Monitoring of Smart Greenhouse

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Abstract - *In recent year, there is a rapid growth in IoT technology and now IoT is also used for monitoring and controlling the greenhouse. In this work wireless control system with a subsequent software is used for design and implementation of smart greenhouse technology. This control system handles the essential factors such as sunlight, temperature, humidity, using real time clock set and micro-controller and carry out wireless transmission of information to remote software. This paper design and implementation of smart greenhouse monitoring system using ZigBee technology. This system is made up of front end data acquisition, data processing, data transmission, and data reception. The processed data is send to the intermediate node through a wireless network. Intermediate node gets all data and sends the data to the PC through serial port, at the same time staff may view analysis and storage of the data. PC provides a real time data for greenhouse fans another temperature control equipment and achieve automatic temperature control.*

Key Words: Internet of Things, ZigBee, Greenhouse, Microcontroller.

1.INTRODUCTION

Greenhouse is an environment which is created by human to grow their crops. It needs to monitor the parameters like temperature, humidity, sunlight.

As intelligent green house is step towards the development of agricultural modernization, agriculture using Internet of Things (IoT) has reduced the human energy over the monitoring of greenhouse environment.

Many research and projects have been done to improve conditions of greenhouse. Quin et al [2] proposed wireless system for greenhouse monitoring and control which was integrated with PIC 16F877 and ZigBee module and the data is stored and displayed on LCD.

Ibrahim and Munaf [3] proposed system for controlling and monitoring environment condition inside the greenhouse which consist of local and central stations. Local station are used to measure parameter and to control the actuators and for each local station a PIC microcontroller is installed which gets the data and send it to central station and receive the control signal that are required for the operation of the actuators

Zhou Jianjun and .et al [5] presented a system which consists of data acquisition controller and greenhouse remote monitoring and control system. The data is stored in database and according to indoor temperature, target temperature and offset temperature, PID (proportional integral derivative) control method is used to control temperature in greenhouse.

In this paper remote monitory techniques are used in green house environment Remote monitoring is a concept of using different climate parameters i.e. temperature, humidity, sunlight and some controlling device will control the unbalanced climatic parameters through these the Green House environment monitoring system will realise the precise measurement, improve crop disaster prevention ability and increase the production.

This paper also introduces some features like the owner can control and know the measurement of his Green House environment from any corner of the world. It also presents the crop from weeds i.e. frequent pesticide control in monitoring system. The short distance wireless communication technology is ZigBee. An android application is provided with server to manage the green house environment. With help of this control system will control like fan control (to decrease temperature), curtains to control sunlight, sprinkler control to maintain humidity.

2. SYSTEM ARCHITECTURE

The architecture of the system is shown in Fig.1 which consist of sensors, Analog to Digital converter, Device Drivers, Max 232 which is connected to computer which is used to control and monitor the greenhouse and that computer is connect to server through internet. An Android mobile application is also used for remotely accessing the computer. Sensor node reads varies values like temperature, humidity and light level which sense the data periodically and sent to computer through ZigBee. User gets a notification on Android App with the current parametric values of greenhouse. With all those values of greenhouse user can perform various action according to needs.
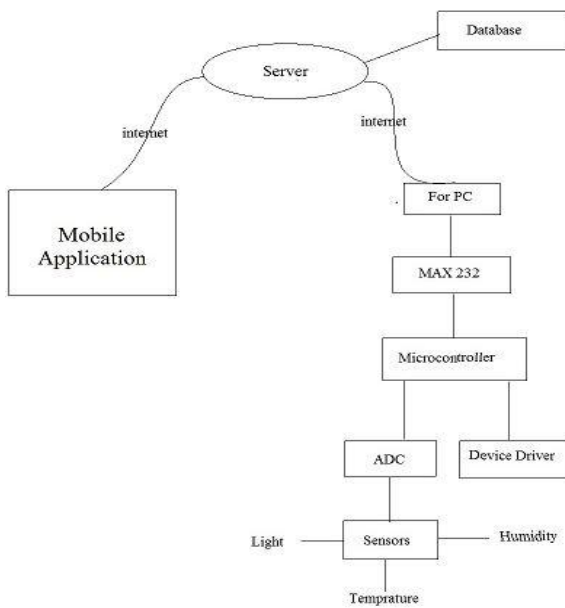
Fig: System architecture

3. SYSTEM HARDWARE DESCRIPTION

3.1. ZigBee

There are various devices which can be used for wireless communication like ZigBee, Bluetooth and Wi-Fi. All these types of devices use Radio Frequencies for data transfer. In this project we are using ZigBee Technology for better communication. It has advantages like it is reliable, self-configuration, supports number of nodes, can be deploy easily, has longer battery life, it is secure, low cost and it is portable. ZigBee is based on the 802.15.4 standard.

Parameters	ZigBee	Bluetooth	Wi-Fi
Standard	**802.15.4**	**802.15.1**	**802.1.b**
Memory Requirements	**4-32 KB**	**250 KB**	**1MB**
Battery life	**Years**	**Days**	**Hours**
Data rate	**250 Kbps**	**1-3 Mbps**	**11 Mbps**
Range	**300m**	**10-100m**	**100m**

Table: comparison of ZigBee, Bluetooth and Wi-Fi

ZigBee chips is integrated with microcontroller and radios. There are three types of ZigBee i.e. XBee Series 1, XBee series 2 and XBee pro. These ZigBee can be used according to the user needs.

3.2. RS 232

In telecommunication RS232 is a standard for serial communication of data. RS232 is used for transmitting the data or signals between DTE (data terminal equipment) such as a computer and DCE (data circuit-terminating equipment). However, it has low transmission speed, low voltage. We are using it for good communication.
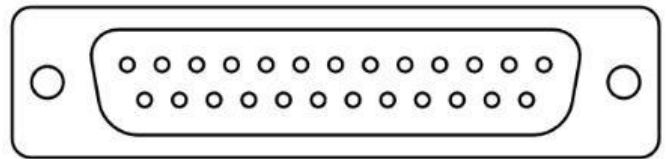
Fig: RS232

3.3. Sensors

In this project we are using various sensors for various purpose. We are using sensors like temperature sensor, light sensor, humidity sensors.

3.3.1 Temperature sensor

The LM35 series circuit temperature sensors, whose output is linearly proportional to Celsius. It has range from -55 to +150° c. This series do not require any external calibration

and trimming.

3.3.2 Light sensors

LDR is a variable resistor that measures light. LDR is a resistor that has an internal resistance increases or decreases dependent on the level of light intensity striking on the surface of the sensor. It has fast response and small in size. The relationship between the change in sensor resistance (R_L) and light intensity (Lux) is

$$Vout = \frac{LDR \times Vin}{LDR + R1}$$

To obtain the value of LDR the equation will be:

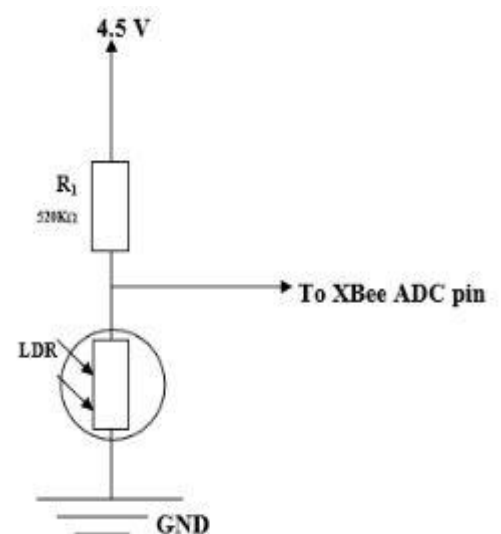$$LDR = \frac{Vout \times R1}{Vin - Vout}$$

Fig: voltage divider of LDR sensor

3.3.3 Humidity sensors

Capacitive-type humidity sensor is used for monitoring the humidity inside the greenhouse. The humidity sensor is connected to the Analog to Digital and ADC is connected with ZigBee and further data is transferred to computer that is being monitored by user.

4. PROPSED WORK

In this project we are using ZigBee technology and an Android application. The sensors are deployed in the greenhouse which senses the current climatic values of the greenhouse. The sense data is in analog form so the data is transferred to ADC. ADC will convert the analog signals into digital form and transmit that data to microcontroller. Microcontroller computes the values and send those computed values to the computer. Computer will act as a server and sever will connected to the mobile application through the internet. Sensor will sense the environment of the green house and give all the information to the computer and according to that information computer will notify about all the climatic condition to the mobile application. A database is also maintained which holds the threshold values of climate in the greenhouse if the values exceeds those threshold values user will get the notification on the mobile application and with the help of the mobile application User can perform the action like turn on the fans when temperature is high and this information will go to the server and it perform the action according to that.

5. CONCLUSIONS

In this paper, WSN technology ZigBee is used for monitoring and controlling environmental condition of the greenhouse which reduces the cost, increases the efficiency of crop field and proposing an Android application for remotely accessing the greenhouse environment which will reduce the human effort.

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