CROP FIELD MONITORING USING GSM

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ABSTRACT

To monitor the crop field by using GSM. The factors affected on crop can be controlled and manage using wireless sensor network**.** In this study, the some important factors involving in the crop field monitoring display on LCD and inform to end user by sending message on their cell phone using GSM. Temperature is one of the factor which is help to monitor the crop field. The current record of humidity, temperature, light intensity sends on user's cell phone. Basic factors affecting plant growth are sunlight, humidity, temperature etc.These physical factors are very hard to control manually in crop field and a need for a automated design arises. Automatically controlling all the factors that affect plant growth is also a difficult task as it is expensive and some physical factors inter related, for example, temperature and humidity are related in a way that if temperature increases humidity reduces therefore controlling both are difficult. So an automated control system is designed for a crop field to control temperature, light intensity and humidity as they are some of the main physical factors are affecting plant growth.

Keywords: AVR Controller, GSM Modem, Humidity Sensor, LDR, Temperature Sensor, WSN, Zigbee Module.

I. INTRODUCTION

In crop field monitoring temperature, humidity, light intensity etc these factors are necessary. These parameters should be within the specified range. All these real time parameters are measured and sent to coordinator through zigbee. As an open and global standard for wireless sensor network zigbee protocol IEEE 802.15.4 shows advantages on low cost, low power consumption and low data rate. Zigbee's network layer supports three network topologies; star, mesh, and cluster tree. Star networks are common and provide very long battery life operation[2]. Zigbee based wireless control system in crop field is composed of coordinator and end devices including sensor nodes and GSM modem organized as a star network. By running software, the coordinator periodically receives data from the wireless sensor nodes and displays them on its LCD. Meanwhile, it sends orders to GSM in network which sends message to end user[5].

Wireless technology today is growing rapidly to a greater extent in such a way that even the agriculturist today use cell phones. So it would be convincing to provide with all the environment conditions of the soil and the plant to the farmer through mobile phones. The optimal plant growth depends upon the air temperature, humidity and active radiation of light, which results in maximum photosynthetic activity[4].Crop field

monitoring using WSN thus represents a class of network applications with enormous potential benefits for the farmers and society as a whole.

It has been identified that the rate of photosynthesis depends on the amount of light energy falling on to the leaves as light intensity reduces the photosynthesis rate reduce and respiration rate increases therefore to get the maximum out of the plants food production the photosynthesis rate needs to be kept high in day time. Temperature of the atmosphere can drop to values below the optimum temperature and reduces the rates of plant's respiration and photosynthesis rates and when the temperature keeps at a dropped value from the optimum value the yield would be less if the plants are subjected to natural environmental conditions. It is to be understood the terms photosynthesis and respiration. Photosynthesis is the process by which food is made by plants. They absorb CO_2 and H_2O from the atmosphere and uses light energy to convert them to glucose molecules and store as glycogen. Oxygen is formed as a byproduct in this process. Respiration is the process by which food (organic molecules) is broken down to release CO_2, H2O and energy. These processes depends uses enzymes depends on temperature. At high temperature around 50°Cthe enzymes are denatured and at low temperature they are inactive. Therefore controlling temperature is an essential in crop field. Due to the above mentioned processes in a plant a need for controlled temperature, humidity and light intensity level is required and it is has to done by an automated system.

Comparison of Wireless Technologies

Table 1 Comparison of Wireless Technologies

Parameters	**Bluetooth**	**Zigbee**	**Wi-Fi**
Standard	802.15.1	802.15.4	802.11b
Memory Requirement	250KB+	4-32KB	1MB+
Battery Life	Days	Years	Hours
Data Rates	1-3Mbps	250Kbps	11Mbps
Range	10-100m	300m	100m

II. SYSTEM DESIGN

The hardware unit of prototype of the system is represented by the block diagram below. It contains a AVR16 microcontroller as the main processing unit and it gets input from the temperature sensor(LM35), humidity sensor, and LDR(light dependent sensor). From the data obtained from the sensors are displayed on the LCD display. There are two transmitters and one receiver. The Zigbee module is used for communication between these three node. These system require 5volt power supply. The block diagram of the system is as shown in below fig.1

The parameters which we want to measure are physical parameters (i.e in non –electrical form).so as to convert it into electrical form we are using sensors. The output of sensor is in analog in nature to convert it into digital form we apply it to ADC which is inbuilt in AVR: atmega16controller. The converted digital output of sensor is analyzed by controller for taking proper action. After that controller ask ZIGBEE module it is ready or not. Then controller sends these data through UART to ZIGBEE transceiver .The information is send to master module. It will receive it and decodes it. Then give it to AVR: atmega16controller and according to information

is received, will display on LCD. Likewise information will be updated after every fixed duration. Further the GSM modem would be connected to microcontroller for sending the SMS.

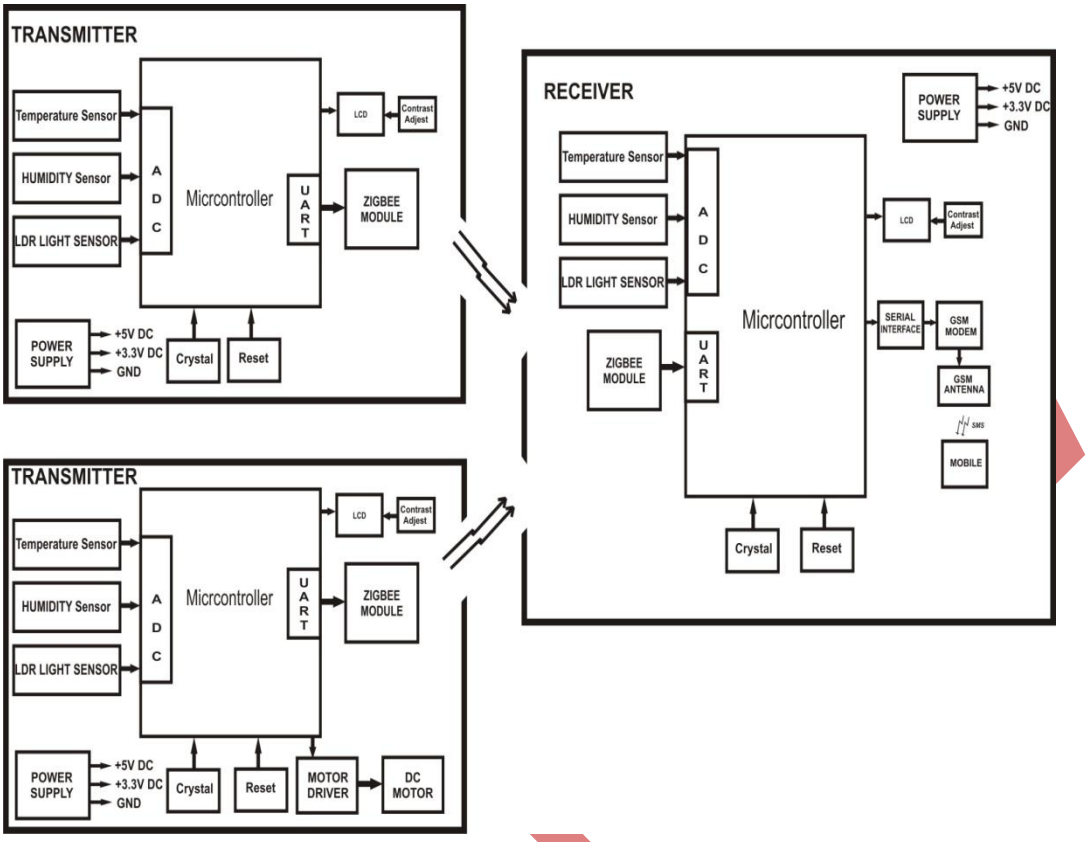

Fig 1Block Diagram of Zigbee Based Sensor Network

The Master Part of AVR microcontroller consists of GSM module and DPDT switch. When we measure temperature and humidity it display on LCD and this information is also send on agriculturist cell phone with the help of GSM. We use here DPDT switch because AVR microcontroller has only one ADC. During the communication it connects to zigbee and when reading of temperature and humidity is out of range or any problem is create during the measurement the switch is connect to GSM and send massage on user's cell phone through GSM antenna

III.TECHNICAL OVERVIEW

This system consists of various technological methods which can be explained through following

3.1Temperature Sensor

Various types of temperature sensors are available in market and sensor depending on the use can be implemented. The LM35 is commonly used temperature sensor which has temperature range of -55ºC to +150ºC. It can be used with single power supplies, or with plus and minus supplies. The LM35 output voltage is linearly proportional to celcius temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ºkevin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. the LM35's low output impedance, linear output and precise inherent calibration

make interfacing to readout or control circuitry easy. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±1/4ºC at room temperature and ±3/4ºC over a full 55 to +150ºC temperature range. The temperature sensor is as shown in fig 2.

Fig 2 Temperature Sensor

Fig 3 Humidity Sensor

3.2 Humidity Sensor

To measure humidity, amount of water molecules dissolved in the air environments, a smart humidity sensor module SY-HS-220 is opted for the system under design. The humidity sensor SY-HS-220 is shown in fig.3

The humidity sensor is capacitive type comprising on chip signal conditioner. It is mounted on PCB. The PCB consists of CMOS timers to pulse the sensor to provide output voltage. Moreover, it also consists of oscillator, AC amplifier, frequency to voltage converter and precision rectifiers. It also helps tp impediment to the noice. The humidity sensor used in this system is highly precise and reliable. It provides DC voltage depending upon humidity of the surrounding in RH%. This work with +5 v power apply and the typical current consumption is less than 3 mA. The operating humidity range is 30% RH to 90%RH.

3.3 Zigbee module

The zigbee, the RF module, is heart of wireless sensor mode. The Zigbee shown in Fig 4 from Digi international is a wireless transceiver supporting the IEEE 802.15.4 protocol. Low Rate Wireless Personal Area Network Protocol(LRWPAN). For wireless sensor network or for mesh networking use Zigbee or Digimesh

Fig 4 Zigbee Module

This allows addressable communication between nodes. Data may be send individual nodes(point to point) or to all nodes in range(point to multipoint) using broadcast address. Zigbee is low cost, low power, wireless mesh networking standard. Zigbee can control 254 devices at a time and has the data transfer rate of 250kbpsk. Because of Zigbee's low cost, low power consumption and ability to connect large number of devices, it could be consider best option to be used in wireless control and monitoring application[2]. Zigbee is also complaint with IEEE 802.15.4-2003 standard, which also allows this technology to be used worldwide.

Features of Zigbee Module

The silent features of Zigbee are as follows

1) Power output 63mW(+18dBm) North American version
2) Indoor/Urban range: up to 300ft(90m)
3) RF Data Rate: 250Kbps
4) Interface Data Rate:Up to 115.2Kbps
5) Operating frequency:2.4GHz
6) Receiver Sensitivity: 100dBm(all variants)

The Zigbee standard is built on top of the IEEE 802.15.4 standard. The IEEE 802.15.4 standard defines the physical and MAC (Medium access control) layers for low rate wireless personal area network. The physical layer supports three frequency bands with different gross data rates: 2,450Mhz(250kbs-1), 915MHz(40kbs-1),and 868MHz(20kbs-1)[4]. It also support functionalities for channel selection, link quality estimation, energy measurement and clear channel assessment. Zigbee standardizes both the network and the application layer. The network layer is in charge of organizing and providing routing over a multi hop network, specifying different network topologies: star, tree, peer-to-peer, and mesh. The application layer provides a framework for distributed application development and communication.

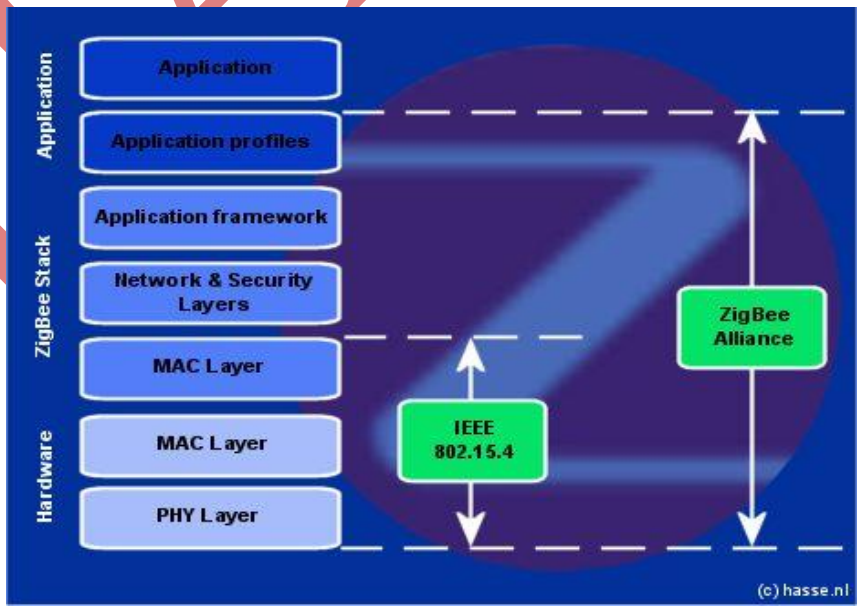

Fig 5 Zigbee Architecture

3.4 Light sensor

A simple LDR with proper light arrangement can be used to operate as a light sensor. A photo resistor or light dependent resistor or cadmium sulphide cell is a resistor whose resistance decreases with increasing incident light intensity. It can also refer as photo conductor. A photo resistor is made up of high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump in to the conduction band.the resulting free electron conducts electricity, thereby lowering resistance. A photoelectric device can be either intrinsic or extrinsic. LDR is a cost effective light sensor.

3.5 GSM

The Global System for Mobile Communication has been a great source in providing connectivity in our communication network. A system can use a GSM modem with a SIM card to get connected to a network and can operate according to the instructions given by the user[5]. This system can also use SMS sending and receiving feature to notify or communicate to the other modem on the end of the communication network. A GSM modem is a device which supports one or more evolutionary technology in GSM evolutionary family. It works on "AT commands "which are the basic building blocks of a GSM modem command sequence. The main purpose of this to inform current
updates of crop field to the farmers.

IV RESULT AND ANALYSIS

Table 2 Reading of Temperature at Different Time

Time	Temperature in ° C
11.00AM	30
12.00 PM	32
13.00 PM	31
14.00PM	32
15.00PM	33
16.00PM	33

The above result was received from the temperature sensor, which was connected to the coordinator node consequently the coordinator node was connected to the GSM and LCD.

Table3 Reading of Humidity at Different Time

Time	Humidity in % RH
11.00AM	35
12.00PM	18
13.00PM	19
14.00PM	18
15.00PM	16

The above result was received from the humidity sensor, which was connected to the coordinator node consequently the coordinator node was connected to the GSM and LCD

Table 4 Reading of light intensity

Time	Light Intensity in Lux
11.00AM	268
12.00PM	272
13.00PM	270
14.00PM	275
15.00PM	260

The above result was received from the light sensor, which was connected to the coordinator node consequently the coordinator node was connected to the GSM and LCD

Table 5 Zigbee Transmitter and Receiver for Different Distance

Sr No.	Distance in Meter	Zigbee Analysis For receiver
1	5-10	The Zigbee receiver receives data from transmitter
2	11-32	The Zigbee receiver receives data from transmitter successfully
3	33-35	The Zigbee receiver receives data from receiver with some data missing
4	36-40	No data received by Zigbee receiver from transmitter

The proposed WSN system consisting of three sensor nodes has been deployed in a crop field. Each sensor node measures temperature & humidity. Fig. 6 shows a one sensor node.

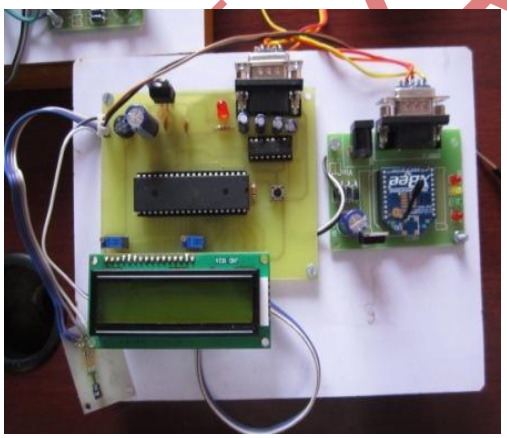

Fig 6 Sensor Node

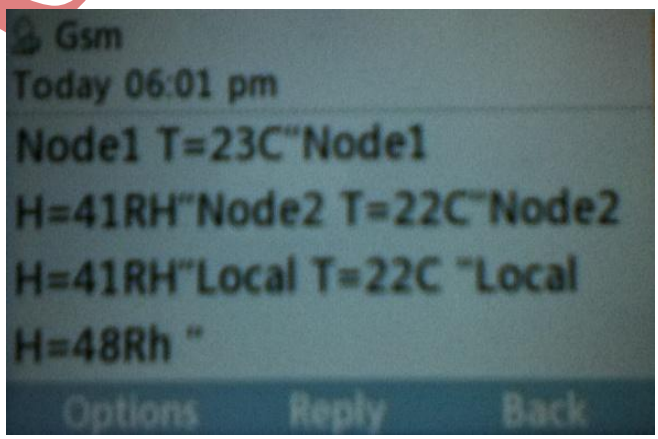

Fig 7 Reading Of Temperature Humidity On Cell Phone

In order to conserve power and increase the lifetime of WSN, periodical sleep and wake up modes of the sensor nodes are applied. At a time, only one of the sensor nodes i.e. either sensor node 1 or sensor node 2 senses data and transmits its data to coordinator. The coordinator collects data in time multiplexed manner. The coordinator collects data from the two sensor nodes and to transmit its own data along with collected data on cell phone.

Also, power consumed by CPU is always much greater than cell phone. The temperature and humidity values measured by the three wireless sensor nodes are shown in fig.7

V CONCLUSIONS

Crop field monitoring is an important class of sensor network applications with enormous potential benefits for the farmers and society as a whole. This paper presents the design and the implementation of a Wireless Sensor Network that monitors the air temperature, humidity and light intensity in a crop field. Three commercial sensors have been successfully integrated to measure these environmental key variables in a crop field. It helps farmers to increase the crop production with better quality. It also has capability to detect the fire. The sensor data is wirelessly transmitted to a LCD that logs the field data within seconds. The data collected can aid the farmers in achieving maximal crop productiveness. To make sensor network energy efficient, sleep mode has been used for the sensors as well as the RF modules. The WSN once installed is also economical to use since the only additional costs of messages.

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