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Monitoring and Controlling Nursery Plants Using Robot

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Abstract: Microcontroller-based Green House control devices automate equipment and quantities in greenhouses, reducing human monitoring and ensuring optimal plant growth, crop yields, and resource efficiency. These systems are crucial for agriculture and horticulture sectors, as they control soil moisture, temperature, and other climatic parameters, enabling high-frequency data acquisition and reduced labor requirements. This project aims to design a micro-controller-based circuit that monitors and records temperature, humidity, soil moisture, and sunlight in the natural environment, enabling maximum plant growth and yield. Utilizing a low-power ATMEL AT89S52 chip, the circuit communicates with sensor modules in real-time, controlling temperature, moisture, humidity, and day light in greenhouses. A 16x2 character LCD displays information. This economical, portable, and low-maintenance solution integrates monitoring devices and provides suggestions for remedies. The study focuses on determining the effectiveness and functionality of greenhouse control devices.

Keywords: green house, heating, radiation, temperature, watering, ventilation

I. INTRODUCTION

Irrigation is crucial for greenhouse systems, as it ensures plants survive in certain conditions. Manual systems are inefficient and can lead to plant death if insufficient water supplies are not provided. To address this issue, automatic watering systems and remote monitoring are used, reducing time and requiring fewer workers. Sensors like temperature sensors and soil moisture probes control temperature and watering in the greenhouse.

The greenhouse monitoring project measures temperature, humidity, and light parameters using sensors and an ADC. A microcontroller controls these parameters using relay interfaces, which can be connected to fans or heaters. The temperature and light values are sent to a computer via serial port, which can be displayed on a PC using hyper terminal.

The proposed system is an embedded system that monitors and controls microclimatic parameters in a greenhouse to maximize crop production. It uses sensors, an Analog to Digital Converter, microcontroller, and actuators to minimize human intervention. When climatic parameters cross a safety threshold, sensors sense the change and the microcontroller reads the data from input ports. The microcontroller then performs necessary actions using relays until the strayed parameter is brought back to its optimum level. The system is low-cost, effective, and user-friendly, with an LCD display for continuous alerts. This low-cost solution eliminates existing drawbacks and offers a flexible, low-cost solution for greenhouse cultivation.

A. Objectives:

- Lack of mechanization in farming
- Required excess efforts for different process.
- Required more man power.
- Excess time consumption for performing individual process.

B. Problem Definition:

Irrigation is crucial for greenhouse systems, as it ensures plant survival. Manual systems are inefficient and can lead to plant death if insufficient water supplies are not provided. To maintain plant health and overcome issues, automatic watering systems and remote monitoring are used. These systems help maintain the plant's health and ensure optimal conditions for optimal growth.

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C. Scope of Study:

Automatic watering in greenhouses reduces time and requires fewer workers using temperature sensors and soil moisture probes.

II. LITERATURE REVIEW

The proposed system is an embedded system which will monitor and control the microclimatic parameters of a greenhouse on a regular basis round the clock for cultivation of crops or specific plant species which could maximize their production over the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible extent using sensors, Analog to Digital Converter, microcontroller and actuators (Stipanicev, Marasovic 2003).When any of the above mentioned climatic parameters cross a safety threshold which has to be maintained to protect the crops, the sensors sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC.

The microcontroller then performs the needed actions by employing relays until the strayed-out parameter has been brought back to its optimum level. Since a microcontroller is used as the heart of the system, it makes the set-up low-cost and effective, nevertheless. As the system also employs an LCD display for continuously alerting the user about the condition inside the greenhouse, the entire set-up becomes user friendly. Thus, this system eliminates the drawbacks of the existing set-up and is designed as an easy to maintain, flexible and low cost solution.

III. SYSTEM DESIGN

This project involved the implementing of a greenhouse control device in order to control, monitor and maintain the desired temperature in the green house by turning ON the Heater/cooling system as when due also study the soil moisture content (when water is needed) by turning the water valve ON or OFF.

Proposed System

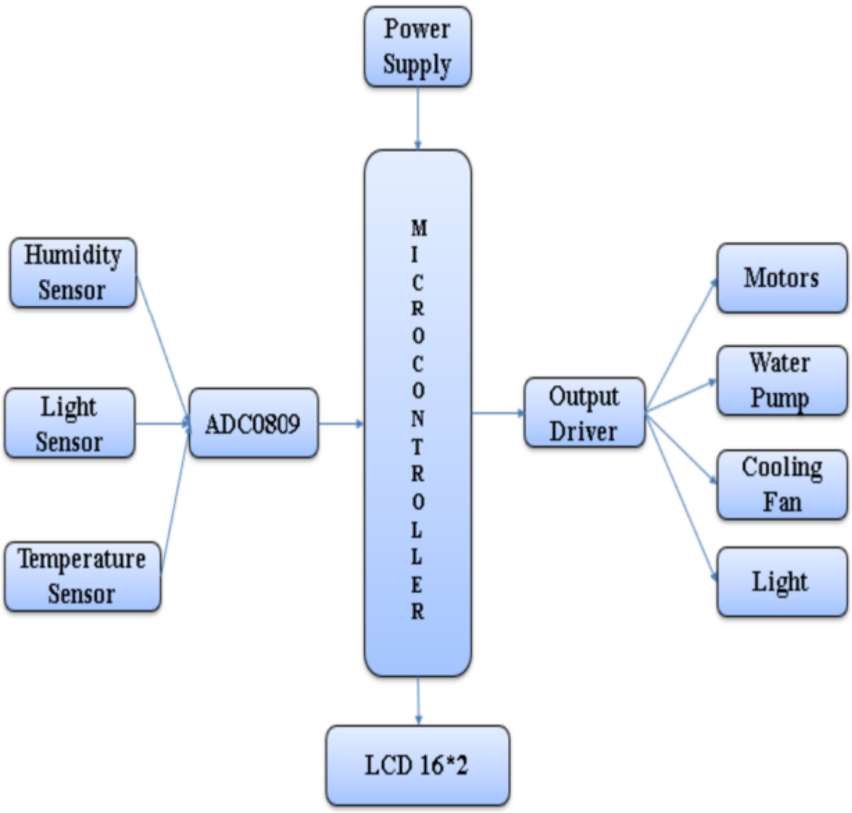

Figure 1: Proposed System

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IV. COMPONENTS OF SYSTEMS

1. Microcontroller:

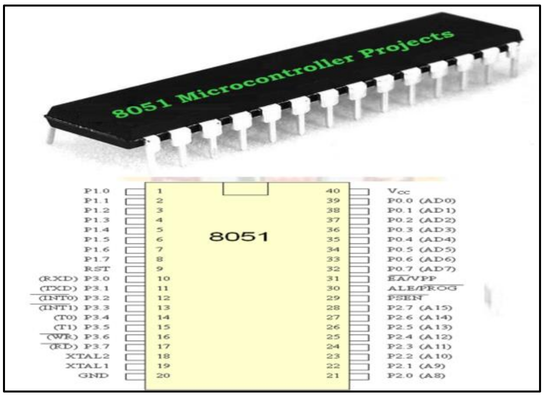

Figure 2: Microcontroller

Features:
1. It is an 8 bit microcontroller
2. 8bit accumulator, 8bit Register and 8bit ALU.
3. On chip RAM 128 bites (data memory).
4. Power saving mode (on some derivatives)

D. Temperature sensor:

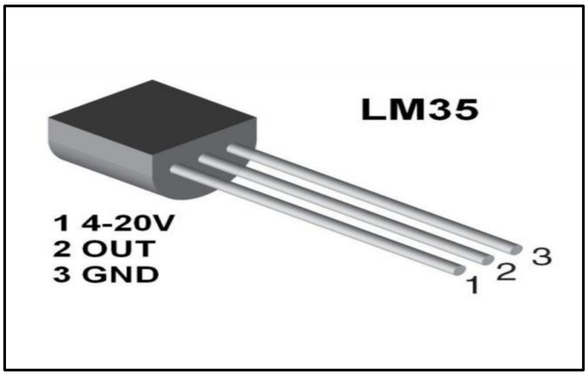

Figure 3: Temperature Sensor

Features:
1. Based on the semiconductor LM35 temperature sensor
2. Can be used to detect ambient air temperature

E. Humidity Sensor

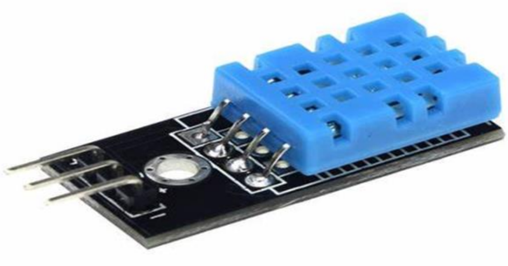

Figure 4: Humidity Sensor

This is a multifunctional sensor that gives you temperature and relative humidity information at the same time. It utilizes a DHT11 sensor that can meet measurement needs of general purposes. It provides reliable readings when environment humidity condition in between 20% RH and 90% RH, and temperature condition in between 0°C and 50°C, covering needs in most home and daily applications that don't contain extreme conditions.

F. MHTR sensor (Methylene tetrahydrofolate reductase)

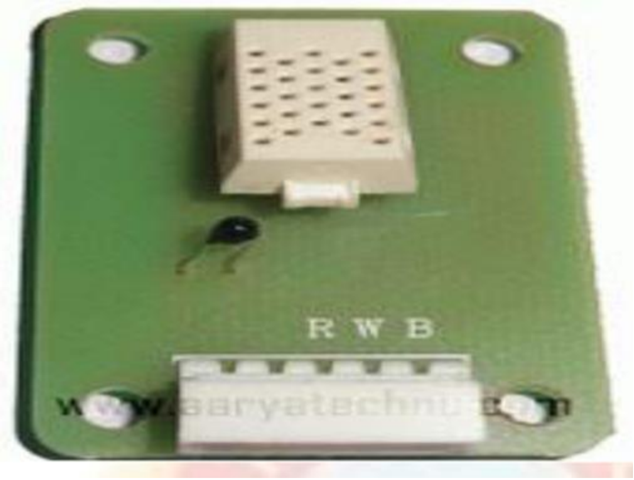

Figure 5: MHTR sensor

Specifications

Rated voltage DC 5V ±5%
Rated power 1.6 mA (max 3 mA)
Temperature operating range 0 ~ 60ºC
Humidity operating range under 95% RH
Humidity measuring range 20 ~ 95% RH
Temperature storing range 0 ~ 70ºC

G. Light Sensor

Figure 6: Light Sensor

A Light Dependent Resistor (LDR) is a light sensitive device made of high-resistance semiconductor materials. Its resistivity depends on electromagnetic radiation, with resistance ranges from several mega ohms to hundreds ohms. Photons absorb energy, lowering resistance, and unique photo resistors may react differently to specific wavelength bands.

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H. Power Supply System

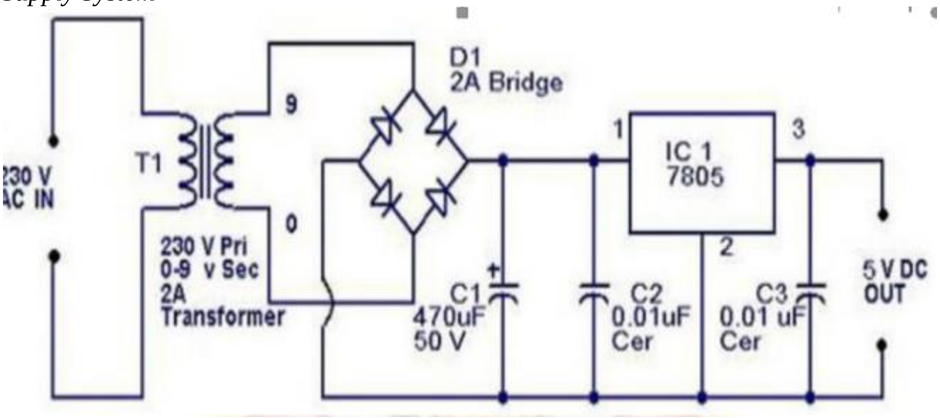

Figure 7: Power Supply System

V. COST ESTIMATION

Project Components	Cost
Microcontroller 8051	750
Humidity Sensor	120
Temperature Sensor	250
Light Sensor	120
DC motor	219
LCD Display (16*2)	350
ADC0809	520
Cooling fan	420
DC water pump	189
LM35 Sensor	250
Transformer	500
Connecting wires ,register, capacitor inductor etc.	200
Others	2000
Total	**5888**

VI. FUTURE SCOPE

We can monitor more parameters like Humidity, pH of soil, pressure, and water level and at the same time control them. We can send this data to a remote location using mobile or internet. We can draw graphs of variations in these parameters using computer.

VII. 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 shown that the system performance is quite reliable and accurate. This will reduce the time of using the manual way of watering. Fewer workers are needed to maintain the plants or crops. Sensors such as temperature sensor (Thermistor) and soil moisture probe are used to control the temperature and watering in the greenhouse.

The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at a reduced cost and at the same time providing a flexible and precise form of maintaining the environment.

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