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An Automated System for the Farmers to Monitor the Availability of Electricity through Smart Technologies

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Abstract: Economical back bone of our country is agriculture. Irrigation is an inseparable part that thrive agriculture as a successful process. Hence, it is required for the farmers to visit the farm land very frequently to water the cultivation land. The process of watering the plants needs electricity. But, the problem lies in the distribution of electricity. In India, electricity is not distributed throughout the day. Therefore, it is mandatory for the farmers to monitor the arrival of power supply to proceed with their work and it is a very much irritating job to watch out for things that are very uncertain. When looking at the problem, it is found more serious as the farmland can be very remote to the residence of the farmer. An automation system could be an optimized solution for a problem of this kind. In order to get a solution, we could make use of the existing technologies to automate the process of watering the farmland. We could focus on infrastructure technologies like cell phones and software technologies that support remote accessing. The mobile technologies like General Packet Radio Service (GPRS), Global System for Mobile Network (GSM) would be used much better to thrive it in to action. The proposed system is designed to understand the arrival of electric power by sensing an electric light like a light from a small bulb that is associated with a wireless system. This system sends a message to the cell phone of the farmer. As cell phones are possessed by everybody, it might not be a problem to associate the process to the person. The system does not require smart phones that are costlier but a variant of even low cost mobile phone could also do these jobs. The farmer is initiated to switch on the electrical motor to draw water from the sources like bore well. The proposed system is enhanced to switch on and off the electric motor through the cell phone remotely. The further process to switch off the electric motor after the storage unit is filled can be done through time line constraint or a remote system can be built to sense overflow and switch off the power supply without human intervention. The implementation of the system considerably reduces the risks of farmers as they need not walk to and fro during the night time and some steps could achieve things without great procedures.

Index Terms: GSM, SMS, microcontroller, LCD, irrigation, electricity

1. INTRODUCTION

Agriculture is the centre part of our Indian economy. It is the major resource for food production against huge population. In agriculture, irrigation is a crucial part that needs a lot attention. For this purpose, the farmers depend on electric motor pumps to drain water from the bore wells/wells. In India, the government provides a cost free usage of electricity to run the motors for irrigation purpose. Now-a-days, it is found that the need for electricity is hiked enormously and the power production is found inverse to the demand. Hence, the government executes a cycle of power cut for few times a day and it happens very frequent in rural areas. Most of the people in rural areas are involved with agriculture. It is mundane for the farmers to monitor the arrival of power supply to proceed with their work; also it is an irritating job to watch out for things that are very uncertain. The farm land can be very remote to the residence of the farmer. An automation system could be an optimal solution for this problem.

The development of mobile phone as a remote control application for the electric motor can be used for irrigation purpose. Here, the irrigation motor is controlled by the microcontroller and the status of the motor is sensed and the same is transmitted to the registered mobile phone via GSM network as a SMS.

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On notification, the farmer can take the option to switch on the irrigation motor. Conventional remote monitoring systems using GSM modem for Attention (AT) command interface [1]. The modem used in this method interprets the working condition of the motor to the user cell phone as short messages.

2. WORKING PRINCIPLES

GSM is a cellular network that connects two mobile devices by searching the cells in the immediate vicinity [2]. The GSM module and microcontroller are connected using Universal Asynchronous receiver/transmitter (UART). Here, the GSM modem interacts with the farmer's registered cell phone to inform the condition obtained from the microcontroller. The serial port adapter and AT modes are needed to be configured properly. Based on the received signals, the micro controller enables switching on/off the motor through the starter that uses relays. The relay is controlled by the ports.

This system works on Short Message Service (SMS) feature of the mobile phone. The farmer has to send a SMS to the irrigation system to switch on/off the irrigation motor. The SMS may be blank message and a button on the cell phone key pad may be synchronized to send a blank message to the system at the farm land. The switch on/off status of electric motor will be sent to the farmer as a response from the other side of the system that connects the remote irrigation motor. It depends on the farmer that what to choose to control the irrigation system [3][4][5][6]. To water the land, it is mandatory to know the moisture condition of the soil. Based on the condition of the soil, the time to water the land will be estimated by the farmer and an alarm can be set as an extension of this system. The notification of the alarm may help the farmer to send the request to switch off the running motor. Thus, the irrigation motor can be controlled through mobile devices that use GSM technology. Figure 1 depicts the methodology of the proposed automation system.

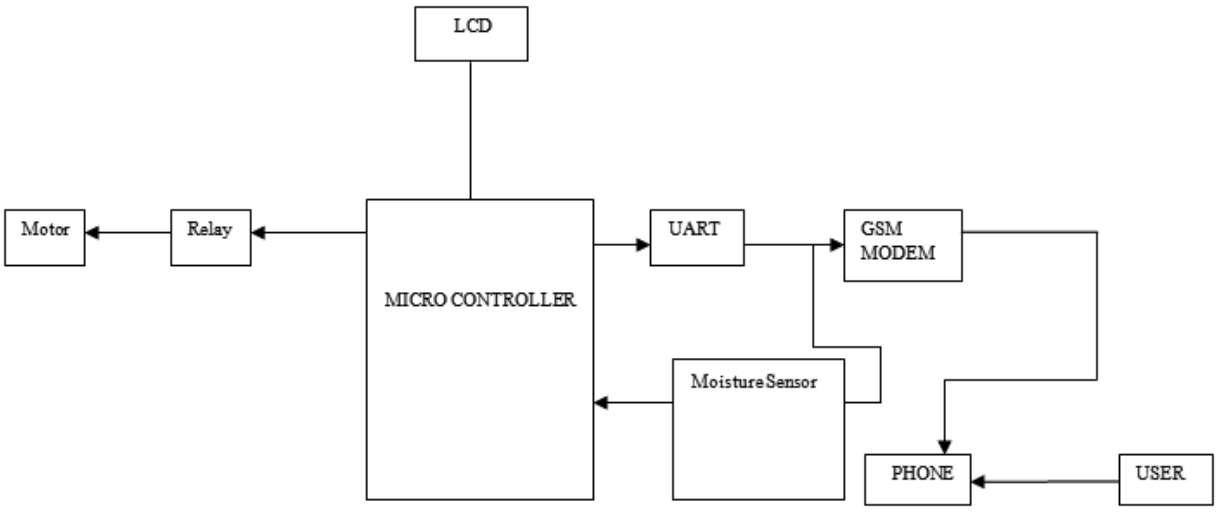


Figure 1: Methodology of the proposed system

3. COMPONENTS

A. Relay

A relay is an electromagnetic switch that could be operated by a relatively small electric current. The functional part of the relay switch is an electromagnet. The advantage of using relays is that they operated both electrically and mechanically. The relays are a part of most of the electrical and electronic devices. Relays could be used to control a circuit where there is low power signal; also they could be used to control multiple circuits. The high end applications of relays require high power to drive the electric motors and so on. Such relays are called contactors.

B. Relay Design

An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and intensifies the magnetic field. Thus, the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit. Figure 2 shows an inner section diagram of a relay.

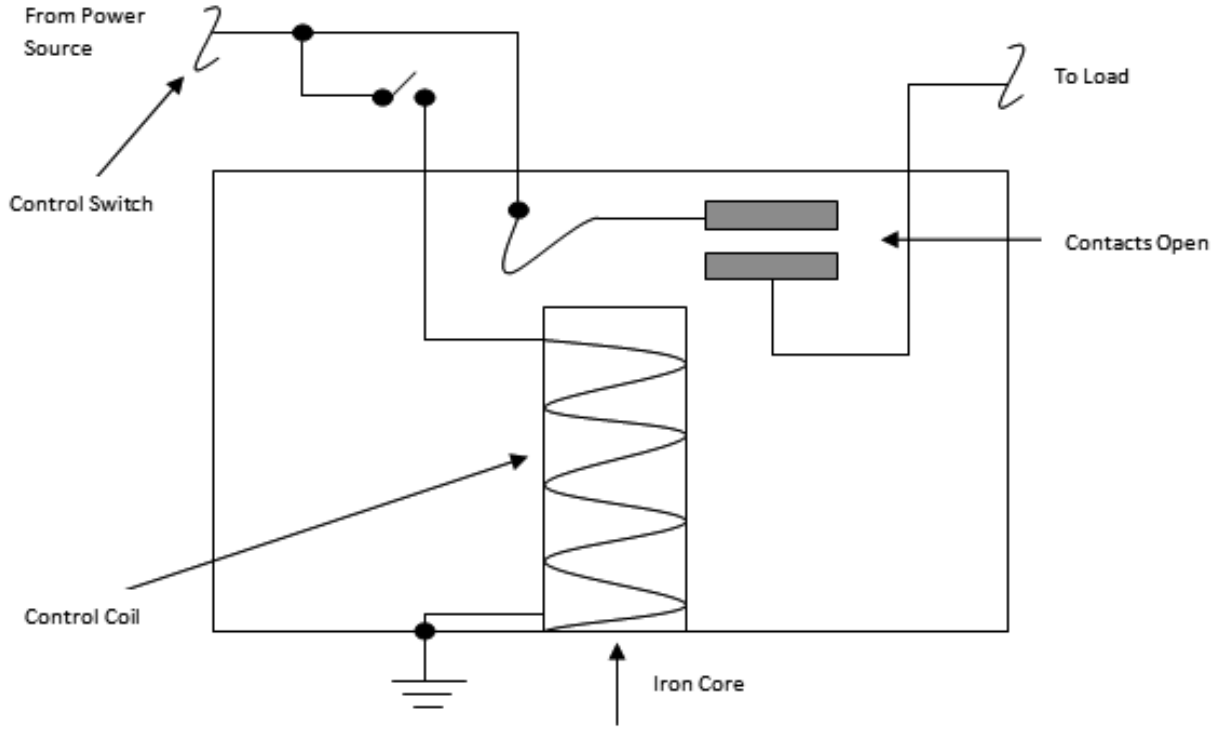


Figure 2: Inner section of a relay

As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

C. Moisture Sensor

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages. A moisture sensor helps to makes sure the need for watering the farm land. Soil moisture sensors measure the volumetric water content in the soil. Since, the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. Figure 3 shows the moisture sensor.

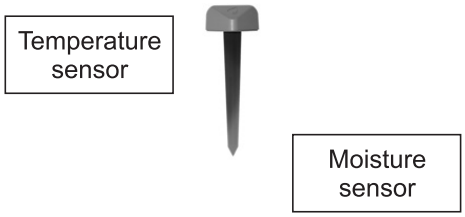
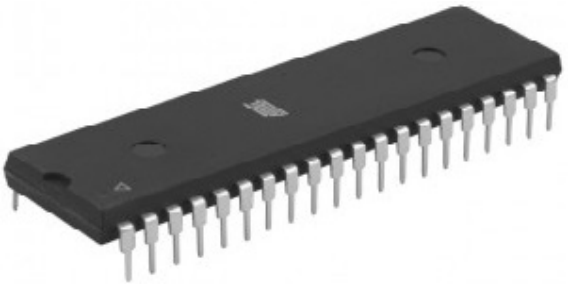


Figure 3: Moisture Sensor

D. Microcontroller

An 8051 series microcontroller is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. This is achieved by using an op-amp as comparator which acts as interface between the sensing arrangement and the microcontroller. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. An LCD display is interfaced to the microcontroller to display status of the soil and water pump. The sensing arrangement is made by using two stiff metallic rods inserted into the field at a distance. Connections from the metallic rods are interfaced to the control unit. This paper makes use of the existing potential of the microcontroller along with GSM technology, such that whenever the water pump switches ON/OFF, an SMS is delivered to the concerned person regarding the status of the pump. Also, it is designed to control the motor pump through SMS. Figure 4 shows a microcontroller.



Figuew 4: Microcontroller

E. Liquid Crystal Display

Liquid Crystal Display (LCD) component helps to visualize the status of motor pump at the off-side of the cell phone. This is an interfacing component that uses a parallel port communication. Figure 5 shows LCD.

Figure 5: LCD

F. Universal Asynchronous Receiver/Transmitter

Universal Asynchronous Receiver/Transmitter (UART) is a computer hardware device that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as RS-232, RS-422 or RS-485. The universal designation indicates that the data format and

transmission speeds are configurable. The electric signaling levels and methods are handled by a driver circuit external to the UART.

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