Efficient Reception of Packets using Zigbee Protocol Wireless Sensor Network

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Abstract: The great potential of Wireless Sensor Network is being seen in industrial, consumer and commercial application. The wireless technology is becoming one of the most prominent areas of research. With the development of network and communication technology, the WSN has solved the inconvenience into people's lives. WSN has good functions of data collection, transmission, and processing. In the older technology there was a shortcoming of average packet time delay, large power dissipation, less efficient reception of packets, large propagation delay, low speed communication. Besides there were other limitations like limited battery life time nodes incapability of data aggregation, processing, storing and then passing it to the base station accordingly.. As in the earlier Technologies WSN node based leach protocol could not provide the above necessary requirements for the system to operate under well adverse environmental situations.

In this dissertation, we have used a ZigBee protocol in WSN system for ensuring that the nodes may operate for a longer period of time, reducing packet time delay, establishment of a re-linking algorithm and provides an efficient reception packet and sufficient throughput The advantage of ZigBee Technology is that it covers a range of 1-100m For comparison purposes, we have taken the oldest technology i.e. SEP .To allow different systems to work together, standards are needed. ZigBee/IEEE 802.15.4 protocols are developed for this purpose. Moreover, ZigBee protocol in WSN has resulted in the low power consumption, enhancement of life time of battery reduced average packet time delay less power dissipation improved an efficient reception of packets, reduced propagation delay, high speed communication among wireless communication devices. On comparing the results of both that is the previous work over which work has been done earlier and present work it has been observed that modified system performs better.

Keywords— Leach, Sep, Zigbee, Adhoc network.

1. .INTRODUCTION

1.1 Overview

Wireless Sensor Networks (WSN) have gained a world-wide attention in recent years due to the advancement made in wireless communication, information technologies and electronics field .The concept of wireless sensor networks is based on a simple equation: Sensing + CPU + Radio = Thousands of potential applications. It is an "In situ" sensing technology where tiny, autonomous and compact devices called sensor nodes or motes deployed in a remote area to detect phenomena, collect and process data and transmit sensed information to users. The development of low-cost, low-power, a multifunctional sensor has received increasing attention from various industries. Sensor nodes or motes in WSNs are small sized and are capable of sensing, gathering and processing data while communicating with other connected nodes in the network, via radio frequency (RF) channel.

WSN term can be broadly sensed as devices range from laptops, or mobile phones to very tiny and simple sensing devices. At present, most available wireless sensor devices are considerably constrained in terms of computational power, memory, efficiency and communication capabilities due to economic and technical reasons. That's why most of the research on WSNs has concentrated on the design of energy and computationally efficient algorithms and protocols, and the application domain has been confined to simple data oriented monitoring and reporting applications. WSNs nodes are battery powered which are deployed to perform a specific task for a longer period of time, even years. If WSNs nodes are more powerful or mains-powered devices in the vicinity, it is beneficial to utilize their computation and communication resources for complex algorithms and as gateways to other networks. New network architectures with heterogeneous devices and expected advancements in technology have eliminated current limitations and expanded the possible spectrum applications for WSNs considerably.

1.2 Wireless Sensor Node Architecture
The basic block diagram of a wireless sensor node is presented in Figure 1.1. It is made up of four basic components: a sensing unit, a processing unit, a transceiver unit and a power unit. There can be application dependent additional components such as a location finding system, a power generator and a mobilize.
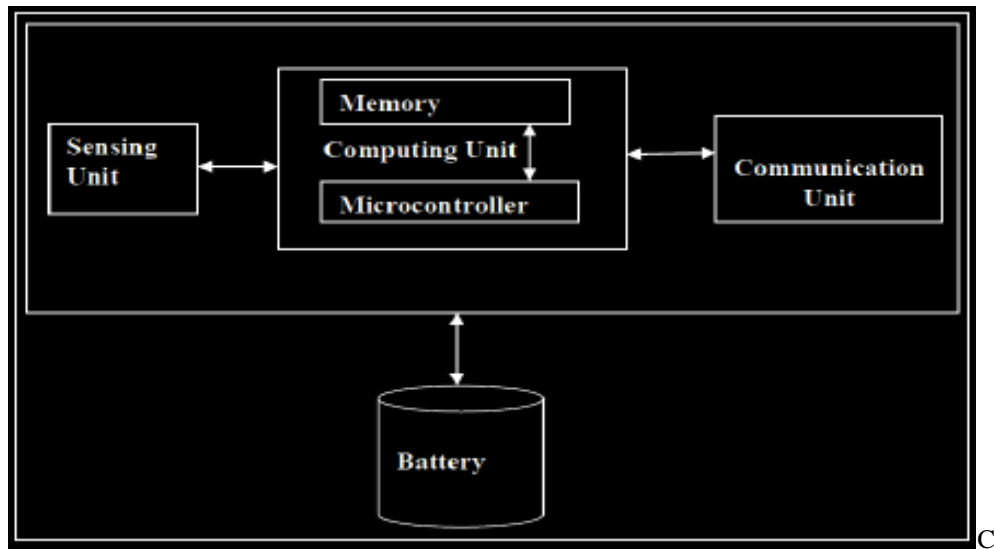

Fig 1.1: Architecture of   WSN   node

1.2.1 Sensing Unit
Sensing units are usually composed of two subunits: sensors and analog to digital converters (ADCs). Sensor is a device which is used to translate physical phenomena to electrical signals. Sensors can be classified as either analog or digital devices. There exists a variety of sensors that measures environmental parameters such as temperature, light intensity, sound, magnetic fields, image, etc. The analog signals produced by the sensors based on the observed phenomenon, are converted into digital signals by the ADC and then fed into the processing unit.

1.3 Routing Challenges and Design Issues in WSNs
Wireless sensor networks have their own unique characteristics which create new challenges in the design of routing protocols for these networks. First, sensors are very limited in transmission power, computational capacities, storage capacity and most of all, in energy. Thus, the operating and networking protocol must be kept much simpler as compared to other ad hoc networks. Second, due to the large number of application scenarios for WSN, it is unlikely that there will be a one-thing that fits-all solution for these potentially very different possibilities. The design of a sensor network routing protocol changes with application requirements.

For example, the challenging problem of low-latency precision tactical surveillance is different from that required for a periodic weather-monitoring task. Thirdly, data traffic in WSN has significant redundancy since data is probably collected by many sensors based on a common phenomenon. Such redundancy needs to be exploited by the routing protocols to improve energy and bandwidth utilization. Fourth, in many of the initial application scenarios, most nodes in WSN were generally stationary after deployment. However, in recent development, sensor nodes are allowed to move and change their location to monitor mobile events, which results in unpredictable and frequent topological changes. Due to such different characteristics, many new protocols have been proposed to solve the routing problems in WSN. These routing mechanisms have been taken into consideration for the inherent features of WSN, along with the application and architecture requirements. To minimize energy consumption, routing techniques proposed in the

literature for WSN employ some well-known ad hoc routing tactics, as well as, tactics special to WSN, such as data aggregation and in-network processing, clustering, different node role assignment and data centric methods. In the following sections, introduce to current research on routing protocols have been presented.

1.3.1 Node Deployment
Node deployment in WSN is application dependent and affects the performance of the routing protocol. The deployment can be either deterministic or randomized. In deterministic deployment, the sensors are manually placed and data is routed through pre-determined paths; but in random node deployment, the sensor nodes are scattered randomly creating an infrastructure in an ad hoc manner. Hence, random deployment raises several issues as coverage, optimal clustering etc. which need to be addressed.

1.3.2 Energy Consumption without Losing Accuracy
The sensor nodes can use up their limited supply of energy performing computations and transmitting information in a wireless environment. As such, energy conserving forms of communication and computation are essential. Sensor node lifetime shows a strong dependence on the battery lifetime. In a multihop WSN, each node plays a dual role as data sender and data router. The malfunctioning of some sensor nodes due to power failure can cause significant topological changes and might require rerouting of packets and reorganization of the network.

2. PRESENT WORK

2.1 Problem Formulation
Wireless sensor networks are generally deployed in inhospitable territory where the lightweight hubs or nodes are normal to recognize an occasion and send significant information to the Base Station (BS). However in such remote spots it is for the most part not practical to replace batteries regularly. Clustering is ways to deal with minimize energy utilization of such system. However the methodology ought to be sufficiently adaptable to maintain a strategic distance from exorbitant battery channel of the group heads especially those close to the BS and to address topology changes as hubs cease to exist. In this way a ZigBee for Wireless Sensor Network is introduced. Here a few hubs are put to rest to drag out the system lifetime. ZigBee chooses a hub as a group head if its remaining vitality is more than framework normal vitality and if a hub's remaining vitality comes to five percent of its underlying vitality then it specifically sends information to BS staying away from hub disappointment amid information gathering or total. The objectives of this plan are, expansion soundness time of system, what's more, minimize loss of detected information.

2.2 Objectives
1) Establishment of   Wireless Sensor Network.
2) Introducing ZigBee protocol as an energy efficient protocol for the improvement of   wireless network system.
3) Application of ZigBee over wireless sensor network to establish a link between the nodes for reliable transmission of packets from source to sink(base station)
4) Calculation and comparison of energy and throughput.

2.3 Methodology Steps
Step 1: Randomly deployment of nodes using Matlab.
Step 2: Apply mobility to the sink
Step 3: Application of ZigBee protocol over network in overcoming the shortcomings left   in the older technologies as already mentioned.
Step 4: Application of ZigBee protocol over WSN for improving the efficiency of routing protocol
Step 5: Determination of throughput and propagation delay.
Step 6: Comparing improvement of throughput and propagation delay from previous   technologies.

2.4 ZigBee/IEEE 802.15.4 Protocol Stack
The rapid progress of wireless communication and embedded micro-sensing micro electromechanical systems (MEMS) technologies has made wireless sensor networks (WSN) possible. A WSN consists of many inexpensive wireless sensors, which are capable of collecting, storing, processing environmental information, and communicating with neighboring nodes. In the past, sensors are connected by wire lines. To allow different systems to work together, standards are needed. ZigBee/IEEE 802.15.4 protocols are developed for this purpose. ZigBee/IEEE 802.15.4 is a global hardware and software standard designed for WSN requiring high reliability, low cost, low power, scalability, and low data rate. Table x.1 compares ZigBee/IEEE 802.15.4 against several other wireless technologies. The ZigBee alliance (ZigBee, 2004) is to work on the interoperability issues of ZigBee/IEEE 802.15.4 protocol stacks. The IEEE 802.15 WPAN Task Group 4 (IEEE Std 802.15.4, 2003) specifies physical and data link layer protocols for ZigBee/IEEE 802.15.4. The relationship of ZigBee and IEEE 802.15.4 is shown in Figure 3.1. In the current development, IEEE

802.15 WPAN working group creates two task groups 15.4a and 15.4b. The former is to specify an alternate physical layer, the ultra-wide band (UWB) technologies. The latter is to enhance the IEEE 802.15.4 MAC protocol so that it can tightly couple with the network layer functionalities specified by ZigBee.
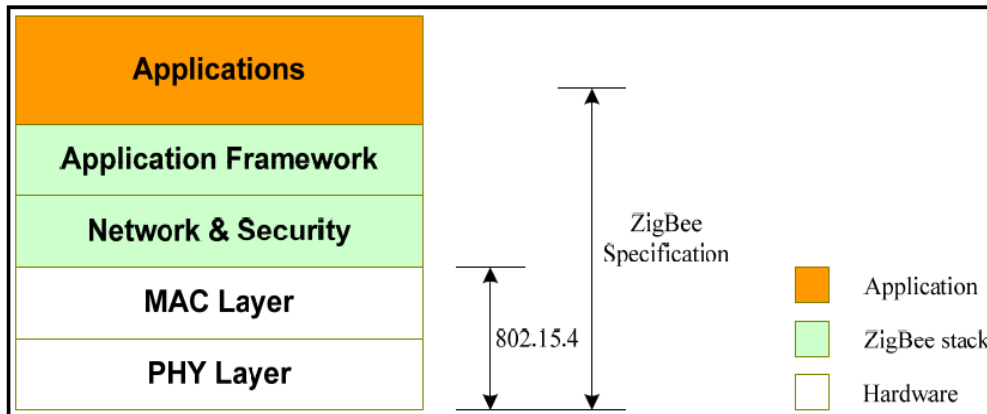

Figure 3.1**:** ZigBee/IEEE 802.15.4 Protocol Stack.

Companies such as Chipcon (Chipcon, 2005), Ember (Ember, 2005), and Free scale (Free scale, 2005) provide system-on-chip solutions of ZigBee/IEEE 802.15.4. For home networking, ZigBee/IEEE 802.15.4 can be used for light control, heating ventilation air conditioning (HVAC), security monitoring, and emergency event detection. For health case, ZigBee/IEEE 802.15.4 can integrate with sphygmomanometers or electronic thermometers to monitor patients' statuses. For industrial control, ZigBee/IEEE 802.15.4 devices can be used to improve the current manufacturing control systems, detect unstable situations, control production pipelines, and so on.

3.   RESULTS AND DISCUSSIONS

3.2 Simulated Results

In this section, the proposed algorithm is evaluated via computer simulation using MATLAB simulator. All simulation results are obtained on the basis of proposed approach ZigBee protocol for efficient reception of packet. Figure 4.1 show node deploy in predefined area.
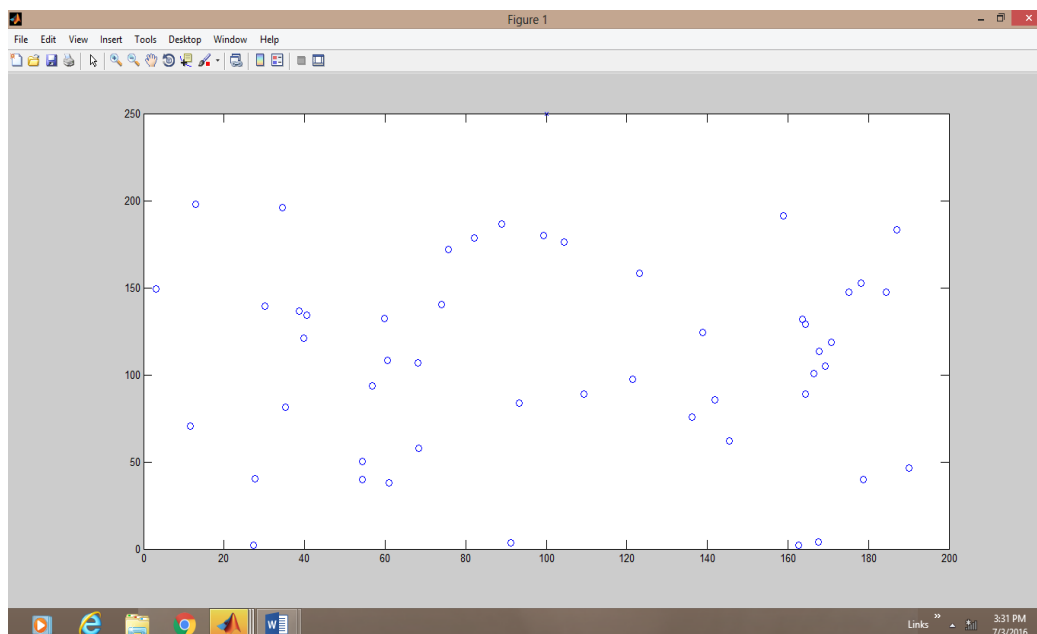

Figure 4.1:Nodes Deploy

  The deployment of nodes in the above figure decides the life time of overall network system. Figure 4.2 show the distribution of node according to sink node.
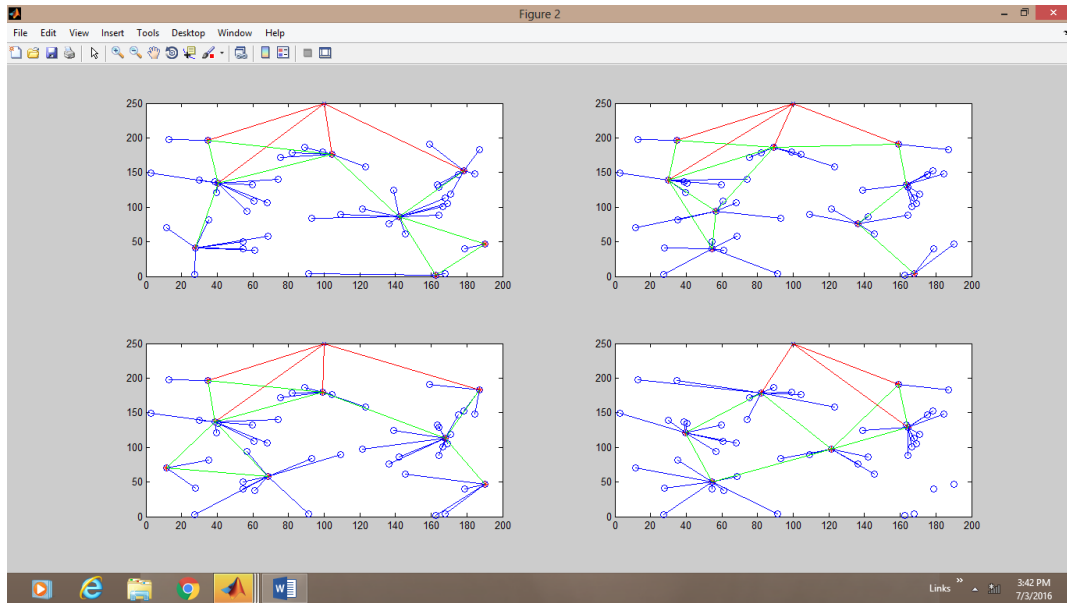
Figure 4.2:Node Distribution According to Sink Node

The above graph shows the linking mechanism of nodes.
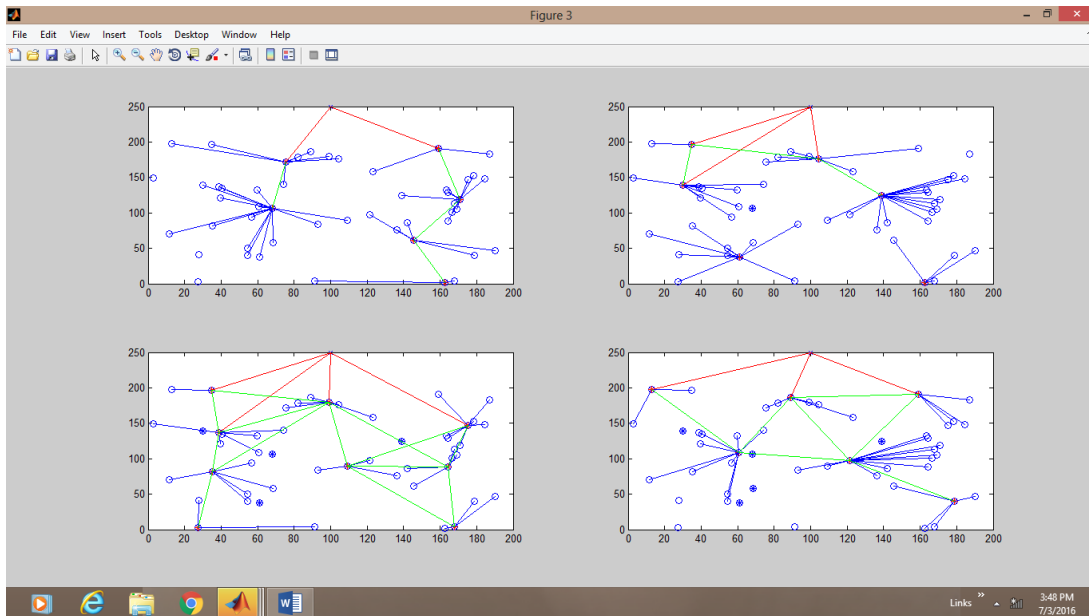Figure 4.3 show the distribution of node according to sink node.

Figure 4.3: Node Distribution According to Sink Node

According to the above graph it clearly indicates that different nodes shows linking pattern in defined area. Figure 4.4 show the distribution of node according to sink node.
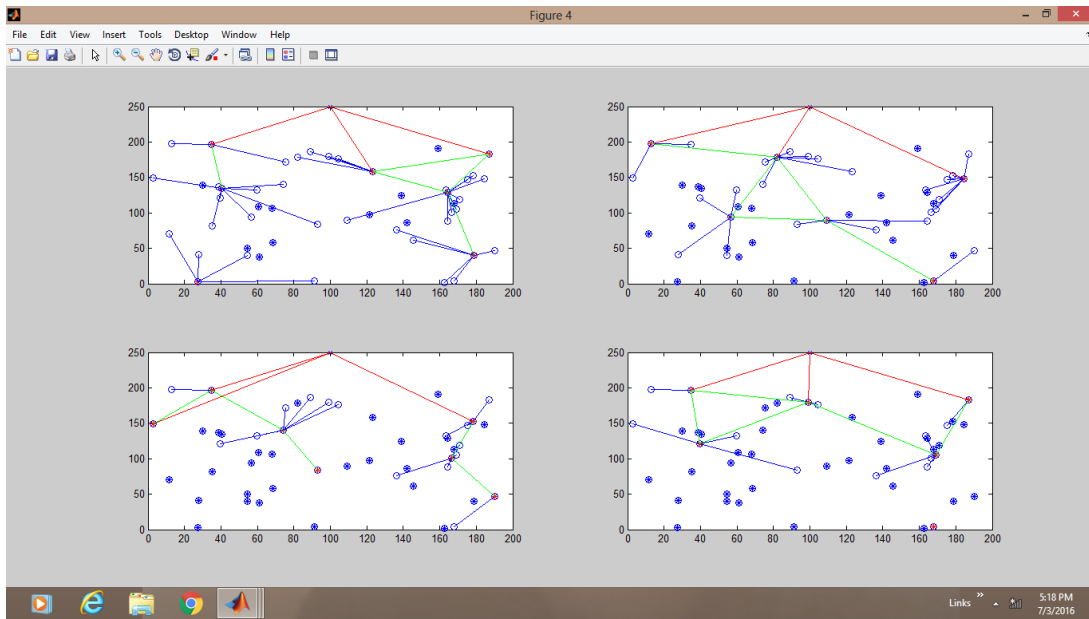
Figure 4.4:Node Distribution According to Sink Node.

The nodes distribution in the area as shown in the figure above decides for how long established link remains active. Figure 4.5 show the distribution of node according to sink node.
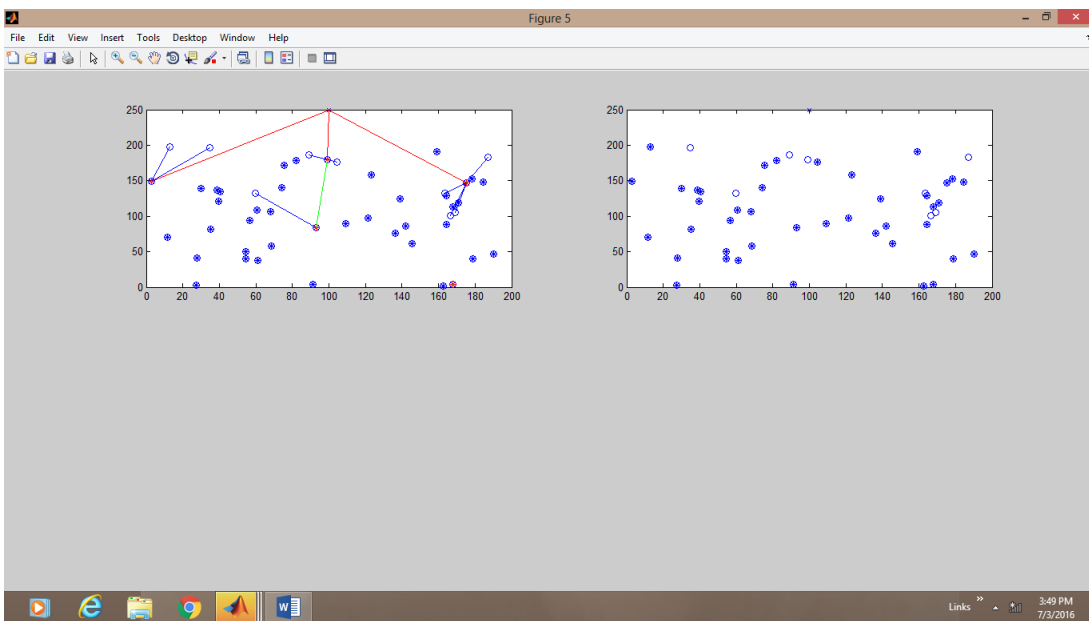

Figure 4.5: Node Distribution According to Sink Node.

It has been cleared from the above graph that introduction of ZigBee protocol results efficient reception of packets.

Figure 4.6 show efficient reception of packet by introducing ZigBee protocol in WSN.
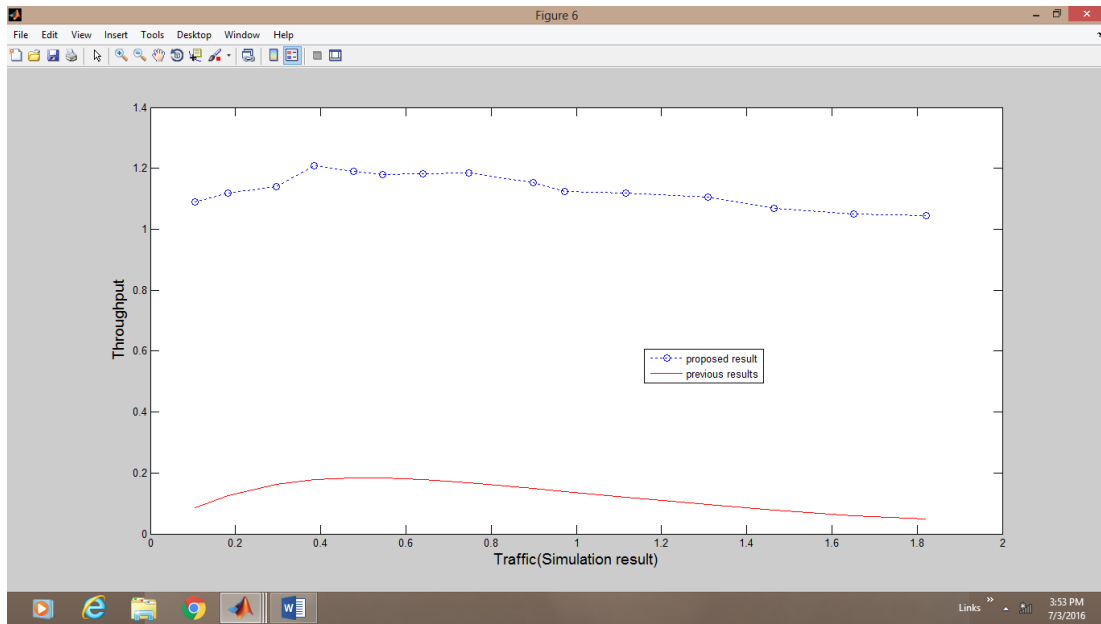
Figure 4.6: Efficient Reception of Packet.

The above graph shows that simulated work has yielded a better and an efficient reception of packets in comparison to previous works done earlier.

Figure 4.7 show comparative analysis of introducing ZigBee propagation delay according to simulation time with basic WSN protocol.
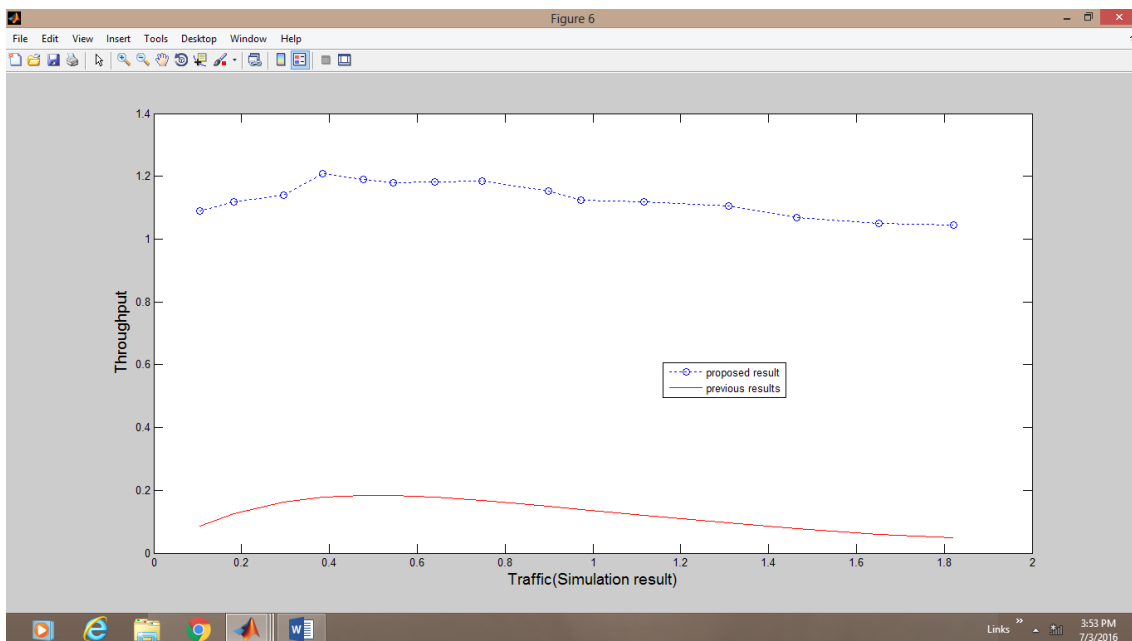

Figure 4.7: Comparative Analysis of Propagation Delay.

4. CONCLUSION AND FUTURE SCOPE

4.1 Conclusion

In wireless sensor networks, heterogeneous nodes increase networks complexity. Most clustering algorithms based on network heterogeneity perform in respect of nodes initial energy. But it is obvious that over time a homogeneous network also becomes heterogeneous with nodes of unequal remaining energy. On the other hand, over rounds an initially set advanced node can become a normal node and vice versa. These issues are considered while designing ZigBee protocol for clustering and routing for

heterogeneous WSN. Performance of the protocol is compared with SEP. ZigBee is found to perform equally well for homogeneous as well as heterogeneous network. In our approach, nodes are selected as a cluster head based on their residual energy and systems average energy. Nodes having more or equal energy than systems average energy always have higher chances to become a cluster head, so the distribution of energy consumption is done in an equitable fashion. In ZigBee nodes switch between sleep and active modes thus it can better adapt to applications with heterogeneous energy capacities in sensor networks.

4.2 Future Scope

For further extent of this work, include inter cluster head communication to further increase the lifetime of cluster heads far away from the BS. Energy-efficient security mechanism involving efficient key distribution and management mechanisms can be applied to lightweight sensors to ensure data integrity.

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