Greenhouse Monitoring System Using GSM

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Abstract— In traditional method of farming, human labors were required to visit the greenhouse at specific time need to check the humidity level, light, CO2 and temperature level manually. This conventional method is considered time consuming and needs a lot of work and effort. Therefore this research focuses on developing a system that can automatically monitor and predict changes of temperature, light, Humidity and CO2 level in the greenhouse. The objective of the research is to develop a automatic temperature monitoring system using sensors and Short Message Service (SMS) technology. The proposed system has a measurement which capable of detecting the levels of temperature, light, Humidity and CO2. This system also has a mechanism to alert farmers regarding the parameter changes in the greenhouse so that early precaution steps can be taken. In this research, several tests had been conducted in order to prove the viability of the system. Test results indicated that the reliability of the system in propagating information directly to the farmers could be gained excellently in various conditions [1].

Index Terms— automatic monitoring, Enviornmental parameters, GSM, Microcontroller, Sensors, SMS,

1 INTRODUCTION

1.1 Background

A greenhouse is a structure with a glass or plastic roof and frequently glass or plastic walls; it heats up because incoming solar radiation from the sun warms plants, soil, and other things inside the building. In other word, a greenhouse is a structure usually made of glass or clear plastic that provides protection and a controlled environment for raising plants indoors. Water is the most important element in our life. Without it, we cannot survive. As we know, most of the gardener uses manual system to their plant in the garden and also in the greenhouse. This system is inefficient. When we manually do this, the possibility to get some plant can drown. In order to overcome this problem, automatic greenhouse used. [2]

1.2 Objectives

The main objective of this project is to automatically control the system in greenhouse using temperature sensor, humidity sensor, and light sensor co2 sensor. The concern with a lot of consumer needs and demand for the agriculture products has stimulated awareness among the farmer that increases their products in the market by implementing advance technologies in this industry. The products that are important that may come to the farmer's interest that controls the use of natural sources and natural environment which controls agriculture with various aspects. In this paper uses sensors and Global System for Mobile Communication (GSM) and short message service (SMS) to carry out data from the green house with sensors directly alert the farmers to their mobile phone. Therefore, this problem makes farmers' interest to implement agro - conditions sending alert notification messages to farmers using GSM and SMS technology.

1.3 Scope

This project involves the evolution of temperature, light, humidity, co2 automatically. The automatic controlling of the parameters in system is used in a greenhouse. Sensor used to control the temperature is temperature sensor. Other than that, this system should also monitor the temperature level. The automatic monitoring system can be implemented in various conditions such as in monitoring temperature, humidity, light and CO2 levels. However this paper focuses solely in remotely monitoring levels of these parameters in greenhouse. By utilizing existing technology, the natural environment and resource which we get naturally, the temperature is very important criteria for the plants to be monitored efficiently. Previously, human labor plays major role in the monitoring farm and plants in the agriculture field. For some crucial plants such as vegetarian and flowers plants, which need 24 hours attention from human so that the plant quantities and qualities are controlled with proper management by the collected data and information from the fields. This will provide enormous foundation for future growth and future development of their plants in the green house. However, with the increasing size in farming areas, this type of manual practice is increases time consuming and cost of the labor.

However, with the growth of management in agriculture techniques and with modern telecommunication technologies which provide great assistance with the implementation in the agriculture industry.

2. SYSTEM DESIGN

The hardware unit of the prototype of the system is represented by the block diagram bellow. It contains a 89S52 microcontroller as the main processing unit and it gets inputs from the temperature sensor (LM35), Light sensor(LDR), Humidity sensor(HSM20G) and CO2 sensor. From the data obtained from the sensors the program controls the actuator components such as fan, sprinkler, LED and Relay4 to achieve the system requirements. It also uses a GSM module which sends information from of SMS to the user from which the data obtained from the sensors and the data obtained from the user.[2]. The system operates according to the flow chart show. The temperature monitor and control system consists of a

LM35 temperature sensor a user mode switch the fan for cooling. The user mode switch is connected to pin in the microcontroller and tested whether the switch is ON, if it is ON (pin read as high) the microcontroller saves the value to the EEPROM set by the user by. The analogue input value is converted to a digital value using ADC and given to the microcontroller. Then it will be written to an address location of the EEPROM. The program then checks again whether the user mode switch is pressed and if it is ON once again the program converts the analogue input value to digital and saves it in the variable and the EEPROM. If the switch is OFF the program goes into automatic mode and regulates the temperature to the value set by the user. In this mode the temperature sensor detects the current temperature value and inputs it to pin of the microcontroller. The input is an analogue input and it is converted to a digital input and calibrated .Then it is displayed and checked with the user defined value by subtracting the current temperature value from the user defined temperature value saved in the EEPROM. If the result is negative it means that the current temperature value is greater than the user defined temperature value so the microcontroller makes the pin high to ON the cooler fan to bring down the temperature to the user defined value and sends SMS alerts to the user. If both the values are equal the result is zero then both pins are set to low hence fan is switched off and sends SMS alert to user mobile.

The humidity level is also controlled to a predefined ideal value like temperature monitor and control system. The analogue value is converted to a digital value and saved in EEPROM. Then this value is subtracted from the ideal value and if the result is zero then pin made high and sends SMS alert to user mobile. When the result is negative again the pin is low and sends SMS alert to user mobile. Similarly for CO2 and Light sensor.[3]

2.1 Experimental setup

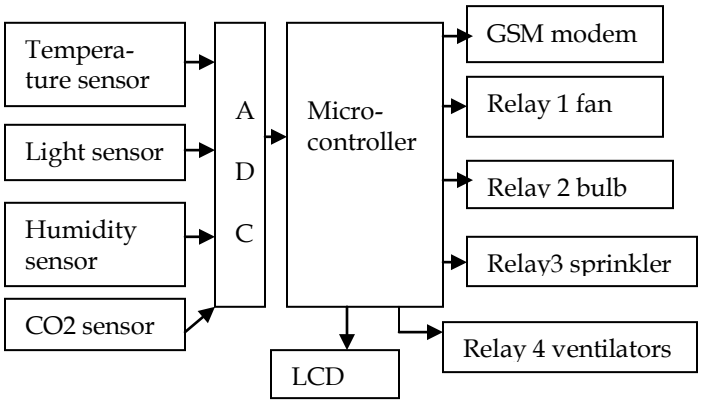


Fig 1 .block diagram of experimental setup

3. CONTROL UNIT

3.1 Microcontroller (AT89S52)

We are going to use microcontroller of 8051 family. The microcontroller is the heart of the proposed embedded system. It constantly monitors the digitized parameters of the various sensors and verifies them with the predefined threshold values and checks if any corrective action is to be taken for the condition at that instant of time. The Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost14 effective solution to many embedded control applications. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning.

Features

- Compatible with MCS-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- 256 x 8-bit Internal RAM
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Mode

3.2 ADC (analog to digital converter)

Sensors can senses the variation in environmental parameter such as temperature, humidity, light & CO2 and gives the reading in variation with voltage. So using the analog signal we can't directly send to the GSM modem. So, we have to use analog to digital converter (MCP3204/3208). The Microchip Technology Inc. MCP3204/3208 devices are successive approximation 12-bit Analog to-Digital (A/D) Converters with on-board sample and hold circuitry.

Features

- 12-bit resolution
- ± 1 LSB max DNL
- ± 1 LSB max INL (MCP3204/3208-B)
- ± 2 LSB max INL (MCP3204/3208-C)
- 4 (MCP3204) or 8 (MCP3208) input channels
- On-chip sample and hold
- SPI serial interface (modes 0,0 and 1,1)
- Single supply operation: 2.7V - 5.5V

3.3 LM35 (Temperature Sensors)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling.

Features

1. Calibrated directly in ° Celsius (Centigrade)
2. Linear + 10.0 mV/°C scale factor
3. 0.5°C accuracy guarantee able (at +25°C)
4. Rated for full −55° to +150°C range
5. Suitable for remote applications
6. Low cost due to wafer-level trimming

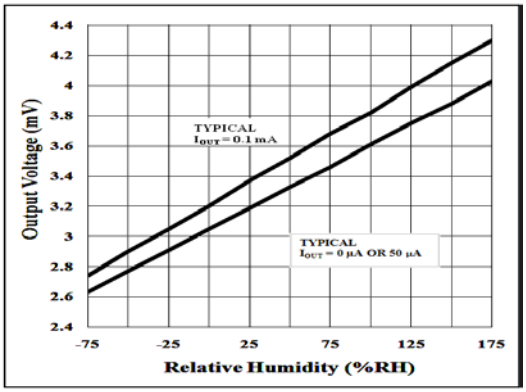


Figure 2: Voltage VS Temperature Calibration Curve

LM 35 is calibrated in ºC and is linear in +10 mV/ ºC scale factor with 0.5ºC accuracy .The calibration curve given here will make the scenario clear

3.4 Humidity Sensor (HSM-20G)

These modules convert relative humidity to the output voltage. Humidity Sensor is designed to operate on DC 5 V, 0-60º **c,** 30-90º **c** RH , output voltage is DC 1.980 mv ± at 25 ºc 60% RH.

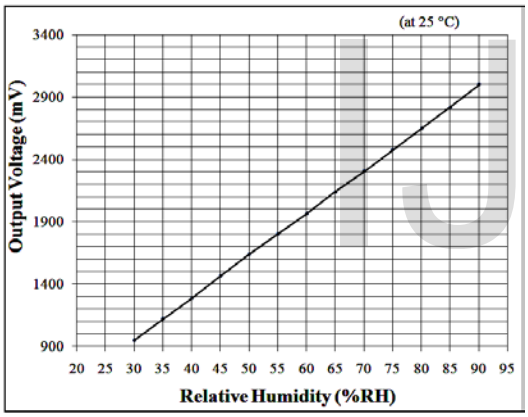


Figure 3 : Standard Characteristics of Humidity sensor

3.5 LDR- Light Dependent Resistor

Two cadmium sulphide photoconductive cells with spectral responses similar to that of the human eye are used. The cell resistance falls with increasing light intensity. Applications include smoke detection, automatic lighting control, and batch counting and burglar alarm systems.

3.6 GSM Module

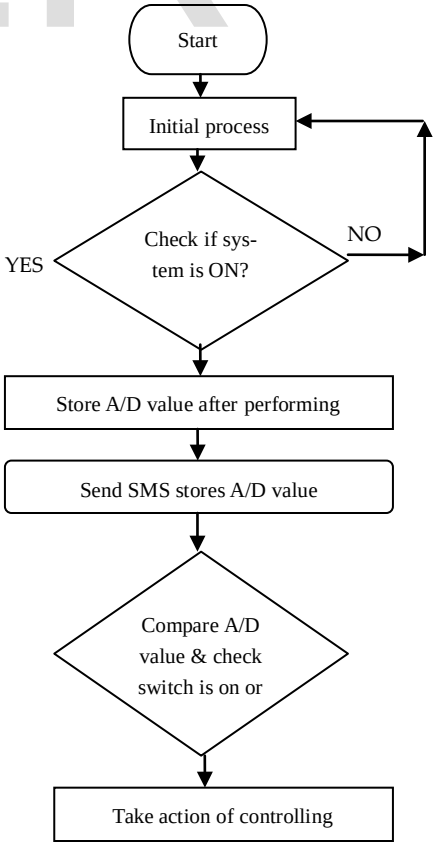
A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

4. System Design

Initially a temperature point is set. The temperature sensor senses the change in input temperature .After signal conditioning this analog signal is given to the micro-controller. The micro-controller converts it to digital format using on chip ADC. If the temperature sensed is below the low threshold value, the controller unit will start the heater. Once it reaches the set limit it will switch off the heater. If the temperature sensed is above the set limit, it will start the blower to bring the temperature down. Once it reaches below a set point, it will switch off the blower. In this way, temperature is controlled. Similarly, an intensity of light can be controlled. Initially intensity point is set. Light dependent resistor senses the change in input intensity of light. If the intensity of light sensed is below the low limit set, the controller unit will switch on bulb. Once it reaches the set limit it will switch off the bulb. In this way, intensity of light is controlled. Humidity can be control by using a humidity sensor. Initially Humidity is set. Humidity Sensor senses the change in humidity. If the humidity sensed is below the low limit set, the controller unit will turn on the dehumidifier. Once it reaches the set limit it will switch on the humidifier. In this way, humidity is controlled. After it senses intensity of temperature, light and humidity it gives digital display at the output on LCD.

5. Software Description

Software is developed in embedded C language. Keil software is used for programming and controlling of light Intensity, temperature, humidity, and soil moisture. Flowchart for Greenhouse automation is as follows.



6. Results And Discussion

The results obtained from experimental set-up of greenhouse monitoring system using GSM are as given below:

6.1Temperature sensor LM35

The values of output given by the temperature sensor at different temperature conditions are as mentioned in the table 1. The formula used for calculating the output is:

Formula:

Temp (degree Celsius) = (Vout/5)*100

Temp range (in degree Celsius)	Temp sensor output (in volts)
9.2	0.46
24	1.2
30	1.5
42	2.1
49.6	2.48

Table. 1: Temperature sensor outputs

6.2 Humidity sensor HSM20G

The values of output obtained at the output of the humidity sensor at different environmental conditions are as given in the table 1. The formula used for calculating the output is:

Formula:

Relative humidity= ((Vout/Vcc)-0.16)/0.0062….. at 25 deg cel
Vsupply= 5V

RH value (in %)	Sensor voltage range(volts)
0	0 to 0.6
0 to 19.35	0.6 to 1.4
19.35 to 21.5	1.4 to 1.56
25.8 to 29.83	1.6 to 1.725
30.6 to 40.32	1.75 to 2.05

Table. 2: Humidity sensor outputs

Thus the above tables give the experimental results of greenhouse monitoring system using GSM. We had checked out the results with the two sensors i.e. temperature and humidity sensor.

7. Conclusion

Thus we validated our results for greenhouse monitoring system with the results in paper by Sushma Kolhe[4]. Thus we can say that the greenhouse monitoring system using GSM is far better than the same system using the different technologies.

8.Future Scope

Time bound administration of fertilizers, insecticides and pesticides can be introduced.A speaking voice alarm could be used. The system can be modified with the use of a data logger and a graphical LCD panel showing the measured sensor data over a period of time.

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