Automatic Plant Irrigation System using Arduino

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***Abstract*—In the present era, food scarcity and water scarcity occurs due to the increase in population. So to avoid this problem we have to promote the agriculture sector . But water wastage is more in this sector in the form of water logging while watering the agricultural fields through irrigation. Therefore an automatic plant irrigation system has to be designed for the proper water supply in the fields. This paper deals with an automatic plant irrigation system which automatically senses the moisture content of the soil and decide whether irrigation is needed or not and how much water is needed for soil. This system uses AtMega328 microcontroller. It is programmed to sense the moisture content if the soil over a period of time. When the moisture content is less than the limit which is predefined, it will start supplying the desired amount of water till it reaches the limit. So when the soil is dry the pump will automatically water the fields and when the soil is wet the pump will automatically switch off, there by eradicate the need of manpower and conserve the time**

Keywords—Arduino, Irrigarion, water conservation

I. INTRODUCTION

Irrigation is an artificial way of watering the soil for the proper growth of the plant. It[1] is mainly used in the dry areas and the places where rainfall is less. Irrigation also helps to suppress the weeds growing in the agricultural fields. The old methods used for irrigation was manual irrigation using buckets and watering cans, by using sprinkler irrigation, localized irrigation, drip irrigation etc. But by using these techniques we can't predict the amount of water that is to be watered or the sufficient quantity of water that a crop needs. Due to this water logging will occur while using these techniques to water the crops. So there is a need for the improvement on these existing techniques in order to conserve water. So to prevent the water which is being wasted during irrigation, an automatic plant irrigation system has been developed. This works by sensing the moisture content of the soil and decides whether the pump has to operate or not. The water supply needed for this irrigation can be from any source like pond, stream, well etc. This system is not so expensive as we compare to other systems and is time saving, as the works done by the system is automatic.

II. SYSTEM DESCRIPTION

Block diagram of the system is as in figure (1). This system work by sensing the moisture content of the soil and decide whether the pump has work or not and how much water is needed to water the plants. Resistance of soil varies with moisture. We are taking this resistance as one arm of an voltage divider whose other are consists of 470 K resistor.According to voltage division rule,

$$V_m = \frac{R_m}{R_T} V_s \quad (1)$$

$$V_m = \frac{R_1}{R_1 + R_2} \quad (2)$$

Where
V_m – Voltage across the mth resistor
R_m – Resistance across which the voltage is to be determined
R_T – Total resistance
R_1 – Resistance of soil
R_2 – 470k Resistor
V_s – applied voltage

so the voltage[2] across the probe varies with moisture. This voltage is read via at the A_0 pin of Arduino. The analog value is converted by internal ADC of Arduino and we will get a reading in-between 0 and 1023. The value 0 is for fully wet condition and the value 1023 for fully dry condition. The program continuously compares the read value with set reference value. Here the value we set while programming is 400. When the read value goes above 400 pump will automatically turn on by making the given pin high. We can vary this value according to the quantity of water needed for the soil for cultivation. This high value that is being read will switche on transistor and the current will start flowing through the relay coil and it will get energized. Hence the pump gets turned on. When moisture rises above the set value the given pin will be made low and this inturn switches off transistor and relay and pump gets switched off.

III SYSTEM DETAILS

1. Sensing circuit

The sensor used here is made up of two conducting metal probes. It consists of a pair of electrodes to measure the resistance of soil. Resistance of soil varies with moisture. So these probes senses the moisture content of the soil. Smaller the value of resistance, greater is the moisture content of the soil.

2. Pump

A 12 V dc motor is used with the pump. By activating the motor driver circuit by the read value of the Arduino board with the set reference value, the pump will automatically turn on and turn off.

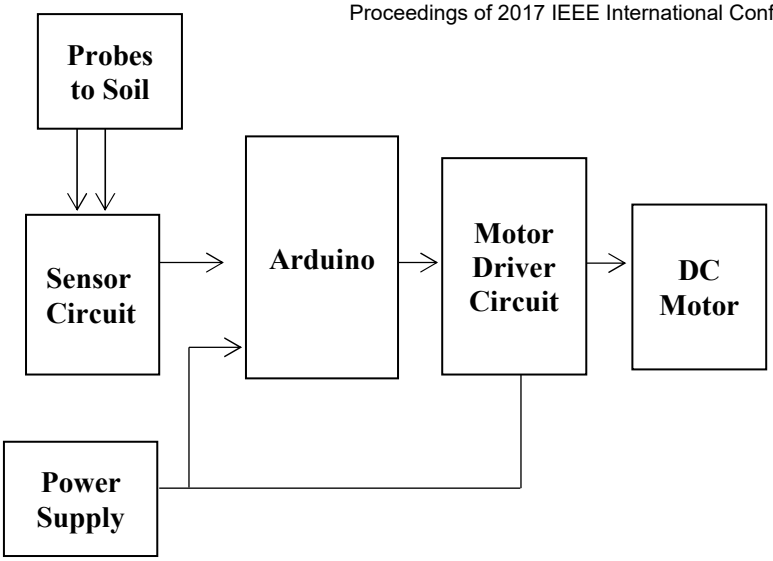

Fig .1 shows the block diagram of automatic plant irrigation system.

3. Relay

It is used to switch on and switch off the pump according to the water requirement of the soil

4. Freewheeling diode

Since the relay coil cannot change its current instantly, a diode is placed parallel to the relay coil. This diode will provide a path for the current when the coil is switched off. Otherwise, a sudden voltage spike will occur on the switch contacts or will destroy the switching transistors of the motor driven circuit.

IV HARDWARE CONSTRUCTION

We did our project with less components since it is a demonstration figure (2). As the area of irrigation increases we can use more number of moisture sensors and temperature sensors so that it will work according to the climatic conditions. Resistance varies with moisture. As the soil moisture sensor is analog, an ADC in Arduino is used to convert into digital from which it will represent the resistance. Dry soil will have the maximum resistance and wet soil will have the minimum resistance. After sensing the value it will automatically decide whether the pump has to be turned on or turned-off. The pump will turn on as the current passes through the relay coil and it will get energized and switches off as the value reaches the threshold value.

V SOFTWARE IMPLEMENTATION

The software used here is Arduino. It provides [3] a number of libraries to make the programming of the system so simple. As our prototype, the controller AtMega 328 is programmed which contains some resistance value ranging from 0 to 1023. 0 means fully wet condition and 1023 means fully dry condition. A value is being set in between these two value which will decide whether the pump has to be switched on or off.

VI NECESSITY OF THE PROJECT

Due to the increase in population, water scarcity occurs. Figure (3) illustrates [4] the per capita water use and per capita water resource. From the above graph it is clear that as years passes per capital water use increases and per capita water resources falls. So it's our duty to save the planet from water depletion and conserve a single drop of water that being wasted unnecessary during irrigation. While doing this, water wastage will be more by water logging. So an automatic plant irrigation system is necessary to conserve water since the pump gets turned on and off automatically after the use. One of the main objective of this system is to remove human control from fields for watering the plants and it is time saving.

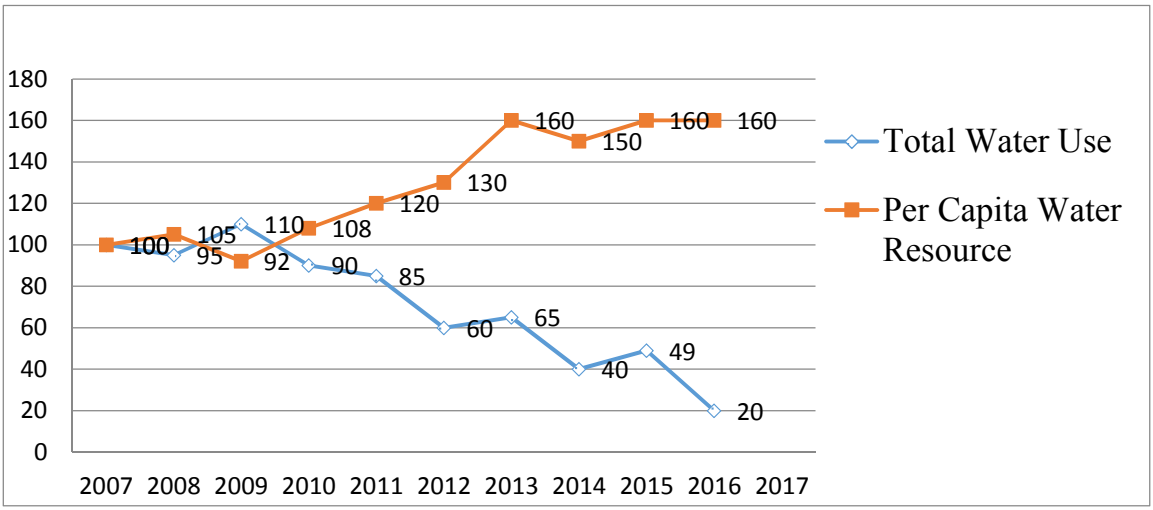

Fig.2 total water use and per capita water resource.

VII ADVANCED PRACTICAL USES.

This system [5] can be developed, if there is a vast agricultural land. We should use a number of moisture sensor to the system and should include temperature sensor so that it will work according to the climatic conditions. The efficiency of this system is less because most of the components used in this system are made of plastic. The direct sun rays from the sun towards the agricultural fields will destroy the system, since it is made of plastic.

So these circuits can be place in a specially build rooms or on special coverings to prevent the direct sun rays falling on it. Hence the life span of the system can be increased. This techniques can also be used in houses. As the number of pots increases, we have to use more number of sensors to it. We can use of LCD display to view the final reading of the system. We can also use a more efficient motor to pump the water in the agricultural fields more powerfully.

VIII ADVANTAGES

This system [6] conserves water and eradicate the presence of workers for watering their agriculture fields completely, since the pumping technology is automatic. Hence it is also a time saving device. Water logging in farms can be avoid by using this system since it is automatic. Also we can vary the availability of

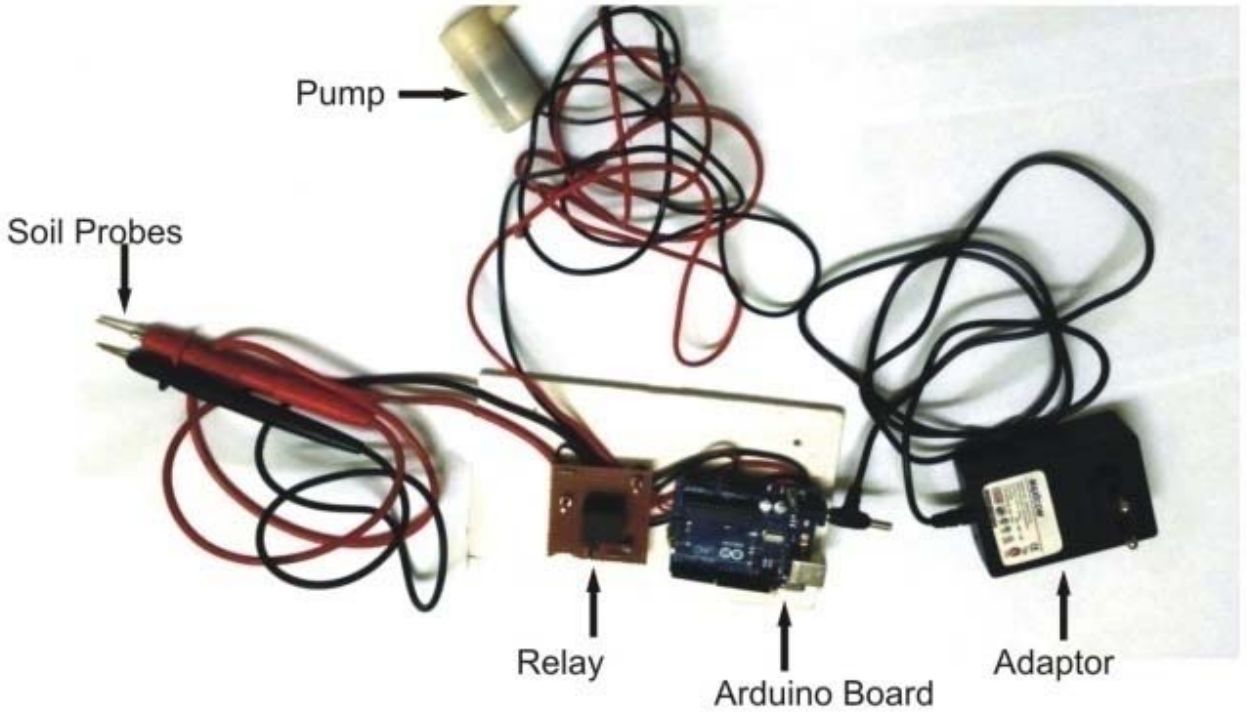

Fig.3 Hardware setup of automatic plant irrigation system

water delivered by knowing how much water a crop needs to grow healthy.

IX RESULT

This miniature model of automatic plant irrigation is being tested in two different soils. One soil is wet and the other is dry. Only in the dry condition the pump will start working, since the requirement of water is more for that soil for the proper growth of the crops and in wet soil the pump won't work since the soil does not need any water due to the presence of water in it hence this project will conserve water during irrigation.

X CONCLUSION

Automatic plant irrigation system has been designed and constructed. The miniature model of the system worked according to specifications quite properly. This system components are easily available and they work quite reliable. By improving the irrigation efficiency in agricultural sector, this industry become more competitive and sustainable. Also in dry areas, where there is no sufficient rainfall, proper irrigation is not possible. Hence by using this irrigation system by monitoring the moisture content of soil are can meet the water requirements necessary for the field. To save effort of farmers, the important considerations are water and time. In present condition, they need to wait until field is fully watered. This restricts them to do other activities. This idea is not only meant for farmers but also for watering the plants. In our present era,

the farmers are irrigating their crops at regular interval of time. The techniques they use will consume more water by creating water logging and results in water wastage. This system that we designed will completely eliminate the stress of manual labour.

Two types of soils have been tested and it will only work when the soil condition is dry. For the future work, this project can be implemented in large scale by using many number of moist sensors and temperature sensors and by using a powerful motor to pump the water more efficiently. This will result in energy conservation and it is one of the great solution for water depletion and water scarcity.

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