A MODERN APPROACH FOR SMART IRRIGATION SYSTEM

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ABSTRACT

This paper focus on a smart irrigation system, which is cost effective, and a middle-class farmer use it in the farm field. In today's world, automation is playing an important role. Automation allows us to control appliances from a very long distance even take design by its own using algorithms. It not only provides comfort but also reduces energy consumption and timesaving. Today industries are using automation and control mechanism, which is high in cost and not suitable for use in an agricultural land. In this paper design of a smart irrigation, technique at low cost is usable by Indian farmers. The objectives of this paper are to control the water motor automatically and select the direction of the flow of water in a pipe with the help of soil moisture sensor. Finally, send the information of the farm field to the mobile message and e-mail account of the user. (Chandan kumar sahu, 2015)

Keywords: Soil moisture sensor, Electromagnetic valve, Arduino, GSM Modem

Broad Area: Agriculture

Sub Area: Irrigation

INTRODUCTION

In India, Agriculture is a major source of food production and a source of livelihood to the growing demand of the human population. In agriculture, irrigation is an essential process that influences crop production. Generally, farmers visit their agriculture fields periodically to check the moisture level of soil and based on their experience decide motors to irrigate respective fields pump the requirement water. The farmer needs to wait for a certain period before switching off the motor so that water is allowed to flow in sufficient quantity in respective fields. This irrigation method takes a lot of time. Traditionally farmers will present in their fields to do irrigation process and the cost of irrigation was low so they do not need to worry about the time take to irrigate the land. But nowadays farmers have to pay the huge sum of money to irrigate same part of the land which is a headache for a farmer to track correct time of running of water motor. Automation in irrigation system makes farmer work much easier. Sensor-based automated irrigation system provides a

much easier solution to farmers where the presence of farmer in the field is not compulsory. A small processor programmed for control an electromagnetic valve to start watering. Today INDIAN farmers need these types of cheap and simple user interface for controlling sensor based automated irrigation system. Now a day's internet is widely used. By the connection of internet, the farmer knows about the field irrigation status. This helps farmers to know the status of farm field watering status through a message whether the farmer is far away from field know the status of water motor is ON or OFF. In this paper, authors create a prototype for full automation accessing of irrigation motor where Prototype includes a number of moisture sensor node placed in different directions of the farm field. Each sensor is integrated with a wireless networking device and the data received by the "ATMEGA-328P" micro-controller, which is used with "ARDUINO-UNO" board. The GSM module is used to send messages through mobile network correspondence to the micro-controller process. The soil moisture in each direction of the field is sensed by sensor node and the sensed data is sent to microcontroller node through wireless networking device. On receiving sensor value the controller node checks it with required soil moisture value. When soil moisture in a particular field is not up to required level then controller node switch on the motor to irrigate associated field and the ARDUINO-UNO process all data and notification SMS is sent to the registered mobile phone which is registered in GSM module. (S.Harishankar, 2014)

IMPORTANCE OF IRRIGATION

The irrigation of in India depends on monsoon. Rainfall controls agriculture, but the agriculture is said to be “the gambling of the monsoon” as the monsoon rainfall is uncertain, irregular and uneven or unequal. So irrigation is essential for agriculture. In INDIA there are 80% of the total annual rainfall occurs in four months, i.e. from mid-June to mid-October. So it is very necessary to irrigation for farm field during the rest of the eight months. (Chandan kumar sahu, 2015)

METHODS OF IRRIGATION

There are different types of method for irrigating farm field for different types crop field. Basically, Indian farmer uses these three methods channel system, sprinkler system, drip system. Channel system is a traditional method of irrigation. But a smart irrigation system is a new technology to irrigating farm field automatically.

1. **Canal System:** This system is widely used in farming irrigation system. As this system is a very low-cost system for irrigating a large area farming field. In this system, pipes are connected with a water pump and while pump started water flow through the pipe a from the lake, river, bore well to the farming field. And the farmer fully engaged for irrigating the crop field with a number of workers. A huge amount of water waste and a large number of workers are engaged in watering.

FIGURE 1: Canal Irrigation (Panoram, n.d.)

2. **Sprinkler System:** This system is more useful whether the water is available in smaller quantity. When pump started then water flow through the main pipe and also flow through the perpendicular pipes. A nozzle on the top of the perpendicular pipe is joined and rotating automatically at regular intervals. This system is very useful on the sandy soil. Less number of worker required water waste is less.

FIGURE 2: Sprinkler Irrigation (Agriculture, n.d.)

3. **Drip Irrigation:** In this system waterfall drops by drop at the position of the roots. It is the best technology for watering fruit plants, gardens and trees. Water flows through the main pipe and divided into sub-pipes. Specially prepared nozzles are attached to these sub-pipes. In this system waste of water is very less and No worker need for irrigating. When the farmer knows the status of the farm field then start the motor and chose the direction from nozzles. Then automatically watering the plants and after some time the farmer check the status of the field and while the whole crop is irrigating then OFF the motor.

FIGURE3: Drip Irrigation (System, n.d.)

Smart Irrigation System

Shortage of water is not really the main problem major problem as in India usage of water is much more as compared to that of another country. Due to lack of proper method of irrigation and information which is required for the proper usage of water resources. Also due to the excess water in the crops, farmers' does not get the proper output of their cultivation land and farmers also suffer a huge amount of lose. A per report of National Crime Record Bureau i.e. NCRB states that in the year of 2016 number of farmers committing suicide due to the huge amount of lone on the was 6867. In India, farmers spend a fair amount of money for the irrigation purposes and the output which they get is not very satisfying as the correct amount of water is not supplied to the food crops. If we are able to reduce the wastage of water not only it will help the environment but also helps the farmers to reduce their investment and increase their income. For the irrigation purposes, this research designs a project model that will tackle the maximum amount of irrigation problems faced by the farmers. To make proposed device the following points must be considered:

1. It is Economical
2. User-Friendly
3. Low power consumption
4. Easy to install
5. Reduces Water Consumption

Some of the basic components required to build this project are:-

1. Micro-Controller
2. Moisture Sensor
3. GSM Module
4. Water flow controller
5. Solar Panel

All these components are easily available and their cost is also quite low. So the financial burden over the farmer will be greatly reduced. Investment is of one time which is for the drip irrigation system installation. Cost of drip irrigation system can be reduced by using different methods.

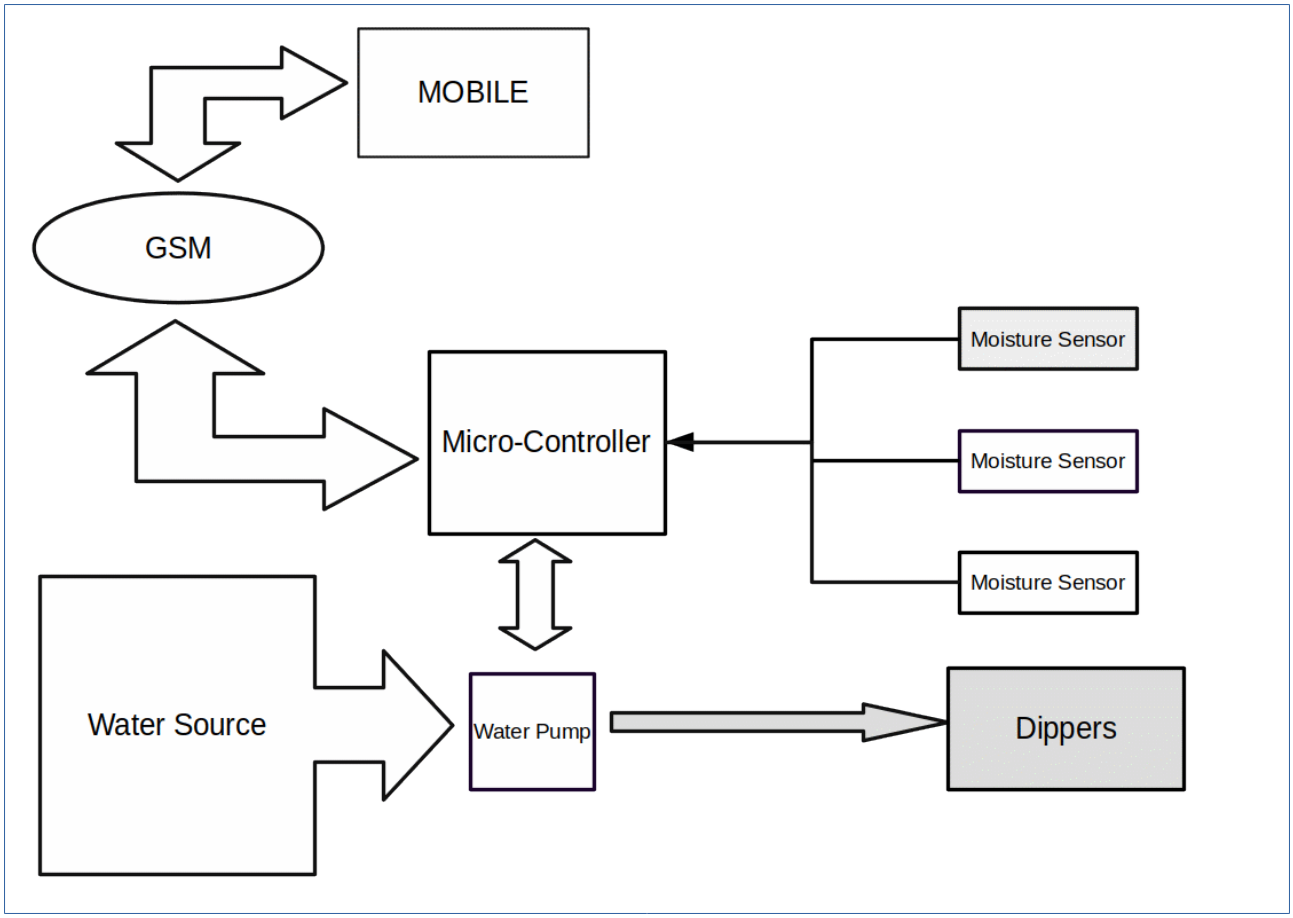

FIGURE:4

In this device moisture sensor first, sens the moisture level of the soil and sends this data inside the micro-controller. Then the Micro-controller analyze the data send by the sensor and on the basis of comparison micro-controller decides to turn on or off the drip irrigation system if the micro-controller switch on the water pump for irrigation at that time a signal will be sent to the GSM module by the micro-controller which will send the message to the farmers mobile.

SYSTEM COMPONENTS

1. **Soil Moisture Sensor:** Moisture sensor devices, systems, and methods of making and using the same employ a pair of elongated, probe-like, conductive sensor elements, coupled as part of an LC oscillator circuit. The use of an LC oscillator circuit can minimize adverse effects of conductivity variances in the medium being monitored, because the resistance of the medium (and, thus, the medium's conductivity) has minimal or no effect on the resonant frequency of an LC oscillator circuit. An LC oscillator circuit of suitable stability for moisture sensing applications includes first and second comparators connected such that the output of the first comparator is coupled to the

inverting input of the second comparator. An inductor is coupled between the output and inverting input of the first comparator and a capacitance C is provided between the output of the second comparator and the inverting input of the first comparator. The capacitance C is composed primarily of the capacitance value provided by the pair of probe-like sensor elements and the dielectric constant of the medium in which the probe-like sensor elements are disposed of. The capacitance is averaged over the length of the probe-like sensor elements. (Patent No. US 5445178 A, 1995)

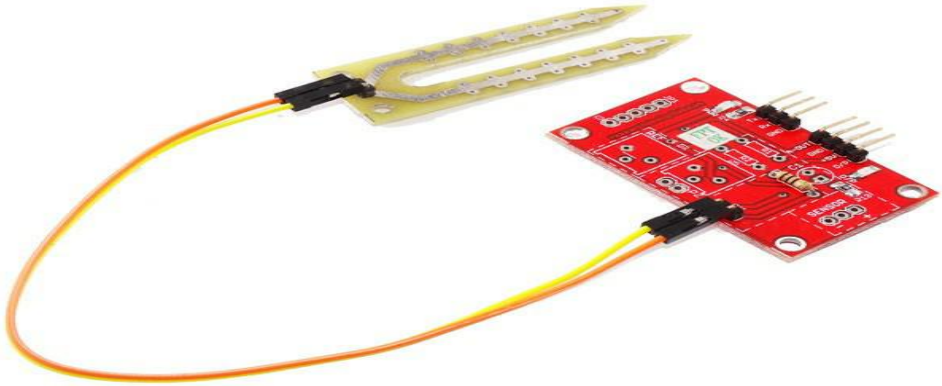

FIGURE 5: Soil Moisture Sensor (Lab, n.d.)

2. **Arduino:** Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. (Rev3 A. U., n.d.)

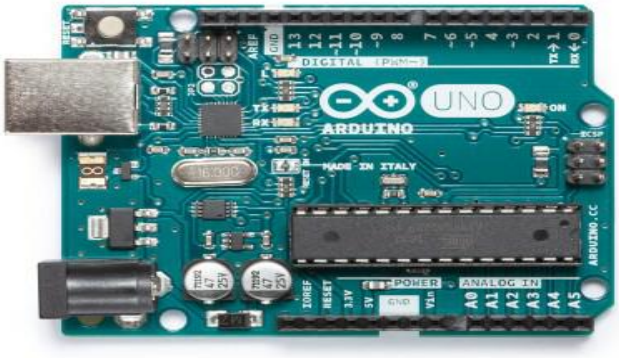

FIGURE 6: Arduino UNO (Rev3 U. , n.d.)

3. **GSM Module:** Global System for Mobile communication (GSM) is the digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long-distance communication. There are various GSM modules available in the market like SIM900, SIM700, SIM800, SIM808, SIM5320. SIM900A module allows users to send/receive data over GPRS, send/receive SMS and make/receive voice calls, the GSM/GPRS module uses USART communication to communicate with micro-controller or PC terminal. AT commands are used to configure the module in different modes and to perform various functions like calling, posting data to a site.

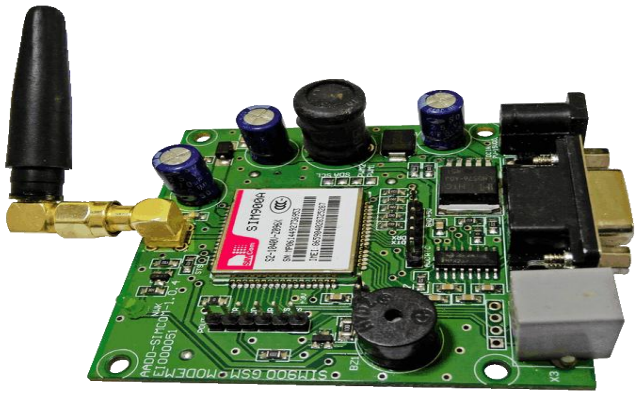

Figure 7: GSM Module (MODEMS, n.d.)

4. **Electro Magnetic Valve:** The solenoid is an electromagnetic part of a valve, comprised of a coil, core tube, core, and enclosure. The selection of 2- way, 3-way, and 4-way solenoid valves, designed to handle the most demanding fluid control applications.3-Way Electromagnetic Valves have three pipe connections and two orifices. When one orifice is open, the other is closed and vice versa.

Which is automatically controlled by the water requirement of the sensor node?

Figure 8: Electro Magnetic Valve (3/4-way, n.d.)

Arduino UNO Soil Moisture Sensor

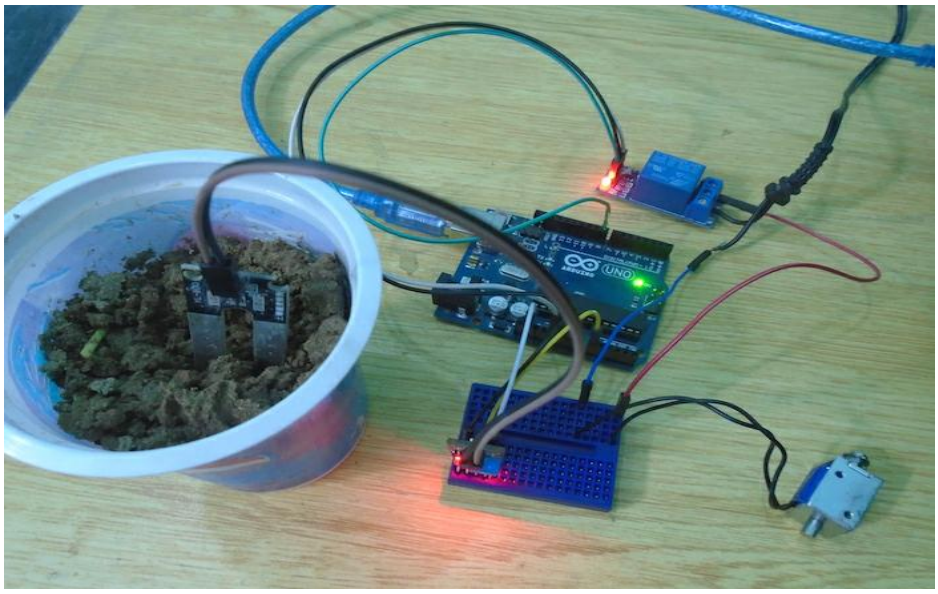

Figure 9:Working Soil Moisture Sensor

SYSTEM WORKING

In a large area of the farm field, there is use a large number of pipes for watering plants in different directions from the socket of the motor. Which is changed by the farmer to irrigate a particular direction of the field? But the uses of electromagnetic valve the pipe system are always connected and electromagnetic valve automatically changes the direction of the water required area of the field and the valve is controlled by the Arduino. While the valve is open then the water motor ON automatically. And send a message to the registered mobile number by which farmer know the status of the farm field while farmer far away from the field.

COST ANALYSIS

In a smart irrigation system, there are used very high-cost instruments to control the system. Proposed method uses a very low-cost hardware which is easily available to an INDIAN farmer and they can easily buy them and implement in the farm field. Decreasing the number of sensors are also for a cost-effective of the smart irrigation system.

Total Cost	Quantity	Unit Cost	Components
80	1	80	Soil Moisture Sensor
450	1	450	Arduino
1000	1	1000	GSM Module
1500	1	1500	3-Way Solenoid Valve
70	1	70	Pipes

These are the approximation value of the used hardware in a smart irrigation system which total is approximately Rs.10, 000.00-15,000.00. This is very low in cost and easily implement in a farm field.

CONCLUSION

In this paper, a prototype for the automatic irrigation system is presented. Here prototype includes sensor node and control node. The sensor node is deployed in irrigation field for sensing soil moisture value and the sensed data is sent to controller node. On receiving sensor value the controller node checks it with required soil moisture value. When soil moisture in irrigation field is not up to the required level then the motor is switched on to irrigate associated agriculture field and an alert message is sent to the registered mobile phone. The experimental results shows that the prototype is capable of automatically controlling the experimental results show that the prototype is capable of automatic controlling of irrigation motor based on the feedback of soil moisture sensor. This system is used in a remote area and there are various benefits for the farmers. By using the automatic irrigation system it optimizes the usage of water by reducing wastage and reduces the human intervention for farmers. It saves energy also as it automatic controlling the system. So there is the system is OFF when the field is wet and automatically start when the field id dry. It is implemented in all type of irrigation system (channel, sprinkler, drip).

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