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A NOVEL AUTOMATED IRRIGATION SYSTEM

P.Saranya[1], Mr. D.Vijayanadh[2],

[1]*PG Scholar,Departmant of EEE, Hindusthan College of Engineering and Technology,*
[2]*Assistant Professor, Department of EEE, Hindusthan College of Engineering and Technology*

Abstract- Irrigation is one of the fundamental evils in agriculture in developing countries. Usually the farmers don't have much awareness on how to irrigate effectively, so they tend to use more water than required for agriculture by manually. Automatic irrigation system is developed to optimize water use for agricultural crops in which the humidity sensor, temperature sensor, float sensor, flow sensor are placed on the root zone of the plants. This project is designed to overcome these problems. The algorithm which is developed with set values of these sensor and it can be programmed into PIC microcontroller to control the water flowing. With the help of embedded technology it is easy to control the environmental conditions such as soil moisture, temperature, float and flow level. These components are powered by rechargeable batteries and these are charged by photovoltaic panel to achieve full energy. This technique allows the farmers to gather the information about the soil conditions through Zig-bee technology .This project offers an optimal solution to support irrigation management that allows farmers to increase their productivity with minimum usage of water.

Keywords- Automation, internet, measurement, water resources wireless sensor networks(WSNs), Solar Panel.

I. INTRODUCTION

Typically in these developing countries uneducated farmers tend to use more water than required by manual techniques, hence wasting them. Soil moisture sensors and temperature sensors are typically needed in such situations to indicate to the farmer when it is needed to irrigate the field and when not needed. The current work aims to develop a microcontroller based low cost soil temperature and moisture monitoring system that can track the soil temperature and moisture at different locations of the field in real time and thereby allow water to be automatically pumped on to the field if the soil temperature goes above or the soil moisture falls below a prescribed limit depending in the nature of crop grown in the soil. And also to drain water from the field when excess water stores during rainy season by manual techniques is a major problem faced by the farmers .Float sensor in this situation sense the water level in the field and thereby activates the solenoid valve to drain the water from the field if the water level goes above the required level. The sensors take the inputs like moisture, temperature and provide these inputs to the microcontroller. The microcontroller converts these inputs into its desired form with the program that is running on it and gives outputs in the mode of regulation of water flow according to the present input conditions. The software or a small operating system that's running on the Microcontroller, provides a very simple to use.

II. AUTOMATIC IRRIGATION SYSTEM

Wireless Sensor unit(WSUs) which consist of RF transmitter, sensor, PIC microcontroller and power supply. WSNs that uses distributed wireless network for the automatic irrigation system. It is based on PIC16F877A Microcontroller and process information of soil moisture sensor(humidity sensor).

Temperature sensor (Therimstor NTC-470), float sensor and the flow sensor. These sensors are charged by rechargeable batteries. The charge is maintained by photovoltaic panel to achieve full energy.

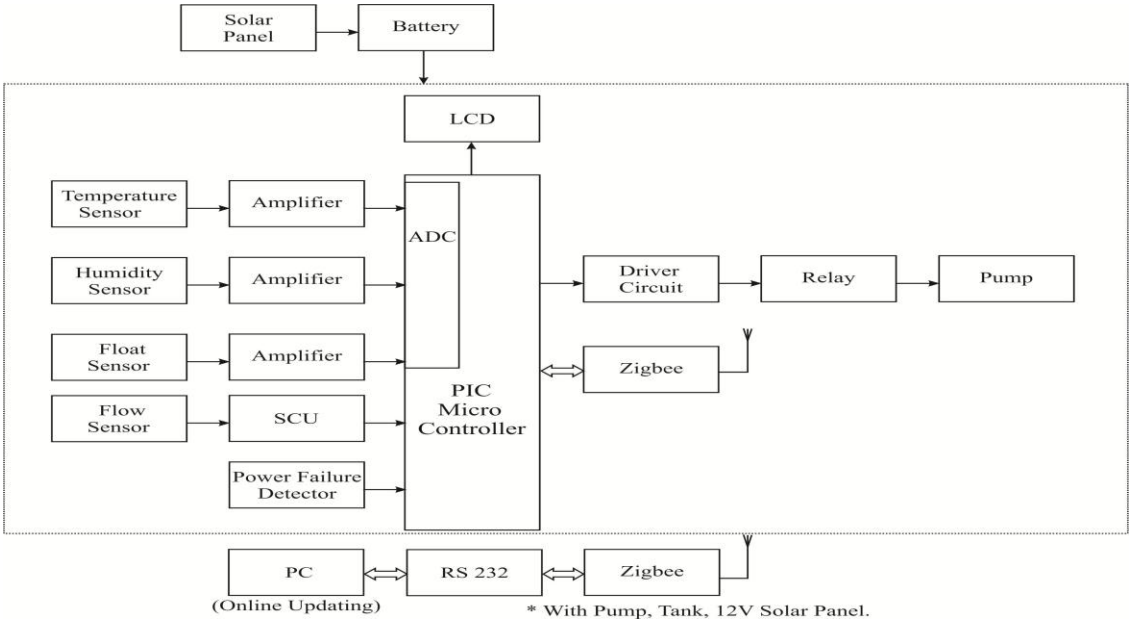

Figure 1 Block Diagram of the Automatic Irrigation System

Humidity sensor sense the moisture content present in the soil. Temperature sensor sense the temperature of the soil. The float sensor senses the water level in the land. Flow sensor will sense the pumping when it reaches below the setting value. These sensors will sense the soil conditions at the same time. The data obtained by these three sensors are in the Analog form. The analog signals send to the amplifier, so that the analog signals thus obtained will get amplified. The amplified analog signals are transmitted to the PIC Microcontroller (PIC16F877A) . PIC Microcontroller has a built in A/D converter, so the amplified analog signal will be converted into digital signal. Since the PIC16F877A uses flash technology, so that data is retained even when the power is switched off. Easy programming and erasing of the data are other featsures of PIC 16F877A. The measured digital data regarding the existing soil conditions such as soil moisture, soil temperature and water level, flow in the land are sending to the LCD Display. The digital data will be displayed in the LCD Display. The obtained soil condition values will be compared with the set value. According to that the relay will activate the pump automatically to flow water to the land, only when the soil moisture value is below the set value. If the water level in the land goes above the set value, then the relay will of the pump. The information about the soil conditions are frequently sends to the user through Zigbee technology [16]. These components are powered by rechargeable batteries and these are charged by photovoltaic panel to achieve full energy. Solar panel is used for charging battery even though when the power is in off stage.

2.1 PIC16F877A Microcontroller

PIC Microcontroller is of the type PIC16F877A as an integrating system. Technology that is used in PIC16F877A is flash technology, so that data is retained even when the power is switched off [24]. Easy Programming and Erasing are other features of PIC 16F877A [10]. It has an internally built in analog to digital converter. So, the analog to digital converter is not needed externally. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory [2]. The main advantage of CMOS and RISC combination is low power

consumption resulting in a very small chip size with a small pin count [5]. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The PIC start plus development system includes PIC start plus development programmer and MP LAB. The PIC start plus programmer gives the product developer ability to program user software into any of the supported microcontrollers[12]. The PIC start plus software running under MP LAB provides for full interactive control over the programmer.

2.2 Types of Sensors

2.2.1Humidity Sensor (SY-HS-220)

Humidity sensor is of capacitive type, measures the relative humidity [17]. It is mounted on the PCB, which also consists of other stages employed to make sensor rather smarter.The humidity sensor used in this system is highly precise and reliable. It provides DC voltage depending upon humidity of the surrounding in RH% [1]. This work with +5 Volt power supply and the typical current consumption is less than 3Ma[2]. It supply voltage 3.3V to 20V output impendence up to 100K ohms, measure temperature up to 40 to 85 degree Celsius and accuracy up to 2%.

2.2.2 Temperature Sensor (Thermistor-NTC 470)

Thermistor is a contraction of a term “thermal resistors”. Thermistors are generally composed of semi-conductor materials. It have a negative coefficient of temperature resistance i.e. their resistance decreases with increase of temperature [17]. The negative temperature coefficient of resistance can be as large as several percent per degree Celsius. This allows the thermistor circuits to detect very small changes in temperature, which could not be observed with an RTD or a thermocouple [1]. Thermistors are therefore widely use in such applications, especially in the lower temperature range of -100°C to 300°C. Thermistors are composed of a sintered mixture of metallic oxides, such as manganese, nickel, cobalt, copper, iron, and uranium. Their resistances range from 0.5 Ω to 75 MΩ and they are available in a wide variety of shapes and sizes. Smallest in size are the beads with a diameter of 0.15 mm to 1.25 mm.

2.2.3 Float Sensor

Float is the one type of transducer which is used to measure the water level . Float sensor is to be placed in the land. When the water level in the land varies, the float in the land tends to change its position. When the water level goes high, the float tends to move its position up and when the water level decreases, then the float tends to move its position down.The change in the water level will be determined by change in resistance due to float position change. The float changes the resistance value depending on the water level. This change is resistance is converted into corresponding voltage signal which is given to inverting input terminal of the comparator. The reference voltage is given to non inverting input terminal. Float sensor will sense the water level in the land. When the level of the water in the land changes, float position will change accordingly. The change in the float position will leads to the resistivity change. Thus the change in the resistance determines the water level value in the land. The float sensor is provided with 5v power supply.

2.3 Driver Circuit

The driver ADP3418 chip (bottom left), is used for driving high-power field transistors in voltage converters. Above it is seen next to such a transistor (06N03LA), probably driven by that driver. In electronics, a driver is an electrical circuit or other electronic component used to control another circuit or other component, such as a high-power transistor. They are usually used to regulate current flowing through a circuit or is used to control the other factors such as other components, some

devices in the circuit. The term is often used, for example, for a specialized integrated circuit that controls high-power switches in switched-mode power converters. An amplifier can also be considered a driver for loudspeakers, or a constant voltage circuit that keeps an attached component operating within a broad range of input voltages.

2.4 Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

2.5 LCD Display

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

III. SIMULATION OUTPUT FOR AUTOMATIC IRRIGATION SYSTEM

The figure 2 shows the simulation output for automatic monitoring of soil moisture, soil temperature and float for agricultural purpose to avoid the wastage of water. The existing soil moisture value, soil temperature value and the water level value in the land sensed by the humidity sensor, temperature sensor and float sensor are displayed in the LCD Display.

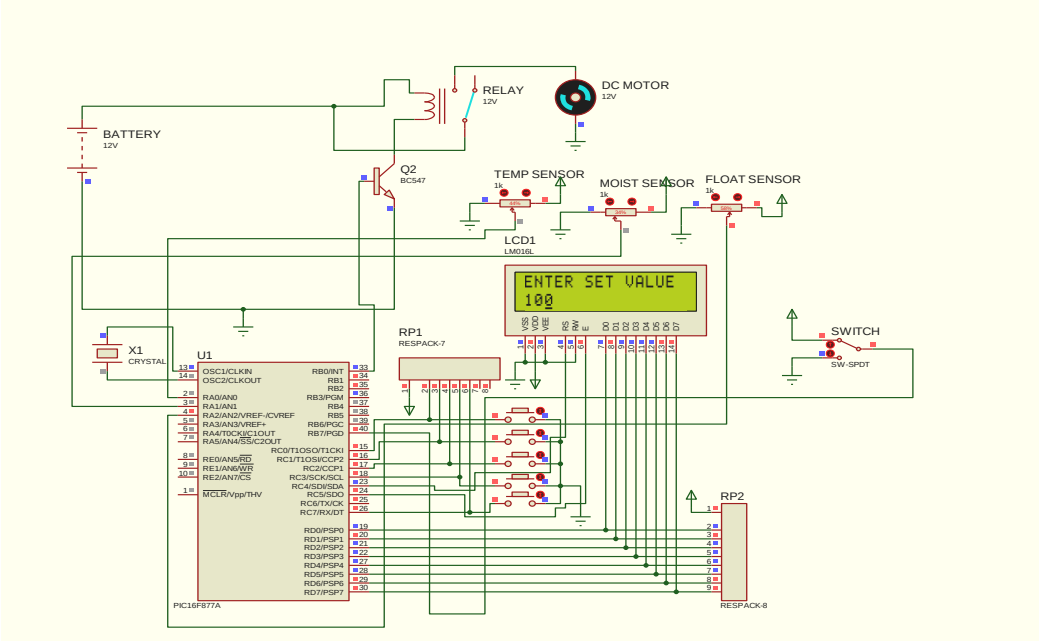

Figure 2 Simulation Results for Entering Common Set Values for Sensors

There are five keys are to be used for setting the value. In this the first key is used to enter the value , then second key is used for moving to the second and third places, third key is used for increment purpose and then fourth is used for decrement purpose and finally the last key is useful for execute purpose . By using the keys, set the common value for soil moisture, soil temperature and for float sensing.

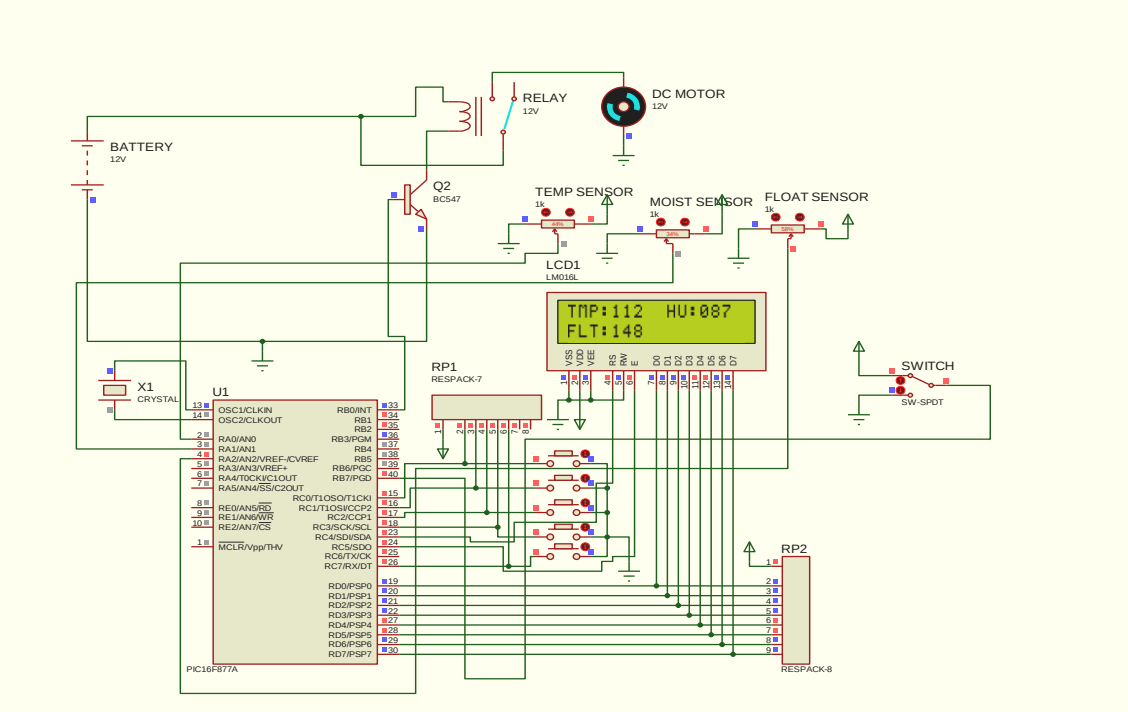

Figure 3 Simulation Results for Adjust Value for Sensors Using Variable Resistor

If common set value for soil moisture (above the set value when compared to the obtained value), for temperature (above the set value when compared to the obtained value) and then for float (50% below the set value when compared to the obtained value) then the motor will move to the OFF states. By Considering the any of the crop in the land, when the soil moisture level goes below 31.03%, immediately the motor turns ON automatically and irrigates the soil. After reaching the maximum soil moisture value of 55.55%, the motor turns OFF automatically.

IV. CONCLUSION

By using this technique, we can monitor the soil moisture, soil temperature and water level in the land using LCD Display. This will be very much useful to facilitate irrigation automatically without any wastage of water . The obtained soil condition values will be compared with the set value. According to that the relay will activate the pump automatically to flow water to the land, only when the soil moisture and temperature values are below the set value. If the water level in the land goes above the set value, then the relay will activate the solenoid valve to open automatically in order to drain water from the land. The information about the soil conditions are frequently send to the user through zigbee technology**.**

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