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Farming Assistance by using Semi Automation

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Abstract: The objective of the proposed system is to design a simple, easy to install, microcontroller (AT89C51) based system to monitor the micro parameters of environment specifically, light, temperature, humidity, soil moisture. The system controls it by actuating lamp, fan, fogger, water pump respectively according to the necessary condition of the crop. This will reduce labour requirement, provides proper utilization of water, it saves time and money and increase the crop yield and life. The system is a handy one for the farmer to assist with the help of the technologies and semi automation, since partly, involvement of the human is necessary to restart the system and in other aspects too.

Keywords: LCD, GSM, ARM, AT89C51, ULN2003A

I. INTRODUCTION

In today's world where everything can be controlled and operated automatically, but there are still a few important sectors, where automation has not been adopted or not been put to a full-fledged use, perhaps because of several reasons one such reason is cost. One such field is that of agriculture. Agriculture has been one of the primary occupations of man since early civilizations and even today manual interventions in farming are inevitable due to various reasons. Greenhouses form an important part of the agriculture and horticulture sectors in our country as they can be used to grow plants under controlled climatic conditions for optimum production.
Automating a greenhouse envisages monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence their production. In the system proposed same kind of care is been taken. It consists of microcontroller(89c51), various sensors, GSM, relay and driver circuits for fulfilling the requirements.

II. LITERATURE SURVEY

Earlier various systems based on existing technologies and also proposed an economical and generic automatic irrigation system based on wireless sensors with GSM-Bluetooth for irrigation system controller and remote monitoring system. Systems with simpler features designed with the objective of low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM module. A Bluetooth module is also interfaced with the main microcontroller chip. This Bluetooth module eliminates the usage charges by communicating with the appliances via Bluetooth when the application is in a limited range of few meters. The system informs user about any abnormal conditions like less moisture content and temperature rise, even concentration of CO2 via SMS from the GSM module or by Bluetooth module to the farmer's mobile and actions are taken accordingly by the farmer.

The farmer will be able to monitor and control the parameter by GSM and Bluetooth technologies. Bluetooth based solutions are also used for this purpose. Although Bluetooth eliminates the usage cost of the network to a great extent, its range of operation is limited to a few meters. One cannot remotely monitor and control devices using this technology. Also it is desirable for each home device to have a dedicated Bluetooth module but due to the fiscal expense of this type of implementation, a single module is shared by several devices which has a disadvantage of access delay. Interference is also a problem when using this technology. A carbon dioxide control and monitoring system is configured, uses PC based monitoring system [1].

Greenhouses in India are being deployed in the high-altitude regions where the temperature up to -40° C makes any kind of plantation almost impossible and in regions where conditions for plant growth are hostile. The existing set-ups primarily involves visual inspection of the plant growth, manual irrigation of plants, turning ON and OFF the temperature controllers. It is time consuming, vulnerable to human error and hence less accurate and unreliable. combination of manual supervision and partial automation and is similar to manual set-up in most respects but it reduces the labor involved in terms of irrigating the set-up [2].

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The greenhouse based modern agriculture industries are the recent requirement in every part of agriculture in India. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric circumstances these conditions sometimes may vary from place to place in large farmhouse, which makes very difficult to maintain the uniformity at all the places in the farmhouse manually. It is observed that for the first time an android phone-control the Irrigation system, which could give the facilities of maintaining uniform environmental conditions are proposed. The Android Software Development Kit provides the tools and Application Programmable Interface necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of human life serving multiple needs of humans. This application makes use of the GPRS [General Packet Radio Service] feature of mobile phone as a solution for irrigation control system. GSM (Global System for Mobile Communication) is used to inform the user about the exact field condition. The information is passed onto the user request in the form of SMS [3].

The 'Green House Effect' is the technology to provide plants and trees the required nourishment from the sunlight and to prevent the same from the harmful rays/effects of sunlight. As well as greenhouse environmental information such as temperature, maintaining light intensity as well as fulfilling water requirements etc. Accordingly, monitoring crop itself is as important as monitoring indoor environments. Using these collected greenhouse environmental data, indoor environments can be more effectively controlled, and monitoring crop itself can contribute to improve productivity and to prevent crops from damages by harmful sun ray. In addition, it will be possible for farmers to do control plant growth through closely studying relationship between indoor environmental information and monitored information on crop itself. It is made possible to collect information and control effectively and automatically greenhouse in the site or from a remote place through GSM modem. System components are: temperature sensor, humidity sensor, leaf temperature sensor, leaf humidity sensor, Rain Sensor, Transistor switches, relay nodes for automatic control, and data server to store greenhouse information. The system is implemented using low power wireless components, and easy to install [4].

Wireless Sensor Networks (WSNs) have played major role and attention in recent years. The ambiguous applications of WSNs are immense. These networks used for collecting, storing and sharing sensed data among them self's and to external node. WSNs have been used for various applications such as habitat monitoring, agriculture, nuclear reactor control, security, tactical surveillance and many more applications where human cannot monitor. The monitoring and GSM systems and developed in this project is for use in green house applications, where real time data of climate conditions and other environmental properties are sensed and control decisions are taken by monitoring system and they are modified by the automation system and sends SMS that what operation is performed by them to user. The architecture of a greenhouse monitoring system comprises of a set of sensor nodes and a control unit that communicate with each sensor node and collects local information to make necessary decisions about the physical environment. The Temperature sensors LM 45 senses the temperature and send to controller, it will amplify and send to Control Unit. The Humidity Sensor is used to find the humidity of the Greenhouse. The control units have the MCU to check the reading and make the fan ON or OFF. Then status of the Greenhouse will send to the user Mobile through GSM Module [5].

III. STUDY OF THE SYSTEM

Appropriate environmental conditions are necessary for optimum plant growth, to improve crop yields. 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 with less labor requirements.

The proposed system is an embedded system which monitor the microclimatic parameters of greenhouse such as light, temperature, humidity, soil moisture and control them by actuating lamp, fan, fogger, water pump respectively according the necessary condition of the crop. The status of various sensors and all the devices will be displayed on LCD and send to mobile of owner through SMS using GSM modem.

In this proposed system as shown in figure 1, by using five input sensor such as light sensor (LDR), temperature sensor (THERMISTOR) or LM35, humidity sensor (SL-HS-220), moisture probes and pH probes to monitor the climatic parameters of greenhouse such as light, temperature, humidity, soil moisture, pH of soil. The output of sensor is given to comparator to compare with reference value. The output of comparator is given to the input of microcontroller.

If the parameters of greenhouse are not within limit then the microcontroller will give the signal to turn on the lamp, fan, fogger, water pump according the necessary condition of the crop and also give signal to turn off the controlling devices when the parameters are within limit. The proposed system can be used with various sensors and analyse the output of sensor with the comparator will be provided to the microcontroller 89c51, with 8kB flash,32 I/O lines sufficient to program low end applications. LDR with maximum current of 5mA will be used for better results. Relays operating with coil voltage of 12V will be useful for good interface with the appliances along with the relay driver circuits to protect the microcontroller from reverse current from the appliances. The sensors like HS-220 will be handy for the humidity sensing operating at 5V, temperature of 0-60^{o}C and Operating humidity range = 30-90% RH.

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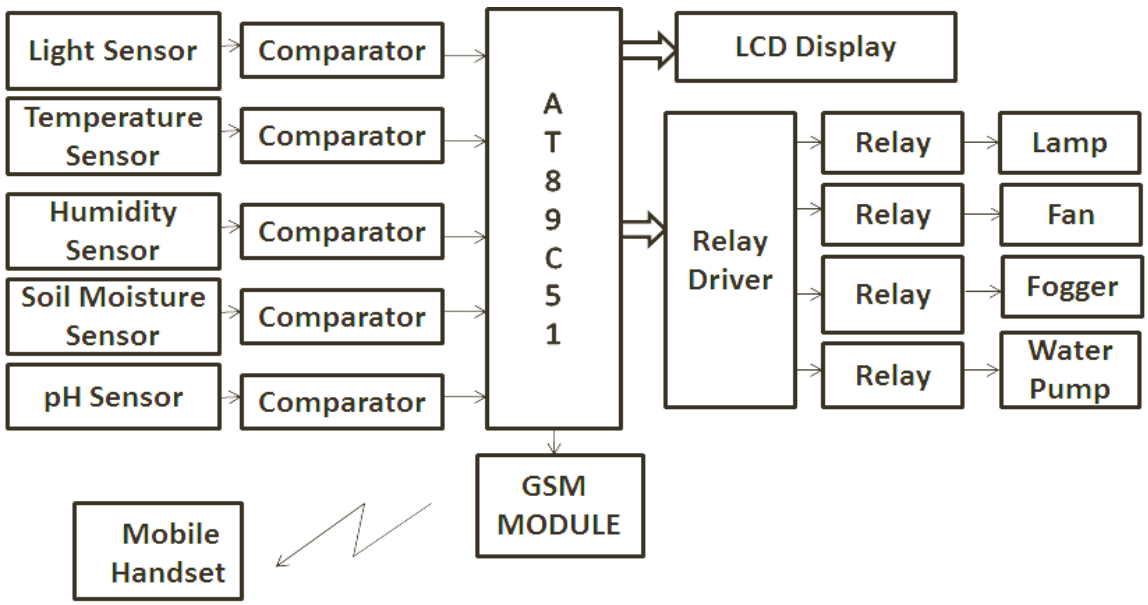

Fig. 1: Block Diagram of proposed system

The status of various sensors and all the controlling devices will be displayed on LCD display and send to mobile of owner through SMS using GSM modem. Various components that can be used in the proposed system are mentioned as below which can be explored in technically.

A. GSM Modem

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band.

B. Light Sensor (LDR)

LDR is a light dependent resistor. Resistance of the LDR is depend on the intensity of the light. As the light on the LDR is changed, resistance of LDR is also changed. Resistance of the LDR is varies from 1k ohm to 500 k ohm.In full light resistance of the LDR is very low below then 1 k ohm and in no light resistance of the LDR is become very high above then 500k ohm.

C. Temperature Sensor (LM35)

In the proposed system either Thermistor or LM35 can be used. LM35 is very accurate and very good sensor to show the temperature in Celsius. For body temperature measurement we use IC LM34 sensor. LM35 is a linear temperature sensor. To convert this output for the input of the ADC we can also use op-amp current amplifier to convert the signal into 0-5 V. We can set the minimum reference voltage by preset (variable resistor) and when temperature rises then output is also increasing with the gain of 5 and connected to the IN0 input of the ADC. The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C).

D. RELAY

An array of actuators can be used in the system such as relays, contactors, and change over switches etc. They are used to turn on AC devices such as motors, coolers, pumps, fogging machines, sprayers. For the purpose of demonstration relays have been used to drive AC bulbs to simulate actuators and AC devices. A complete working system can be realized by simply replacing these simulation devices by the actual devices.

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IV.ALGORITHM FOR PROPOSED SYSTEM

1. Start the system
2. Initialize the system for various interfacing elements such as microcontroller, LCD etc.
3. Display system status on LCD, for checking the correctness of the system.
4. Monitor and compare temperature, light, humidity, soil moisture, soil pH with reference value, so as to take corrective action, if necessary (Do it recursively).
5. Send the digital data from comparator to the microcontroller(89C51).
6. If change detected in parameter take corresponding end action. For example–If temperature rise above preset value turn on the fan and if temperature falls below preset value turn off the fan. Similarly check for every other parameter too.
7. Display the corresponding status for change and end action on LCD.
8. Send SMS for the change in parameter to the user so that user will take appropriate action.
9. Repeat the steps from step 2.

IV.RESULTS OF THE PROPOSED SYSTEM

TABLE I: HUMIDITY SENSOR READINGS

Humidity(%RH)	20	25	30	35	40	45	50	55
Voltage(mV)	660	825	990	1155	1320	1485	1650	1815
Humidity(%RH)	60	65	70	75	80	85	90	95
Voltage(mV)	1980	2145	2310	2475	2640	2805	2970	3135

TABLE II. SOIL MOISTURE SENSOR READINGS

Soil Condition	**Sensor o/p voltage**
Soil is dry	0 V
Medium level of soil moisture	1.91 V- 2.65 V
Slurry Soil	>2.611 V

TABLE III. LIGHT SENSOR READINGS

Illumination Status	**Sensor o/p voltage**
Optimum illumination	2.56 V
Dim light	0.72 V
Dark	0.36 V
Night	0.041 V

TABLE IV. TEMPERATURE SENSOR READINGS

Temperature range in ºC	**Sensor o/p voltage**
10ºC	0.49 V
15ºC-20ºC	0.74 V – 1.01 V
20ºC-25ºC	1.01 V – 1.25 V
25ºC-30ºC	1.25 V – 1.5 V
30ºC-35ºC	1.51 V – 1.75 V
35ºC-40ºC	1.74 V – 2.01 V

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40ºC-45ºC	2.0 V – 2.25 V
45ºC-50ºC	2.25 V – 2.5 V
50ºC-55ºC	2.51 V – 2.75 V
55ºC-60ºC	2.75 V – 3.0 V
60ºC-65ºC	3.01 V – 3.25 V
65ºC-70ºC	3.25 V – 3.5 V
70ºC-75ºC	3.5 V – 3.75 V
75ºC-80ºC	3.75 V – 4.0 V
80ºC-85ºC	4.0 V – 4.25 V
85ºC-90ºC	4.25 V – 4.5 V
90ºC-95ºC	4.5 V – 4.75 V
95ºC-100ºC	4.75 V- 5 V

V. CONCLUSION

The proposed system can monitor and control most of the parameters of the for greenhouse as per requirement. This system reduces the man power requirement significantly and it is very beneficial for the farmers to assist them for the good health of the crops. This system also plays an important role in increase in yield of crops. By the use of GSM and microcontroller it is providing instant responsive approach for the user.

VI. FUTURE SCOPE OF SYSTEM

The performance of the system can be further improved by using other controllers such as ARM9, ARM11 and Arduino. The system can be made to perform better by providing the power supply with the help of good battery backup as well as solar panel, UPS. The system can be well upgraded with Android application so that user will fill its easiness more.

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