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Solar Panel Based Automatic Plant Irrigation System

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Abstract

For Solar tracking and irrigation controller, we need to measure different parameters i.e. surrounding temperature, Water Level and Soil moisture. The key objective of this project is to develop an indigenous, low cost, time based microcontroller based irrigation scheduler. The current research focuses on precision agriculture, soil conservation and crop irrigation scheduling, shedding and water quantity control for increasing water use efficiency. The system is powered by solar system as a renewable energy which uses solar panel module to convert Sunlight into electricity. The solar panel targets the radiation from the Sun. Other than that, the solar system has reduced energy cost as well as pollution. There is a need to develop new indigenous irrigation controller to improve farm productivity and input use efficiency of water and other nutrients. This system presents the design and development of Irrigation controller System built around 89S52 microcontroller. The system consists of microcontroller, peripherals including LCD, GSM Modem and driver circuit relay to switch on/off a motor.

Keywords: Solar Panel, GSM Modem, Shedding, Water, Irrigation

1. Introduction

The irrigation system is defined as a system that distributes water to targeted area. The efficiency of the irrigation is based on the system used. Since antiquity, the human life is based on agriculture and the irrigation system is one of the tools that boost agriculture. There are many other types of irrigation system all over the world but these irrigations are encountering many problems. In fact, there are few modern systems but they mostly fail in one way to another. The automation plays an important role in the world economy; therefore, engineers struggle to come out with combined automatic devices in order to create complex systems that help human in its activities so that the system automatically processes itself without any human intervention. So we would like to develop an automatic irrigation system.

Basically, the project consists of electrical part and mechanical part. The electrical part consists of photovoltaic, which is meant to generate power and the power is stored in the rechargeable battery. The mechanical part consists of pump, to pump out the water from the water source. The parameters in the project are soil humidity condition, water level condition, the position of the Sun. . The solar system is used to generate the power to the entire system and the solar system is much cheaper than the electrical system. It is suitable to the rural area that is why the solar system is used as a power supplier to replace DC motor electricity source. In fact the initial cost of solar installation is higher than use of DC electrical motor but the solar system has no bill compared to electrical which has bill to pay every month. It is a versatile source of renewable energy that can be used in any application. The system consists of hardware and software and, finally, the integration of the two parts to provide the results. The hardware system consists of the sensors, and drivers. In hardware design, we need all the components that are necessary to accomplish the project, and these components are solar panel, DC water pump motor, sensors and some minor components like tank and reservoir.

2. Existing system

Most of the existing systems are manual system. The manual system needs labor for monitoring the productivity and health crop. Considering labor's salary, the system will cost much more than the automatic system, in which there is no assistance to the system. The farmer himself has to check the moisture level of the soil and has to make a judgment whether the field requires water or not. This way of inspecting the moisture level is not accurate and this drawback can be eliminated by using soil moisture sensor which is been used in our architecture. Moreover, the temperature required for the crops to sustain, differs from crops to crops. If the temperature increases or decreases than the expected temperature, it may affect the quality of the crops. This problem can be overcome by using the shielding mechanism, thereby maintaining the desired temperature.

ISSN 2348 – 7968

3. Architecture Design and Components

3.1 Architecture Design

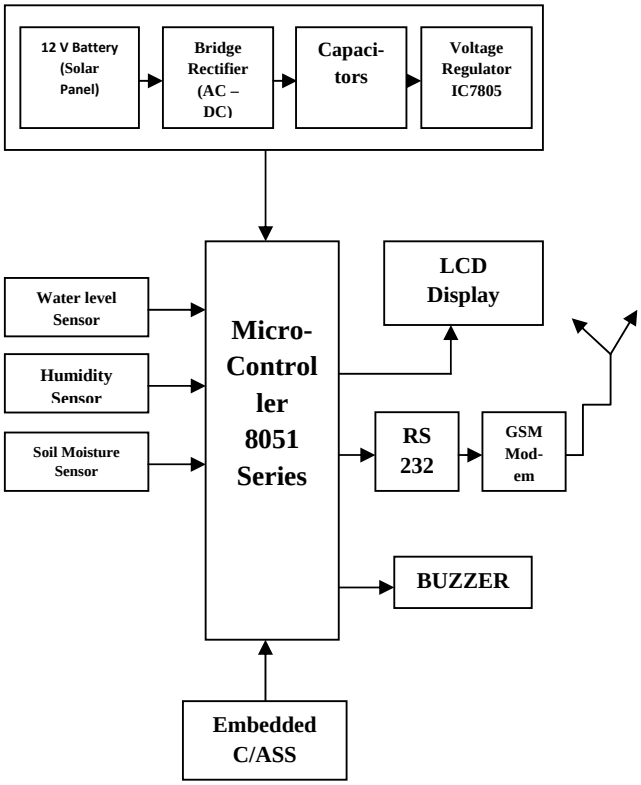

Fig. 1 Architecture of Solar Panel Based Automatic Plant Irrigation System

Working:

On the input side there are three sensors as shown the architecture. Soil moisture sensor will check the moisture of the soil as per the crop which is to be cultivated. When the moisture level of the soil goes above or below the set value, it will direct the microcontroller whether it should pump the water or not. Humidity sensor will check the temperature of the surrounding. If the temperature goes above or below the set value which is needed for a crop to grow, the microcontroller will direct the shedding to shed the entire field thereby maintaining the temperature needed by the crop for its healthy growth. The water level sensor will check whether the water in the reservoir or tank is empty or not. Buzzers are connected at the output side to get rid of birds, animals, and mosquitoes. LCD display is used to notify what actions is been taken by the microcontroller. The entire system is been monitored with the help of GSM module, thereby making it a close loop system, thus, providing feedback to the farmer on what actions is been taken by the microcontroller.

3.2 Components

A) Water Level Sensor:

An annoying drawback of many liquid level sensors is the effect of electrolytic reaction between the liquid and the sensors. Metal electrodes are prone to corrosion and consequent loss of effectiveness (reduced conductivity), with the result that they have to be replaced at frequent. One solution to this problem is to ensure that there is an AC, rather than DC potential between the sensor electrodes. The constant reversal of electrode polarity drastically inhibits the electrolytic process, so that corrosion is considerably reduced.

B) Humidity Sensor:

The humidity sensor HIH4000/HSY220, manufactured by Honeywell is used for sensing the humidity. It delivers instrumentation quality RH (Relative Humidity) sensing performance in a low cost, solder able SIP (Single In-line Package). Relative humidity is a measure, in percentage, of the vapour in the air compared to the total amount of vapour that could be held in the air at a given temperature.

C) Soil Moisture Sensor:

It is a measure of temperature at different levels of the Earth's atmosphere. It is governed by many factors, including incoming solar radiation, humidity and altitude. This variable should be defined as a continuous signal (normally as a sine wave which simulated the day and night temperature changes). An analog temperature sensor that is LM35 is a chip that tells us what the ambient temperature is. These sensors use a solid-state technique to determine the temperature.

D) Solar Panel:

Newly added feature for our project is - Solar Panel. As we were facing problem for regularly discharge of 12v battery used at filed. We finally decided to go for solar panel renewable energy source. It converts light energy from the sun into 12 Volt DC electricity. Slowly charges our 12V battery. It also helps to maintain a charge and

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extend battery's life. It protects battery through long storage periods. This solar panel charger has no moving parts that could wear out over time.

E) 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 non volatile 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 non volatile 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 AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 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 interrupt or hardware reset.

F) GSM Modem:

Short Message Service is GSM techniques to transfer data from distant places such as from one area to the area of the same city or from another city .In our project we are using SMS technique to instant or quick transfer of data or notice to the required destination. It is a convenient facility of the GSM network. A message consisting of a maximum of 160 alphanumeric characters can be send to or from a mobile station. If the subscriber's mobile unit is powered of f or has left the coverage area, the message is stored and offered back to the subscriber when the mobile is powered on or has reentered the coverage area of the network. This function ensures that the message will be received. In our project we are using SIM300 for transfer of data from weather station. Interfacing with PIC is done with RS-232 through D-TYPE 9 pin connector. SIS is the leading manufacturers of GSM modems for lower price in India.

G) LCD:

This is the first interfacing example for the Parallel Port. We will start with something simple. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not all Parallel Ports. It however doesn't show the use of the Status Port as an input for a 16 Character x 2 Line LCD Module to the Parallel Port. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board.

H) Buzzers:

The buzzers used in this architecture, produces ultrasonic sound of 17.4 kHz which is annoying for mosquitoes and another buzzer ranging in the frequency 15-25 kHz which is not annoying for birds. By using these two buzzers, we provide protection to the crops from birds which tries to feed on the crops, and prevents mosquitoes from breeding in the reservoir or tank which is present near the field. Also, piezo buzzers are used to make sure that no animals trespasses the field.

4. Conclusion

The entire system will act as a crop insurance system, as it will protect the crops by shielding it from untimely rain, hail stones, and temperature, thereby helping the farmers to get optimum cultivation. Also, it will help to make proper use of water, as the soil moisture level differs from crops to crops and this will be taken care of by the soil moisture sensor. As the entire system will be powered by solar energy which will be stored in the rechargeable batteries, one need not think of the electricity consumption, as life of solar panel which is available these days is 25 years. Moreover, the entire system is been monitored by GSM model, farmer will always be alerted what actions is been taken by the microcontroller.

5. Acknowledgment

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ISSN 2348 – 7968

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