ESTIMATION OF SOIL PROPERTIES USING EMBEDDED AND GSM TECHNIQUES

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Abstract

In countries like India, irrigation is an essential practice in many agricultural cropping system. Efficient water application and management are major concerns. Self –propelled center pivot and linear-move irrigation systems generally apply water quite uniformly. However, substantial variations in soil properties and water availability exist across most fields. In these cases, the ability to apply site-specific irrigation management to match spatially and temporally variable conditions can increase application efficiencies, reduce environmental impacts, and even improve yields. The development of a distributed in-field sensor-based site-specific irrigation system offers the potential to increase yield and quality by saving water. The main objective of this work is to monitor the moisture content and temperature of the soil in cultivating field. The above parameters are estimated using temperature and humidity sensor. Based on soil moisture, the operation of the electric motor which is used for pumping water will be automatically controlled through electromagnetic relay. The pumping motor will pump the water into the field using drip water system until the field is wet which is continuously monitored by the microcontroller. Also the details about process of the system will be sent through phone using GSM modem. This system optimizes the water content of the soil by saving water.

Index terms : humidity sensor, temperature sensor, agricultural techniques, GSM modem , embedded system.

I.   INTRODUCTION

In the field of agriculture, use of proper method of irrigation is important and it is well known that irrigation by drip is very economical and efficient[1]. In the conventional drip irrigation system. The farmer has to keep watch on irrigation timetable, which is different for different crops. This proposed system makes the irrigation automated. The use of low cost sensors and the simple circuitry makes the system a low cost product, which can be utilized even by a poor farmer. This system is best suited for places where water is in scarcity and has to be used in limited quantity. Also, third world countries can afford this simple and low cost solution for irrigation and obtain good yield on Crops.

The problem of monitoring soil moisture evolution using a wireless GSM network is considered. Continuously sampling moisture levels with these soil moisture sensors incurs high-maintenance and energy consumption costs, which are particularly undesirable for wireless networks. The main hypothesis is that a sparser set of measurements can meet the monitoring objectives in an energy-efficient manner. The underlying idea is that some trade off can be considered in case of inaccuracy in estimating soil moisture evolution for a significant reduction in energy consumption. This paper describes an application of a wireless sensor network for low-cost wireless controlled irrigation solution and real time monitoring of water content of soil based on soil moisture sensors[2}

By using these sensors], the soil condition whether it is wet or dry can be found. If it is dry, pumping motor will pump the water. In this system, the main controlling device is microcontroller. Here soil sensor will give the status of the soil to the sensor Amplifier, based on that microcontroller will display the status of the soil on the LCD and switch on or off the pumping motor through relay. The pumping motor will pump the water into the field until the field is wet which is continuously monitored by the microcontroller.
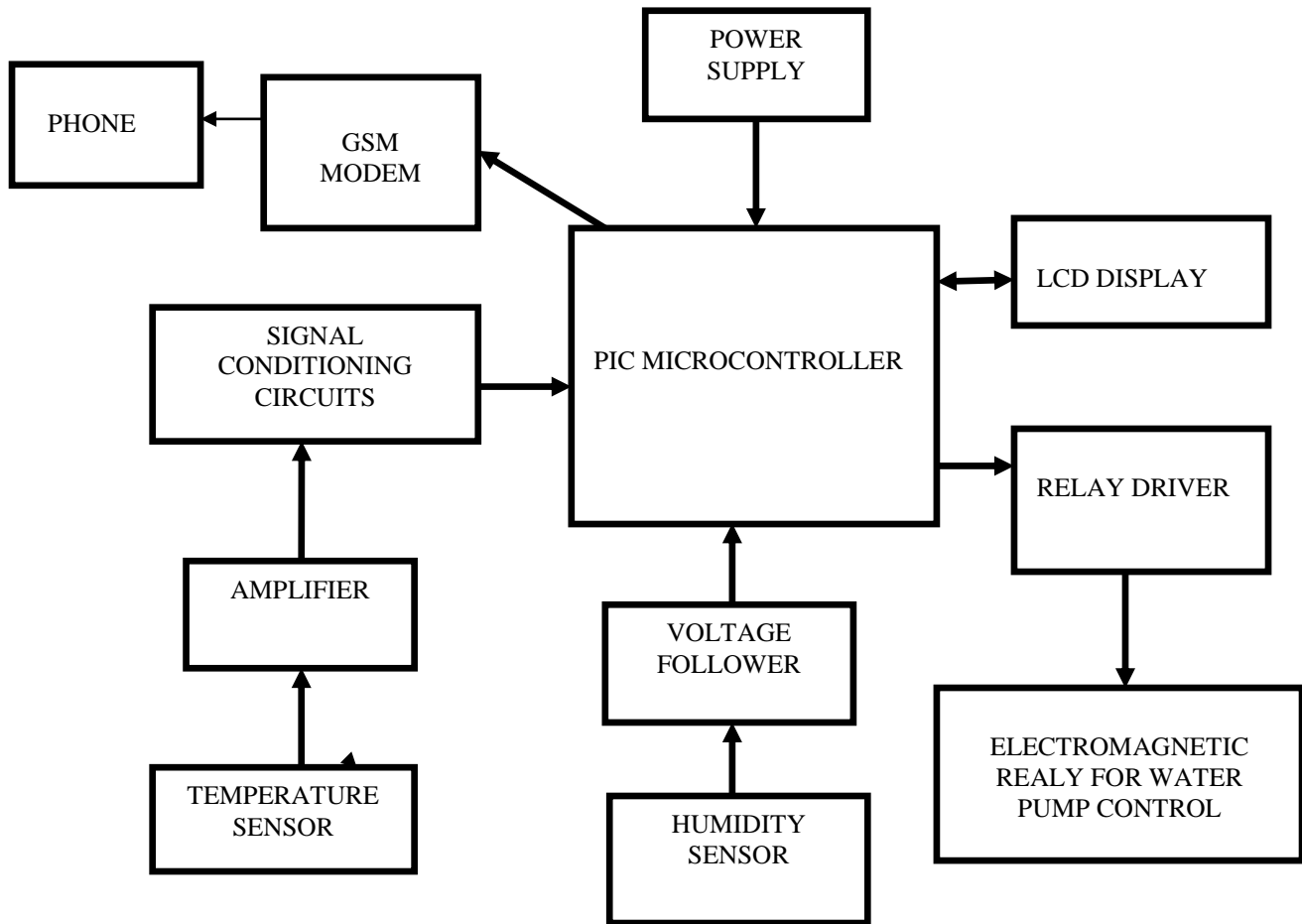
Fig.1 Estimation of soil properties using embedded system

Monitoring temperature and humidity by embedded system:

An Embedded system is a computer that has been built to solve only a few very specific problems and is not easily changed. Tablets are like an embedded system because they may have a special operating system and hardware, and usually they cannot be opened and new parts added. But they are not truly embedded systems, because they are not built into another machine. They allow new applications to be loaded and some peripherals. Figure.1 shows the block diagram for the estimation of soil properties by integrating various sensors with an embedded system. The signal from the sensors is sent to the amplifier[3] and voltage follower which amplifies the input signal and the increase the voltage levels of the signal and this signal is sent to PIC microcontroller. According to the output from the microcontroller the relay driver pumps the necessary amount of water into the soil. The output of the sensors indicating temperature and humidity of the soil moisture will be displayed in the LCD display and the message will be send to the phone through GSM modem[4].

RELAY DRIVER: 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. When the transistor Q2 is in ON state the relay turns ON and the motor pumps water and when Q2 is in OFF state there is no pumping of water to the soil as shown in fig 2.

MICROCONTROLLER: The Intel MCS-51 commonly referred to as 8051 is a Harvard architecture, CISC instruction set, single chip microcontroller (µC) series which was developed by Intel in 1980 for use in embedded systems. Intel's original versions were popular in the 1980s and early 1990s and enhanced binary compatible derivatives remain popular today. Intel's original MCS-51 family was developed using NMOS

technology, but later versions, used CMOS technology and consume less power than their NMOS predecessors. This made them more suitable for battery-powered devices.
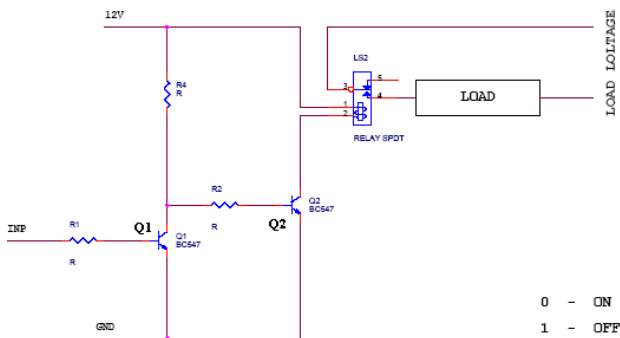

Fig 2.Relay Driver Circuit

VOLTAGE REGULATORS: Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage.

FRAMEWORK FOR PROPOSED SYSTEM: The technical questions arising in precision agriculture are all focusing upon increasing the efficiency of the field which results from networking sensors to monitor important spatiotemporal patterns in the field and integrating the data to display or record information. The sensors that can be used in agricultural field are temperature, humidity, monitoring. In the field of agriculture the most important part is: firstly, to get the information about the fertility of soil and secondly moisture content of soil. After measuring these two factors a farmer can start sowing of seeds. Here a system is developed based on GSM network. The sensor nodes can obtain the soil moisture, temperature, humidity information in real time, and then transferred to the remote monitoring centre by the gateway via the transmission network. This intelligent agriculture monitoring system has the useful characteristics of low power consumption, low cost, large network capacity, flexible disposition, and minor influence on the natural environment. In irrigation process the water level is sensed by the sensors and the information are processed by the controller and transmitted over the

GSM module. At the base station the data is received by the Receiver module and transferred to PC through RS232 interface. The data will be processed by the microcontroller and then can be transmitted to farmer's mobile phone using GSM module. Then these commands can be further given by the farmer through GSM which will initiate or terminate the irrigation process via relay controlled motor in the field depending on the moisture conditions of the soil.

GSM Modem : A GSM Modem is a specialized type modem which accepts a SIM card, operates over a subscription to a mobile operator, just like mobile phone.

TEMPERATURE 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.

HUMIDITY SENSOR: A humidity sensor senses relative humidity. This means that it measures both air temperature and moisture. Relative humidity, expressed as a present, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature[5].

Fig.3 Humidity Sensor

AMPILFIER: An electronic amplifier is a device for increasing the power of a signal. It does this by taking energy from a power supply and controlling the output to match the input signal shape but with larger amplitude. In this sense, an amplifier may be considered as modulating the output of the power supply. Here we use inverting amplifier as a gain amplifier. We can change the gain by adjusting the value of feedback resistance value.

LCD DISPLAY: 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[6].

MOTOR : In any electric motor, operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

HARDWARE: Develop a uniquely decoded 'E' strobe pulse, active high, to accompany each module transaction. Address or control lines can be assigned to drive the RS and R/W inputs. Utilize the Host's extended timing mode, if available, when transacting with the module. Use instructions, which prolong the Read and Write or other appropriate data strobes, so as to realize the interface timing requirements. If a parallel port is used to drive the RS, R/W and 'E' control lines, setting the 'E' bit simultaneously with RS and R/W would violate the module's set up time. A separate instruction should be used to achieve proper interfacing timing requirements[7].

ADVANTAGES OF PROPOSED SYSTEM: By this project we can control the moisture content of the soil in the cultivating field. Based on soil moisture, pumping motor will be automatically switch on or off through relay. This saves the water at the same time and on the other hand the plant can get optimum level of water, so increasing productivity of crop.

II.   RESULT

The result is a scalable, implementable technology that we have tested and validated numerically and in the field. By using this sensor, we can find whether the soil is wet or dry and pumping motor will pump the water automatically. Through gsm modem the temperature, humdity and water level will be message to the landowner. When the motor is running with the light blinking the result is shown in the figures 4,5 & 6.

Fig. 4 Motor Pump is in on condition

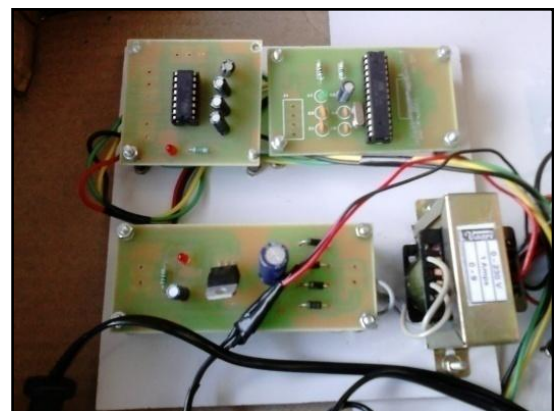Fig.5 light blinking when the motor is in On condition

Fig.6 light is in off condition when motor is not working

III.   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 and message will be sent to land owner mobile. In future, other important soil parameters namely soil pH, soil electrical conductivity will also be incorporated in the system.

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