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ZIGBEE Based Agriculture Management System

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Abstract

Agriculture is a source of livelihood of majority Indians and has great impact on the economy of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So, it needs to be automated for proper yield and handled remotely for farmer safety. This paper proposed idea about monitoring the field area without human interaction. The fundamental concept of this paper is to provide a highly enabled monitoring of field variables. Modern agricultural management relies strongly on many different sensing methodologies to provide accurate information of field variables like soil, climate, and environmental conditions. Almost every sensing technique may find an application in agriculture .A zigbee based Agriculture management system in real time system is implemented using Zigbee network in the present study. Experiments were carried out at lab scale to sense the temperature, soil moisture, water level. Based on the information received by the user through GSM, an action of control can be taken from any place

Keywords: Wireless Sensing Network, Zigbee Technology, Agriculture Field Monitoring, ARM7.

Introduction

The wireless sensor networks is challenging in that it requires an enormous breadth of knowledge from an enormous variety of disciplines. Wireless Sensor Network (WSN) consists of spatially distributed autonomous devices which use sensors to monitor physical or environmental parameters such as temperature, water level, humidity. The challenges in the hierarchy of detecting the relevant quantities, monitoring and collecting the data, assessing and evaluating the information, formulating meaningful user displays, and performing decision-making and alarm functions are enormous. The information needed by is provided by Distributed Wireless Sensor Networks [1], which are responsible for sensing as well as for the first stages of the processing hierarchy. The importance of sensor networks is highlighted by the number of recent funding initiatives, military programs. Sensory data comes from multiple sensors of different modalities in distributed locations. An application of WSN [3] in agriculture field is Greenhouse monitoring. Temperature and humidity, which play a vital role in determining the quality and productivity of crops, are controlled inside the commercial greenhouses using WSNs. This system is implemented using Zigbee network, The system module consists of sensing unit which has temperature sensors and soil sensor, water level sensor to sense the temperature, soil moisture, water level in tank. Based on the soil dry and wet condition the pump will ON and OFF, information received by the user when water level in the tank is empty through GSM, an action of control can be taken from any place.

Hardware Implementation

Zigbee Technology

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. The ZigBee standard operates on the IEEE 802.15.4physical radio specification and operates in unlicensed bands including 2.4 GHz, 900MHz and 868 MHz's

Zigbee technology[4] is a wireless communication standards based on IEEE820.15.4 agreement. It relates to network, Safety, application etc. It is the wireless communication technology that has the merit of short distance, simple structure, low power consumption, low data transfer rate, low cost, and high reliability. The complete Zigbee technology[4] agreement made up by Application layer, Network layer, Data link layer and Physical layer, it can transport more than 10m, the frequency band are 2.4GHz and 900MHz, they are all free. The transmission rate is 1 0- 250kb/s, network architecture has Master/Slave characteristic and it can worked as Two-way communication for public use. Zigbee technology depends on its simple architecture, low price and low power consumption to prolong the life . Although Zigbee technology transfer

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rate is not high, but for use in sensing and control, Zigbee.

The ZigBee protocol[4] is designed to communicate data through hostile RF environments that are common in commercial and industrial applications. Support for multiple network topologies such as point-to-point, point to- multipoint and mesh networks.

GSM Technology

GSM, which stands for Global System for Mobile communications, reigns (important)as the world's most widely used cell phone technology. A GSM[5]Module named SIMCOM_300 modem is a specialized type of mode which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM[5] modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

Insert a GSM SIM card into the modem and connect it to an available USB port on your computer .The GSM[5] modem works with AT commands such as

AT+CPIN? : Check whether Detected card is a SIM Card or not.

AT+CREG? : For Network Registration

AT+CMGS=Mobile number: To send a message to another mobile

AT+CPAS : To Returns the activity status of the mobile equipment

Temperature Sensor

One vital measurement essential for monitoring in many agricultural environments is temperature. Dependent on the agricultural product being grown temperature can affect growth such as germination, sprouting, flowering and fruit development. Particular agricultural products have suitable temperature ranges, accordingly the system investigate temperature sensor[2]integrated circuit..Temperature sensor LM35 (precision of 1 ° C and -55 ° to +150 ° C, linear outputof10mV / ° C. The LM35[2] does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +You will need to use a voltmeter to sense Vout. The output voltage is converted to temperature by a simple conversion factor. Use a conversion factor that is the reciprocal that is 100 ºC/V. The output voltage varies linearly with temperature. The general equation used to convert output voltage to temperature is

Temperature (ºC) = Vout * (100 ºC/V)

Soil Sensor

Soil Sensor LM358 [2] is used to check whether the soil is wet or dry and it returns the value to controller which is digital Value (1 or 0).The inverting input of the LM358 i.e., pin 2 is given to the fixed voltage is in the ratio 47k:10k and the non inverting input of the LM358[2] is pulled down and is given to sensing terminal. When the resistance between the positive supply and the non inverting input is high then resulting is the non-inverting input less than the inverting input making sensor output as logic low, which indicates soil is in WET condition And when the resistance falls making available a voltage to the non-inverting input higher than inverting input, so that the output of sensor is logic high which indicates Soil is in DRY condition.

Water Level Sensor

Water Level Sensor LM324 [2] is to find water level in the tank in three different heights(Full, Medium And Empty).LM324 sensor is a Water Level Indicator circuit. This circuit can be used to monitor level of water in a tank. The LM324 [2] consists of four independent, high gain internally frequency compensated operational amplifiers. Which are designed specifically to operated from a single power supply over a wide voltage range. Operation from spilt power supplies is also possible.

When the water is slowly provided into it, as the level of water increases in the tank, the water is detected by the sensor. Sensor which gives signal to the controller which control ON and OFF of the water pump as needed. The port pins P0.5, P0.6, and P0.7 of Controller is then connected to the level display which displays the level of the water in the tank. Application areas include transducer amplifier, DC gain blocks and all the conventional OP amp circuits which now can be easily implemented in a single power supply system.

Functional Description

The Temperature sensor and soil sensor , water level sensors sense the physical parameters and pass through A/D converter to obtain the digital signals that are processed by the microcontroller unit. It is then passed to the node for transmission over Wireless network as shown in the Fig.1. The Zigbee node[3] receives the data and scan for available node to transmit the data to the coordinator node. The coordinator receives the data, process it and transmit to the monitoring unit, which is going to be observed by a farmer as shown in Fig 2

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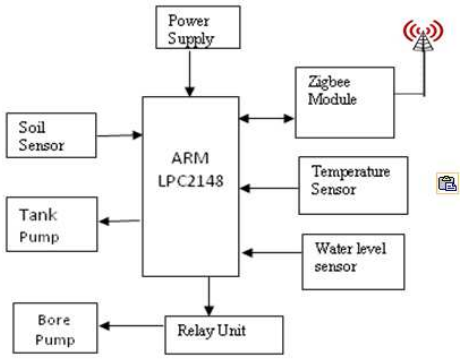

Figure.1: Block Diagram of Transmitter Section

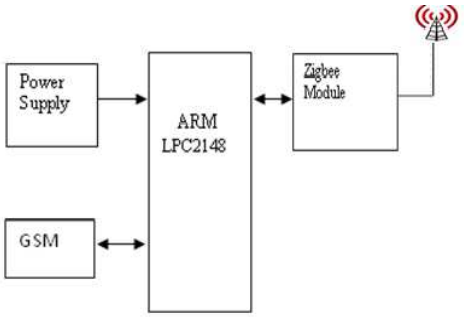

Figure.2: Block Diagram of Receiver Section

The system module consists of sensing unit which has temperature sensors and soil sensor, water level sensor deployed in the field area. Temperature, Soil condition, water level are part of the sensing unit, used to monitor the field. The data sensed by the sensors from different places of a field area transmitted to the data processing unit which are connected to P0, P1 of microcontroller from there the data is send to the Zigbee node to transfer the data to the receiver and the Zigbee node at the receiver end gathers the data and pass through the data processing unit. When any of the sensing unit parameters in the collected data exceeds certain range, through Global System of Mobile (GSM) [5] node is activated or a message is received by the user, indicating the situation in the field area. In the sensing unit a soil sensor which is connected to P1_30, pins of controller which check soil condition. When the soil is dry then automatically the Bore pump will be started, even though tank is empty, tank pump will be ON to fill the tank , the water level is empty in tank, condition is sent to farmer or user by sending a message through GSM

Result Analysis

Figure.3: GSM Initialization

Table.1Time Vs Temperature

S. No	Temperature(c)	Time(s)
1	26.4	11.15
2	26.8	11.18
3	27	11.25
4	27.5	11.33
5	25.8	11.40

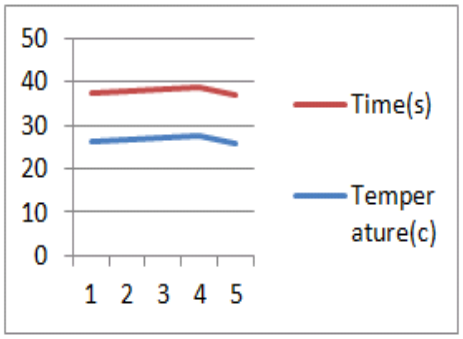

Figure.4: Temperature Analysis

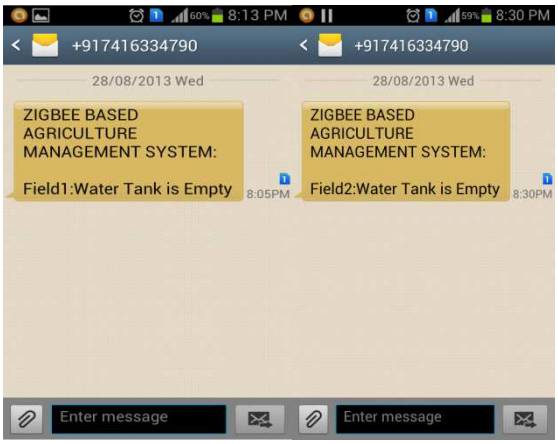

Fig.5: Mobile phone screen showing message in Field1and Field2

The result shown in the figures was received from the temperature sensor, soil sensor,, water level sensor, which were connected to the coordinator nodes and consequently the coordinator node was connected to the personal computer. The temperature changes according to time as shown in Table.1and Fig.4 .And a message is also sent when the field1or field2 water tank is empty to the farmer or user mobile through GSM and it is as illustrated in the Fig. 5.

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Conclusion

Since in earlier day's former always suppose to visit their agricultural land and check the of field variables manually. To avoid more human efforts we can use this technology. It allows user to monitor and maintain the soil even though he is away from his land irrespective of time. It is really effective and economic way to reduce human effort

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