International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

WIRELESS MONITORING AND CONTROLLING OF GREENHOUSE ENVIRONMENT

B Mahitha[1], Pachhala Asha[2], Fathima Yasmeen[3], Goli Satya Sarani[4], Chalikanti Jithendra Sai[5]

[1]Professor, Department of Electronics and Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering & Technology, Vijayawada, India.
[2,3,4.5]students, Department of Electronics and Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering & Technology, Vijayawada, India.

ABSTRACT: *Greenhouse plays a crucial role in the development of agriculture to provide proper environmental conditions for plant growth. The weather and soil conditions in the greenhouse should be independent of the natural environment. The purpose of this paper is to style an easy microcontroller and zigbee based wireless system to monitor and control the values of temperature, humidity, soil moisture and light of the surroundings that are continuously monitored and controlled in order to get maximum yield growth. Here, we are using few sensors namely Temperature sensor, Humidity Sensor, Soil Moisture sensor and light sensor. This system maintains the required conditions for the plant growth.*

KEYWORDS: Greenhouse, Zig-Bee, Microcontroller, Humidity Sensor, Temperature Sensor, Soil Moisture Sensor, Light Sensor.

INTRODUCTION:

Greenhouse is a building where plants are grown. Greenhouses are often used for growing flowers, vegetables, fruits. The size of the Greenhouse ranges from small sheds to large buildings. The demand for quality products, the concern about food security and the impact of climate changes are the factors that have contributed to the development of the greenhouse. It is a known fact, that plants perform their best in the constant environmental conditions. Basic factors affecting plant growth are sunlight, water content in soil, temperature etc.

In commercial greenhouses, the Increase in area also forced the increase in measurement points for finding changes in the environment. However, the increase in measurement points increases the installation cost and maintenance cost. With this cheaper wireless communication technology, it is now easy to build a system with many wireless sensor nodes and along with actuators to monitor and control the environmental parameters. Wireless sensor networks have the advantage of low cost installation, reliability andhigh flexibility. The system is able to monitor and control the environmental parameters such as temperature, light, soil moisture and humidity. In this paper, we present the wireless monitoring and controlling of greenhouse environment.

LITERATURE SURVEY:

GourabSengupta et.al [1] prepared a paper "Multi-sensor Integrated System for Wireless Monitoring of Greenhouse Environment" that explains the wireless climate monitoring system which is organised as three stations – sensor station, coordinator station and the central control station. Each sensor station is furnished with sensors to monitor the environmental parameters such as temperature, humidity, soil moisture etc. The data from the sensors is collected and sent to the coordinator station using ZigBee wireless modules. The coordinator station acts as a channel between the sensor station and the central control station. It is also responsible for the actuation of heaters, sprinklers etc to control the greenhouse climate. The central control station is a PC based system which runs the application software. The user can enter control parameters using the software. This system allows past data to be analysed to study the trend of the measured data.

Zhang Xinrong et.al [2] prepared a paper "Design of Wireless Monitoring System for Greenhouse Environmental Parameters Based on Fuzzy Control" that describes the development of greenhouse environmental information monitoring technology and a temperature and humidity monitoring system based on fuzzy control is analysed. This system can automatically monitor the temperature and humidity through the wireless network,

the monitoring parameters were monitored by the sensors, and monitoring data is processed by the fuzzy control system. The system can detect the changes of indoor temperature and humidity in real-time, which can provide decision-making, and has wide range of applications.

Zhisong Wang et.al. [3] Proposed a paper, "Research of intelligent greenhouse remote monitor system based on embedded network and wireless transmission technology". The greenhouse environment intelligent control system is designed based on embedded network and wireless technology. It can analyse and dispose the environmental factors. It uses C/S mode in wireless network. The system can have high benefits in agricultural field. The designing the data acquisition subsystem, we send sensors with different functions into a wireless data acquisition module. This design not only reduces the number of wireless nodes, improve the reliability of data acquisition, but also enhances the scalability in greenhouse by modularized design.

Liang-Ying et.al. [4] Proposed a paper named "Greenhouse Environment Monitoring System Design Based on WSN and GPRS Networks". A system for greenhouse monitoring based on wireless sensor network (WSN) and GPRS net is explained. In this paper, the real time monitoring parameters in greenhouse like soil moisture, soil humidity, co2, light intensity and temperature are monitored. ANT protocol is also used to achieve real time monitoring.

Mr.DattatrayaShinde et.al. [5] Proposed a paper "IOT Based Environment change Monitoring & Controlling in Greenhouse using WSN". This system is built on the basis of IOT technology & Raspberry Pi. This system will help the farmer to maintain the field using remote controlling. With this controlling device action, the quality and the productivity of crops is much better than that of crops growing without controlling actions. The time taken by each controlling device is distinguished, which is useful for farmers for the approximate idea of total power consumption & total expenditure per year for specific crop.

Ziyu Wan et.al. [6] Proposed a paper "Environment Dynamic Monitoring and Remote Control of Greenhouse with ESP8266 NodeMCU" that is a combination of greenhouse management system including dynamic monitoring of environment system and remote control system. Environmental parameters including air temperature, air humidity, CO2 concentration, soil moisture were selected to show the interior environmental state of a greenhouse. These parameters were monitored using the sensors which were linked with NodeMCU. The ESP8266 NodeMCU was used to connect to Wi-Fi and to communicate with IOT platforms-Thingspeak and Blynk based on HTTP protocol.

M. Longhi et.al. [7] Proposed a paper named "RFID-Based Localization for Greenhouses Monitoring Using MAVs". This paper presents a low-cost RFID system for MAV localization in indoor environments, such as greenhouses. It is used to collect the information from sensors. Experiments were performed to validate our proposed system, noting that our approach is applicable for other environmental monitoring scenarios, e.g., humidity, light intensity, etc.

PROPOSED SYSTEM:

The proposed system consists of two main stations namely: sensor station and base station. The SS is a micro controller based while BS is personal computer based system. The function of the two stations is explained below:

LOCAL STATION: It is mainly responsible for the collection and transfer of data from sensor nodes to the microcontroller. The microcontroller is interfaced with the Zig-bee module through Kiel software. The sensor station consists of following sensors. They are: - temperature and humidity sensor, soil moisture sensor and light sensor. The zigbee at the local station takes the input values from sensor nodes and pass it to the central station. The local station consists of sensor nodes, microcontroller, zigbee and actuators.

CENTRAL STATION: The central station is mainly responsible to provide the control actions to the local station. The values taken from the zigbee at local station are received by the zigbee at the central station through wireless communication. Here, the personal computer is mainly responsible for the control actions. According to the data given to personal computer the control actions are provided to each parameter at the local station via zigbee module. The central station consists of zigbee module, UART module and personal computer.

BLOCK DIAGRAM:

The paper consists of local station and one central station. The main functionality of the Local station is to obtain the values of greenhouse parameters with the help of three sensors namely temperature, humidity and light sensors. These sensors are directly connected to AT89S52 microcontroller in which ADC(0808) is present. The wireless ZigBee module is connected to the microcontroller to maintain the wireless connection with the zigbee module at the central station. A PC was placed at the central station where the threshold values for each parameter are given. And the values are compared with the obtained values from local station. Depending on the values at the central station, the control action takes place. The control actions are passed via zigbee module to the local stations. The microcontroller provides the control signals to the actuators when the control actions are received by the local station. Figure 1 shows the block diagram of local station. Figure 2 shows the block diagram of central station.

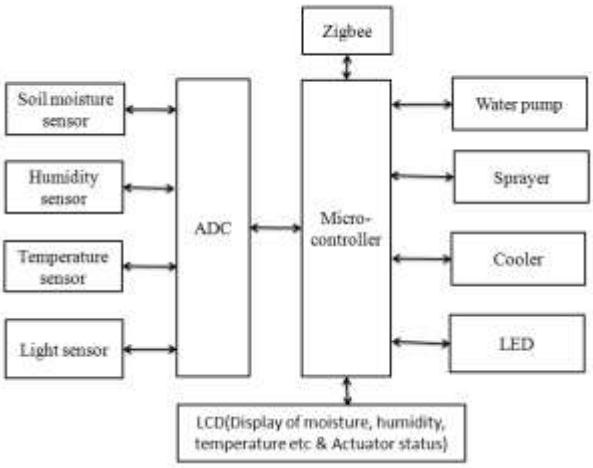

Figure 1: Local Wireless Station.

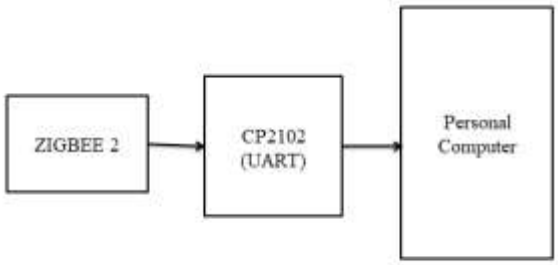

Figure 2: Central Station.

FLOW DIAGRAM:

The sensor values are given to microcontroller. These digital outputs are displayed on the LCD. The zigbee at the local station communicates with the zigbee at central station, and the values are compared with the threshold values given in the computer. If the temperature value increases over 32 degrees then fan turns on. If the humidity decreases under 31 degrees then sprayer turns on. If light is not detected then LED turns on and if moisture is not detected then water pump turns on.

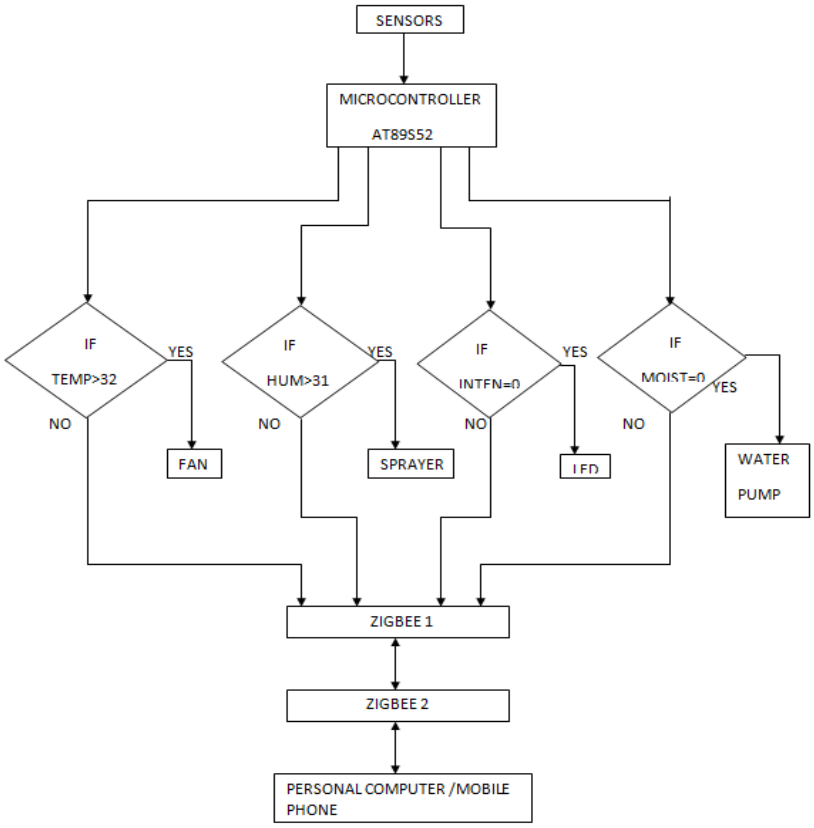

FIGURE: FLOW DIAGRAM

HARDWARE IMPLEMENTATION:

SOIL MOISTURE SENSOR: A soil moisture sensor is a sensor which measures the water content in soil. Insert the sensor in the soil and it can measure moisture or water level content in it. The digital output 5V is displayed when the water content in the soil is high. And, it displays a 0V output when the moisture in the soil is low. A potentiometer is also included to the sensor to set the desired moisture threshold value. The output goes high, when the sensor measures more moisture than the set threshold value and the output goes low, when the sensor measures less moisture than the set threshold value. The digital output can be connected to a micro controller through ADC. The sensor value is displayed on the LED at the micro controller.

HUMIDITY AND TEMPERATURE SENSOR: The DHT11 is a basic, fundamental, ultra low-cost digital temperature and humidity sensor. To measure the surrounding air, it uses a capacitive humidity sensor and a thermistor. The measuring range of humidity and temperature is 0°C to 50°C.Itgives a digital signal as output.

LIGHT SENSOR: LDR stands for LIGHT DEPENDENT RESISTOR. An LDR is a component that has variable resistance which depends on the light intensity that falls on it. When light falls on the LDR then the resistance decreases and increases in the dark times. The main use of this LDR is to sense the absence and presence of light.

ADC: ADC (Analog-to-Digital Converter) is used to convert the analog signals into digital representations. The analog signal consists of infinite number of values. ADC converts those values to particular states, that we can measure them as physical quantity. ADC converts data periodically. The major advantage of ADC is that, the noise can be eliminated efficiently from the original signal and digital signal can travel more efficiently than the analog one.

MICROCONTROLLER: The microcontroller used in this project is AT89S52. The AT89S52 comes under the family of 8051 microcontroller. The AT89S52 is a low power

CMOS 8-bit microcontroller with 8K bytes of flash memory. The AT89S52 has the following features:8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry.

ZIGBEE: Zigbee is a wireless networking standard which supports low power and low data rate. It is basically a two way communication used between sensors and the system. It is a short distance communication ranging between 10 to 100 meters. The data rate is about 250kbps. 868MHz, 902 to 928 MHz and 2.4 GHz are the operating frequencies of Zigbee. Zigbee technology is the most reliable technology in realising home and industrial automation.

ACTUATORS: An actuator is a component that is responsible for moving and controlling of a system. An actuator mainly requires a control signal and a source of energy. When the actuator receives a control signal, it converts the signal's energy to mechanical motion. The actuators used in this system are water pump, sprayer, cooler and LED.

UART MODULE: UART stands for UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER. USB UART cable also called as USB serial port cable. The UART's main purpose is to receive and transmit the data. It is a common debugging tool in embedded system Software development.

RESULT:

CONCLUSION:

This paper implements a greenhouse monitoring and controlling system based on zigbee wireless sensor network. By the experimental test, it has been confirmed that the system can monitor and also can control the environmental parameters such as temperature, humidity, light and soil moisture. And, it shows good communication between the two zigbee's and sensor nodes.

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