3. Shows the performance of network lifetime.

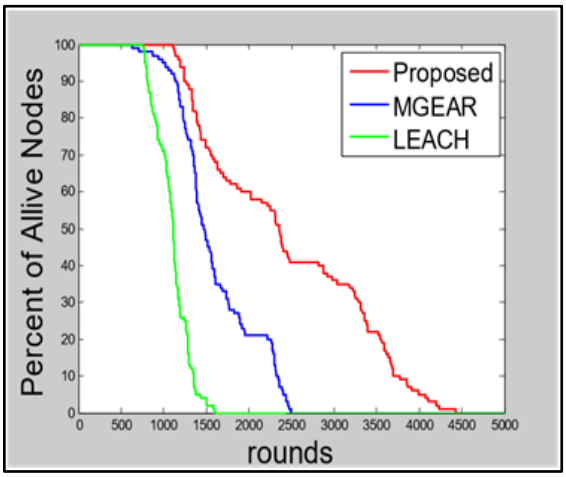

Fig. 3. Performance using network lifetime.

- Residual energy

The residual battery energy of network is expected in order to analyze the energy consumption of nodes in every

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round. Residual energy makes certain dignified degradation of network life.

Proposed protocol yields minimum energy consumption than LEACH and M-GEAR as shown in Fig. 4. Dual amplification power levels are used; so that by using low energy level for by and by cluster transmissions regarding to cluster head to BS transmission leads in saving more quantity of energy.

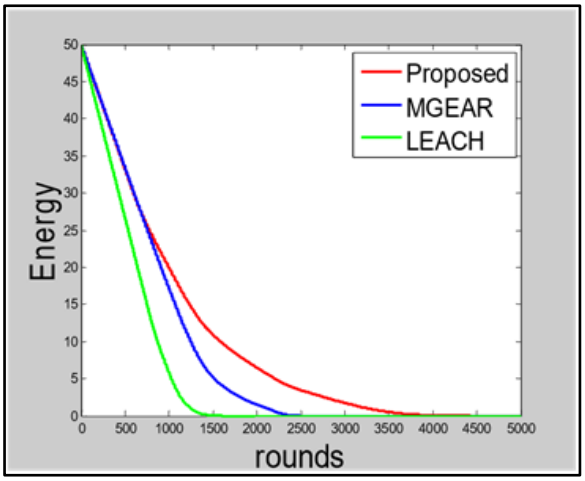

Fig. 4. Performance using remaining energy.

• Throughput

To estimate the results in terms of throughput, the no. of packets received by BS are compared with the no. of packets sent by the nodes in each round. Their protocol gives better throughput due to increased network life time. Fig. 5 shows the analysis of throughput comparison with LEACH and M-GEAR.

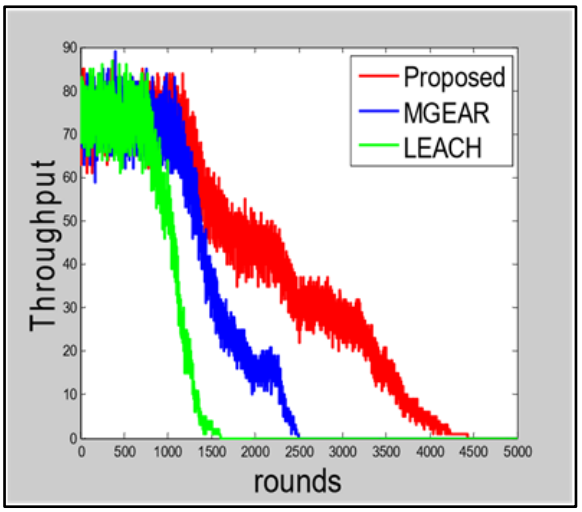

Fig. 5. Performance using throughput.

C. *Energy Efficient Oriented Routing Algorithm in Wireless Sensor Network.*

Lin-Huang Chang, Tsung-Han Lee, Shu-Jan Chen and Cheng-Yen Liao presented an energy efficient oriented routing algorithm to improve routing protocol for low power and lossy network (RPL) by combining the hoping transmission no. (ETX) and remaining energy metrics. In order to avoid the energy exhaustion of neighboring nodes and results in energy black hole proposed model provides the switching mechanism for optimal path selection to balance the residual energy of communication nodes. The simulation result showed that overall network lifetime for proposed model gave 12% better performance than RPL mechanism. Fig. 6 presents a comparison of energy consumption for original RPL nodes and their proposed mechanism. [7]

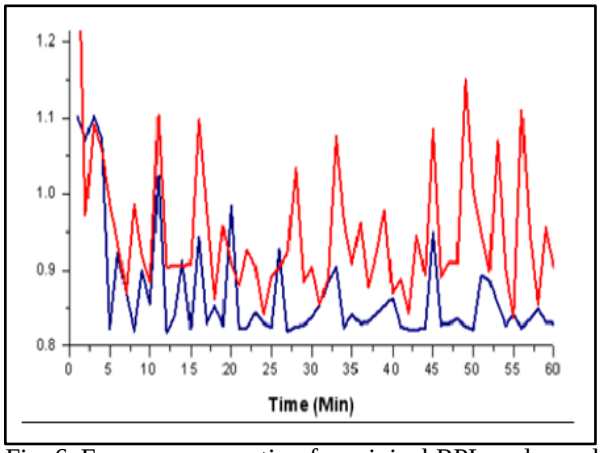

Fig. 6. Energy consumption for original RPL nodes and oriented routing algorithm.

D. Energy Efficient Routing Algorithm Sleep Scheduling in Wireless Sensor Network.

S.D. Dwivedi and P. Kaushik presented a protocol called energy efficient routing protocol with sleep scheduling compared with Gossip Based Sleep Protocol for WSNs.Hou and Tipper have proposed flat structure based protocol called Gossip-based Sleep Protocol (GSP) [10] that employs probabilistic based sleep modes. At the beginning of a gossip period, each node chooses either to quiet having probability of p or to stay keep off with probability 1 - p for the period, so that all the sleep nodes will not have ability to send or receive any packet during the period. When an active node receives any packet, it must again transmit the same. All sleeping nodes will be active at the end of each period. All the nodes repeat the above process for every period.

The author introduce scheme for increasing the lifetime of densely deployed wireless sensor network by keeping only a necessary set of nodes active. The base of the routing protocol is start from the efficient construction of the broadcast tree with a path from each node towards the sink, and with higher remaining energy at each node of the tree. The tree is reconstructed at the starting point of each and every period so that none of these nodes succumb before other nodes, which means that all nodes will expire at around the same time. Node sleep mechanism is more energy efficient as more number of nodes has ability to sleep, and this helps to prolong the network lifetime. Their simulation result showed that proposed protocol had more number of sleep nodes and therefore provided longer network lifetime. [9]

E. Energy Efficient Dynamic Query Routing Tree Algorithm For Wireless Sensor Network.

S. G. Kim and H. S. Park proposed a query-based *Energy Efficient Dynamic Routing Tree algorithm* (EDRT)

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scheme, which is constructed influentially for each and every query. The main objective of the EDRT is to minimize the number of hops by raise the quantity of data merge processing, thus reducing the total number of generated messages to reach the destination. The EDRT is build in such a way that messages generated from sensor nodes can be merged more often and earlier. The idea of EDRT is to increases the-network processing opportunities by using the parent nodes and sibling nodes. In-network processing the number of message transmission is reduced by partially assembling results of a collective query in intermediate nodes, or merging the results in one message. They have designed the EDRT in such a manner that data assembling processing occurs as early as possible in result collection by convey result messages to the parent and friends node.

Their simulation results showed that proposed method can reduce message transmissions in comparison to *query specific routing tree* (QSRT) and *flooding-based routing tree* (FRT). The messages that are transmitted for EDRT can be decreased by 37% and 12%, compared to FRT and QSRT, respectively. And the messages that are getting in BS are increased by 8% and 4%, compared to FRT and QSRT, respectively. Fig. 7 and 8 shows the performance of algorithms for various network sizes and performance of data gathering in sink node, respectively. [11]

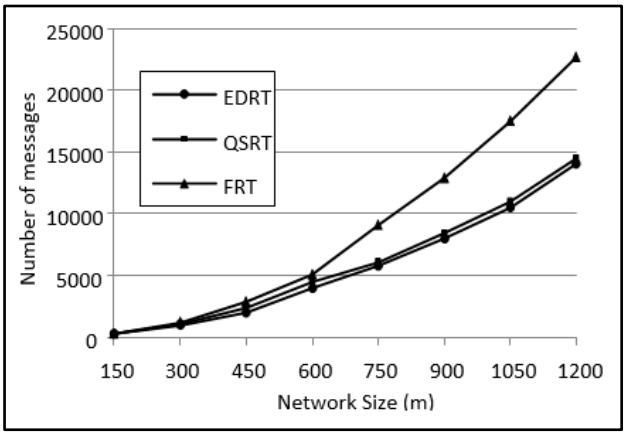

Fig 7. Performance in various network sizes.

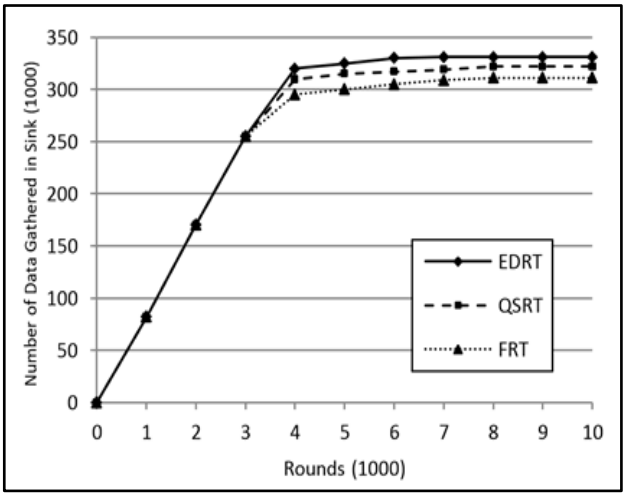

Fig. 8. Performance of data gathering in sink node.

F. An Energy Efficient MAC Protocol for Wireless Sensor Network.

W. Ye, J. Heidemann and D. Estrin introduced S-MAC, a medium-access control (MAC) protocol describe for wireless sensor networks. Wireless sensor networks have battery-fulfilled computing and sensing devices. A network of these devices will cooperate for a common application such as environmental monitoring. S-MAC required three novel techniques to decrease the energy consumption and support self-configuration. To reduce energy consumption in listening to an idle channel, nodes sleep in a periodic manner.

Neighboring nodes form virtual clusters to auto-synchronize on sleep schedules. Here Author compare the proposed MAC Protocol with IEEE 802.11 and finally, For reducing the contention latency for sensor network application S-MAC protocol was practiced that requisite store-and-forward processing as data move through the network. Figure 9 and 10 shows that S-MAC outperforms by 802.11 in energy consumption in the source node and in the intermediate node. [13]

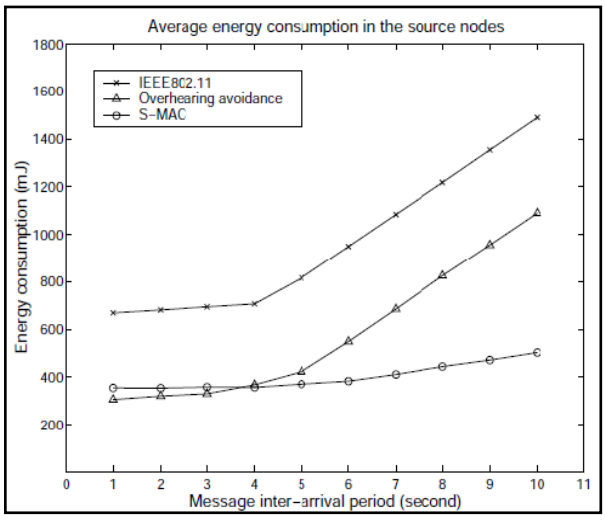

Fig. 9.Measured energy consumption in the source node.

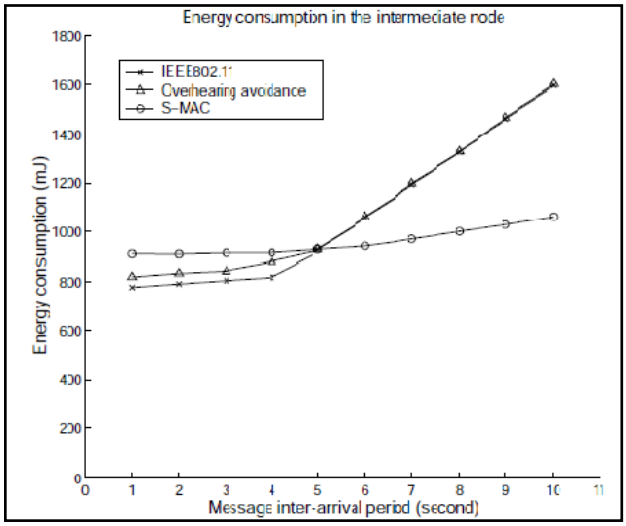

Fig.10. Measured energy consumption in the intermediate node.

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G. *An Energy Balanced Algorithm of LEACH Protocol in WSN.*

C.FU, Z.JIANG, W.WEI and A.WEI introduced a new improved algorithm of LEACH protocol (LEACH-TLCH) which is intended to provide moderation to the energy consumption of the entire network and extend the life of the network. The new algorithm is implemented by Matlab simulation platform. The obtained results indicate that both energy efficiency and the lifetime of the network are better than that of LEACH Protocol. Figure 11 and 12 shows the Performance of algorithm for network lifetime and the better performance in gaining low energy consumption. [15]

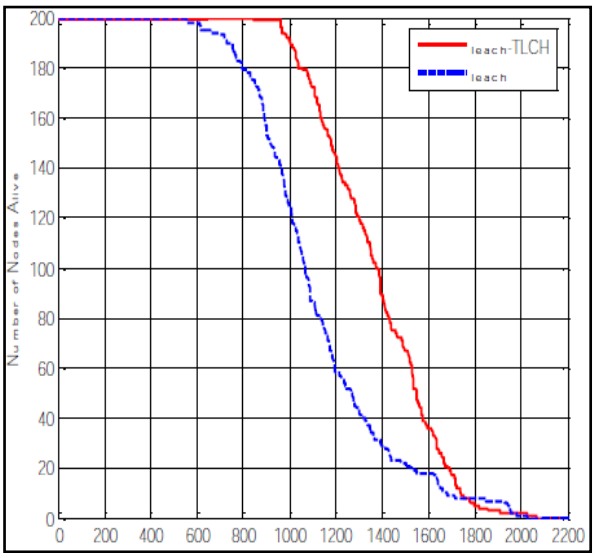

Fig. 11. The network lifetime.

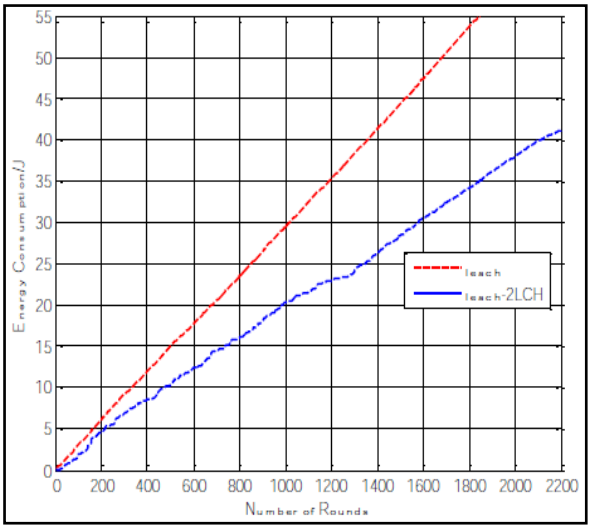

Fig .12. Total energy consumption

H. *Greedy Algorithm for Target Q Coverage in Wireless Sensor Network.*

H.KIM, Y.H.HAN and Sung-Gi MIN introduced a heuristic greedy-TQC algorithm to use the residual energy of sensors to generate multiple scheduling cover sets. Figure 13 shows the network lifetime with the optimal Algorithm and the Greedy-TQC algorithm. The optimal algorithm shows better performance and gives more lifetime than the greedy algorithm, but the greedy-TQC algorithm nearly obtained the best solution. Also, the Greedy-TQC algorithm has lower running time than the optimal algorithm. Simulation results verified that the proposed greedy-TQC algorithm achieves efficient scheduling to extend the network lifetime. They also give the result in which the greedy-TQC algorithm provides a lifetime that is close to that of the optimal solution, and it quickly solves the TQC problem. [17]

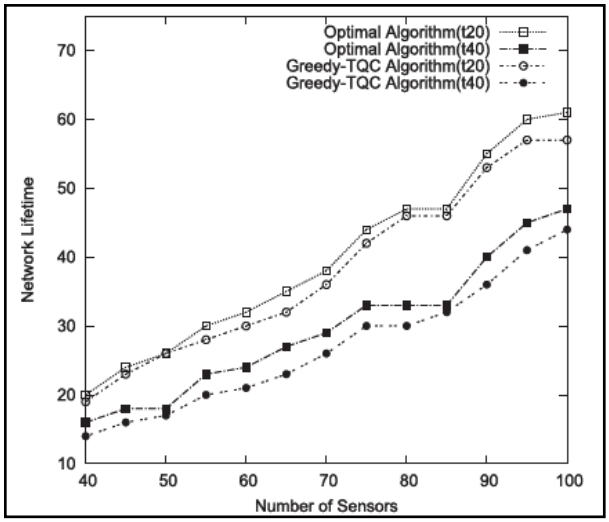

Fig .13. The network lifetime versus the number of sensors.

I. Wireless Sensor Network for Continuous Monitoring A Patient's Physiological Conditions Using ZigBee.

Ramanathan.P, Thimmasamudram and P.Manjrekar presented a Wireless Sensor Network (WSN) for invigilating a patient's physiological conditions in a successive manner using Zigbee.In the experiment groups of persons were made to undergo the test. Person A was come in the age group of 1-10 years. Person B was come in the age group of 11-30 years and person C was come in the age group of 31-80 years. Physiological conditions of these 3 groups of persons were invigilated using physiological sensor. The result of physiological sensor has to be send via zigbee and the same has to be transmitted to the remote wireless monitor for receipt the observed patient's physiological signal. The remote wireless monitor is build up of zigbee and Personal Computer (PC). The RS-232serial port communication interface transmitted the measured signal to the PC that is data collection. When the measured signals over the standard value, the personal computer gives Global System for Mobile communication (GSM) short message to the care taker.The results get by using wsn in terms of precision and reliability of measurement is poor in comparison to the result obtained from WSN using zigbee ensures that it effectively works for successive monitoring a patient's physiological conditions. The results and motive of this study released that an outstanding research project was developed and the abnormal conditions of the patients were analyzed. So the effectiveness of this WSN using zigbee is more compared with the effectiveness of WSN. [19]

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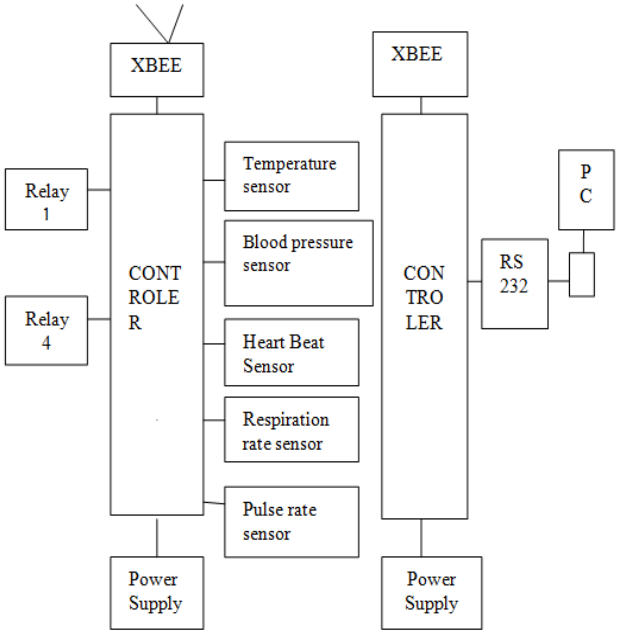

Figure.14. Block Diagram of Transmitter section and receiver using ZigBee.

IV.CONCLUSION

In this paper we have presented routing and scheduling techniques for wireless sensor networks, to achieve low energy consumption and increase network lifetime and throughput. The nodes are synchronized to each other with the help of a reference node.

The research has been motivated by the optimization of routing and scheduling algorithm with RS-232 protocol and zigbee.We also presented the simulation result of protocol with zigbee on network simulator ns2.

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