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Microcontroller based Smart Irrigation System

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Abstract: - This system proposes a model of variable rate automatic solar based irrigation system. Solar power is used as only the source of power to control the overall system. Sensors are placed on the paddy field and these sensors continuously sense the water level and give the message to the farmer informing the water level. Without visiting the paddy fields, farmers can get the information about the water level. Based on the water level, a farmer can control the motor by sending a message from his cellular phone even from a remote place. However, if the water level reaches to the danger level; the motor will automatically start without confirmation of farmer to ensure the proper water level in the site. At the end of this paper, a complete hardware implementation of this proposed automated irrigation system is presented.

Key Words: — ***Smart irrigation, solar power, solar pump, soil moisture sensor, humidity sensor, temperature sensor, battery.***

I. INTRODUCTION

Aim is to develop a wireless three level controlled smart irrigation system to provide irrigation system which is automatic for the plants which help in saving water and money. The main objective is to apply the system for improvement of health of the soil and hence the plant via multiple sensors. Appropriate soil water level is a necessary pre-requisite for optimum plant growth. Also, water being an essential element for life sustenance, there is the necessity to avoid its undue usage. Irrigation is a dominant consumer of water. This calls for the need to regulate water supply for irrigation purposes. Fields should neither be over-irrigated nor under-irrigated. The objective of this thesis is to design a simple, easy to install methodology to monitor and indicate the level of soil moisture that is continuously controlled in order to achieve maximum plant growth and simultaneously optimize the available irrigation resources on monitoring software LabVIEW and the sensor data can be seen on Internet. In order to replace expensive controllers in current available systems, the Arduino Uno will be used in this project as it is an affordable microcontroller. The Arduino Uno can be programmed to analyze some signals from sensors such as moisture, temperature, and rain. A pump is used to pump the fertilizer and water into the irrigation system. The use of easily available components reduces the manufacturing and maintenance costs. This makes the proposed system to be an economical, appropriate and a low maintenance solution for applications, especially in rural areas and for small scale agriculturists. This research work enhanced to help the small-scale cultivators and will be increase the yield of the crops then will increase government economy.

Block Diagram:

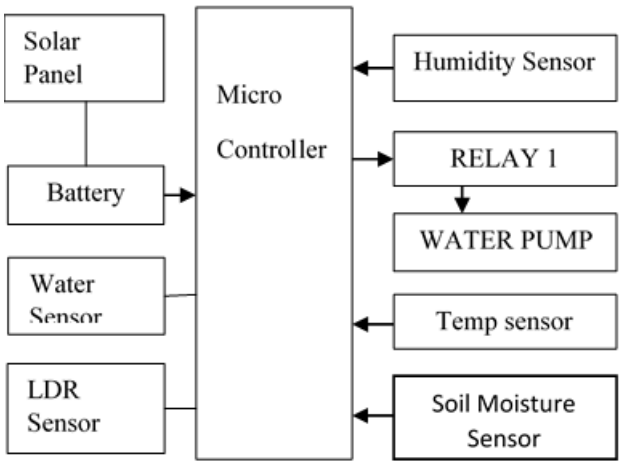

Fig.1. Basic block diagram of Proposed Model

The block diagram of the voice control car and it generally shows the interconnection of all the components with each other. The 12V power supply is given to the DC motors and the Arduino. The motors are connected to the motor driver module. The motor driver is connected to Arduino and the 12V power supply. The Arduino is connected with the Bluetooth module which is connected with the mobile application. After all the interconnection of the components

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the car will work with the voice send via mobile application by the user. This proposed project is controlling the car not by using a sensors or transmitter but using Bluetooth which is a very simple communication medium in the present day. The remote in this project is an android device, which has an inbuilt Bluetooth module. The Bluetooth is a serial communication medium
through which we can connect two devices. Here we have inserted a Bluetooth module which gets connected to the phone's Bluetooth, that allows us to communicate and allows to take command over it. The project is Bluetooth based because it gives us wider range of control and more efficiency. It also gives us the advantage of changing the remote anytime, meaning that we can use any android devices including phones, tablets, computers. Physical barriers like walls, doors, etc. do not effect in controlling the car.

II. Description Of Components Used In Proposed Model

A. Solar Cell:

A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photoelectric cell (in that its electrical characteristics-- e.g. current, voltage, or resistance-- vary when light is incident upon it) which, when exposed to light, can generate and support an electric current without being attached to any external voltage source.
Specification: 2A/150m.

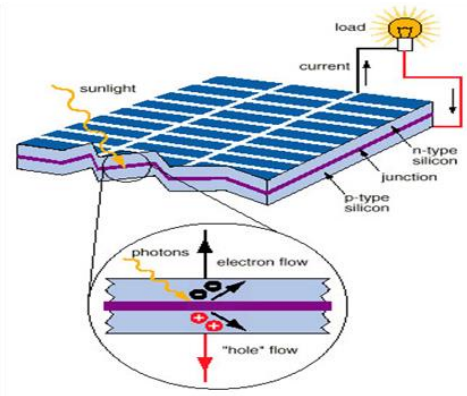

Fig.2.Solar Cell

B. Microcontroller:

Microcontroller is used as the heart of automation system to control the all actions required. The status of soil read by sensor is send to the microcontroller in the form of 0 &1. If soil is dry it will send 1 and if wet then 0, depending on the sensor used. According to the soil status the controller will send signal to the relay drive along with LCD display and GSM module. The microcontroller here used is W78E052, under the family of 8051. The microcontroller is placed in the controller board where power supply and other connections can be done.

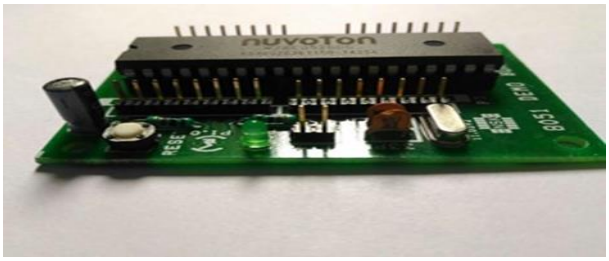

Fig.3.Microcontroller

C. Relay:

Relay is a common, simple application of electromagnetism. It uses an electromagnet made from an iron rod wound with hundreds of fine copper wire. When electricity is applied to the wire, the rod becomes magnetic. A movable contact arm above the rod is then pulled toward the rod until it closes a switch contact. When the electricity is removed, a small spring pulls the contract arm away from the rod until it closes a second switch contact. By means of relay, a current circuit can be broken or closed in one circuit as a result of a current in another circuit.
Relays can have several poles and contacts. The types of contacts could be normally open and normally closed. One closure of the relay can turn on the same normally open contacts; can turn off the other normally closed contacts.
Relay requires a current through their coils, for which a voltage is applied. This voltage for a relay can be D.C. low voltages upto 24V or could be 240V a.c.

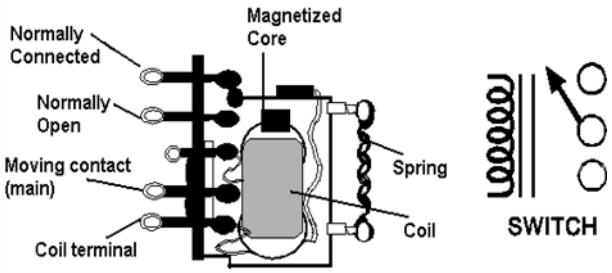

Fig.4.Relay module

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A relay is an electrical switch that opens and closes under 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. It was invented by Joseph Henry in 1835. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered, in a broad sense, to be a form of electrical amplifier.
These contacts can be either Normally Open (NO), Normally Closed (NC), or change-over contacts.

- Normally-open contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called Form A contact or "make" contact. Form A contact is ideal for applications that require to switch a high-current power source from a remote device.
- Normally-closed contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called Form B contact or "break" contact. Form B contact is ideal for applications that require the circuit to remain closed until the relay is activated.
- Change-over contacts control two circuits: one normally-open contact and one normally-closed contact with a common terminal. It is also called Form C contact.

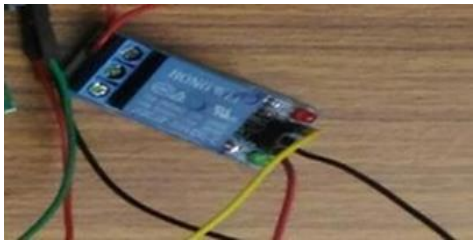

Fig.5. Relay Driver

D. Battery:

An automotive battery is a type of rechargeable battery that supplies electric energy to an automobile.[1] Usually this refers to an SLI battery(starting, lighting, ignition) to power the starter motor, the lights, and the ignition system of a vehicle's engine.

Automotive SLI batteries are usually lead-acid type, and are made of six galvanic cells in series to provide a 12 volt system. Each cell provides 2.1 volts for a total of 12.6 volt at full charge. Heavy vehicles such as highway trucks or tractors, often equipped with diesel engines, may have two batteries in series for a 24 volt system, or may have parallel strings of batteries.

Lead-acid batteries are made up of plates of lead and separate plates of lead dioxide, which are submerged into an electrolyte solution of about 38%sulfuric acid and 62% water.[2] This causes a chemical reaction that through conductors to produce electricity. As the battery discharges, the acid of the electrolyte reacts with the materials of the plates, changing their surface to lead sulphate. When the battery is recharged, the chemical reaction is reversed: the lead sulphate reforms into lead dioxide and lead. With the plates restored to their original condition, the process may now be repeated.

E. Crystal Oscillator:

A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them were called "crystal oscillators".

Fig.6. Crystal Oscillator

A miniature 4 MHz quartz crystal enclosed in a hermetically sealed HC-49/US package, used as the resonator in a crystal oscillator.

F. Soil Moisture Sensor:

Soil moisture sensor is used to measure the soil resistivity or volumetric water contain of soil in terms of threshold. When sensor is placed in field, it measures the moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil.
The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures moisture, it is compared by comparator LM393 with the set threshold if compared value is more than the set value then, the digital output goes high and an LED indicates the glows. When the

moisture in the soil is less than the set threshold, the output remains low and LED remains off. The digital output is send to connected micro controller to sense status of field. The sensor also outputs an analog output which can be connected to the ADC of a micro controller to get the exact moisture level in the soil. This types of soil moisture sensor are easily available in market and easy to use and also low cost.

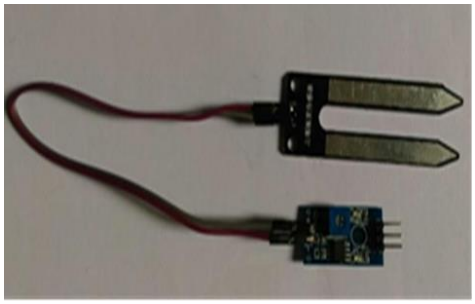

Fig.7. Soil Moisture Sensor

III. Features Of Proposed Model

- Low cost to design the circuit
- Easy to implement the circuit
- Low power consumption.
- High reliability
- Good performance.

IV. Conclusion

This paper involves establishing a contemporary design technique of monitoring and controlling the moisture level of soil using embedded. Providing comprehensive tools that need to build any measurement or control application in dramatically less time. The project also includes rain sensor, which is very important in the project to avoid unnecessary power wastage. No longer only are farmers able to generally use much less water to grow a crop, they're able to increase growth yields and the satisfactory of the crop by using better management of soil moisture at some point of vital plant growth degrees. Embedded system for computerized irrigation of an agriculture subject gives an able solution to assist web page- precise irrigation control that permits producers to maximize their productivity whilst saving the water.

V. Acknowledgement

Before we get into thick of things, I would like to add few heartfelt words for the people who are part of our team as they have been unending contribution right from the start of construction of the project. Apart from the team, I can have indebted to the number of persons who have provide helpful and contributed guidance in the draft of material. I acknowledge with deep sense of gratitude towards the encouragement in the form of substantial assistance provided each member of my team. I would like to extend my sincere thanks to our mentor Dr. R.N. Baral and Prof. Praveen Chaurasia, and Head of Department of Electronics and Communication Department Dr. RPS Chauhan.

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