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Monitoring and Controlling of Green-house system

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Abstract— This paper deals with the design of monitor and control of 'greenhouse' system. It is being used for intelligence agriculture purpose which is installed in the farm, building terrace. The main objective of this project is to protect the plants from excessive water, temperature, humidity etc. It integrates and automates by turning ON or OFF all monitoring devices in the green-house. This is due to the MCU technology that can be easily modified and re-modified with portability. There is also an alarm circuit to call the attention of the Supervisor. This study focuses on determining the effectiveness of greenhouse control device.

Index Terms- Wireless sensor network, Digital Agriculture, Environment Monitoring; Greenhouse monitoring environment

1. INTRODUCTION

We live in a world where everything can be controlled and operated automatically, but there are still a few important sectors in our country 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. 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 produce. Automating a greenhouse envisages monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence their produce. Automation is process control of industrial machinery and processes, thereby replacing human operators.

2.SYSTEM MODEL

2.1 Parts of the System

• Sensors (Data acquisition system)
i. Temperature sensor
ii. Moisture sensor
iii. Light sensor (LDR)
iv. Water sensor
• Analog to Digital Converter
• Microcontroller (AT89C51)
• Liquid Crystal Display
• Actuators – Relays
• Devices controlled
i. Water Pump (simulated as a bulb
ii. Sprayer (simulated as a bulb)
iii. Cooler (simulated as a fan)
iv. Artificial Lights (simulated as 2 bulbs)

2.2 Basic block diagram

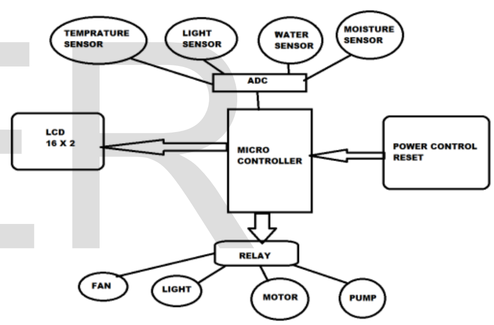

Fig. 1 Block Diagram

2.3 Steps Followed In Designing the System

Three general steps can be followed to appropriately select the control system:

Step # 1: Identify measurable variables important to production. It is very important to correctly identify the parameters that are going to be measured by the controller's data acquisition interface, and how they are to be measured.

Step # 2: Investigate the control strategies. An important element in considering a control system is the control strategy that is to be followed. The simplest strategy is to use threshold sensors that directly affect actuation of devices.

Step # 3: Identify the software and the hardware to be used. Hardware must always follow the selection of software, with the hardware required being supported by the software selected. In addition to functional capabilities, the selection of the control hardware should include factors such as reliability, support, previous experiences with the equipment (successes and failures), and cost. 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 . It checks if any corrective action is to be taken for the condition at that instant of time. In case such a situation arises, it activates the actuators to perform a controlled operation.

3.HARDWARE DESCRIPTION

3.1 Transducers

A transducer is a device which measures a physical quantity and converts it into a signal which can be read by an observer .It can also be read by an instrument . The sensors used in this system are:

1. Light Sensor
2. Humidity Sensor
3. Temperature Sensor
4. Moisture sensor

3.2 Analog to Digital Converter

In physical world parameters such as temperature, pressure, humidity, and velocity are analog signals. A physical quantity is converted into electrical signals. We need an analog to digital converter (ADC), which is an electronic circuit that converts continuous signals into discrete form so that the microcontroller can read the data. Analog to digital converters are the most widely used devices for data acquisition. In our project we using ADC0809 IC. The ADC0809 data acquisition component is a monolithic CMOS device with an 8- bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals.

3.3 Microcontroller

In our project we used AT89S52 Microcontroller. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry- standard 80C51 instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost effective solution to many embedded control applications. The microcontroller is interfaced with the ADC in polling mode. INT0 is used for the LCD mode selection switch in order to switch between two modes of display:

1) Sensor output display
2) Actuator status display

Port details:

Port 0: Interfaced with the LCD data lines.

Port 1: Interfaced with the ADC data lines.

Port 2: Interfaced with the LCD Control lines and AC Interface control.

Port 3: Interfaced with the ADC control lines.

3.4 Liquid Crystal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector . Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. For an 8-bit data bus, the display requires a +5V supply plus 11 I/O lines. For a 4-bit data bus it only requires the supply lines plus seven extra lines. When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller. Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 8x80 pixels of the display. They have a standard ASCII set of characters and mathematical symbols.

3.5 Relays

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier.

3.6 Power Supply Connection

The power supply section consists of step down transformers of 230V primary to 9V and 12V secondary voltages for the +5V and +12V power supplies respectively.

4.SOFTWARE

4.1 Keil Software

Keil Micro Vision is an integrated development environment used to create software to be run on embedded systems (like a microcontroller). It allows for such software to be written either in assembly or C programming languages and for that software to be simulated on a computer before being loaded onto the microcontroller.

4.1.1 Device Database

A unique feature of the Keil µVision3 IDE is the Device Database, **which** contains information about more than 400 supported microcontrollers.

4.1.2 Peripheral Simulation

The µVision3 Debugger provides complete simulation for the CPU and onchip peripherals of most embedded devices.

4.2 Programmer

The programmer used is a powerful programmer for the Atmel 89 series of microcontrollers that includes 89C51/52/55, 89S51/52/55 and many more. Major parts of this programmer are Serial Port, Power Supply and Firmware microcontroller. Serial data is sent and received from 9 pin connector and converted to/from TTL logic/RS232 signal levels by MAX232 chip [8]. A Male to Female serial port cable, connects to the 9 pin connector of hardware and another side connects to back of computer.

4.3 Proload Programming Software

ProLoad' is a software working as a user friendly interface for programmer boards from Sunrom Technologies. The programmer connects to the computer's serial port (Comm 1, 2, 3 or 4) with a standard DB9 Male to DB9 Female cable. Baud Rate - 57600, COMx Automatically selected by window software. No PC Card Required .

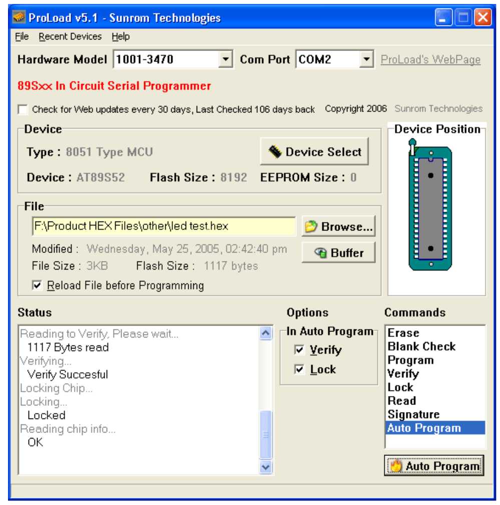

Fig.2 Programming window

2. RESULT ANALYSIS

The design result was achieved when the thermistor (NTC) is connected to the microcontroller as input, outputting as heater or temperature. When the temperature is above threshold level then voltage across the thermistor will be greater and the LED will turn ON. The soil moisture probe is connected as input, outputting through as water valve. When Pin 2 is pulled up to 5v, the moisture probe is placed in water (i.e. moisture is present in the soil) there will be a resistance across the probe thereby developing a voltage across the probe, as such the voltage on that pin 2 will reduce below 5v. When the voltage drops below 5v the moisture LED will be OFF, but when there is no moisture in the soil the LED come ON indicating a dry soil. The float switch is connected to the microcontroller and it can be set up to sense either rising or falling water levels - rising water to measure when a container is full or water has reached a certain maximum level, falling water to measure when a container is empty or has reached a certain minimum level.

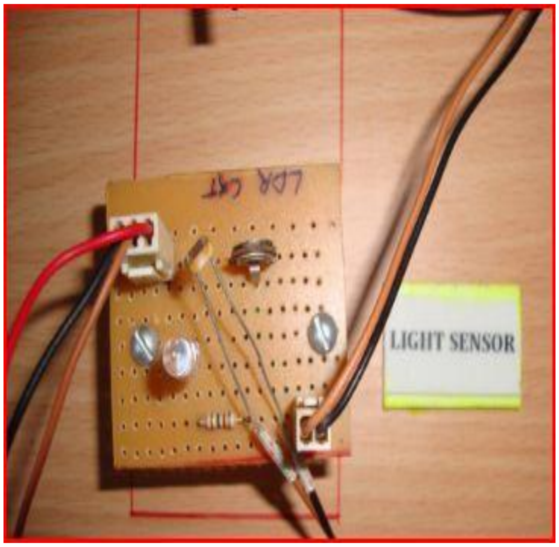

Fig. 3 Light sensor

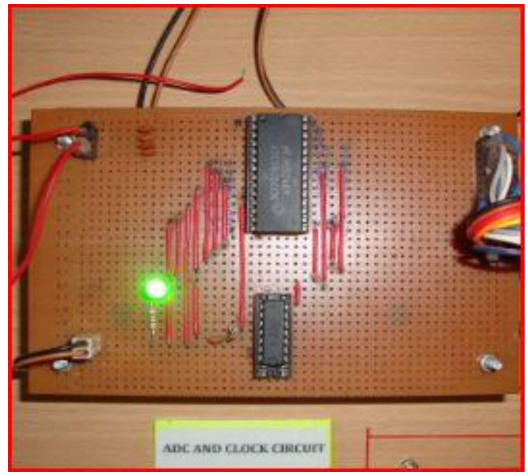

Fig. 6 ADC & Clock circuit

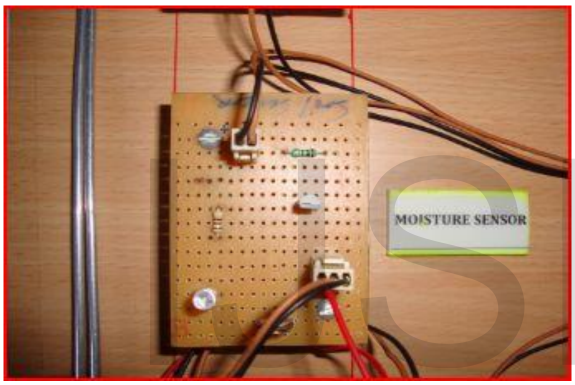

Fig.4 Moisture sensor

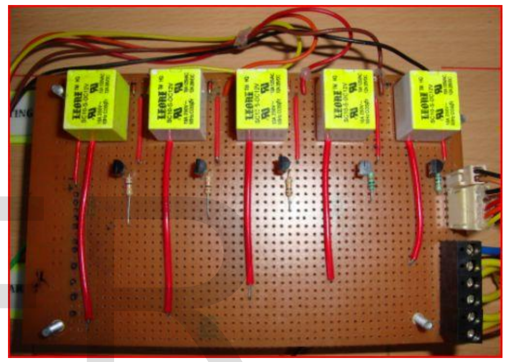

Fig. 7 Relay board

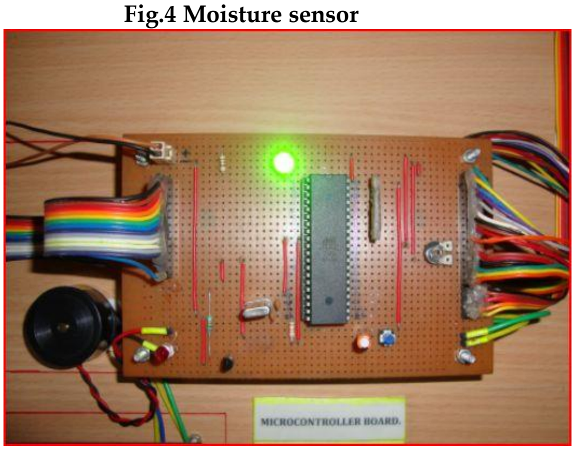

Fig. 5Microcontroller & buzzer circuit

3. CONCLUSION

A step-by-step approach in designing the microcontroller based system for measurement and control of the four essential parameters for plant growth, i.e. temperature, humidity, soil moisture, and light intensity, has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment. The continuously decreasing costs of hardware and software, the wider acceptance of electronic systems in agriculture, and an emerging agricultural control system industry in several areas of agricultural production, will result in reliable control systems that will address several aspects of quality and quantity of production. Further improvements will be made as less expensive and more reliable sensors are developed for use in agricultural production.

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