ABSTRACT

Wireless sensor network (WSN) is a network of independent nodes used for environment monitoring. At the same time WSN developers face challenges that come from failure of communication link due to limited energy. We need to integrate zero wastage and minimum energy consumption technology. As MAC protocol is more energy efficient protocol as compare to others Thus in this paper we use MAC protocol with continuous active/sleep mode rather than cyclic sleep mode. The major aim of this paper is to describe a bio inspired mechanisms using Quorum based technique that save energy at idle stage of the sensor. We try to extend the energy efficiency of sensors by estimating per sensor traffic load and using a grid based Quorum technique with MAC protocol continuous active and sleep schedule.

KEYWORDS: Wireless sensor network(wsn), Bio inspired Quorum Sensing Method

INTRODUCTION

Nowadays wireless sensor networks (WSNs) have reached at many unexpected fields and provide excellent cost performance that can be use practically in wide range of agriculture sector. Lifetime of wireless sensor network is one of the major concerns. Wireless sensors are battery dependent sensors, so it is necessary that they should be use limited energy to precede any desired task. Energy conservation is not only required due to the discharge of battery but also there are many other issues. Most of the part of the energy is spend in the radio operation of the sensors even while sensor is asleep. Routing protocols in WSN’s should be targeted to reduce energy consumption and energy cost per packet. To increase the lifetime and to save energy of wireless sensor networks (WSNs) clustering method is used. For the local aggregation of data sensor nodes are together forms group that is called clustering. Clustering is an effective and practical method to enhance the performance of the system of WSNs. Energy can only be saved by applying communication protocol such as MAC layer protocol, routing protocol and transport protocol [1]. There are various protocol for the conservation of energy like LEACH, TEEN, APTEEN, PEGASIS etc. these are already being used. LEACH is a self-organized routing protocol that distributes the energy load equally among the sensor nodes [2]. The selection of a microprocessor becomes important in power aware design. Modern CMOS and micro-electro-mechanical systems (MEMS) technologies allowed manufacturers to produce a enhance generation of circuits by integrating sensors, signal conditioning, signal processing, digital output options, communications, and power supply units [3]. Solar energy harvesting is most suitable method for save energy. Because solar energy harvesting is produced by sunlight and then energy converted into the electricity. Solar energy harvesting wireless sensor network proposed ecofriendly solution of the challenges faced by conventional WSN [4]. Neural networks are use in energy efficient approaches of...
WSNs. Neural networks give dimensionality reduction and data prediction of sensor from the output of neural network algorithm. These algorithms can lead to lower communication costs and energy conservation [5]. To make use of energy efficiency of biological systems to create a new type of wireless sensor networks there is an evaluation of a combined RF-Biological system. RF receiver is one of the major devices which consume more energy in WSNs [6]. Adaptive and cross layer approach implemented by using Adaptive Access Parameters Tuning (ADAPT) algorithm that is basically based on IEEE 802.15.4 standard. In this paper, our main aim to introduce a low energy consumption method inspired from natural activity. Nature inspired us by various things and in this paper we are using a biologically inspired method for the sensor data communication.

AGRICULTURE WITH SMART GREEN HOUSE

To increase the productivity in agriculture field greenhouse is suitable with every condition of nature. In Smart greenhouse wireless sensors are installed to measure the quality of soil, water level and other environmental parameters. These sensor nodes are once placed in greenhouse and then constitute with wireless sensor network which installed outside or inside of greenhouse to gather the information about soil, water level, temperature, crop growth from the sensor nodes [7]. To know about the real time problem of farming we worked at RARI (Rajasthan agriculture and research institute). There we have observed drip irrigation method in the greenhouse. Drip irrigation is like artificial rain which is used for water spreading in greenhouse. When we were seeing greenhouse setup, we examine measurement problem of temperature, humidity, water spreading method and many other issues. Then we have propose a greenhouse based irrigation control system that control and monitor the level of temperature, humidity, water and moisture in soil.

show the actual image of greenhouse control system. This project simply defines the precision agriculture concept where different kinds of sensor are built to measure different parameter in the agriculture field. We implement five different sensors that are very helpful to know about the real time atmosphere in the greenhouse. These sensors are a soil moisture sensor which sensed moisture level of soil, water level control circuit is designed to measure the exact level of water in the tank where we fix three level for water tank i.e. empty, half and full, light sensor sensed the presence of light in the greenhouse if it’s day then sensor show bulb is OFF otherwise ON, temperature sensor sensed present temperature of atmosphere and humidity sensor calculate the humidity level according to these values fans are to be controlled. Each sensor is connected with microcontroller ATMEGA 16 which controls the transmission and reception of the information from/to the sensors. Global system module (GSM) scheme used to receive information from the field. GSM concept beneficial for the farmer (end user) in terms that if his location be located far away from the field and wants to check real time parameter of field he will just call on the SIM number which is installed in GSM. Figure2 shows the circuit diagram of each of the sensor.

Exiting techniques of Energy conservation

Energy saving in data communication can only be executed in TCP/IP protocol suit. Each and every protocol defines in one of the layers of TCP/IP. So for the energy conservation we have to be concentrate on different layer. MAC layer of TCP/IP suit is mostly used as energy saving layer because it control wireless transreceiver operations. MAC protocol improves efficiency and save energy by eliminating collision and interference of data packet [8]. Energy efficient protocol overcome the problem arrived due to retransmission of data. Cluster based protocol generally applicable for large number of sensors. WSN is based on the clustering strategy of protocol. The LEACH protocol is used for the energy conservation in wireless sensor networks. LEACH protocol is low energy adaption clustering hierarchical protocol that minimizes the length of the traffic. Researcher explains a common RF-biological system which converts electromechanical signal into the electrical signal. Introduce a bio-mechanical signal interpreter (BMSI) which produces a signal to active the

Figure 1: Real time image of greenhouse monitoring

Figure 2: Circuit diagram
main sensor node [1] [2] [6]. Researcher studied about the neural networks which find the finest path for data routing that further conserve the maximum part of the energy. Researcher identifies a solar energy harvesting protocol which is one of most reliable method of renewable energy. Solar energy is simply produce by the sunlight where solar panels convert sunlight into electricity. [4] [5]

ENERGY CONSERVATION USING BIO-INSPIRED TECHNIQUE

Wireless sensors are behaved as transmitter in active mode when they are installed with communication link. This behavior is also followed by various environmental or biological processes. For the management of various number of sensor nodes in a particular area it’s gone be very difficult to control those sensors. Generally when number of sensors works at same time, collision and interference would be occur due to the transmission of data from each sensor node to the control station. Thus to avoid this situation we have find a new technique i.e. Bio-inspired techniques. Bio-inspired techniques are inspired from basic biological process of various things in the nature. We have studied about three main areas of bio-inspired techniques. First is biologically inspired calculation which describes various form of algorithm that can be used as the processing algorithm of WSNs. Second is bio inspired systems which define set of system architecture that explain biological behavior of the system. Last one is bio-inspired networks; biologically inspired networks are efficient and scalable. Bio-inspired techniques or engineering is spreading in various fields [9]. In this paper we have find the biological solution of consumption of energy in wireless sensor networks. Therefore, for energy conservation a biological process named as Quorum sensing technique is used. Quorum sensing is a biological behavior of bacteria cell. This biologically inspired term explain bacterial process through which bacterial cells interact and control their behaviors and functions and make decisions.

When we go on deep study of quorum sensing technique we find that clustering analysis with number of sensor nodes and communication link is nearly be similar with the quorum sensing technique. In this paper we examined a Grid based quorum system to calculate the traffic of the information packet. We know that most of the energy is consumed by the communication link of the network thus the grid based quorum system mainly used to control communication process of the network [10].

![Figure 3: Behaviour Model](image)

![Figure 4: Effect of bacteria population](image)

**Overview Of Bacteria Behavior In Quorum System**

shows the behavior of bacteria in different environment. We assume large number of sensors as large number of bacteria. As we know that minimum number of bacteria defines Quorum. Similarly time frame request for various sensors is set as Quorum set. When we study about quorum behavior we go with software which explains working of Quorum set. This working and behavior of quorum is very helpful to implement method of energy saving and monitoring of sensors [12].

![Figure 5: Procedure of setup node and set color for patches](image)
GRID BASED QUORUM TECHNIQUE

General idea of grid based quorum is based on the set of request where quorum is as set of request that allow some kind of action when authorization is fixed. When set of quorum isn’t active this is known as non-quorum request set. When non-quorum set active, sensors are deactivated or enter into the sleep mode.

Figure 6: General idea of grid based quorum

Here we going to explain grid based quorum so there is a surety that out of various sensors any two sensors become active and interact at quorum set (some time frames). Figure shows the basic idea of grid based quorum where quorum set define by an m×m grid. In this scenario 1 row and 1 column are selected as a quorum set from m×m grid for each pair of sensor [11]. To understand the grid quorum concept we assume two sensors i.e. sensor1 and sensor2. Figure 6 shows two point of interaction among these two sensors. One interaction point shown at R1 and C2 and second one is shown at R2 and C1. The interaction point shows the wake up time frame of the quorum set. [11]

Calculation Of Traffic Load For The Selection Of Grid Size

Calculation of traffic load means how many data packets transmitted by each sensor node at a limited distance. Energy consumed during the transmission of traffic load is dependence on distance. We assume traffic of packet measure for the period of one time unit. Let us assume a circular shaped area of network where sensor nodes installed. We assume that radius of circular are network is ‘R’. Sink node is placed at the center of network and other sensor nodes are established into the line of network. Data packets have to transmit from the sensor node to the sink node so the traffic load during this transmission have to measure. Consider the distance between sensor and sink node is ‘r’ during one time unit

\[ F(r) = \frac{S_i(r)}{\pi(2r + \varepsilon)\varepsilon} \]

Here

\[ S_i(r) = \pi(2r + \varepsilon)\varepsilon \]

\[ \sum_{i=1}^{n} S_i(r) = \pi(2r + \varepsilon)\varepsilon + \sum_{i=1}^{n} S_i(r) \]

Symbols used in equation (i) and (ii) are defined as

\[ r = \text{distance between sensor node and sink node} \]

\[ R = \text{radius of the circular shaped network} \]

\[ S_i(r) = \text{recursive function} \]

\[ P_{i,r} = \text{State transition probability} \]

\[ \varepsilon = \text{Quantization interval} \]

\[ \rho = \text{Density of node that is number of node per unit area} \]

According to the state transition probability of the radio device we can be calculate the correct traffic load that Occur at a particular sensor node. From the equation2 we can calculate \( S_i(r) \) and \( S_i(1 - \varepsilon) \) and so on. At least for \( r' \) \( S_i(r') \) can be examined [10]. Now with the help of arithmetic calculation of per sensor traffic load it gone be easy to observe exact size of grid for every sensors. As we studied that grid size increase the duration of sleep mode to overcome the idle condition that in turn reduces the extra consumption of energy. Grid size m×m indicates long size of grid of sensor.

Since, Mac protocol is most energy efficient protocol thus; to remove the extra consumption of energy the idea of grid based quorum and traffic load calculation are applied with Mac layer protocol. Mac protocol extends the sleep mode of sensor when traffic load becomes low. Traffic load decide the grid size for data transmission so lower the traffic load, lower the grid size. When traffic load increases which is calculated by the mathematical formula then MAC protocol repeatedly set the wake up mode. For the proper working of MAC a scenario will be set up and A threshold level will be decided for the selection of grid size. Whereas number of thresholds is regulate by the traffic load per sensor. When the traffic load decline, quorum set (wake up time frame) of a sensor should also be decrease. To accomplish energy saving MAC protocol it is necessary to decide compatible grid size which sensor can do by using the mathematical formula of traffic load per sensor [12]. Therefore, small size grid of sensor becomes active faster than large grid size.

CONCLUSION

In this research paper we mostly focus on the various energy saving techniques which reduced the consumption of energy through sensor in the smart green house. We compare most of the energy saving techniques and then examine that MAC protocol based grid quorum system technique is better than others. To examine this technique we propose a greenhouse monitoring system, where energy conserved with calculation of exact traffic load situation which is then applied to grid based quorum system. Our paper’s main motto to overcome the major problem of energy conservation with easy task in WSNs. In future work we will further work for traffic load limitation.
REFERENCES


