Design of Smart Irrigation System

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Abstract— In agriculture, it is very important to monitor the soil moisture, so that one can know when to irrigate the field. Hence, automated irrigation based on moisture sensing can be revolutionary. In this paper the designed system not only checks the moisture content in the soil, but also pumps the water into the field automatically. Here, we are using soil moisture sensors which will let us know about the moisture level in soil. In this system, the main controlling device is microcontroller. Moisture sensor will give the status of the soil to the microcontroller. Based on that microcontroller will display the status of the soil on the LCD. If the moisture content is lower than threshold level, the microcontroller will switch (ON/OFF) pumping motor using relay. The pumping motor will pump the water into the field by using drip water system until the field is wet which, in turn, is continuously monitored by the microcontroller. This saves the water and at the same time the crops will get optimum level of water, so increasing productivity of crop.

Key words: Microcontroller, LCD, Agriculture Techniques, Soil Moisture Sensor, Pumping Motor, Relay, Solar Power Etc

I. INTRODUCTION

In India, the agriculture plays the important role in the economy and development of the country. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. There is a need in the residential/commercial irrigation industry for an irrigation controller that responds to soil moisture sensors in individual zones as a way of conserving water. An ideal controller should be "user friendly", i.e., easy to program and requiring a minimum number of keys or push-buttons to operate the controller. It should also allow irrigation to take place in zones where watering is required, while bypassing zones where adequate soil moisture is indicated- To add flexibility, it should be possible to selectively deactivate any of the moisture sensors to thereby override the modification to the controller performance caused by sensor inputs. Moreover, the system should be easy to trouble shoot in the event of faults in any of the plurality of zones.

II. PROPOSED SYSTEM

In our proposed scheme we had used 89S52 Microcontroller soil sensor, LCD are used for the sake of automation of drip irrigation that monitors the agriculture field and yields the accurate results to the farmer. We used different types of sensors their functionalities is to send the input data to most of the 89S52 Microcontroller. Here, the newly proposed idea suggests division of the area to be irrigated in multiple sectors. Each sector is installed with a pair of electro-magnetic valve and moisture sensor connected to a common controller, to which, a common water pump is connected. Activation of electro-magnetic valve depends on the level of moisture detected by the sensors present in corresponding sector. In addition, an intruder alarming system and automated light controls are also introduced. The intruder alarming system is an IR sensor based system that will alarm the user, the sooner any trespassing takes place. The automated light controls are based on LDR (light depending resistance). As soon it gets dark the LDR will generate a signal and the controller will turn ON the lights attached.

III. IMPLEMENTATION OF SYSTEM HARDWARE

The real time irrigation system in agriculture is shown below with several types of sensors. Also the system employs an easy deployment monitoring system in an agricultural land for efficient accumulation of data about its needs from the multiple locations. Temperature, Humidity, Soil, Level, IR sensors. In case of soil moisture, we will check weather soil is dry or wet. If it is dry means, this condition is very harmful to plants. So immediately release the water into the soil and make it wet. For this we will use the level sensor which is very useful.

A. Description of the Circuit Diagram

1) Microcontroller

The heart of the automatic irrigation system is the 80S52 microcontroller. The 89S52 incorporates therein a 256×8 read/write data memory, which has 8K bytes of EPROM and is expandable to 256K bytes via RAM module [3]. The micrcontroller also includes four 8-bit ports (32 I/O lines), two 16-bit timer/counters, a high performance, full-duplex serial channel and on chip oscillator and clock circuits. Eight of the I/O lines comprising Port 0 function as an address bus 20 and a data bus. Address information at Port 0 may be applied, via an address latch, to the address bus. A moisture sensor is associated with each of the plurality of zones. Each such sensor is periodically interrogated by a pulse signal provided by the micrcontroller via a driver or buffer circuit. This interrogation signal causes the moisture sensors to output an analog voltage which is proportional to the amount of moisture in the soil in which the sensors are embedded. The analog signal is fed to an analog/digital converter which operates to create a digital representation of the measured analog quantity on the data bus leading to the microcontroller. An analog-to-digital converter suitable for use in the system is ADC 0809.It comprises a monolithic CMOS device with an 8-bit A/D converter, an 8-channel multiplexer and microcontroller compatible control logic. Using successive approximation as the conversion technique, this 8-bit A/D converter is readily interfaced to its associated microcontroller by the latched and decoded multiplexer address inputs and latched TTL tri-state outputs. Figure 1 represents the circuit diagram of the

microcontroller based irrigation system and Figure 2 represents the photograph of the prototype system.

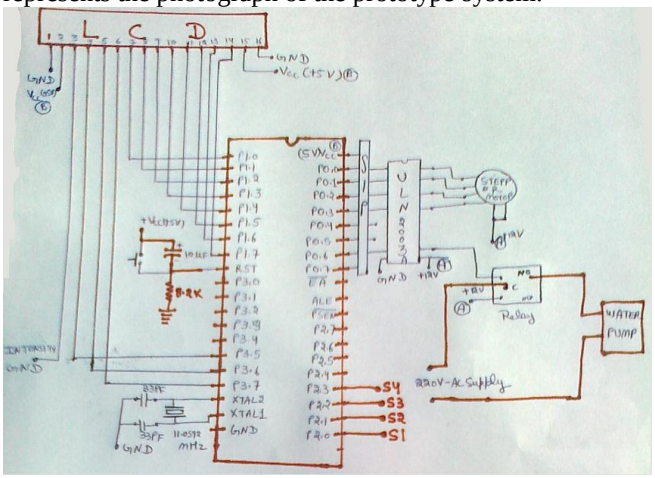

Fig. 1: Circuit diagram of microcontroller based irrigation system

2) Soil Moisture Sensor

The heart of the sensor module is the Microcontroller to which the soil moisture sensor, temperature sensor and wind sensor modules are interfaced. That the system will checks the moisture content in the soil, based on that pumping motor will automatically pumps the water into the field. Here we are using soil moisture sensor. By using this sensor, we can find whether the soil is wet or dry. The Figure 2 below shows the Soil Moisture Sensor Local Circuit.

Fig. 2: The Soil Moisture Sensor Local Circuit.

3) The Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

4) LCD

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images, such as preset words, digits, and 7-segment displays as in a digital clock.

5) Water Pump

A DC voltage based water pump will also be used in order to supply the water in the field. Since we are dealing with the stored DC power, hence we are going to use a DC power water pump.

6) 12 V DC Battery

It is used to store the charge or power that is generated by the Solar Cell Panel. This stored energy will be further used to power the irrigation system. The same stored energy is also used to control the entire system implemented in this project. That means the same stored energy will be used to power up the Microcontroller unit that is used to control the entire system. Also the same energy is used to move the Solar Cell Panel according to the position of the sun.

7) Electromagnetic Valve (Solenoid)

Electromagnetic device which produces a magnetic field when electric current passed through it. These are used mainly in opening and closing of valves. Operation of valves is done using a relay circuit.

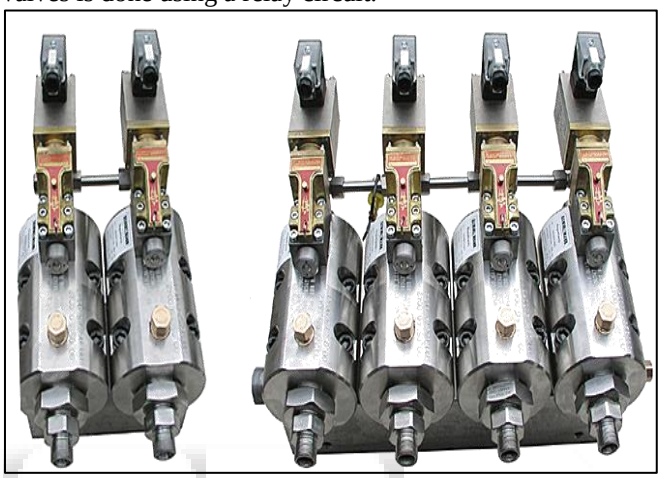

Fig. 3: Relay Circuit

8) Buzzer

Buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or electronic. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click & the system also uses Solar Power System which is depicted in Figure 4 shown below

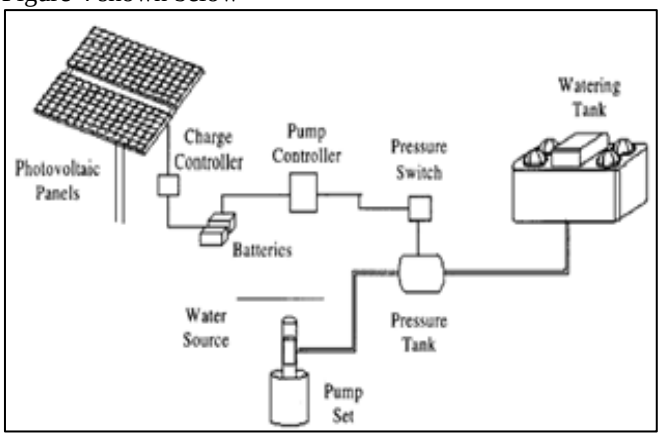

Fig. 4: Solar Power System

9) IR Sensor

Infrared Motion sensor module, where its sensitivity can be adjustable based on BISS0001 PIR motion detector IC that can be used in many cases like Security applications, human body sensor toys. Generally in human body sensor lighting, in Industrial automation and control units, etc. The system also employs the LDR which is shown in Figure 5 below

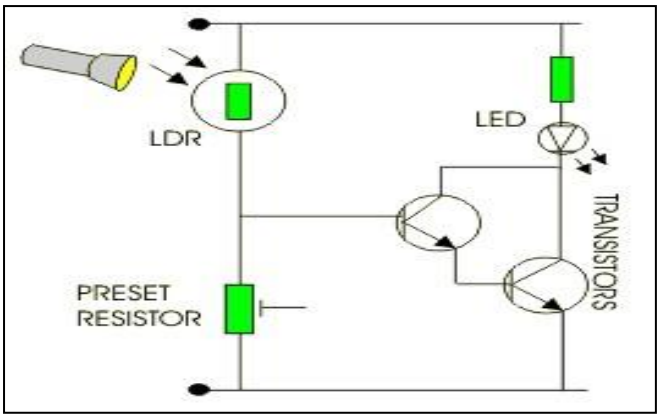

Fig. 5: LDR system

The layout of general system is shown in Figure 6 below

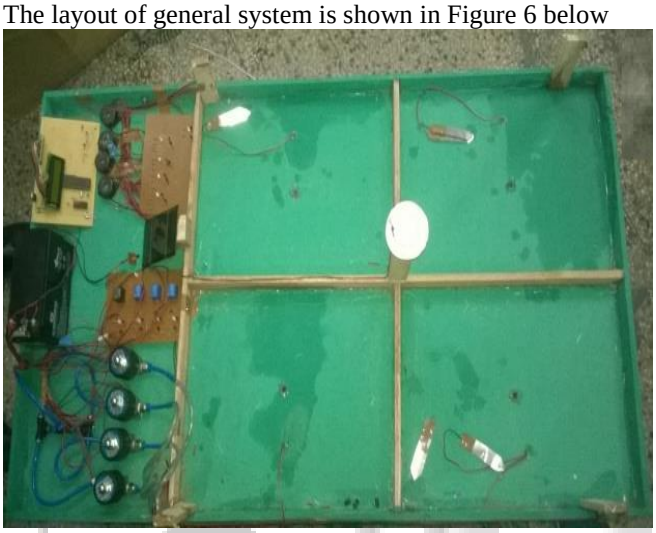

Fig. 6: General Layout

IV. RESULTS AND DISCUSSIONS

The area which is to be irrigated will be divided into a plurality of discrete zones of possible different soil conditions, where each zone includes at least one sprinkler head, soaker hose or other water dispensing device and a solenoid valve having an "on" state and an "off" state for controlling the flow of water to such device for that zone and which comprises a moisture sensor disposed in the soil in each of the zones and, when interrogated, produces an electrical signal proportional to the level of moisture in the soil proximate that sensor- A microcontroller is coupled in controlling relationship to the solenoid valves in each of the plural zones and is effective to periodically transmit the interrogation signals to each of the moisture sensors. The moisture sensors then respond by transmitting the aforementioned electrical signal to the microcontroller. The microcontroller includes circuitry and software for selectively actuating the solenoid valves in the plurality of zones to an "on" state at predetermined times during a weekly period, unless the moisture sensor for that given zone indicates a predetermined sufficient level of moisture present. Thus, the microcontroller activates each of the solenoid valves depending on the interrogated signal destination for a predetermined watering interval beginning with the pre-programmed start time and lasting for a pre-programmed interval unless that interval is shortened in a particular zone where the moisture sensor for that zone indicates that the predetermined sufficient level of moisture has been reached. The intruder alarming system consists of 4 IR sensors deployed at every corner of area. Every set of transmitter and receiver is attached to one side of the area. The sooner any intruder trespasses through any side of the area, the corresponding IR sensor will detect the movement and transmit a signal to the controller. The controller will testify the signal destination and initiate the respective buzzer. It can be seen that the combination of hardware and software provides a irrigation controller that can be implemented at relatively low cost and which is extremely user friendly because it requires only eight keys in all to carry out a myriad of operations and the operator is, at all times, apprised by the display of just what needs to be done to complete the programming of the system so that the solenoid water valves will be made to operate in a desired mode.

V. CONCLUSION

The Soil moisture content based irrigation system was developed and successfully implemented along with flow sensor. Salient features of the system are: Closed loop automatic irrigation system, temperature and water usage monitoring. User can easily preset the levels of the Moisture and is regularly updated about current value of all Parameters on LCD display. In future, other important soil parameters namely soil pH, soil electrical conductivity will also be incorporated in the system.

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