ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 1, Issue 5, November 2012

ENHANCING PERFORMANCE OF A WIRELESS SENSOR NETWORK BY APPLYING AN ENERGY CONTRIBUTIVE APPROACH

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ABSTARCT—Wireless Sensor networks are dense wireless networks of small sensors, which collect and disseminate environmental data. Wireless sensors, and the arrangement of these small, electronic devices into radio networks, have introduced the capability of remotely monitoring a physical environment for a wide variety of parameters. There are many issues in wireless sensor network of concern one of them is minimizing the energy consumption in wireless sensor network and increasing the performance. There are various parameter to measure performance of system we have taken two parameters like packet delivery ratio and throughput to indicate performance of the network. In this paper we have proposed a energy contributive approach. With that approach we not only saved the consumed energy but it also increased the performance of the network. Due to this approach power for sleep cycle in wireless sensor network gets reduced and throughput and packet delivery ratio also increased.

Keywords- Medium Acess Control, Wireless Sensor Networks, PDR,Throghput, Energy contributive approach.

1. Introduction

Wireless sensor network (WSN) is a network of small spatially distributed devices that can communicate with each other over the air. WSNs have attracted wide interests from both academic and industrial communities due to their diversity of applications. In a typical application, a WSN is scattered in a region where it is meant to collect data through its sensor nodes. This low cost, low power device, ad hoc deployment and adaptability wireless sensor is commonly used in home automation, environment habitat monitoring, healthcare applications and even military application [5].

Sensor network is formed with group of nodes. Few sensors data are required by the user, which are called the source node. These sensors share a common channel. Generally the end node where data is processed is far away from the sources and due to lack of any fixed infrastructure, sources transmit data through the intermediate nodes. A sensor participates in two types of operations, sensing and data forwarding of the data coming from other nodes. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node, also known as a mote is a node in a wireless sensor network that is capable of performing some processing, gathering sensory data and communicating with other connected nodes in the network [3, 4]. Wireless Sensor Networks can be applied to a range of applications monitoring of space which includes environmental and habitat monitoring, indoor climate control, surveillance etc.; monitoring things for example structural monitoring, condition-based equipment maintenance etc.; and monitoring the interactions of things with each other and the surrounding space e.g., emergency response, disaster management, healthcare etc.

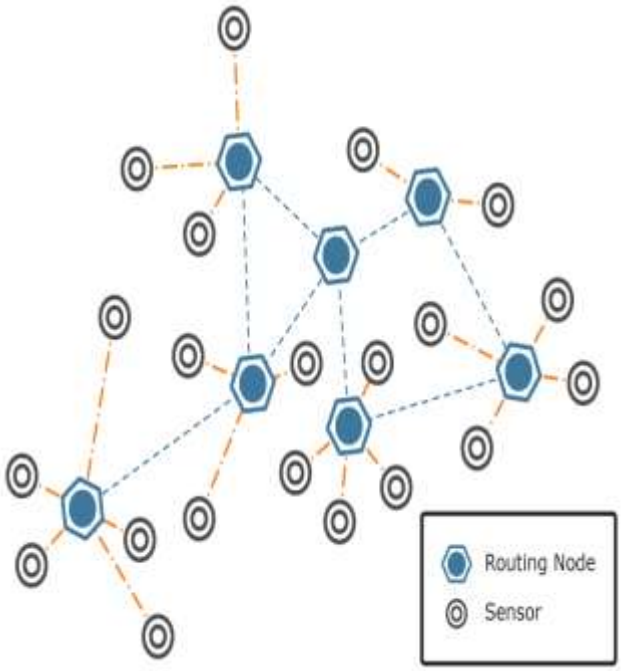


Figure1. Wireless Sensor Network Architecture

2. Sensor

Sensors are hardware devices that produce a measurable response to a change in a physical condition like temperature or pressure. Sensors measure physical data of the parameter to be monitored. The continual analog signal produced by the sensors is digitized by an analog-to-digital converter and sent to controllers for further processing [4, 5]. A sensor node should be small in size,

consume extremely low energy, operate in high volumetric densities, be autonomous and operate unattended, and be adaptive to the environment. Sensors are classified into three categories: passive, Omni-directional sensors; passive, narrow-beam sensors; and active sensors. Passive sensors sense the data without actually manipulating the environment by active probing. They are self powered; that is, energy is needed only to amplify their analog signal. Active sensors actively probe the environment, for example, a sonar or radar sensor, and they require continuous energy from a power source. Narrow-beam sensors have a well-defined notion of direction of measurement, similar to a camera. Omni-directional sensors have no notion of direction involved in their measurements. 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 Most transceivers operating in idle mode have a power consumption almost equal to the power consumed in receive mode. Thus, it is better to completely shut down the significant amount of power is consumed when switching from sleep mode to transmit mode in order to transmit a packet.

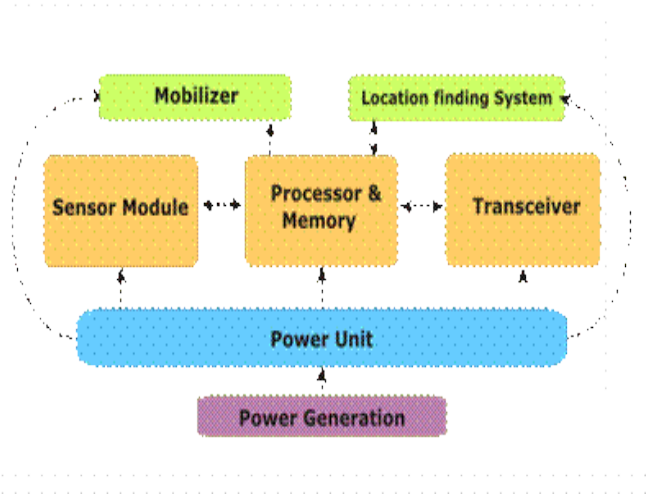


Figure 2.Internal Structure of sensor module.

3. Literature survey

A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions. In our proposed work we have surveyed many research papers [1, 2, 7, 9, and 12] these papers have contributed towards improvement and increasing performance of a wireless sensor network. A Wireless Sensor Network (WSN) consists of a mass of inexpensive, lightweight, battery-operated multifunctional sensor nodes. The feasibility of these sensor networks is accelerated by the advances in MEMS technology, combines with low power, low cost Digital Signal Processors (DSPs) and Radio Frequency (RF) circuits to a particular topic[10,11]. Since it is not practical to replace the batteries of thousands of sensor nodes, the main challenge in sensor networks becomes to maximizing the lifetime of wireless sensor network Therefore approach must be defined so that performance of a wireless sensor network can get increased.

4. Contributive Energy Approach

As discussed earlier that by using energy contributive approach performance of a network can get improved. In research papers [6, 11] we have analyzed that for developing an energy aware approach we have to take care of many things like simulation environment, number of nodes and routing protocol. So in our approach we have analyzed all these aspects. We have designed this approach in a manner so that packet delivery ratio and throughput of the network can be increased [3, 9]. We have defined various levels of energy in this approach so that better analysis can be taken out by using various energy levels a individual node analysis can be done and node energy level can be measured at any instant of time. A view of energy level definition is given below.

```
if ((energyLeft <= 1 ) && (energyLeft >= l1 ))
        energyLevel = 3;
if ((energyLeft >= l2 ) && (energyLeft < l1 ))
        energyLevel = 2;
if ((energyLeft > 0 ) && (energyLeft < l2 ))
        energyLevel = 1;

if (energyLevel == 0)
        strcpy(colors,"-c black -o red");
else if (energyLevel == 1)
        strcpy(colors,"-c red -o yellow");
else if (energyLevel == 2)
        strcpy(colors,"-c yellow -o green");
else if (energyLevel == 3)
        strcpy(colors,"-c green -o black");
```

5. Performance Indices

5.1 Throughput

Throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or a logical link, or pass through a certain network node. Throughput is measured in bits per second.

5.2 Packet delivery ratio

Packet delivery ratio is the ratio of number of packets received at the destination to the number of packets sent from the source.

6. Simulation Environment

We have used Network Simulator (NS)-2 in our evaluation. The NS-2 is a discrete event driven simulator developed at UC Berkeley. NS-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations. It is an object oriented simulation written in C++, with an OTcl interpreter as a frontend. Simulation of protocols is performed on Cygwin operating system using ns-2.29. NS is a publicly available tool for network simulations, built by various researches including LBL, Xerox PARC, UCB, and USC/ISI, and many other contributors as a variant of the "Real Network Simulator", which is "a network simulator originally intended for studying the dynamic behavior of flow and congestion control approachs in packet-switched data networks"

Simulation of wired as well as wireless network functions and protocols can be done using NS2.There are two crucial languages that NS 2 consist are; C++ and object oriented tool command language (OTcl). Output of simulation contains two files Trace file and NAM file. Results can be analyzed on the basis of text or visualization .if we want to analyze numerically we can use trace file and Xgraph. And for analyzing visually we can get animation of nodes by using NAM file.

Trace Root files are used to calculate various parameters like no. of sent packets, no. of received packets, throughput, packet delivery ratio, Delay, network sleep and network life time.

6.1 Simulation Methodology

In our simulation, we used 1000m x 100m environment size we are using 25 nodes .wireless channel has been selected by using omnidirectional antenna instead of unidirectional we can have better directivity so here we implemented omnidirectional antenna there are various routing protocols but here we have opted adhoc on demand distance vector protocol. On the basis of this scenario we will show improvement in throughput and packet delivery ratio in comparison of wireless sensor network implemented without applying approach to scenario of WSN with applying approach.

7. Result Analyses

For analyzing the improvement in wireless sensor network result of simulation can be analyzed by files those have created after simulation. These files are NAM and Trace root file .we get visualization of node deployment and all important relevant knowledge about nodes by NAM file while the comparison of both PDR and throughput is shown by xgraph .These two graphs have been drawn between both scenarios of WSN and after verifying our results from these graphs we can make conclusion remark that efficiency and performance of a wireless sensor network can be improved by implying energy efficient approach to the network.

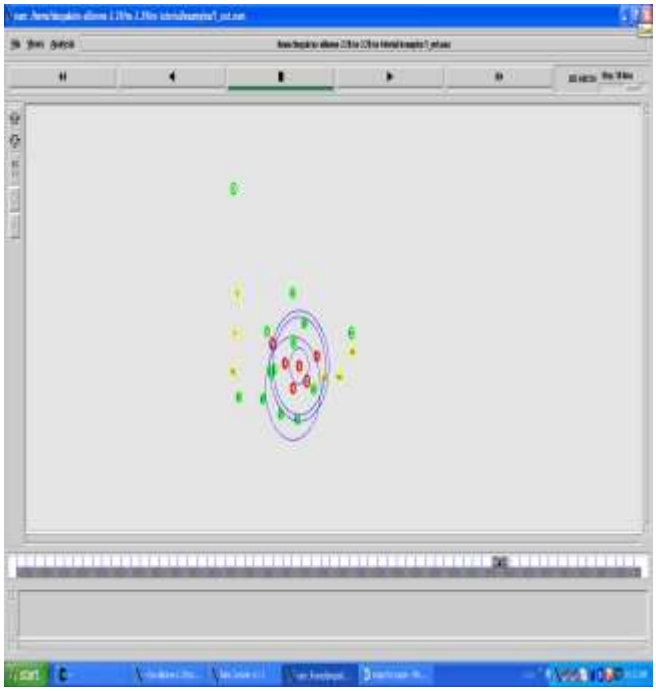
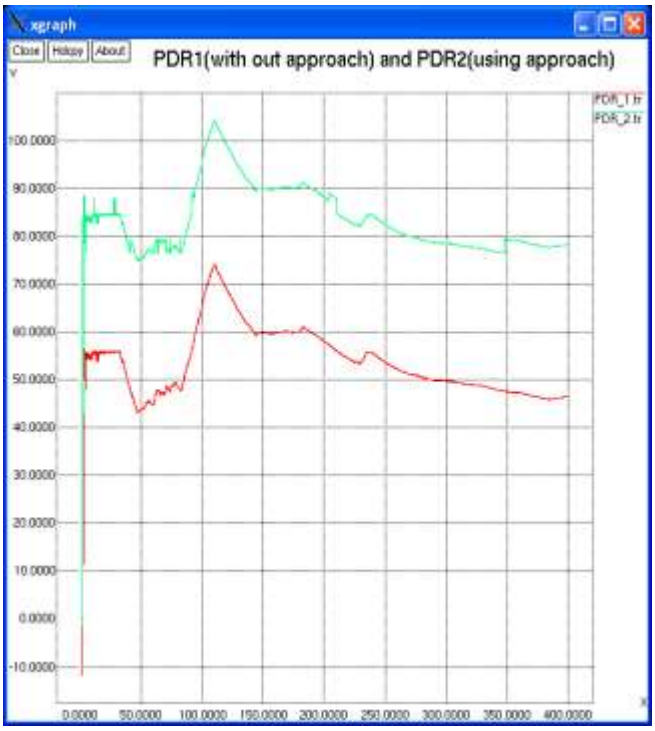


Fig.2 Visualization of nodes with respective energy levels

Graph.1 Shows Improvement in PDR (in green line) after applying energy efficient approach.



Graph.2 Shows improvement in throughput (in green line) after applying approach

7.1 Remark:

In above graphs we have analyzed that packet delivery ratio and Throughput of the wireless sensor network have improved in comparison of the simulated scenario without using contributive energy approach. Here in NAM window we can clearly examine that there are three states of the nodes as we mentioned in our proposed work these nodes reflecting residual energy level during simulation there are three level .High level 3 (green), medium level 2 (yellow) and lower level1 (red). By analyzing these states residual energy can be calculated.

For analyzing Throughput and Packet delivery ratio we have shown results in form of Xgraph .In Xgraph we have drawn two scenarios one is without using proposed approach and another after applying approach by analyzing Xgraph one can easily comment that here in Xgraph the scenario that using proposed approach has increased its performance .In graph two lines are reflecting green one is drawn for scenario with proposed approach while red is without applying proposed approach so by these comparison our object is get clear of improving efficiency and performance of wireless sensor network with proposed approach that is contributive energy approach.

8. Conclusion and future Directions:

There are many evolving trends in wireless sensor network such trends include implement of mobile node into the network, energy conservation of the nodes, deployment of the nodes in efficient manner, energy aware routing , energy efficient protocols. In wireless sensor networking energy is the main concern for designing a network .For WSN system energy must be use efficiently as possible as many researchers have worked on it and many are working in this direction we have also moved a single step in the same direction. Here we have analyzed PDR and Throughput. And we have shown same thing by using Xgraph where we compared two scenarios with and without approach. Here we analyzed network performance on the basis of PDR and Throughput but further analysis of such network can be made on the basis of residual energy of nodes, nodes energy conservation, sleep and active time and energy in the same network.

We have analyzed our simulation with 25 nodes but we can do the simulation with more than 25 nodes instead of we can also determine network performance by including many more parameters like delay, jitter and packet loss ratio.

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