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ORIGINAL ARTICLE

MICROCONTROLLER BASED AUTOMATIC PLANT IRRIGATION SYSTEM FOR GREENHOUSE

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Abstract:

The water is very important parameter required for proper growth of plants. Some of the plant requires more or less water as compared to other Plants. Therefore it should get the water as per its requirement. Also as far as availability of water is concerned, there should be controlled use of water. In traditional techniques there is uncontrolled use of water which affects the growth of plants. It is necessary to provide the controlled water to the crops those are growing in the greenhouse. Therefore, microcontroller based embedded system is designed to control the water supplied to the crops in the greenhouse and presented in this paper.

The present embedded system is designed by using 89C2051 Microcontroller and to sense whether the Soil is wet or dry, two copper rods are used. The voltage produced by water sensor is compared with the reference voltage using voltage comparator IC LM324. To display the status of water pump and soil the LED indicators are used. The solid state relay is used to interface the water pump that supplies the water to the greenhouse. The firmware is developed in assembly in Pinnacle, IDE. The results regarding implementation of an embedded system are interpreted in this paper.

KEY WORDS:

Water sensor, Microcontroller, water Pump, greenhouse.

1. INTRODUCTION:-

It is well known that the water is very important factor required for proper growth of the crops. Generally the crop which requires more water are growing in rainy season and the crops which requires less water are growing in hot season. It is more beneficial for the crops that it should get the water as per its requirement. Also as far as availability of water is concerned, there should be controlled use of water. But in traditional farming it is found that the use of water is uncontrolled which causes wasting of water.

It is possible to provide automatically controlled water to the crops as per its requirement in the greenhouse. By using the microcontroller with suitable water sensor, an electronic system can be developed to provide controlled water to the crops in greenhouse to grow more effectively. The analog signal generated by the sensor is given to comparator to generate digital signal and is then processed by the microcontroller. The objective of this work was to design optimized technique by developing an electronic model to provide automatically controlled water to the crops in the greenhouse. An electronic model is developed by using 89C2051 microcontroller, two stiff copper wires as water sensor, comparator IC LM324 and some circuit components to provide controlled water to the greenhouse as per the requirement of the crops. The LED indicators are used to show the status of soil either dry or wet along with status of water pump either ON or OFF.

2. THE HARDWARE

The block diagram of an electronic circuit that is developed to control the water in greenhouse is shown in following figure, which consists of two stiff copper wires as a water sensor, LED indicators, control unit (relay), water pump & microcontroller 89C2051.

Fig (1) Block Diagram

The block diagram of Automatic Irrigation System comprises three main components namely an 89C2051 microcontroller, sensor with comparator and relay. The circuit consists sensor parts built using op-amp IC LM324. Here op-amps are configured as comparators. Two stiff copper wires are inserted in the soil to sense whether the Soil is wet or dry. The AT89C2051 microcontroller is programmed in Pinnacle software. When the sensor arrangement senses the moisture signal of the soil, it is compared with reference voltage and sends the signal either 1 or 0 to the microcontroller. Here, comparator acts as an interface between the sensing arrangement and the microcontroller. Sensing arrangement is made by using two stiff metallic rods placed into the field at a distance. Once the microcontroller receives the signal it generates the output that drives a relay and starts the motor to pump water to the plants. The status of the water pump and soil is displayed on indicator LED which is interfaced to the microcontroller. Thus, this automatic plant-irrigation system depends on the output of the moisture sensors.

2(a) Water Sensor

The water sensor circuit is constructed by using two stiff copper wires and comparator IC LM324 which is operated at 5V supply.

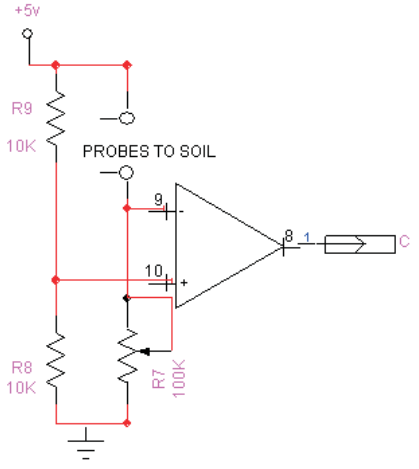

Fig (2) Water Sensor Circuit

When the sensor circuit senses the condition of soil, it compares it with the reference voltage 2.5V by LM324 comparator. When the soil condition (Voltage at pin 9) shown by sensor is less than the reference voltage, i.e. 2.5v (Voltage at pin 10), then the soil is considered as dry and instantly the LM324 comparator output becomes at logic 1. Similarly when the soil condition shown by the sensor is greater than the reference voltage, the soil becomes wet and the LM324 comparator output becomes at logic 0.

2(b) Microcontroller AT89C2051:

The AT89C2051 is a low-voltage, high-performance CMOS 8-bit microcomputer with 2K bytes

of Flash programmable and erasable read-only memory (PEROM). The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry-standard MCS-51 instruction set. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C2051 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89C2051 provides the following standard features: 2K bytes of Flash, 128 bytes of RAM, 15 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, a precision analog comparator, on-chip oscillator and clock circuitry. In addition, the AT89C2051 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. The power-down mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

FEATURES

• Compatible with MCS®-51Products
• 2K Bytes of Reprogrammable Flash Memory – Endurance: 10,000 Write/Erase Cycles
• 2.7V to 6V Operating Range
• Fully Static Operation: 0 Hz to 24 MHz
• Two-level Program Memory Lock
• 128 x 8-bit Internal RAM
• 15 Programmable I/O Lines
• Two 16-bit Timer/Counters
• Six Interrupt Sources
• Programmable Serial UART Channel • Direct LED Drive Outputs • On-chip analog Comparator

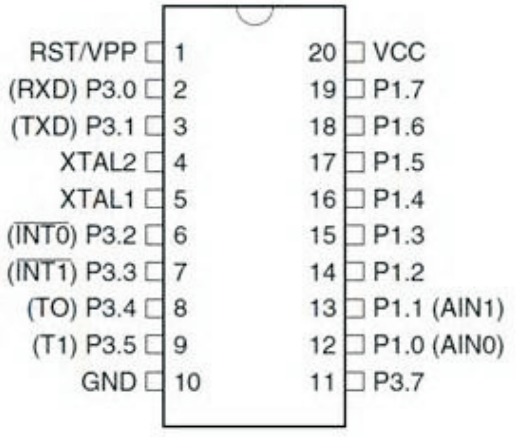

Fig (3) Pin out of AT89C2051

3) The Software:

To run the above system an assembly language program is developed by using Pinnacle. The status of soil is tested and decision is taken about the motor pump accordingly. Following are the programming steps for the system.

I) Reading of the soil status
ii) Turn ON the motor if soil is dry.
iii) Turn OFF the motor if soil is wet.
iv) Repeat the process continuously

4) RESULT AND DISCUSSION:

The system provides with several benefits and can operate with less manpower. The system supplies water only when the moisture of the soil goes below the reference value. Due to the direct transfer of water to the roots water conservation takes place and also helps to maintain the moisture to soil ratio at

the root zone constant to some extent. Thus the system is efficient and compatible to changing environment.

5) CONCLUSION

The paper presents an electronic model based on microcontroller AT89C2051 to control the water for plants in greenhouse at as per the status of soil. The circuit works very efficiently i.e. if soil is dry, the motor pump turns ON automatically and it turns OFF if soil is wet. It is also conclude that same type of model can be developed for the various parameters only by changing the sensors and the controlling devices.

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