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Microcontroller Based Automated Irrigation System

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ABSTRACT

Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Irrigation system uses valves to turn irrigation ON and OFF. These valves may be easily automated by using controllers and solenoids. In this project an attempt has been made to automate farm or nursery irrigation that allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. The Microcontroller based automated irrigation system consists of moisture sensors, analog to digital converter, microcontroller, relay driver, solenoid valve, solar panel and a battery. This system can be used in the areas where electrical power is difficult to obtain. This system is eco friendly and it uses a renewable source of energy.

KEYWORDS : *Irrigation, Microcontroller, Soil moisture sensor, Solenoid valve, Renewable energy.*

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I. INTRODUCTION

The continuous increasing demand of food requires the rapid improvement in food production technology. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes to waste. This problem can be rectified if we use microcontroller based automated irrigation system in which the irrigation will take place only when there will be acute requirement of water.

II. DESCRIPTION OF COMPONENTS

Following are the major components used from which microcontroller based automated irrigation system has been fabricated.

1. Soil moisture sensor
2. Microcontroller
3. Relay
4. Solenoid valve
5. Liquid crystal display
6. Solar panel
7. Ni-Cd battery

2.1 Soil Moisture Sensor

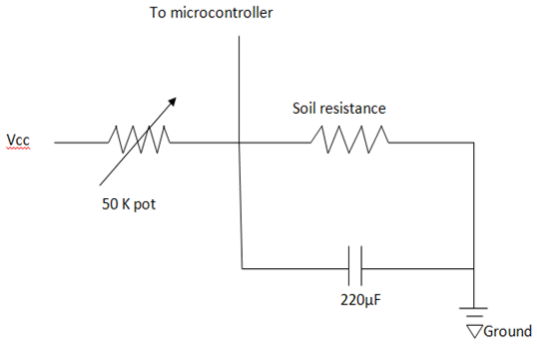

Fig.1: Circuit diagram of the soil moisture sensor

The moisture sensor is buried in the ground at required depth. The working of the moisture sensor is simple and straightforward. The moisture sensor just senses the moisture of the soil. The change in moisture is proportional to the amount of current flowing through the soil.

2.2 Microcontroller

The PICI6F877A is a 8 bit microcontroller and it is a very robust controller that suits this particular application. The PICI6F877A is a low-power CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial appliances and consumer applications. PIC16F874A/877A devices are available in 40-pin and 44-pin packages.

2.3 Relay

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. A relay is able to control an output circuit of higher power than the input circuit.

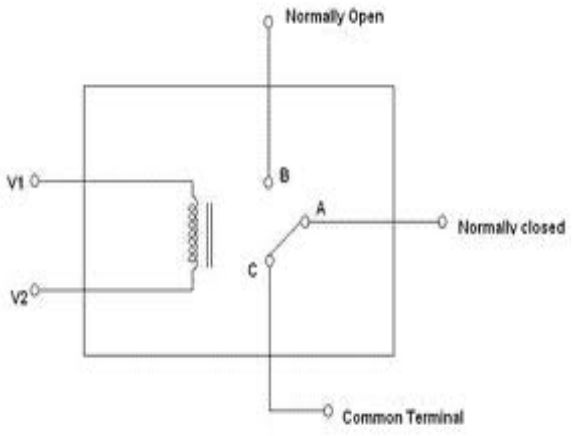

Fig.2: Block diagram of a relay

The above diagram shows the representation of a relay. By default when there is no excitation in the coil the NC (Normally Closed) and C (Common Terminal) are connected through the contact internally. When the coil is excited by providing the required coil voltage, the contact switches from the NC to NO (Normally Open) side. In this case, the C and NC terminals are connected internally.

2.4 Solenoid Valve

A solenoid valve is an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

2.5 Liquid Crystal Display

The LCD will display the alphabets, numbers, characters and symbols. The LCD used here is eight bit parallel type and the display size is 16*2. Liquid Crystal Display is used for displaying the moisture value.LCD consists of three control pins and eight data pins. Based on the commands given to the control pins, data can be read from or write to the LCD. The eight data pins of the LCD are connected to the PORTB pins RB0-RB7. Three control pins are connected to PORTC pins. RC0, RC1, RC2 are used for register select (RS), read/write (R/W) and enable (E) respectively.

2.6 Solar Panel

Solar panel is an assembly of solar cells. Solar cell or photovoltaic cell is made up of silicon semiconductor. Electricity is produced when the sunlight strikes the solar cell, causing electrons to move around. In this project solar panel of 12v, 10 watts Capacity is used.

2.7 Ni-Cd Battery

In this project Ni-Cd battery of 12v capacity is used. Ni-Cd batteries use Nickel hydroxide as positive electrode, cadmium as negative electrode, and an alkaline electrolyte.

III. METHODOLOGY

3.1 Block Diagram

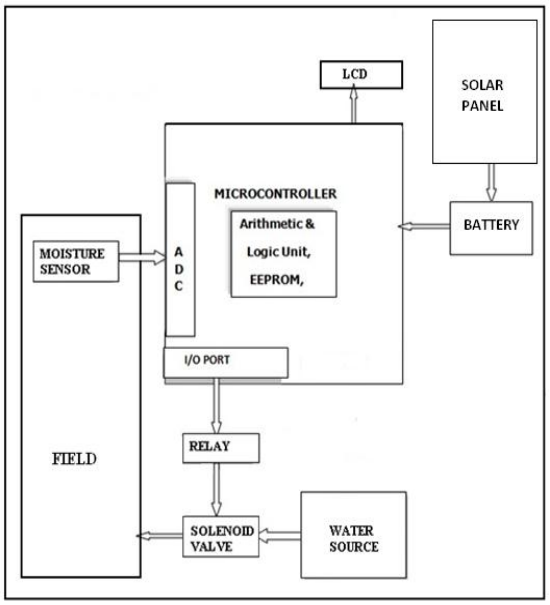

Fig.3: Block diagram of microcontroller based automated irrigation system

The Microcontroller based automated irrigation system consists of moisture sensor, analog to digital converter, microcontroller, Relay driver, solenoid valve, solar panel and a battery. The moisture sensor is buried in the field at required depth. If the moisture content in the field gets reduced to lower threshold limit, the signal is produced from the microcontroller to turn ON relay. The relay in turn opens the solenoid valve then water from the source is supplied to the field. Moisture level sensed from the sensor will be displayed in the LCD display. After reaching upper threshold limit, the sensor gives corresponding signal to the microcontroller and the relay is turned OFF and hence the solenoid valve gets closed.

IV. CONCLUSION

The Microcontroller Based Automated Irrigation System monitors and controls all the activities of drip irrigation system efficiently. Microcontroller Based Automated Irrigation System is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production and it is a simple, precise method of irrigation. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits.

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