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Improve Performance and Analysis of Secure Wireless Multimedia Sensor Networks

G. Gomathy[1] and K. Sujatha[2]

ABSTRACT

Wireless Sensor networks one of the most interesting areas of research in the past few years. A WSN is composed number of wireless sensor nodes are form a sensor field and a sink. These large numbers of nodes, having abilities to sense for surroundings and perform limited computation for communicate wirelessly form the WSNs. Recent in wireless technologies are enabled in a wide range of applications for WSNs in military, traffic surveillance, environment monitoring, healthcare monitoring. Advancements in Complementary Metal Oxide Semiconductor technology is enabled Wireless Sensor Networks to gather and transport multimedia (MM) data as well as not just limited to handling ordinary scalar data anymore. This known as Wireless Multimedia Sensor Networks (WMSNs). Better is relatively cheaper sensors–sensors that are able to sense scalar data and multimedia data for more advanced functionalities such as being able to handle computations are easily. Security, privacy issues, over all requirements and proposed solutions are some of the successful achievements and other related works in the field are also highlighted.

Keywords: WMSNs, QoS, ZigBee, FPGA

1. INTRODUCTION

Multimedia (MM) is content that uses a combination of different forms of data such as text, audio, still images, video and animations. Enabling WSNs [1] support for MM data has recently become an active focus area for researchers all over the world. The availability of cheaper CMOS cameras and microphones: hardware which sufficient to make possible. Successfully achieving this goal for no easy task: with it comes tough decisions to be made since there are a lot of trade-offs to consider. The great requirements of some similar to those in WSNs complex. In the long run, ideal WMSNs are supposed to sense, retrieve, store, process, transmit and communicate, if need be, scalar data as normal WSNs [2]-[3] still images, audio and video data (MM data). The sparking opportunity for new challenges to be strived for meet Quality of Service (QoS), bandwidth, time restrictions for demands for MM data). The advancement for research fields such as embedded systems, computer networks, and sensor nodes are manufactured. The tackling of even more complicated problems and projects today. These problem areas military, health institutions, universities and other academic facilities etc.

The bottleneck constraining development and application of wireless sensor network technology that node energy is limited [1]. The Multimedia Sensor Networks (MSN) that collects objects' images and video information, are reduce node energy consumption for network lifecycle is more urgent [2]. As the Compressed Sensing (CS) emerged in recent years data are compressed by using the redundancy of multimedia sensor network data, and reduce the transmission of redundant information are provide solution to reduce network node energy consumption. Due to the wavelet transformation, discrete cosine transform

1 Research Scholar,

2 Professor, Dept. of EEE, for Electronics, Automation and Industrial Research (CEAIR), Dr. M.G.R. Educational and Research Institute, Chennai, India.

are relatively mature image sparse transform methods, Therefore early image compressed sensing existing transforms while with the study for aspects of measurement and reconstruction algorithm. The normal wavelet transform's defects of direction choice and translation invariance, etc. researchers 3D Dual-tree Complex Wavelet Transform [9] and wavelet tree structure of sparse transform of network data and obtained a sparse representation superior to traditional wavelet transform. It have been proposed in literature [12] and literature distributed multimedia data compressed sensing algorithm and correlation algorithm for video image perception. Compared with previous image sparse transforms, the above algorithms can use the correlation between sensor networks for the transmission amount needed for further data reconstruction. But traditional sparse transform is basis of constructing sparse model among data, and the correlation between the structures for node data cannot be reflected. The current researches, a multimedia sensor networks supporting for image compressed sensing algorithm is proposed in this paper, and based on design and corresponding image sensing reconstruction algorithm are collaborated and reflecting the correlation of multimedia sensing network node sparse coefficient-supporting. The amount of sub-space needed to be searched in reconstruction algorithm iteration are sparse model collaborating design reduced, and the number of measurement needed for reconstructing network data accurately. The current multimedia sensing network compressed for sensing algorithm in this paper can effectively reduce the transmission for data needed in reconstructing network images for premise of guaranteeing of reconstruction and further reduce network node energy consumption.

There are surfaced for the designers of WSNs, in order to meet the requirements for applications like sensed quantities, size of nodes, and nodes' autonomy. The future developments in sensor nodes are produce produce very powerful and cost-effective devices.

They may be used in applications like underwater acoustic sensor, sensing based cyber physical systems, time critical applications, cognitive sensing and spectrum management for security and privacy management. This paper also describes the research challenges for WSNs.

WSNs are usually composed for small, low-cost devices that communicate wirelessly and the capabilities of processing, sensing and storing. The WSNs was motivated by military applications such as battlefield surveillance. Many industrial and civilian application areas for industrial process monitoring and control described by Kay and Mattern (2004), machine health monitoring described by Tiwari (2007), environment and habitat monitoring traffic control are Kay & Mattern (2004) and Hadim (2006). A WSN generally consists of base station that can communicate with a number of wireless sensors for a radio link. Wireless sensor nodes are collect the data, compress it, and transmit it to the gateway directly or indirectly to other nodes. The transmitted data are presented to the system by the gateway connection. This paper discusses for advances in WSNs a wide range of applications and future development in applications like underwater acoustic sensor systems for Sensing based cyber physical systems, time critical applications for cognitive sensing and spectrum management for security and privacy management.

2. DESIGN CHALLENGES

The design of WMSNs areas in embedded systems, signal processing and communications to powerful and efficient network over traditional WSNs. These design challenges are

2.1. Resource Constraints.

In comparison of WSNs, requirement of resources are battery power, memory, data rate, processing capability is more in WMSNs.

2.2. Multimedia Source Coding Techniques

The multimedia traffic is very high efficient source coding techniques should be used for redundant data.

2.3. High Bandwidth Demands

Even after using source coding, Multimedia data stream are higher bandwidth. This requires efficient for transmission and development for novel hardware architecture.

2.4. Energy Consumption

Energy consumption of major concern in WMSN to guarantee QoS requirements.

2.5. Application specific QoS Requirements

Design of WMSN requires for development algorithms QoS requirements are specific to applications.

2.6. Multimedia In-Network Processing's

Aggregation is possible with scalar data in WSNs. The same techniques with WMSNs because multimedia information for multiple packets of the stream. Therefore challenge for future research work.

2.7. Cross layer Coupling of Functionalities

For energy efficient communication cross layer design is essential.

3. MULTIMEDIA SENSOR HARDWARE

The WSNs, WMSNs have got requirements that must be met to provide acceptable quality and fulfil inevitable constraints for time constraints as will be discussed later. Furthermore, constructing an efficient WMSN requires additional research for fields such as signal processing (especially digital signal processing). This is because MM handling demands much more than what traditional WSNs usually do for powerful system has to be built. Some of the numerous challenges and issues faced are discussed in this section:

3.1. Time Restrictions

These actually depend on the type of the application in question, especially important if the application requires live streaming. In this case, end to end delay are low possible. Furthermore, in cases where live-

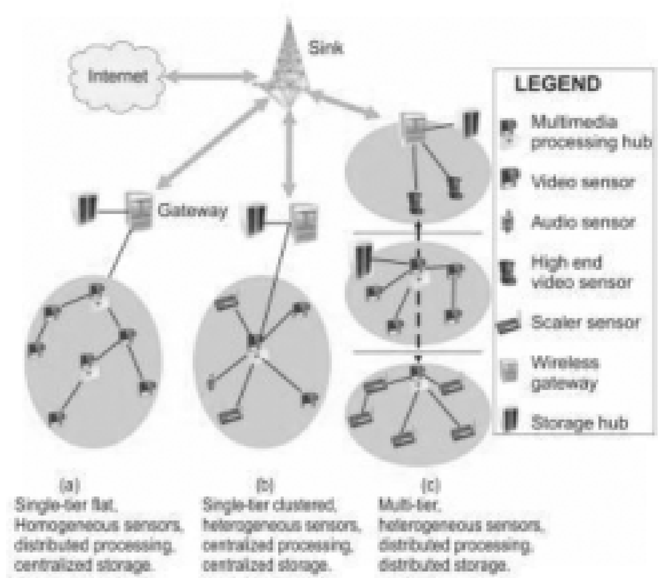

Figure 1: Reference Architecture of a WMSN

streaming is required, more sophisticated algorithms are needed. In applications where live-streaming is not the requirement, basic techniques such as buffering might suffice, but then again, this might not be feasible for all MM applications as WMSNs are limited memory with huge amounts of data to process. Thus, buffering might not always work as well.

3.2. Security and Privacy

This is very important and sensitive for WMSNs are concerned. Some MM applications might demand either security, privacy. A bank monitoring application, things like safe codes should be kept secret car number-plates should be kept secret. The security point of view, some intentioned people may feed useless data to the sensors thus leading to congestion for the whole system which might even lead to the breakdown of the whole system. Whatever the situation, security, privacy are needed to be ensured – in most cases they are needed.

3.3. QOS Requirements

This qualifies are categorized by most important issues to be dealt with in any WMSN. Vast amounts of research are carried out mentioned before applications required by real-time streaming/transmission is live-streaming. Real time demanding applications are few losses. Thus, normally all requirements are application specific. Hence given standard service are ensured depending on any given application. To achieve QoS are mainly through ensuring reliability, timeliness and high quality. Following from MMSPEED is very close but got its own drawbacks that bar it from being ideal such as fact that lot of information needs to store in intermediate nodes. Furthermore, it cannot handle network layer aggregation.

3.4. Limited Resources

The WSNs are comprised of tiny devices with limited resources. Moreover, MM applications for additional load on WMSNs in terms of following concepts:

- CPU performance (processing power). This is because MM data is huge size and requires lot of operations such as data encoding, decoding thus faster CPUs should be put in place.
- Memory even data encoding is done, still the data remains huge and hence, generally, WMSNs end up yearning for more memory compared to traditional WSNs.
- Battery power, data rate, among others.

3.5. Energy Consumption

The WSNs energy is a vital resource even more paramount importance for WMSNs if a given standard QoS is to be ensured. In WMSNs are very huge computations are carried out lot of data processing and transmission of huge data inevitable. All operations require energy/power. Unfortunately most energy consuming operations is radio transmission and most common means of transmission in most sensors. Apparently need for energy aware algorithms for WMSNs since the communication functionalities are predict power consumption in WSNs and does not apply to WMSNs [49].

3.6. Bandwidth

We have to keep in mind wireless networks, bandwidth is not limited to unstable. MM streaming requires very high bandwidth deal with the large amounts of data ranging from scalar to multimedia. The high bandwidth and low power spectral density can be provided by Ultra-Wide Band (UWB) technology recently.

3.7. MM In-Network Processing

The huge size of MM data aggregation would great difference and solve couple of issues concerned with WMSNs. However, even if aggregation have successfully applied to scalar data in WSNs, it is very difficult to apply aggregation techniques for WMSNs. This is one of the open research areas for the future.

3.8. Cross-Layer Optimization

The problems and challenges are associated with MM streaming in WSNs differ from stack layer to stack layer. The few tests are fewer implementations for field of WMSNs currently are mainly applied at individual stack layers. Difficult for an efficient and especially energy wise – cross-layer design would be ultimate the best.

3.9. Resource Allocation

The limited nature of WMSN resources methods of allocating these resources throughout network life time should be put prolong for the network is flexible for networks actually need to flexible. Hybrid Automated Repeat Request Schedulers and other functional blocks operate seamlessly coupled for Dynamic Resource Allocation techniques so as to go this issue more for systems that requires flexibility to transmit broad band traffic.

3.10. End-to-End Throughput

This is responsible for links in a WMSN for source to sink regardless route used. There is no protocol specifically designed for this purpose yet it is of paramount importance for performance and QoS is to be achieved. Two protocols were suggested:

- The Radio Link Control protocol (RLP or RLC) [50] - is based on Nacknowledgements (NACK) are does not retransmission timeouts. It is also used for Universal Mobile Telecommunications Systems.
- Adaptive Selective Repeat protocol (ASR) [51] - relies for retransmission timeouts for configured dynamically.

3.11. Routing

Routing is another crucial challenging issue are concerned in the field. Along with it come issues for end to end delay from having transfer huge data and also rather long session periods. These efficient routing algorithms are used to routing becomes a complicated issue because;

- Huge amount of data to be concerned with. The creates node need to transport the various packets separately various paths for efficient transmission: the so called multipath transmission.
- Since end to end delay is vital in MM applications, especially preferred to choose the shortest path possible as this contributes to the overall performance of the network. Choosing the shortest path and yet, sometimes, simultaneously considering the multipath factor is not an easy task.
- Sometimes some nodes get overloaded with packets. These nodes need to be successfully bypassed subsequent packets. Such nodes are need to be noticed and bypassed dynamically since routes keep changing time to time which is challenging to overcome.
- The solutions offered to some of the above problems, discussed in short as follows:
- Use the shortest path possible to reduce the end to end delays.
- Implement less complex algorithms are trying to solve problems regarding routing.

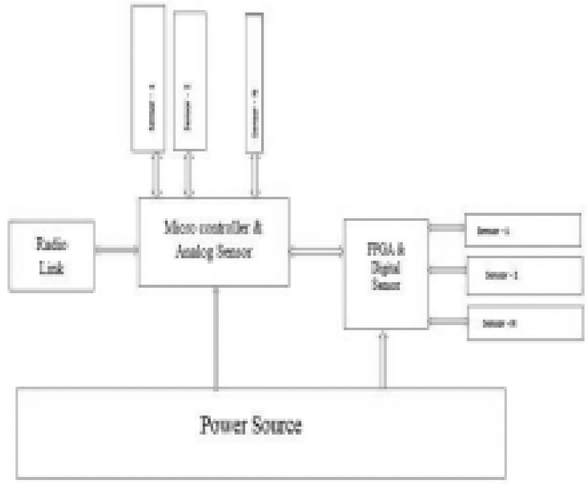

Figure 2: Sensor node architecture

The architecture of the nodes is shown. Microcontroller is the heart of the system and it supports peripherals for Analog to Digital conversion. The computational task of the system includes processing of locally sensed information and the information obtained from other sensor. Microcontroller with inbuilt analog to Digital converter performs digital conversion, filtering, Processing and communication with the monitoring station. Sensor Block includes elements which are intended to take measurement from the environment. For Multi modal sensing several sensors are present on board. The sensors of a reconfigurable node can be categorized into analog and digital sensors. Signals which are obtained from analog sensors are connected to the ADC of the microcontroller. Digital Sensors send signals to the FPGA, and they have sensors with digital interfaces. Microcontroller in the system acts as a master device and sends control signals to the FPGA. This will activate the appropriate sensor interface. The processing of data obtained from the digital sensors will be performed by the micro controller. The analog sensors will be continuously sensing and sending the data to the node, while the digital sensors can be controlled through some reconfiguration code disseminated throughout the network. By this the system is made energy efficient. ZigBee module is used for communication between the nodes for transmission, reception of data and Passing the reconfiguration code. Microcontroller acts as a configuration controller that takes care of loading the dynamic modules.

4. RESULTS AND DISCUSSION

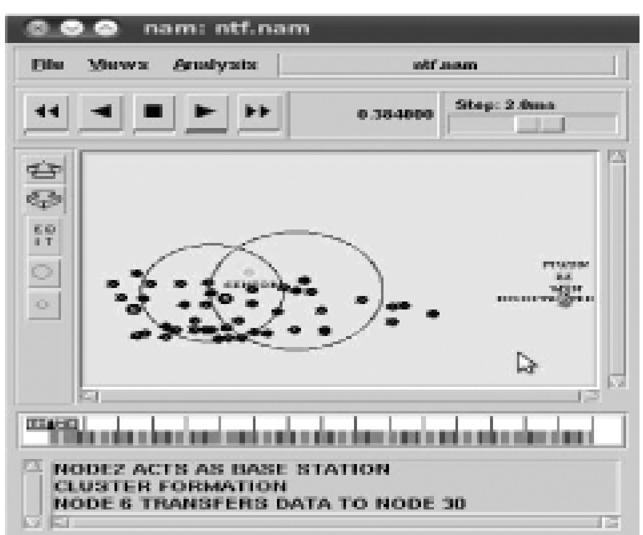

Figure 3: Base Station is used to create cluster formation

In above figure is Base station is used to constructed cluster formation. In AODV protocol is 50 nodes used.

In above figure is Energy consume for WSN and MWSN. In AODV protocol is 50 nodes used.

In above figure is energy reserves for WSN and MWSN values are plotted in graph. In AODV protocol is 50 nodes used.

In above figure is node percentage for WSN and MWSN values are plotted in graph. In AODV protocol is 50 nodes used.

In above figure is No. of Intruder nodes for WSN and MWSN values are plotted in graph. In AODV protocol is 50 nodes used.

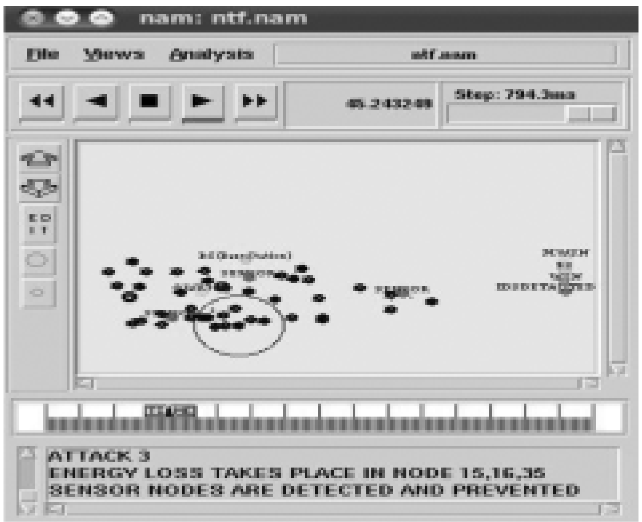

Figure 4: Energy consume for WSN and MWSN

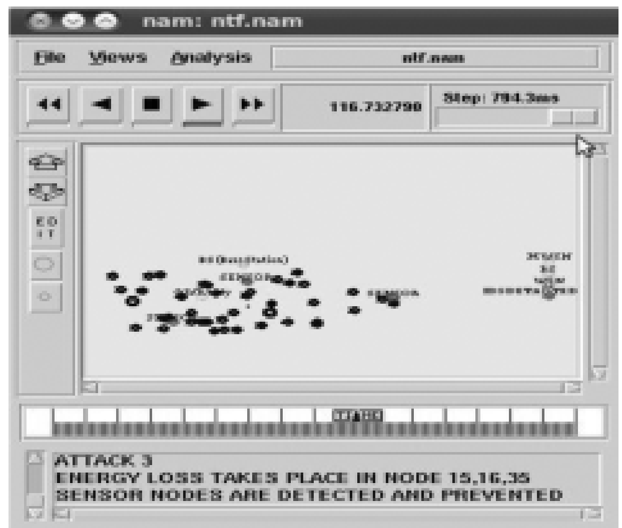

Figure 5: Sensor node attack detected for WSN and MWSN

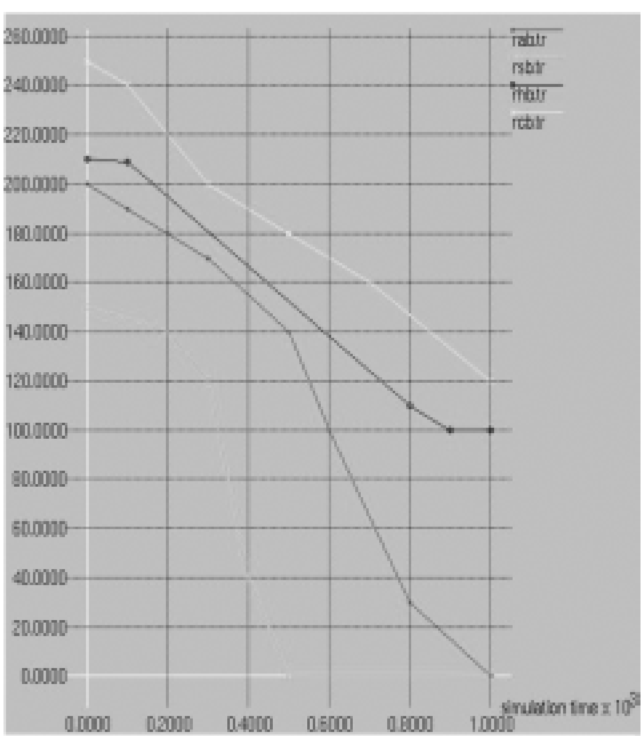

Figure 6: Energy reserves for WSN and MWSN

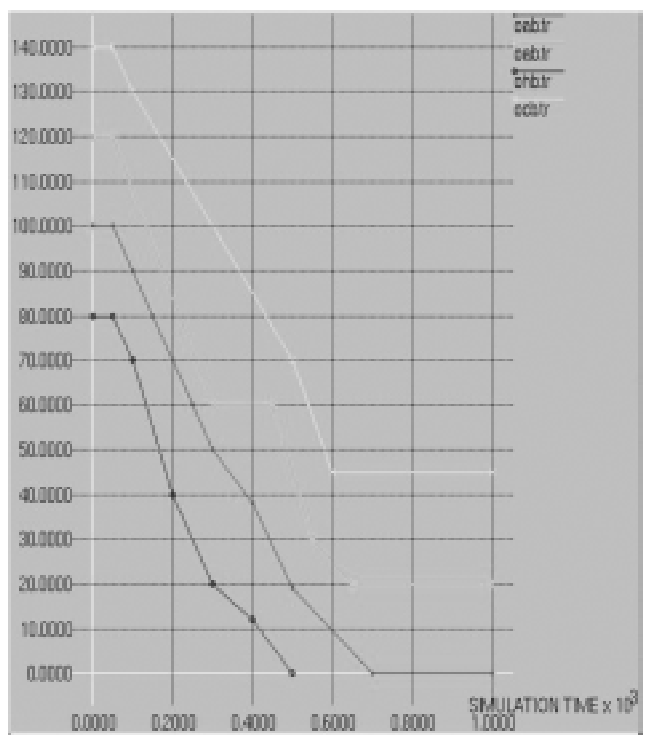

Figure 7: Node percentage over simulation time

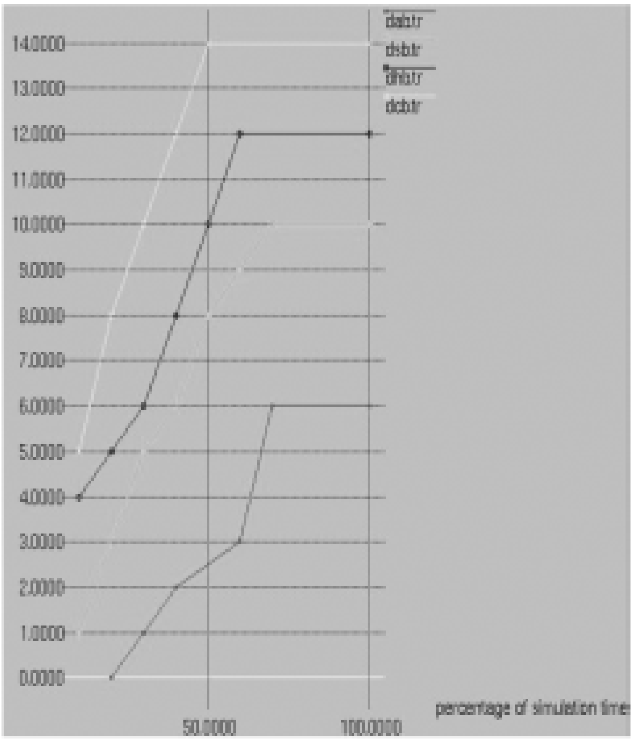

Figure 8: No. of Intruder nodes over simulation time

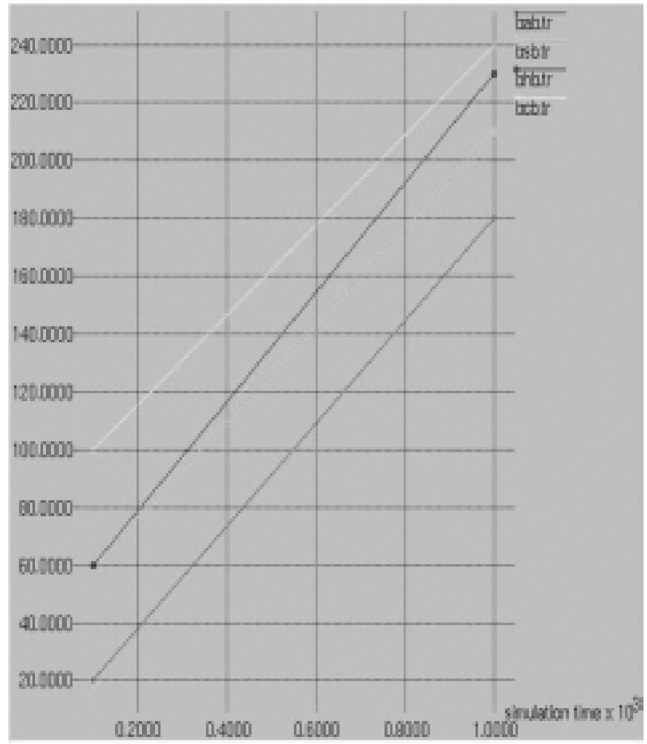

Figure 9: MSG to the BS over simulation time

In above figure is MSG to the BS for WSN and MWSN values are plotted in graph. In AODV protocol is 50 nodes used.

5. CONCLUSION

The proposed work can be used in WSN application fields where the system is expected to be flexible with ultra-low operation. As the technology of WSN has potential for numerous applications, flexibility becomes essential in improving the performance. Control of network is made possible without need to physically reach the deployment site. The updates used are essential in achieving new functionalities. Real time implementation is possible using FPGA, microprocessors, analog sensors, digital sensors and communication module. PC can be made as a server in the reconfiguration process and the desired data can be collected from the network in an efficient way with power management strategies. Algorithms used in reconfiguration aim at reliable updating mechanism and aggregation aim at reduction in power consumption. At the pc side, application can be build for collecting data and sending commands from the server.

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