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DEVELOPMENT OF POWER EFFICIENT MECHANISM FOR WIRELESS SENSOR NETWORK

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Abstract - *Sensor Networks are dense wireless networks with small, low cost sensors. It is emerged as promising paradigm to monitor the physical world through sensing, processing and communicating environmental data. The applications of wireless sensor network include health, military, environmental, home, & other commercial areas. Due to the battery constrained sensor nodes, power consumption is a major challenge in wireless sensor network.*

There is a high demand for a power efficient mechanism in wireless sensor network. In this paper, a power efficient mechanism for sensor deployment (PEMS) method is proposed to reduce power consumption. The proposed model was implemented in Cooja Simulator. The results show that PEMS method provides less power consumption comparing to the existing deployment method.

Keywords: *Wireless Sensor Network, Power Consumption, Cooja Simulator*

1. Introduction

A Computer Network is a communication network for sharing resources between nodes, computing devices that use a common telecommunications technology. Computer networks support many applications and services, such as access to the World Wide Web, digital video, digital audio, storage servers, printers, and use of email and some other instant messaging applications.

Sensors have the capability to collect large amounts of unknown data. WSNs to become truly ubiquitous, a number of challenges and obstacles must be overcome. There are several challenges for Wireless Sensor Network. They are mobility, heterogeneity of nodes, power constrained nodes using batteries and so on.

Power consumption is the energy used per unit time. Power consumption is of great importance in digital systems. The battery life of portable systems such as cell phones and laptop computers is limited by power consumption. The critical issue is in development of Wireless Sensor Networks applications is the limited amount of energy usually available in the motes. An application can take years to drain the sensor nodes battery or consume it in a matter of weeks. Wireless Sensor Network's operational life strongly depends on the power consumption. The rest of the paper is organized as follows : section 2 describes literature review , section 3 methodology, section 4 results and finally concluded with the section 5.

2. Literature survey

Ruay-Shiung Chang and Chia-Jou Kuo[1] said that one of the major issues in wireless sensor network is developing an energy-efficient routing protocol. Since the sensor nodes have limited available power, energy conservation is a critical issue in wireless sensor network for nodes and network life. Mohamed

Elshrkawey Samiha and M.Elsherif[2] described that Wireless Sensor Networks (WSN) consist of low power devices that are distributed in geographically isolated areas. The energy consumption is an important concern for WSN.

Navdeep Singh Randhawa et.al[3] explained that In wireless sensor network, the energy efficiency protocols are utilized to improve the energy conservation of the system and enhance the lifetime. Sanjeev Ghosh and Srija Unnikrishnad [4] elaborated that Technological advancements in low power integrated circuits and wireless communications have made it possible to use efficient, low cost, low power small devices in remote sensing applications.

A very important issue in wireless sensor networks is the scarcity of power and hence optimal use of available power is of prime importance.

Silvio Croce, Francesco Marcelloni[5] in their work titled "Reducing Power Consumption in Wireless Sensor Networks Using a Novel Approach to Data Aggregation" said that Saving energy is a very critical issue in wireless sensor networks (WSNs) since sensor nodes are typically powered by batteries with a limited capacity.

Lourthu Hepziba Mercy.M, Balamurugan.K et.al[6] said that Wireless sensor network requires robust and energy efficient communication protocols to minimize the energy consumption as much as possible.

Noor Zaman[7] said that Wireless Sensor Network (WSN) is known to be a highly resource constrained class of network where energy consumption is one of the prime concerns.

Mohammed Saad Talib[8] described that Energy in Wireless Sensor networks (WSNs) represents an essential factor in designing, controlling and operating the sensor networks. Minimizing the consumed energy in WSNs application is a crucial issue for the network effectiveness and efficiency in terms of lifetime, cost and operation. Antônio Dâmaso et.al[9] concluded that Power consumption is the main concern in developing Wireless Sensor Network (WSN) applications.

3. Proposed system and Methodology

Wireless Sensor Network is a group of dispersed and dedicated sensors for monitoring and collecting and storing the physical conditions of the environment and organizing that data at a location. Power Consumption is a major challenge in wireless sensor network. One of the famous mechanisms for deploying the sensors is Ellipse deployment method.

There is a necessity to still development more power efficient mechanisms. In this paper, Power Efficient Mechanism for Sensor network (PEMS model was developed to reduce the power consumption, so that network lifetime can be extended. In PEMS method, the motes are deployed in centroid positions of a triangular arrangement.

Algorithm

INPUT: Sender motes and receiver or sink motes

OUTPUT: Optimized power consumed value

Step-1: Deploy the required motes into the canvas

Step-2: Calculate the triangle positions to deploy

Step -3: Place the motes at the calculated positions

Step -4: Set the sender mote and receiver mote

Step -5: Perform operations like transferring of packets

Step -6: check out the average power consumed value

4. Experimental Results

Cooja simulator is efficient to simulate wireless sensor networks. Cooja simulator is the default simulator of contiki operating system which helps to simulate the wireless sensor networks in addition to that it helps to do the performance evolution. Contiki operating system is a light weight operating system which is developed mainly for wireless sensor nodes.

Different types of motes that are available in the simulator are Sky mote, Z1 mote, Cooja mote and so on. In this paper, the motes utilised are sky mote and Z1 mote. Where Sky mote is a low power wireless sensor module which has many things to provide like high data rate sensor network applications, requiring ultra low power.

The ellipse deployment model was treated as the existing system in which motes were deployed in an elliptical fashion. In PEMS model the motes are deployed at the centre position of the triangular regions.

Parameter	Description
Motes	30 sender motes and 1sink mote which is of sky mote type
Deployment model	Elliptical , PEMs
Protocol	RPL

Table 1: Parameters used in the Simulation

The following diagrams illustrate the various performance parameters such as average power consumption,

Average Power Consumption:

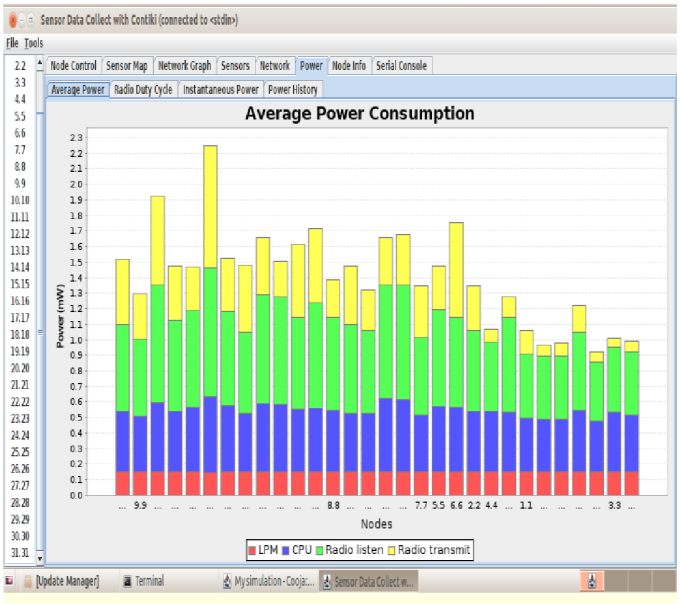

Figure 1: Average power consumption

Network graphs show interconnections between a set of entities. An entity represents a node or mote.

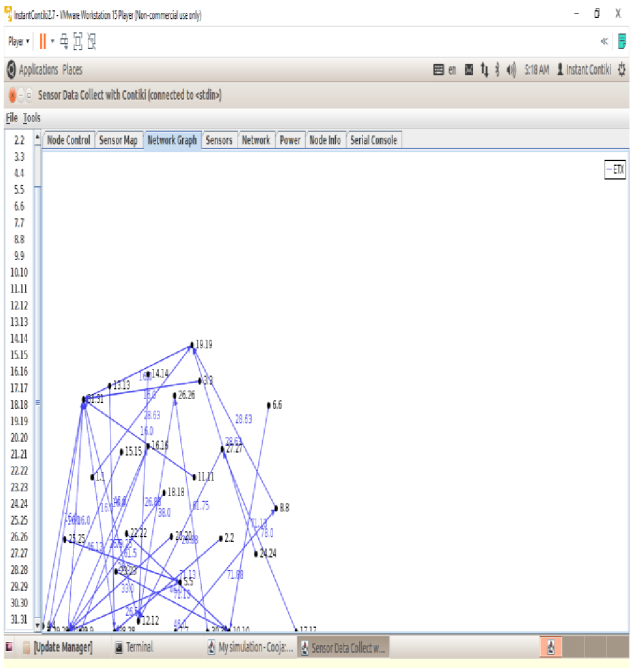

Figure 2: Network graph

Sensor Map is mapping / interconnecting of set of nodes.

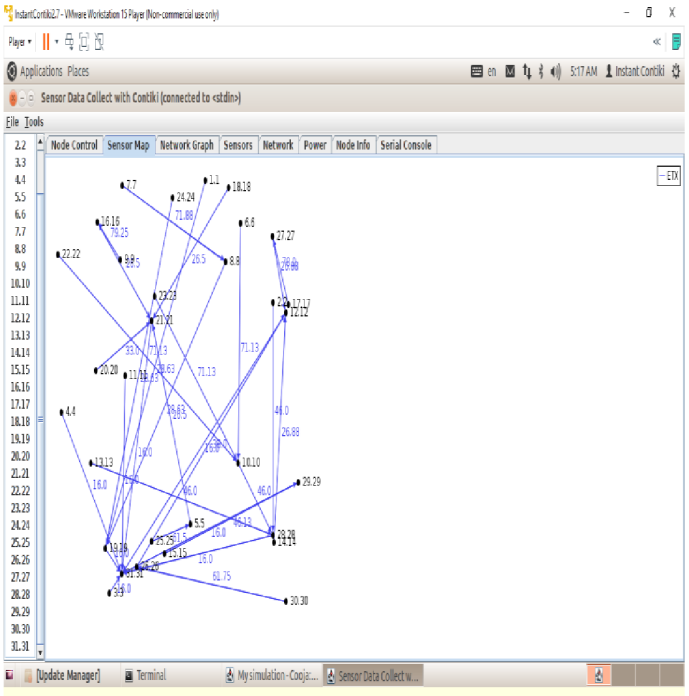

Figure 3: Sensor map

Graphs for CPU Power, LPM Power, Listen Power, Transmit Power and also entire Power

CPU Power:

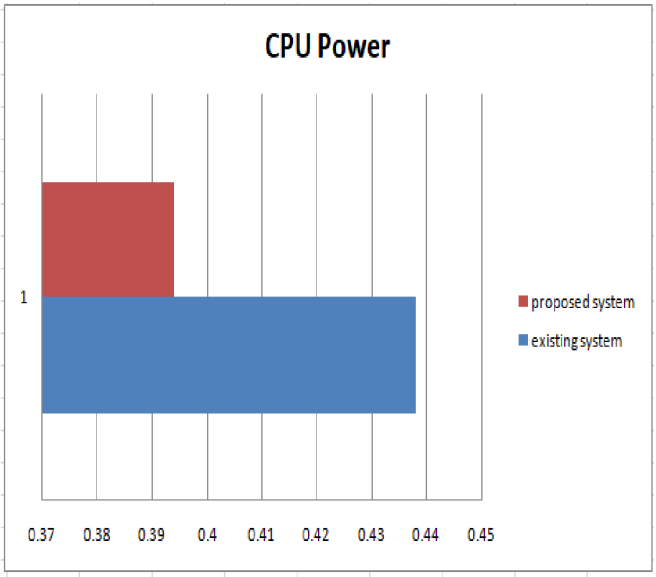

Figure 4: CPU Power

LPM Power:

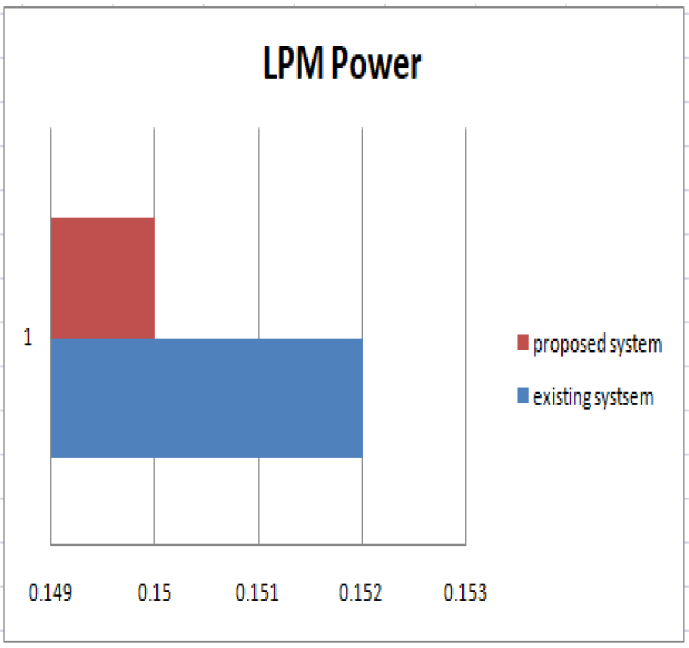

Figure 5: LPM Power

Transmit Power:

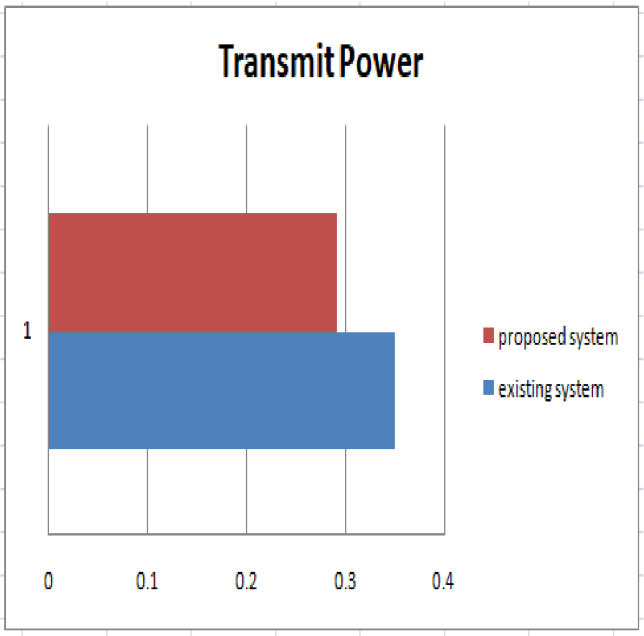

Figure 7: Transmit Power

Listen Power:

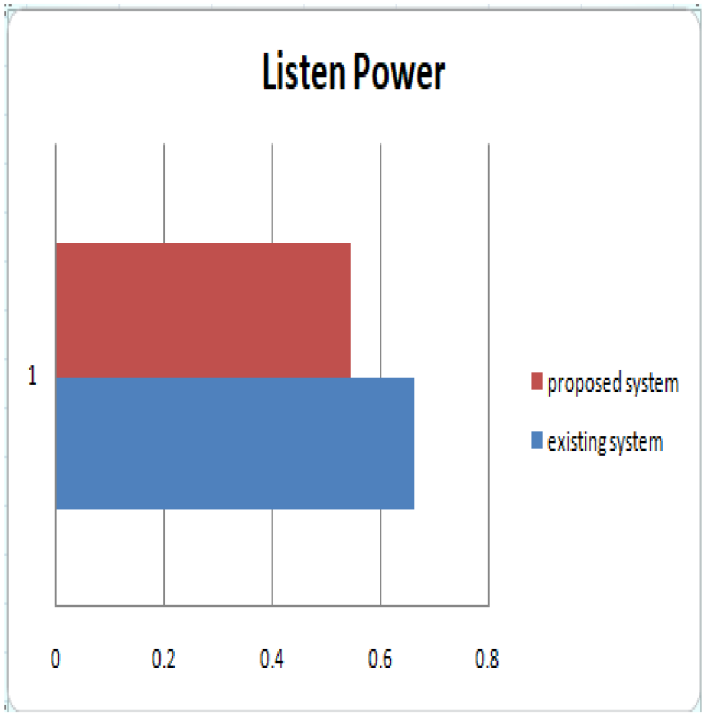

Figure 6: Listen Power

Power:

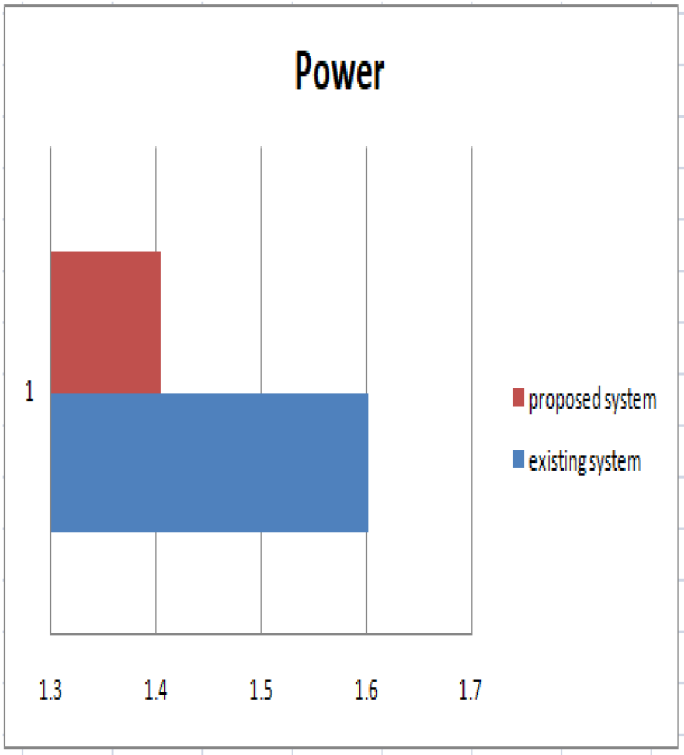

Figure 8: Power

Comparative study:

Comparison b/w the results of existing system and proposed system

	Existing System	Proposed System
CPU Power	0.438	0.394
LPM Power	0.152	0.150
Listen Power	0.663	0.546
Transmit Power	0.351	0.292
Power	1.602	1.404

5. Conclusion and Future Scope

Wireless Sensor Network (WSN) is a network of a large number of wireless sensors used to monitor the system, physical or environmental conditions. In this PEMS model and elliptical model are evaluated through simulation using cooja simulator.

PEMS algorithm reduces power consumption and in extending the network life time compared to the other Elliptical deployment model. In future, artificial intelligence mechanisms can be used to mitigate the deployment patterns.

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