Smart Green House Automation

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Abstract—Smart Green House Automation is a complete system to monitor and control the environment parameters inside a greenhouse. It is necessary to design a control system to monitor various parameters like Temperature, Humidity, Soil moisture, Light Intensity. Here controlling process takes place effectively by both manual and automatic manner. This software uses an Android mobile phone for monitoring as well as controlling green house, connected to a central server which is connected to a microcontroller via serial communication. Microcontroller communicates with the variety of sensor modules.

Key words: Embedded system, 8051 Microcontroller, Android Phone, Green House, Monitoring, Controlling

I. INTRODUCTION

Farmers are unaware about the exact conditions of weather so the activity performed by them is not precise. They perform their activity as per their feeling and observation so every time it may not give the accurate result. So to give accurate result about what activity should performed in green house by the farmers in different environment conditions this system is used. By using greenhouse we can increase the productivity. In our system we can monitor the conditions of environment as well as control the conditions from remote place. So it is very useful system. It is based to perform following activities that are to monitor the system and control the system from remote place that is control the weather inside greenhouse by performing actions like water sprayer on/off or open rooftop etc. It contains basically 8051 microcontroller, computer server and android phone in the system. This system works in two modes manual mode and automatic mode. Automatic mode is based on the threshold range. When sensors reach a certain threshold it will send the signal to microprocessor, microprocessor will process that signal and perform appropriate actions.

II. EXISTING SYSTEM

Some of the previous systems used android phone to monitor the greenhouse but lacked to control it using android from remote locations. One of them was based on Global System for Mobile Communications (GSM) in which notifications are sent via SMS, but disadvantage of this system was every time user had to type commands which was time consuming and costly. The biggest disadvantage of these systems was that one person always had to be present in the green house or in the vicinity of the green house.

III. PROPOSED SYSTEM

The first problem which is overcome in our system is that a person need not always be present in the green house or in the vicinity of green house. Plants in greenhouse are grown under controlled environment. The temperature differences can cause harm to plants. Sometimes the farmers cannot predict which action needs to be taken to control the environment and may take wrong decisions thus causing more harm to the plants in the green house. Our system will allow him to take proper decisions by providing the farmer with accurate information. Thus this system helps farmer to control greenhouse from remote locations.

IV. METHODOLOGY

This embedded system for monitoring and controlling the green house is based on measuring the humidity, temperature, light intensity and soil moisture measurement by sensors that located at different places. The monitoring and controlling is conducted through Android Smartphone. There are three main modules in our project which are microcontroller processor, PC working and android phone.

A. Hardware Description & Hardware Implementation:

The monitoring and controlling of greenhouse component consists of sensors for the humidity, 8051 microcontroller, serial communication, wireless connection, LED module change for water sprayer, stepper motor, model of greenhouse, personal computer as server, and power supply unit. RS232 defines the asynchronous serial communication method between the server computer and 8051 microcontroller. The output for the sensor become an input to microcontroller and sent to computer through serial communication. The task of the computer is to transfer the data through wireless communication to application software at Android Smartphone. The task of the Android Smartphone is to control the microcontroller and the other components, by giving commands. The microcontroller will read the sensor periodically and update the value of sensor to android.

1) 8051 Microcontroller:

The AT8051 is a low power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout.
B. Software Description:

The software is designed to process the humidity value, monitoring and controlling the green house. The software includes the various measurements of the sensor, analog to digital converters send humidity value from sensor to microcontroller. Then continue to display the value in application at Android, control the microcontroller from the application in Android and update to user by sending the value of sensor for monitoring the green house. The microcontroller 8051 is to convert analog to digital, send the value of sensor through serial communication to PC, and control the stepper motor, water sprayer, shutter and fans of greenhouse and updating the user. The program is written in 8051 IDE. The server used to process the value from the sensor, serial, and wireless communication by PHP serial programming and PHPmyadmin to transfer and receive the input for controlling and output for monitoring.

C. Software Implementation:

While developing android application software of our project we have installed Android environment setup which includes Eclipse, Java Runtime Environment (JRE), Java Development Kit, Android SDK, Android Development Tools (ADT) plugin for Eclipse.

Our android application code contains following classes

1) WelcomeActivity Class:
   WelcomeActivity class is the is the launcher activity class. Using setContentView(R.layout.welcome) method we are setting welcome xml layout to this activity. It contains start button. Inside onClick() method of the Start button we are calling the MainActivity Class.

2) MainActivity class, RoomActivity Class, ScreenFourActivity Class, ScreenThreeActivity Class:
   These classes uses setContentView() method to set the layout of the activity. In this activity there are four toggle buttons on the room n layout file and four text views their names are Fan, Light, Temp_sensor and LightSensor. There is also menu button on this activity. It contains the four rooms as menu items.

3) Server Class:
   This class is responsible for socket connection. This class connects to server on port number 8080. It reads the data from server and writes the data to server.

4) ConfigActivity Class:
   In this class we will insert ip address and port number and check for ip address is inserted or not & also has FileReadWrite Class.

D. User Interfaces:

1) Server Side:
   - Admin page
   - Welcome page
   - Registration page
   - Hardware connection page

2) Client Side:
   - Registration page
   - Login page
   - Server connecting page
   - Configuration page
   - Temperature view page
   - Temperature control page
   - Humidity view page
Humidity control page

E. System Architecture:

The system is basically divided into 3 modules viz. The Microcontroller, the Server Machine, the Android Phone. The sensors are placed at different locations in the greenhouse. They will sense the temperature and light intensity and pass the values to the microcontroller. The values will be converted from analog to digital for processing. The microcontroller will send the notification to the server. The server will update the log and will also notify the user on android phone. If the system is in auto mode, then the microcontroller will take the decision and will only notify the user. If the system is in manual mode, then it will notify the user and will wait for the user to take the action. The communication between the computer and the android phone takes place with the help of internet. Also the communication between the microcontroller and computer takes place with the help of RS232 communication channel. The system model consists of sensors, microcontroller, interface such as relay and actuators. Actuators such as ventilation fan, sprayer, heater, water pump, artificial lights are used. Our proposed system aim is to design a microcontroller-based circuit to monitor and record the values of temperature, light intensity level of environment that are continuously modified and it is controlled in order to optimize them to achieve maximum plant growth and yield. Controlling process takes place effectively by both modes, automatically and manually. Depending upon the application, we will set particular threshold level for each climatic parameter. When any of parameters level cross a safety threshold then microcontroller will perform the needed action by employing relay(motor driver) until the strayed-out parameter has been brought back to its optimum level.

![System Architecture](image1)

**Fig. 2: System Architecture**

![System Flowchart Design](image2)

**Fig. 3: System Flowchart Design**

V. FLOWCHART REPRESENTATION

The following flowchart depicts the flow of actions which will take place in the greenhouse monitoring & controlling system. Here firstly, for both the parameters, data is retrieved from the sensors. This data values are compared with the threshold values and if they do not match, then necessary action is taken to bring the temperature and other parameters into control.
VI. EXPERIMENTAL RESULTS AND ANALYSIS

We got results based on both automatic mode and manual mode. Automatic controlling process is fully done based on coding. During this process if any of sensor module does not work properly no inputs will be given to microcontroller or wrong result will be obtained. So, at that time human involvement will be very useful for greenhouse environment. Zigbee based wireless sensor network is used to successfully transfer the information stored in microcontroller to PC in control room which is far away from environment.

A. Performance Measurements:

The below picture depicts the working of our hardware model.

Fig. 4: Shows the Working of an Actuator (Fan)

Fig. 5: Shows the Working of an Actuator (Bulb)

Also our Android Software will be working in the following ways:

Fig. 6: First Page of the Greenhouse App

Fig. 7: Login Page

After starting the application, the user cannot directly run the application. The user should be a registered user. If the user is not registered, then he/she should get themselves registered first.

Fig. 8: The Registration Page
Here on this page, the user will come to know about the details of the climatic conditions in the greenhouse and according to those details, the user can take the actions.

Our system is also having a server, where all the actions taken and all the data will be stored and updated timely so that the user will come to know that at a particular time in past what action was taken and by which of the registered user. For accessing that data, the user needs to login. The data is accessible to registered users only.

VII. CONCLUSION

In this paper we have discussed about smart greenhouse automation with advantages of system like low cost and accuracy. This system proposes a greenhouse system in which user can control their greenhouse from remote location by using android mobile. This system is capable of controlling the essential parameters necessary for plant growth, viz. Temperature, humidity, soil moisture and light intensity etc.

REFERENCES


