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Automatic Irrigation System using Arduino Uno

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***Abstract**: In the present world, an increase in population occurs due to water scarcity and food scarcity. So to reduce this problem we have to contribute for the growth of agriculture sector. But the problem in this sector is there will be more wastage of water in the form of logging of water while watering the land for irrigation. Therefore, an irrigation system which is automatic has to be developed for supplying water properly and systematically in the fields[1]. In this paper an irrigation system for plants is designed that helps supply exact amount of water in the fields without wasting it by sensing the soil moisture content in the soil. By taking this value it decides whether irrigation is needed for the field or not. In this system we are using AtMega328 microcontroller. This microcontroller senses the content of moisture of soil over a time period. If the content of moisture is less than the predefined limit, it sends the information to the farmer so that he can start to provide water to the fields till the threshold is reached.*

***Index Terms**: Arduino, Atmega328 microcontroller, Lora module, Soil moisture sensor.*

I. INTRODUCTION

One of the most important problems faced by the world is scarcity of water. We require a system which uses water limitedly without any wastage. Irrigation systems which are smart measures the moisture of plant in order to operate an automatic irrigation system and that reduces the use of excess water. The sensors which are used in this system requires good maintenance for proper performance. Automatic plant irrigation system will concentrate on watering the field regularly by using moisture sensor without any human monitoring. Lot of water can be transpired by healthy plants that results in humidity increase of Green house air. We should avoid relative humidity which is above 80-85% because plant transpiration and incidence of the disease can be increased by it. Condensation on greenhouse structure and on plant surfaces can be prevented by successive heating and sufficient venting[1]. During the warmer summer months, air humidity of greenhouse increases by using cooling system. Humidity control inside the greenhouse can be a challenge during periods with humid and warm conditions outdoor.This system is crop specific and its usage hence is limited. For efficient management of water in crop production it is critical to have a proper scheduling of irrigation, under the conditions of water scarcity particularly. The effects of applied frequency of irrigation, amount of water supplied for irrigation and use of water are particularly important. So our project designs a system which is simple, using an AtMega328 controller which is fixed in Arduino called Arduino Uno for automating the irrigation system and watering the fields with minimum human interventions [2].

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II. SYSTEM DETAILS

This system eradicates the workers presence in agricultural fields for watering completely, since the technology for pumping water is automatic. It is also a device which saves most of the user's time. By knowing amount of water that a crop needs we can vary the delivery of water. So by using this system we can save lot of time, and water too as it is an automatic system for pumping water [2].

A. *Arduino Uno:*

Arduino is a solitary board microcontroller intended to make the application progressively available which are intuitive items and its environment. The equipment highlights with an open-source equipment board structured around an 8-bit Atmel AVR microcontroller or a 32-bit Atmel ARM. Current models comprises a USB interface, 6 simple info pins and 14 computerized I/O sticks that enables the client to join different expansion sheets[7].The Arduino Uno board is a microcontroller dependent on the ATmega328. It has 14 advanced information/input and output pins in which 6 can be utilized as PWM outputs, a 16 MHz artistic resonator, an ICSP header, a USB association, 6 simple inputs which are analog, a power jack and a reset catch. This contains all the needed help required for microcontroller. So as to begin, they are essentially associated with a PC with a USB link or with an AC-to-DC connector or battery. Arduino Uno Board changes from every single other board and they won't utilize the FTDI USB-to-sequential driver contribute them. It is included by the Atmega16U2 (Atmega8U2 up to rendition R2) customized as a USB-to-sequential converter.

B. *Atmega328 microcontroller:*

The Atmega328 is a mainstream microcontroller chip created by Atmel. It is an 8-bit microcontroller that has a flash memory of 32K, 1K of EEPROM, and 2K of inside SRAM. It has 14 digital I/O pins, of which 6 are analog input pins and 6 pins are used as outputs of PWM. These pins of I/O account for 20 of the pins.The Atmega328 chip has an analog to digital converter (ADC) within it. This must be or else the Atmega328 wouldn't be fit for interpreting simple signs. Since there is an ADC, the chip can translate simple info, which is the reason the chip has 6 pins for simple information[4]. The ADC has 3 pins put aside for it to work AVCC, AREF, and GND. AVCC is the power supply, positive voltage, that for the ADC. The ADC needs its very own capacity supply so as to work.

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GND is the power supply ground. AREF is the reference voltage that the ADC uses to convert a signal which is analog to its corresponding digital value.

C. *Soil moisture sensor:*

A soil moisture sensor estimates the amount of water contained in a material, for example, soil on a volumetric or gravimetric premise[3]. To get a precise estimation, a soil temperature sensor is likewise required for alignment. The soil moisture sensor comprises of two probes which are utilized to measure the volumetric substance of water. The two probes enable the current to go through the soil and after that it gets the value of resistance to quantify the value of moisture[5].

Advantages:

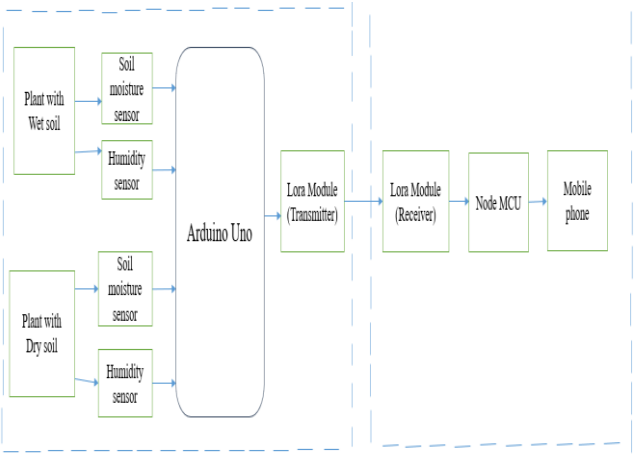
1.It can be connected to range of DC output signals.
2.When compared to other measurements it is relatively inexpensive[10].
3. After specific calibration of soil it is accurate

D. *Lora Module:*

LoRa (short for long range) is a spread spectrum adjustment strategy got from chip spread range (CSS) innovation. For worldwide Internet of Things networks, LoRa is considered as long range, low power wireless platform. Smart IoT applications are enabled by LoRa technology that solve the greatest challenges in our planet: reduction of natural resource, efficiency in infrastructure, management of energy, disaster prevention, controlling pollution and more[9]. Lora can transmit and receive data up to 5km in urban areas and 15km in suburban areas. For this module, low power consumptions are possible through Adaptive data rate that provides effectively processing gain which varies output data rate depending on payload coupled with chirp spread spectrum technology.

III. PROPOSED METHOD

Our system includes plants with different soil, Atmega328 microcontroller, an Arduino and Lora module. Each plant is connected with a soil moisture sensor and their analog values will be sent to Arduino[3]. The Arduino we use in this system is Arduino Uno. It has an inbuilt Atmega328 microcontroller in it. This Atemga328 microcontroller is programmed to receive the moisture condition input signal of the status of the soil is displayed through an LCD display[7]. Arduino is programmed to have a threshold value of the soil. If the soil moisture value is less than the threshold value, then an SMS will be sent to the owner of the land through Lora Module. This is done by designing an android application that collects data from the IP address which is assigned to it[5].



IV. RESULTS

The proposed system was tested by placing soil moisture sensor once in dry soil and then in wet soil. The analog values of this sensor were visible in the android application that is designed to see the status of the soil. Soil moisture sensors were connected to Arduino Uno board and this board is connected to Lora module. When the moisture value is less than the threshold then LoRa module helps to view the status of that soil in the android application.

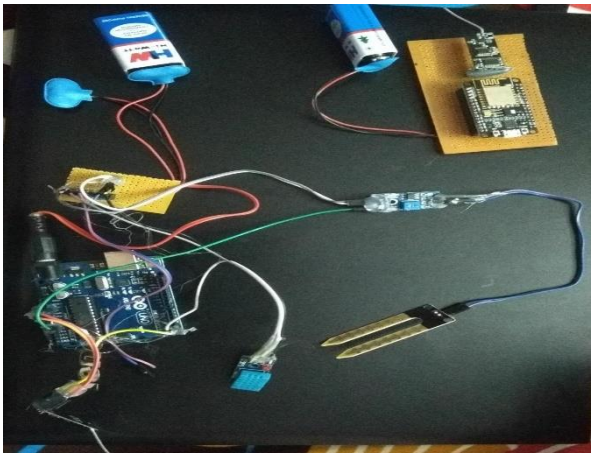


Fig1. Implementation of the Proposed System

Type of soil	Level of moisture observed	Level of moisture required
Red soil	25.78	27.4
Fine sand	16.13	15.00
Clay	19.54	20.13

Type of soil	Temperature and Humidity observed	Temperature and Humidity required

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Red soil	52%	<35%
Fine sand	45%	<50%
Clay	43%	<41%

V. CONCLUSION

Designing and constructing automatic irrigation system has been completed. The components of this system are available easily and they work reliably. The industry will become more sustainable and competitive by improving the efficiency of irrigation in agricultural sector. In dry areas also, proper irrigation is not possible where the rainfall is not sufficient. Hence by measuring the soil moisture content by using this irrigation system, we can meet the requirements of water which is necessary for the field. Our main aim is to save the farmers efforts for watering the field. In present world, farmers irrigate their fields at regular period of time. They use the techniques that consume more water and it results in wastage of water.

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