AN EFFICIENT GHP MONITOR AND CONTROL SYSTEM USING MICRCONTROLLER BASED GSM

Prasun Aggarwal, Harsha Mann

Abstract— Automating the data acquisition process of the soil conditions and various climatic parameters that govern plant growth, allows information to be collected at high frequency. This paper, presents a universal system for continues monitoring and controlling the greenhouse parameters and optimize them to achieve maximum plant growth and send this information via GSM thereby eliminating the deployment of a separate system for each parameter and human interference.

Index Terms— GHP, GSM, HIH4000, Humidity measurement, LDR, LM35, PIC16F887.

1 INTRODUCTION

Today everything can be controlled and operated automatically, but there are still few sectors where automation is not fully adopted or not been put to a full-fledged use, perhaps one reason is cost. One such field is Agriculture. Appropriate soil and climate conditions are necessary for the optimum growth of plant, increase crop yield and efficient use of water, resources and fertilizers. The existing systems are PC or SMS-based to keep the user update of the conditions inside the greenhouse but are unaffordable, bulky, difficult to maintain, and less accepted by the unskilled farmers.

This paper presents a system which automating a greenhouse envisages monitoring and controlling of the climatic parameters which, directly or indirectly govern the plant growth and hence their production. This system continuously updates the workers about the conditions in field. This system has been implemented and tested on Proteus 7.7. The system monitors Humidity, Temperature, Sunlight and Water level. The hardware and software is tested and working efficiently. When any one of the above mentioned parameter cross a threshold which has to be maintained to protect the crops, the sensor senses the change and reads this data and processes it. The system continuously displays the data on the LCD. The rest of this paper is organized as follows. Related work is reviewed in Section 2. Section 3 describes the Proteus 7.7 implementation of the circuit and its analysis and section 4 describes the waveforms. The future scope of this paper is presented in section 5 and result of paper in section 6. Section 7 concludes the paper.

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2 RELATED WORK

The moisture content in the soil is a very crucial factor in the process of transpiration as the absorption of minerals from the soil through the process of osmosis is directly dependent on the moisture of the soil. The greenhouse works best when the temperature is not too hot and not too cold. During the day the rays from the sun penetrate the greenhouse and warm up and light up the surroundings. Light escapes through the glass walls but the heat in the form of infra-red radiations get trapped inside the green house leading to an incubating effect and the temperature inside gradually increases. The increased temperature leads to an increase in the rate of transpiration which is harmful to the plants.

The proposed system is an embedded system continuously monitors and controls the microclimatic parameters of greenhouse on a regular basis round the clock for cultivation of crops or specific plant species which could maximize the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible extent. The system comprises of sensors to monitor the climatic conditions, microcontroller to collect the information from sensors and process them and generate outputs on the basis of input signals and display the parameters on LCD display. The system comprises of actuators that respond according to the output generated by the microcontroller. Whenever any of the microclimatic parameter value go above the threshold, microcontroller will convey this information to the worker or farmer via GSM and the farmer from any remote place can take necessary action by again sending a message back to the system and microcontroller according to the received message on the particular actuator. In response to the user message the system will adjust the heating, fan, lightning, irrigation immediately, hence protect greenhouse from damage.

This system helps in increasing the yield of crops.

3 PROTEUS 7.7 IMPLEMENTATION AND ANALYSIS OF THE EXPERIMENTAL RESULTS

[1] Voltage step down from 220V to 12V
[2] V_{cc}= +5V.
[3] For relay operation applied voltage is +12V.
[4] Software used= MPLAB X IDE by Microchip Technology Inc.
[5] Programming Language used= Embedded C.
The sensors and calculated values for the various components are as follows:

1 C = 470µF, 47uF, 22pF, 0.1uF, R1 = 1K, 10K.
2 Variable resistor R= 2.2K.
3 Microcontroller-PIC16F887A.
4 ULN2004A.
5 LDR, LM35, Humidity sensor.

The circuit is simulated and its PCB is generated. The experimental value of the components was adjusted after carrying on the simulation process so as to obtain desired output.

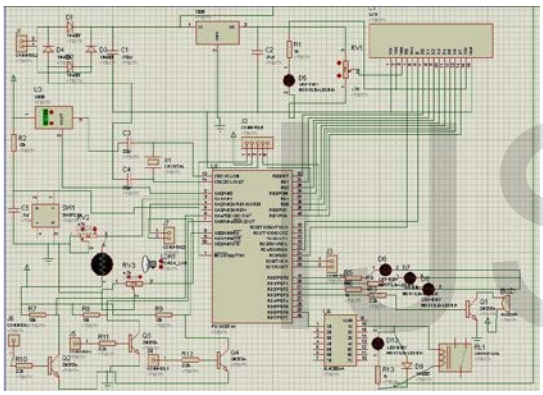

Fig. 3.1 Control circuit

Fig. 3.2 Complete Hardware implemented system

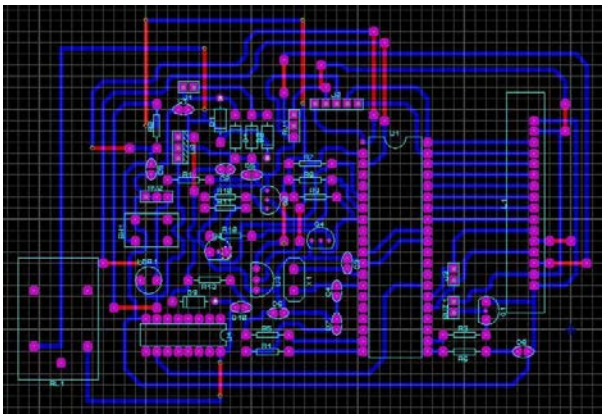

Fig. 3.3 PCB layout

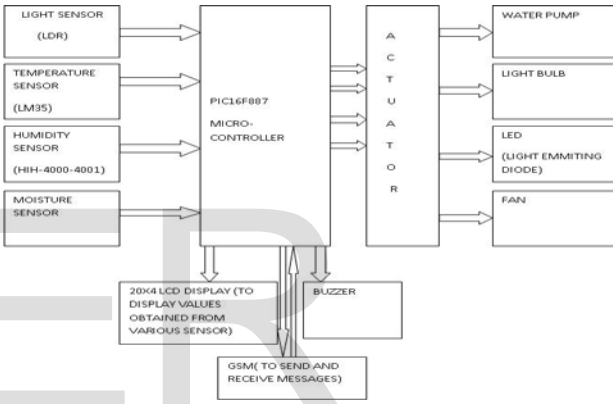

Fig. 3.4 Complete system

4 WAVEFORMS

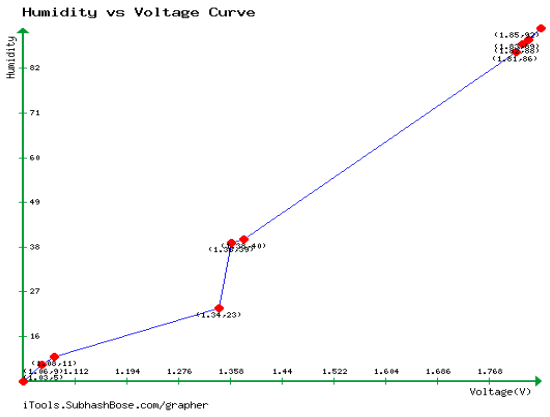

Fig. 3.5 Humidity v/s Voltage

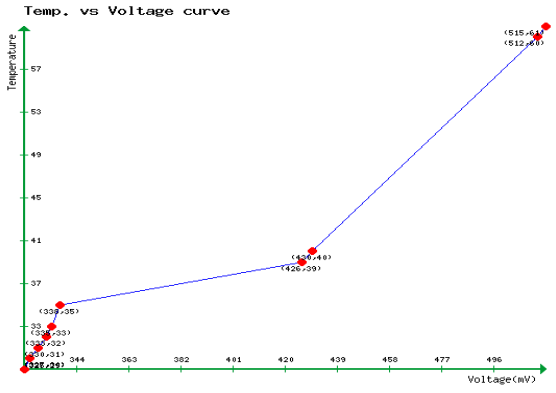

Fig. 3.6 Temperature v/s Voltage

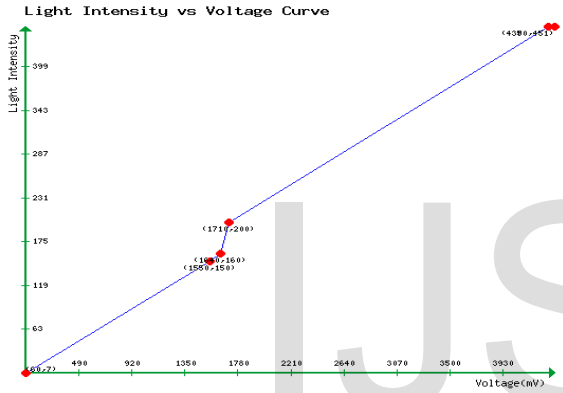

Fig. 3.7 Light intensity v/s Voltage

TABLE 1
VOLTAGE VARIATION ACROSS THE MICROCONTROLLER ALONG WITH THE VARIATION IN WATER LEVEL IN THE SOIL

[1] Soil Condition	[1] Transducers Optimum Range
[1] Dry	[2] 0volts
[1] Optimum level of Soil Moisture	[3] 1.9-3.5volts
[1] Slurry Soil	[4] >3.5volts

5 FUTURE SCOPE

This system can be easily mounted in the field. A speaking alarm can be use in place of normal buzzer. The device can be made to perform better by providing the power supply with the help of battery source which can be rechargeable and non-rechargeable, to reduce the requirement of AC source. Time bound monitoring of fertilizers, pesticides and insecticides can be introduced. A multi-controller system can be developed that will enable a master controller along with its slave controller to automate multiple greenhouse simultaneously.

6 RESULT

The system has been operated and tested under various conditions and results obtained are:-

1. Whenever temperature of the system goes beyond a certain threshold then the system will send a message to the user. The user will reply back to the system by a special text message and fan will get on.

2. Whenever humidity of the system goes beyond a certain threshold then the system will send a message to the user. The user will reply back to the system by a special text message and led will blink.

3. Whenever moisture of the system go below a certain threshold then the system will send a message to the user. The user will reply back to the system by a special text message and pump will get on.

4. Whenever light falling on the system go below a certain threshold then the system will send a message to the user. The user will reply back to the system by a special text message and bulb will get on.

7 CONCLUSION

A system to monitor and control greenhouse has been implemented and working efficiently and displaying desired results on the LCD. The system has successfully overcome quite a few shortcomings of the existing systems by reducing power consumption, maintenance and complexity, at the same time providing a precise form of maintaining the environment.

8 ACKNOWLEDGMENT

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9 REFERENCES

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