Self-Regulated Moisture Sensitive Irrigation System

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Abstract

Water is a limited resource yet most of the farmers use irrigation techniques which leads to wastage of water. Optimum utilization of water for irrigation is serious need of the hour. This paper proposes a self-regulated approach in the irrigation industry. This approach uses water level sensors at storage tanks and moisture sensors at the field for conservation of water. Using integrated ICs and latest technology this system is made completely free from any human intervenience. As mobile phones are an integral part of human life, GSM module was used to notify the farmer about every update.

Keywords: Framer, GSM, Irrigation, Microcontroller, Soil Humidity

I. INTRODUCTION

Agriculture is practiced in India since human civilization a long ago at present 61.5% of Workforce in India is directly working in the agriculture being broadest economic sector. India produces 80% of agricultural produce basically sugarcane and numerous vegetables for cultivation of such cash crops huge quantity of water is required. The need for the water is fulfilled from canals from rivers, groundwater well-based systems, tanks and other rainwater harvesting projects out of which groundwater system is the largest, therefore optimum utilization of groundwater for irrigation is serious call of hours. It is hence necessary to understand the importance of plant and soil system for optimum utilization of water by use of latest technology. Traditionally water was lifted from the groundwater system by humans using animal power and then used for irrigation supplied to the filed by way of flood irrigation. This method required human interference at the initial stage of lifting the water from ground level and to irrigate the fields. Most of the time, fields were over flooded with more water than what is required to the plants leading to wastage of water and may cause soil erosion. Nowadays drip irrigation is used for supply of water from storage tanks through pipes, valves etc. and allow it to drip slowly at the root of the plant which considerably reduces the wastage of water but arrest of total wastage of water cannot be ruled out. Valves which come in various types are used to control the flow of water manually or automatically but in either case a close inspection on the water tanks is needed. If one holds less knowledge about drip irrigation then surface drip irrigation can cause a problem by supplying less water than required by the plants or vice versa.

We like to introduce a system, which is fully automated from the initial stages of pumping water automatically into the tanks and supply to the fields in consonance with the water required by the plants. The whole system is divided into three parts water level indicators in the water tank, automatic soil irrigation system and the notification system. The system does not require human interference at all on the contrary the farmer gets an alert on their cell phone through GSM module. The system is introduced with microcontroller that acts as the brain of the system.

II. PROPOSED SYSTEM

The system is divided into three parts. Firstly, every user has to register his valid phone number into the system; this is the phone number where the user receives notification in the form of short message service (SMS). Two water level indicators are used to ensure that the tank is never empty or over flooded. This two water level indicators are installed in water tank, of which one indicate water tank is empty and the second indicates tank is full. The third arm of the system is the automatic irrigation system. Which makes sure that the plants are only irrigated when the moister contain of the soil reduces.

A. Water Tank System

Water storage tanks are primarily used for providing water for irrigation in farming. This storage tanks require manual monitoring and controlling process to prevent overflowing of water leading to wastage of water. Using microcontroller, the water level controller circuit is able to monitor the water level and carefully pump the water from ground water reservoirs using motors. Micro-controller is programmed to sense the water level and turn on/off the valve that fills water in the tank. Whenever the water level is below the minimum level the lower water indicator sense it and sends signal to microcontroller. The microcontroller turns the relay

on that indeed turns on the inlet valve that lets water enter into the tank and the water level in the tank increases. Two LEDs are used to indicate the water level, one for max level and the other for min level Self-made water level sensors are used, made with metallic strips. One of the strip is connect to VCC and the other to the base of transistor, transistor we use here is BC547 i.e. NPN transistor. The basic operating principle of NPN transistor is, when very less current passes through the base of NPN transistor it allows the current to flow from collector to emitter. The current required for this operation to take place is few micro-amps of current in case of BJT. Thus, when no water is in the contact of two metal strips no current flows from one strip to the other. When water touches these two plates very less current flows from the plate connected to VCC to the plate connected to the base of BC547. Now, the transistor acts as a close switch and current flows from collector to the emitter, where the collector is connected to the I/O pin of the microcontroller and the emitter is connected to the ground terminal, by all the above operation the microcontroller's I/O pin get shorted with the ground terminal.

This acts as the input to the microcontroller. Thus, according to its program it sends this notification to the user using AT commands, and turns the inlet water valve on. Allowing water to flow inside tank until the water level sensor at max limit senses the water. After which the inlet valve is turned off and again the notification is send to the user.

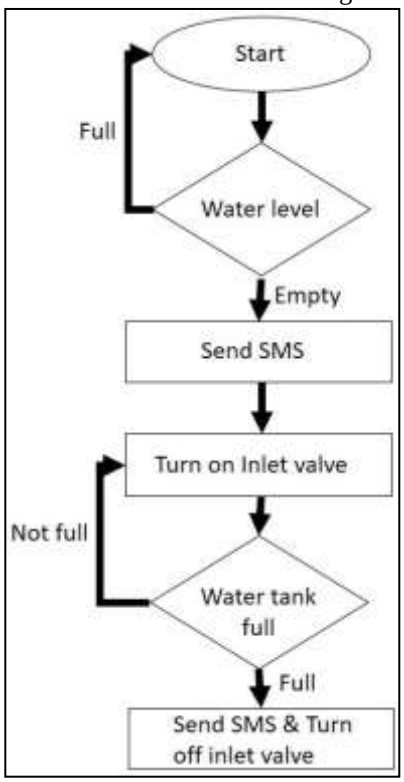

Fig. 1: Water Tank System

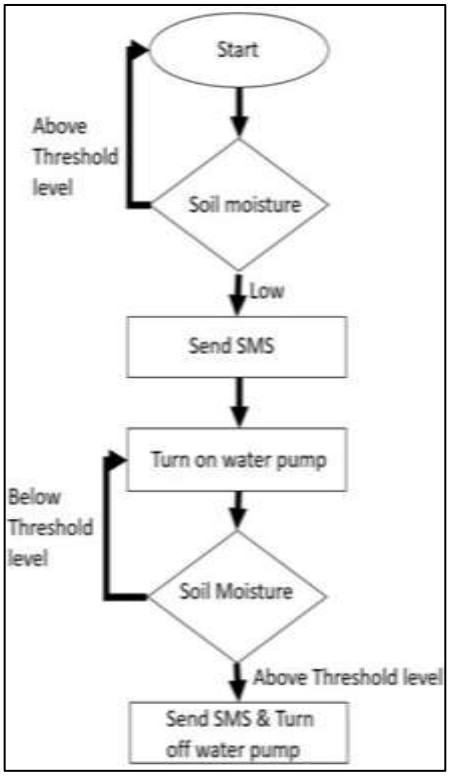

Fig. 2: Automatic Irrigation System

B. Automatic Irrigation System

Automatic irrigation system includes water pump motors and op to coupled relays used to drive water pumps and soil humidity sensor. Opto coupled relays are used to physically isolate relay and the microcontroller. In this system op to coupled IC PC817 and two probe soil moisture sensors are used. One of the probe is connected to the 5v and another probe is connected to the I/p of LM358 which is an OP-AMP. This OP-AMP is used as a comparator, which gives us feature of setting up threshold level of soil moisture using preset resistor. Varying the value of this preset resistor we can adjust the threshold level. When the soil moisture level is above threshold level no operation takes place, but as soon as the soil moisture level goes below the threshold level the output of the OP-MP goes low. The output of OP-AMP been connected to the I/O pin of the microcontroller change in the input voltage makes microcontroller turn on the water pump motor through reply. This water pump motor is used to provide water to the field whose soil moisture level is decreased. For demonstration we have used two humidity sensors, practically for a field huge matrix of sensors needs to be used.

C. Notification System

Notification system includes microcontroller 89S52 and GSM module 800L. Microcontroller PIN 10(RXD) pin and PIN 11 (TXD) pin are connected to RXD pin and TXD pin of 800L respectively. GSM module uses AT commands for communication. Microcontroller through serial port PIN 10(RXD) and PIN 11(TXD) send the required AT commands. AT commands are always followed by carriage return i.e. \r. (0D in hex), like "AT+CMGC\r". The notification system is used to notify the user about every update. For example, if the water tank is empty it turns on the inlet valve and notifies the user. The microcontroller continuously monitors the parameters. And whenever there is any change in these parameters it notifies the user through SMS. The soil humidity

sensor continuously monitors the humidity of the soil and sends signal to the microcontroller. Whenever the soil is humid the output of this sensor is high, now if the soil humidity goes below the predefined level the humidity sensor's output goes low. The microcontroller turns on the pump that supplies water to the field and send notification to the user. Following procedure is followed to send the notification. First, we send AT message to the GSM module, after wait time of 5 microseconds. Then we send AT+CMGF=1 this command puts the GSM module in message mode. After which we send AT+CMGS=" +91845204****" this tells the GSM module to send the message on given number, finally after all the above procedure we send the actual body of message like for example in this case "Water level full".

III. CONCLUSION

Self-regulated moisture sensitive irrigation system has been successfully designed and tested. The protocols of the system works according to specification and were quite satisfactory. The system was implemented with the blend of advanced IC's and growing technology. The system being fully automatic, proves to be beneficial for farmers whose pumps sets are located at far distance from their homes. Along with conservation of water it also reduces physical efforts and inconvenience in different irrigation techniques. Moisture content of the soil is measured through sensors and supply of water is controlled accordingly. The farmer's gets constant notification of the operations carried out at the field site making it easy to diagnose any problem

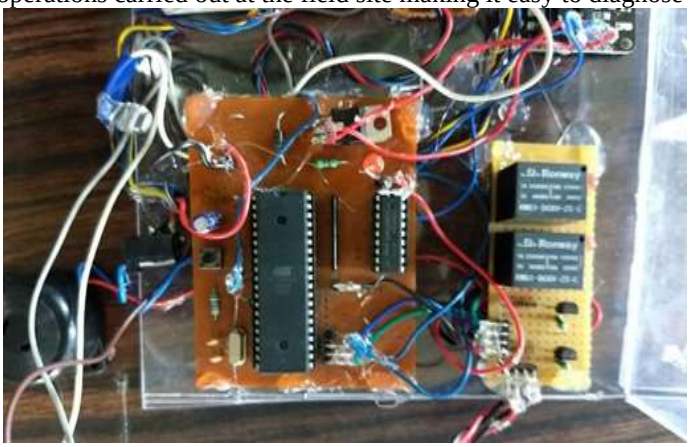

Fig. 3: Microcontroller & Opto Coupled Relay

Fig. 4: Final Interfacing

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