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Energy Efficiency in Wireless Sensor Network for Risk Analysis using RMS Algorithm

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ABSTRACT

This paper focus on the reduction of battery draining in the wireless sensor network using big data technique, and avoiding the failure of nodes in wireless sensor network, also to avoid repeated transmission and energy wastage in network, data collision through the repeated transmission. It will monitor the values of sensor and make the decision whether the value is risk or not, if the value is found as risk the data will be pre-request and transmitted to the server.

1. INTRODUCTION

In wireless sensor network, all the sensor nodes are battery operated. So there is a major role for battery life time. We required battery source for data transmission. When the same data is transmitted frequently, then there is a chance of fast draining of battery. To avoid the fast draining of battery, here introduced a concept called big data. Big data is the technique where the battery draining is reduced by sending the request for data to the node from the server so that only the data required by the server will be transmitted by the node to server or base station. In existing system, the sensed data is transmitted in a particular time interval only if there is a change in the sensor value. In proposed system, the data is transmitted only when there is a request for sensor value from the server or base station. So we can avoid the repeated transmission of same data. Also it will monitor the values of sensor and make the decision whether the value is risk or not, if the value is found as risk the data will be pre-request and transmitted to the server. Battery power consumed in the network is shown by plotting the graphs for residual energy and the through put with and without RMS algorithm. When compared with the existing system, the residual energy is high &throughput is low. The simulation is done by using NS2 software.

2. LITERATURE SURVEY

Big data represent a new era in data exploration and utilization and covers various industrial applications, for example, professionalizing business intelligence operation in the automobile industry, solving routing and scheduling problems in transportation systems, improving the performance of supply chains by minimizing the negative effect of demand uncertainties, providing security for buildings and physical infrastructure in home surveillance and security systems, and analyzing supply chains with radio-frequency identification technology from both the risk and benefit perspectives.

Viaene proposed IT departments are under pressure to serve their enterprises by professionalizing their business intelligence (BI) operation. When their systematic and structured approach to BI is linked into the business, companies can be effective.

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Hing Kai Chan; Chan, F.T.S. proposed, Many optimization techniques have been proposed over the years to improve the supply chains performance. Although these approaches have been shown to be effective, most of them were developed without considering difficulties in supply chains to simplify the analysis. In fact, uncertainties can deteriorate the performance of supply.

Tsan-Ming Choi proposed RFID technology is an important tool in modern supply chain management. This paper analytically studies the RFID uses in a two-echelon single-manufacturer single-retailer supply chain with the vendor managed inventory (VMI) scheme. First, modals of the supply chain under a retail replenishment problem with and without RFID are constructed. Second, both the risk levels and the expected profits of the supply chains are explored. Third, the supply chains with and without RFID measurement which can coordinate are proposed.

Gaukler, G.M. proposed a model to help evaluate the impact of an introduction of item-level radio-frequency identification (RFID) in a retail environment where commonly in stock-out-based substitution. There are two main thrust areas in this work. First, the impact of RFID in a centralized setting are examined where retailer and manufacturer are one entity. This thrust area is concerned with evaluating the RFID profitability and exploring which product properties favour an RFID implementation. Second, the impact of RFID in a decentralized setting are examined, where retailer and manufacturer independently maximize their profits. The problem of sharing the costs of RFID, from both the perspective of tag costs and fixed costs are investigated.

Kumar Somappa, A.A; Kristensen, L.M. proposed wireless Sensor Networks (WSNs) are applicable in numerous domains, it includes industrial automation where WSNs may be used for monitoring and control of industrial plants and equipment. However, the requirements of the industrial systems differ from the general WSN requirements. In recent years, standards have been defined by several industrial alliances.

W. Shen, T. Zhang, F. Barac, M. Gidlund presented the first priority-enhanced MAC protocol that is compatible with industrial standards for industrial wireless sensors and actuator networks. The experimental results show that the proposed protocol achieves a higher performance than those obtained by current industrial standards.

B. C. Villaverde, S. Rea, D. Pesch presented a route selection algorithm. In the algorithm, local information is shared among neighboring nodes to meet the requirements of industrial applications. Simulation results show that the proposed algorithm satisfies a typical quality of service requirements with low control overhead. The aforementioned routing protocols obtain good performance for different application environments. However, their performances are not ideal when gathering real-time big data for risk analysis of industrial operations because they did not comprehensively consider the signal transmission characteristics and routing requirements for industrial WSN.

3. EXISTING SYSTEM

A major challenge for WSN is ensuring that real-time data can be transmitted to the data center. Sensor nodes require enough energy to relay the data gathered by many surrounding sensors. Therefore, energy is one of the most important indicators in WSN and energy consumption should be managed well to maximize network lifetime. To solve the aforementioned problems, an energy-efficient routing algorithm for WSN needs to be designed to gather big data in real time.

Figure.1 shows the block diagram of the nodes at the existing system which consists of sensor input, signal conditioning multiplexer, A/D convertor, battery, microcontroller, RF transceiver and the FLASH EEPROM.

In existing system, three typical experimental scenarios are selected, namely, residence, office and factory environments. The received signal strength indicator (RSSI) values of nodes are tested in different environments, different locations of the same environment, and dynamic environments. The signal

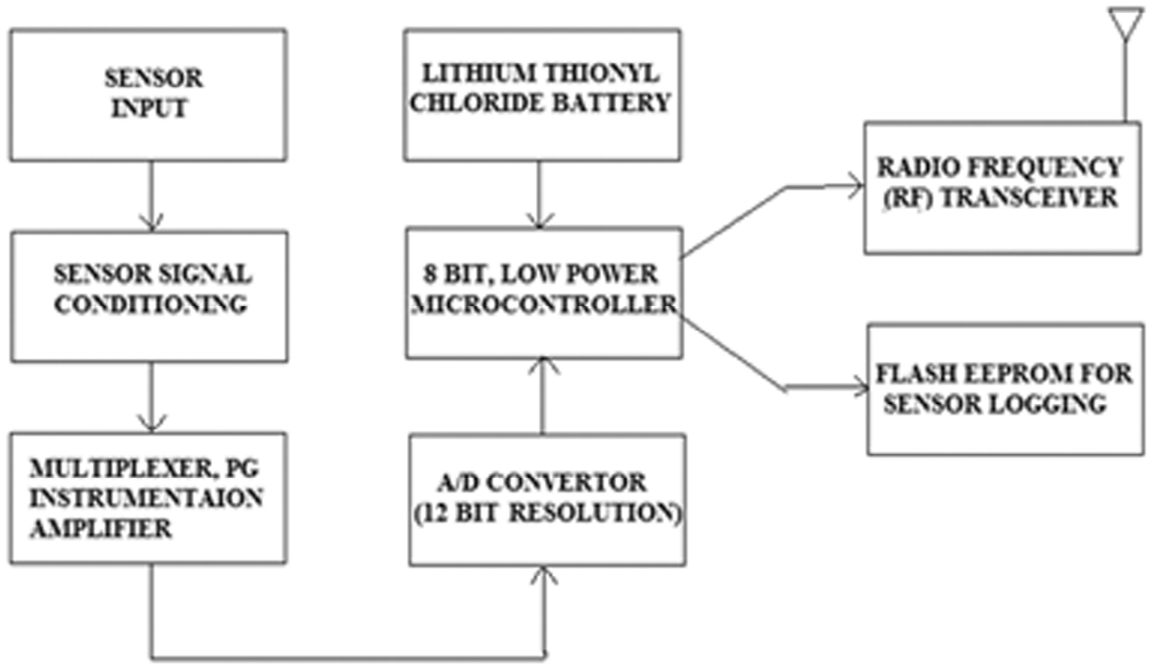

Figure 1: Sketch for Existing System

transmission characteristics in an indoor environment are analyzed on the basis of the test results. According to the characteristics, an adaptive clustering routing algorithm based on RSSI called real-time big data gathering (RTBDG) is proposed to gather real-time big data for the risk analysis of industrial operations. The proposed RTBDG algorithm can adaptively build routing with changes in indoor environment. The experimental results show that RTBDG can obtain a better performance in the aspect of energy consumption than the other three algorithms.

4. TESTING SYSTEM

The testing system is designed using the following parameters: a signal center frequency of 2.4 GHz, a maximum data transfer rate of 250 kbps, and an output power of the transmitter node of 3.2 dBm. The wireless sensor nodes are in a stationary state, and no interference exists from moving object. The RSSI value for the residence environment, office environment and industry environment are tested in a typical residence, multi-person office and integrated circuit chip manufacturing laboratory.

5. RTBDG Algorithm

Nodes are deployed on a rectangular field; the networks are supposed to have the following properties:

1) Sensor nodes are immobile after being deployed.
2) All nodes are homogeneous and energy constrained.
3) BS can send signals of sufficient strength so that all nodes can receive its signals.
4) BS knows the network topology.
5) Sensor nodes send data with a fixed transmission power.
6) The propagation channel is symmetrical.

The RTBDG algorithm proposed to gather big data used in the risk analysis of industrial operations. Therefore, sensor nodes should screen the gathered data according to the requirements of risk analysis. The screening process can be described as follows:

1) The normal reference ranges of the data collected by sensor nodes are established.
2) Data are collected at a regular time interval t_1.
3) The data collected by sensor nodes with a normal reference value are compared. If these data are within the normal reference ranges, the data are stored at a regular time interval t_2 ($t_2 n\ t_1$, n is a natural number and can be set according to the requirements of risk analysis). Otherwise, both the abnormal and stored data are transmitted to BS by the established routes.
4) If the amount of data stored in sensor nodes reaches the preset upper limit value of the storage capacity, all of the stored data are also transmitted to BS by the established routes.

6. CONCLUSION

The RTBDG algorithm can achieve high performance in the aspect of energy consumption and network lifetime for gathering big data in real time.

6.1. Advantage

1) The sensor values are screened by the node controller unit.
2) If any change occurs in the constant sensor value, the data will be transmitted to the server.
3) The data will have transmitted only when values from the sensors changes.
4) So we can avoid transmitting the repeated or same value from node to receiver.
5) So the energy wastage can be avoided.

6.2. Limitations

1) Accuracy of the sensor values can be affected due to environmental condition.
2) So frequent fluctuations may occur which leads to continuous transmission of changed values to the server.
3) Battery power draining also makes some changes in recorded sensor values.

7. PROPOSED SYSTEM

In proposed system we consider an intelligent node which monitors all the sensor values and also monitor the level of battery and adjust the sampling rate for the sensors. Then it will monitor the values of sensor and make the decision whether the value is risk or not. If the value is found as risk the data will be transmitted to the server in other cause in order to pre-request by the server data can be transmitted. Following figure shows the block diagram for proposed system at the single node. Each node consists of two or more sensors for monitoring the sensed values.

7.1. Normal Data Transmission

Figure 2 shows the data will be transmitted frequently with or without time interval. Due to frequent transmission of data from sensor node to base station, the battery will have drained soon.

7.2. Transmission Using Big Data

When we are using big data, the data will be transmitted only if the pre-request is send by the base station to the sensor node. So we can avoid battery draining and can reduce it.

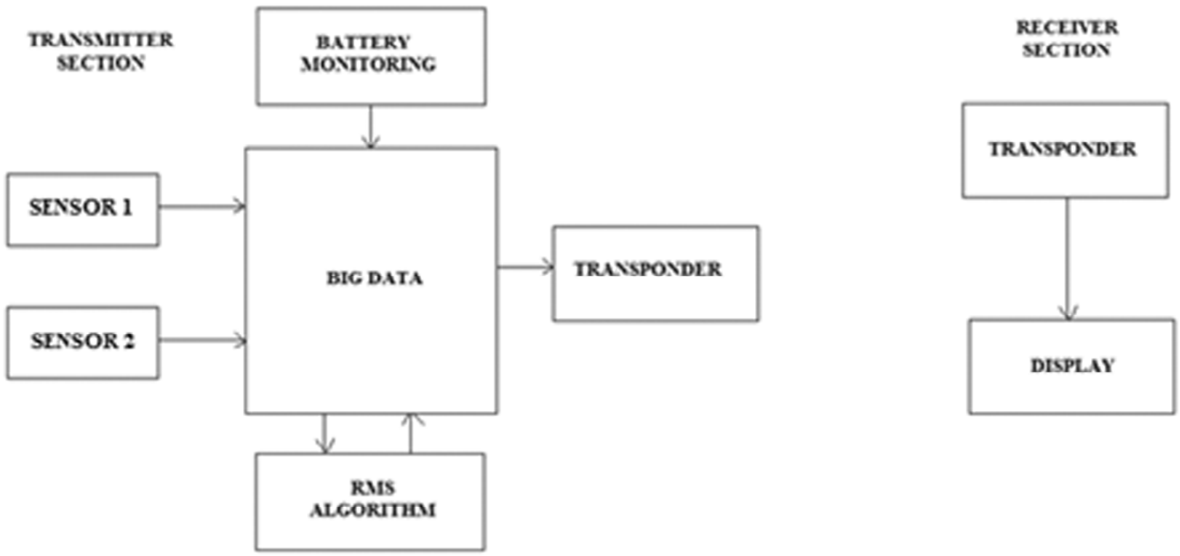

Figure 2a: Sketch for Proposed System

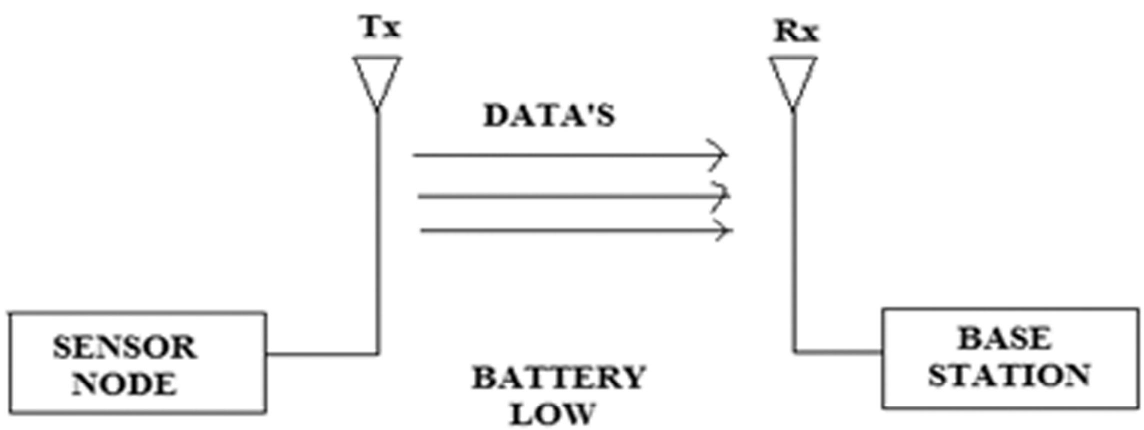

Figure 2b: Normal Data Transmission

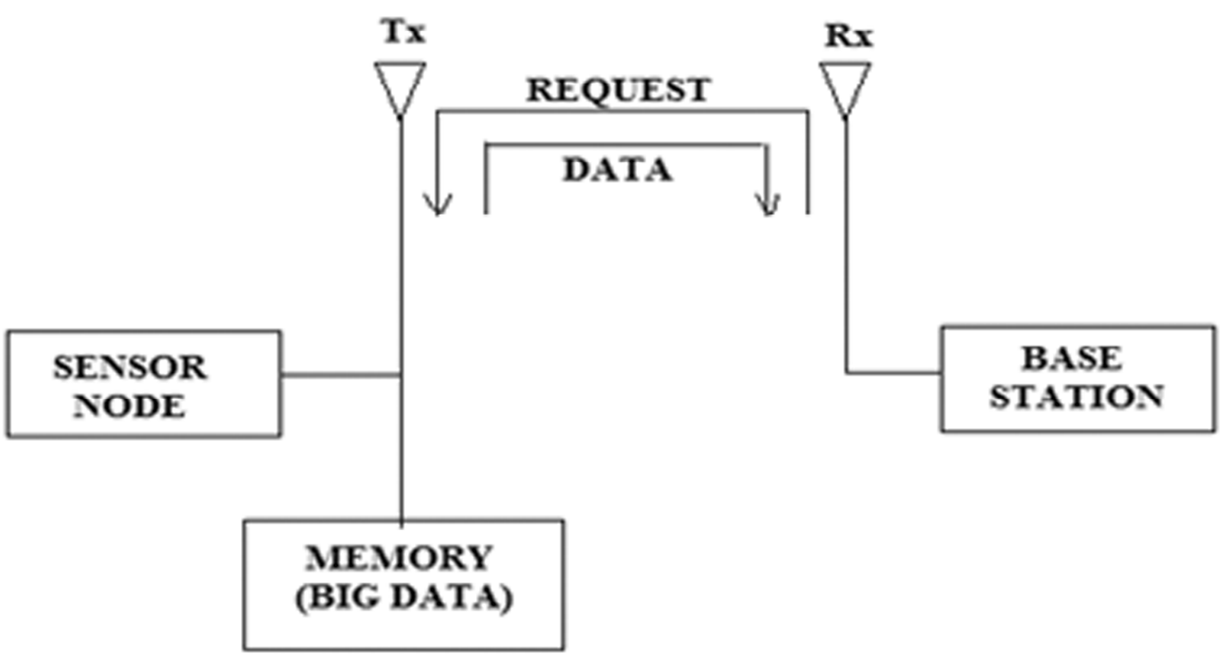

Figure 3: Data Transmission Using Big Data

8. NS2 SIMULATION OUTPUTS

The main objective of proposed system is to reduce the draining of battery life by avoiding repeated data transmission, energy wastage in network and to avoid data collision through the repeated transmission. The reduction of battery draining in proposed system output can be analyzed by plotting the graph for throughput &residual energy with and without RMS algorithm.

Output Graphs

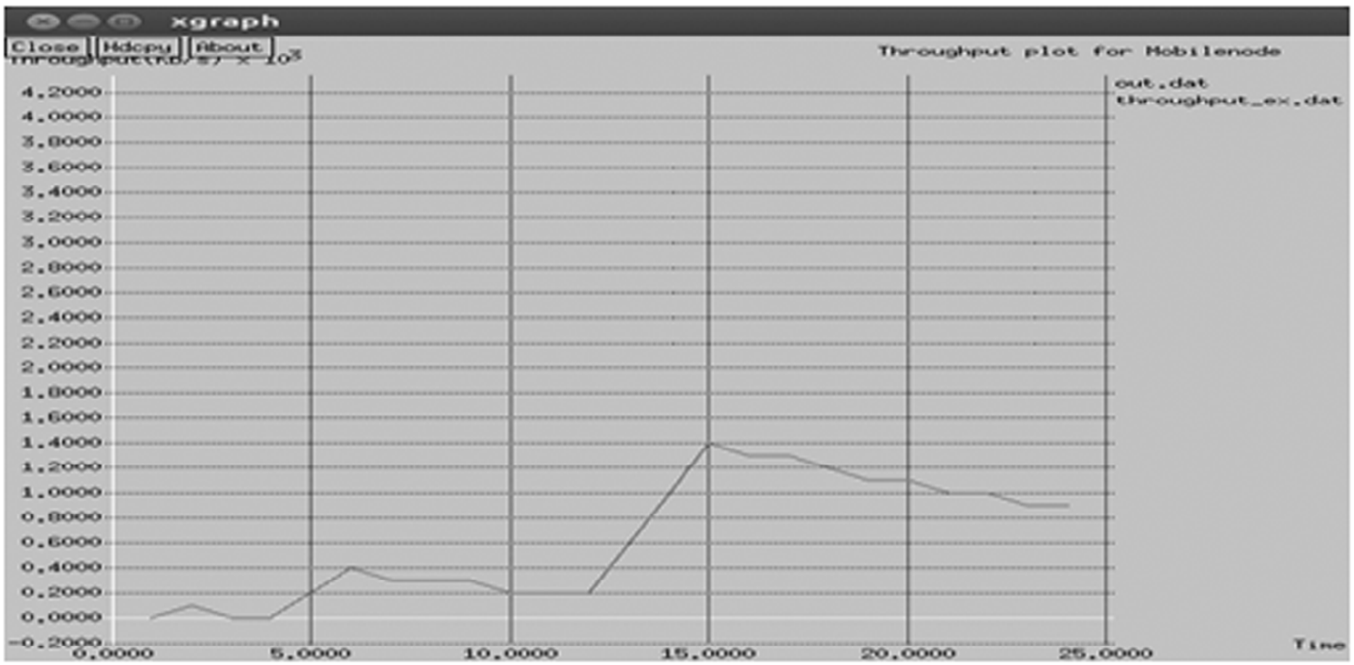

Figure 4a: Through Put

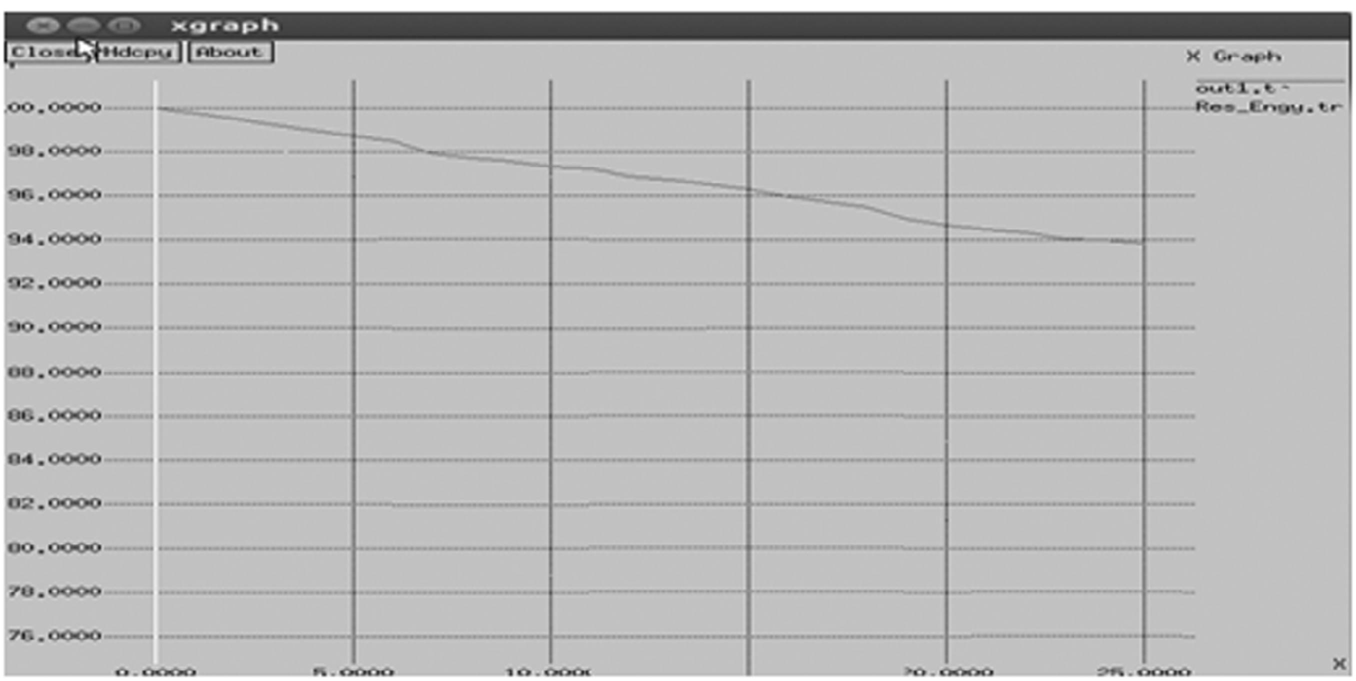

Figure 4b: Residual Energy

Comparison of Graphs

The figure 5 shows the improvements in the residual energy of the existing system Vs proposed system.

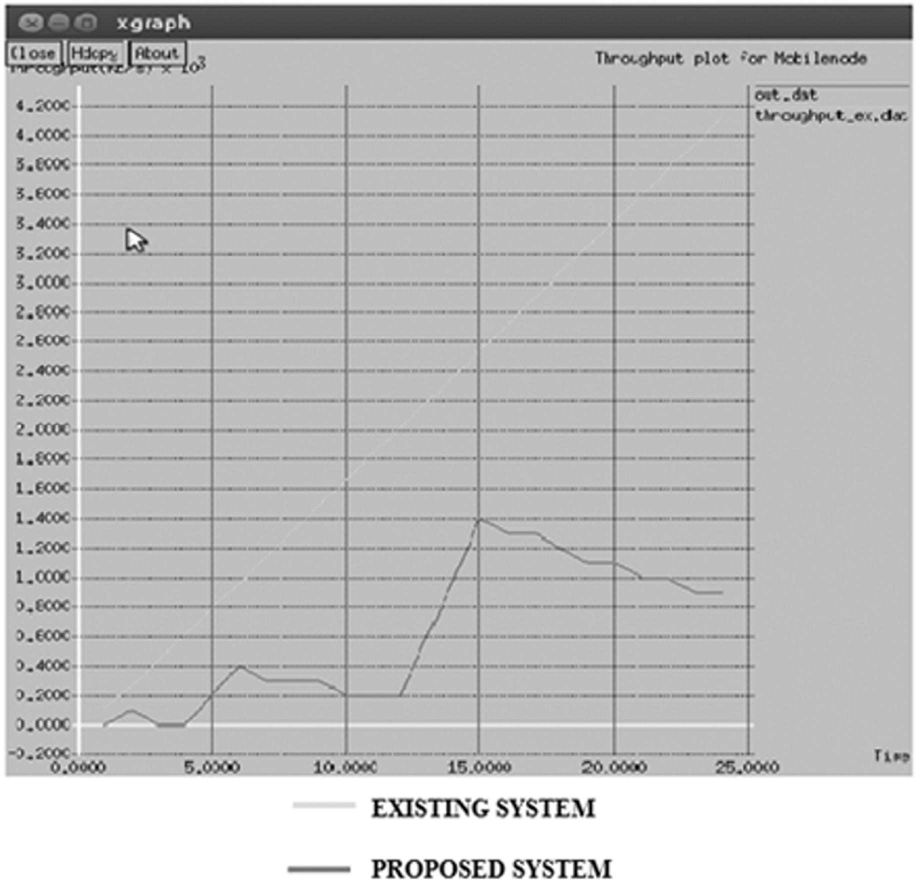

Figure 5a: Through put Comparison

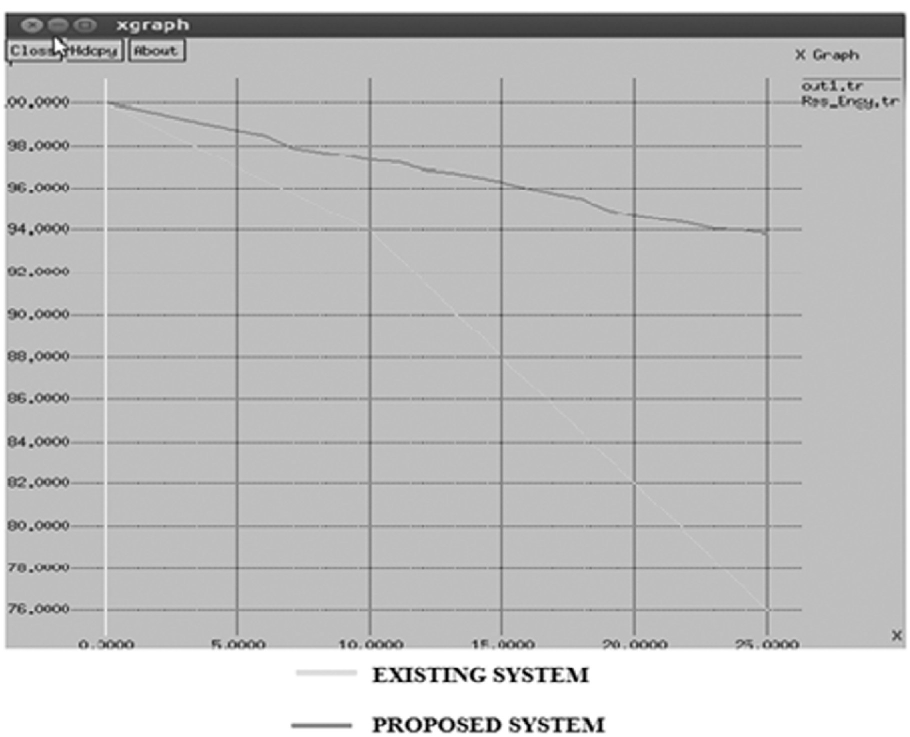

Figure 5b: Residual Energy Comparison

6. CONCLUSION AND FUTURE WORK

Big Data gathering and analysis is performed and energy efficiency is achieved through RSM algorithm by controlling the data transfer between the nodes and base station. The result has been generated using ns2 simulation. Throughput and residual energy are plotted by comparing with RSM algorithm and without RMS algorithm in big data analysis. The result clearly shows the difference in both methods. Data transferring rate has been reduced which proportionally increases the nodes lifetime and RMS algorithm provides maximum processing efficiency for individual nodes making them more intelligent. And in other case data connection is established between the nodes and base station if base station needs to record the values collected in the nodes. Only for this two cases communication is established, so transmission of data in the network was reduced which proportionally decreases the consumption of power in network and increases the life time of the network.

The analysis is performed using ns2 simulation tool. In future work the network is created using PIC 16F877A microcontroller which acts as brain of the nodes and tarang RF module is used for developing a WSN network. The completed work which submitted as simulation was implemented in hardware and analyses the output to prove this method is more efficient than other methods proposed in base work.

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