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An Automated Irrigation System to Improve Water Usage Efficiency in Irrigation Sector

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***Abstract*: The aim of the project is to amount of irrigation to agricultural fields by observing the moisture content of soil. This is used to address water scarcity at the regional national level. The project automates the process of manually irrigating the fields by switching the pump ON/OFF. It is implemented by using ARDUINO series microcontroller, programmed such as to collect input signals that measure moisture content of soil through sensing arrangement. On receiving the signal, the microcontroller produces an output that drives a relay and operates the water pump. Also, LCD is used which interacts with microcontroller for displaying the moisture content of soil and water pump status. Hence the system reduces human intervention and provides required irrigation to field. This is essential because water must be provided to the plant at a particular time for a good yield. Thus, it is useful in real time scenario and end users are interested in using this system.**

***Keywords*: Arduino, DHT11 sensor, Soil moisture sensor, LCD, GSM, DC motor, WIFI module.**

1. Introduction

Agriculture is the backbone of all developed countries. It uses 85% of available fresh water resources worldwide and this percentage continues to be dominant in water consumption because of population growth and increased food demand. Due to this, efficient water management is the major concern in many cropping systems in arid and semi-arid areas. India is the country of village and agriculture plays an important role for development of country. In our country, agriculture depends on the monsoons which has insufficient source of water. So, the irrigation is used in agriculture field. In irrigation system, depending upon the soil type what is provided to the plant. In agriculture, two things are very important, first to get information about the fertility of soil and second to measure moisture content in soil. Now a day, for irrigation, different techniques are available which are used to reduce the dependency of rain. And mostly this technique is driven by electrical power and on/off scheduling. In this technique, water level indicator placed in water reservoir and soil moisture sensors are placed in the root zone of plant. Irrigation system

Irrigation is the agricultural process of applying controlled amounts of water to land to assist in the production of crops, as well as to grow landscape plants and lawns, where it may be known as watering. Agriculture that does not use irrigation but instead relies only on direct rainfall is referred to as rain-fed. Irrigation has been a central feature of agriculture for over 5,000 years and has been developed independently by many cultures across the globe.

Present Extent:

In year 2000, the total fertile land was 2,788,000 km^2 (689 million acres) and it was equipped with irrigation infrastructure worldwide. About 68% of this area is in Asia, 17% in the Americas, 9% in Europe, 5% in Africa and 1% in Oceania. The largest contiguous areas of high irrigation density are found

Efficiency:

Modern irrigation methods are efficient enough to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little. Water use efficiency in the field can be determined as follows:

Field Water Efficiency (%) = (Water Transpired by Crop ÷ Water Applied to Field) x 100

2. Automated Irrigation System Using WSN and GPRS Module

Automated Irrigation system using WSN and GPRS Module having main goal is that optimize use of water for agriculture crops. This system is composed of distributed wireless sensor network with soil moisture and temperature sensor in WSN. Gateway units are used to transfer data from sensor unit to base station, send command to actuator for irrigation control and manage data of sensor unit. Algorithm used in system for controlling water quantity as per requirement and condition of filed. It is programmed in microcontroller and it sends command through actuator to control water quantity through valve unit. Whole system is powered by photovoltaic panels. Communication is duplex take place through cellular network. Web application manage the irrigation through continuous monitoring and irrigation scheduling programming. It can be done through web page.

A. Existing System

An automated irrigation sensor was designed and implemented to use in agricultural crops. In this system, various sensors such as soil moisture and humidity sensor are connected

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to the input pins of Arduino microcontroller. The sensed values from the sensor are displayed in LCD. If the sensed values go beyond the threshold values set in the program, the pump will be automatically switched ON/OFF.

B. Hardware Requirements

1) NodeMCU

The Arduino is an open source, computer hardware and software company project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.

Arduino Components:

- Pinouts
- Power Pins
- Serial pins
- Analog Pins
- The Control Pins

2) Soil moisture sensor

This sensor can be used to test the moisture of soil, when the soil is having water shortage, the module output is at high level, else the output is at low level. By using this sensor one can automatically water the flower plant, or any other plants requiring automatic watering technique. Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

3) DHT11 sensor

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability.

4) LCD display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other.

5) DC motor

mains electricity to a suitable low voltage supply for electronic circuits and other devices. A RPS (Regulated Power Supply) is the Power Supply with Rectification, Filtering and Regulation being done on the AC mains to get a regulated power supply for Microcontroller and for the other devices being interfaced to it.

6) Transformer

A transformer is an electrical device which is used to convert electrical power from one Electrical circuit to another without change in frequency.

An Electrical Transformer Turns ratio = V_p / V_S = N_p/N_s

Power Out= Power in V_S X I_S=V_P X I_P

V_p = primary (input) voltage

N_p = number of turns on primary coil

I_p = primary (input) current

7) Regulator

Voltage regulator ICs is available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection'). Many of the fixed voltage regulators ICs have 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right.

C. Software Requirements

The software modules used in this system are,

1. Arduino IDE
2. ThingSpeak

1) Arduino IDE

Node MCU allow us to program the ESP8266 Wi-Fi module with the LUA programming language or Arduino IDE.

The software used in this project are Arduino IDE.

The Arduino software allow (IDE) us to write programs and upload them to our board.

It runs on Windows, MAC OS X, and Linux.

The Arduino IDE supports the languages C and C++ using special rules of code structuring.

2) ThingsBoard Cloud

ThingsBoard is an open-source IoT platform that enables rapid development, management, and scaling of IoT projects. Our goal is to provide the out-of-the-box IoT cloud or on-premises solution that will enable server-side infrastructure for your IoT applications.

D. Working

An automatic irrigation control system has been designed to facilitate the automatic supply of adequate of water from a reservoir to field or domestic crops in all agricultural seasons. One of the objectives of this work is to see how human control could be removed from irrigation and also to optimize the use of water in the process. The method employed is to continuously monitor the soil moisture level to decide whether irrigation is needed, and how much water is needed in the soil. A pumping mechanism is used to deliver the needed amount of water to the soil. The work can be grouped into four subsystems namely; power supply, sensing unit, control unit and pumping subsystems which make up the automatic irrigation control system. A moisture sensor was constructed to model the electrical resistance of the soil; a regulated 12 volts power supply unit was constructed to power the system; the control circuit was implemented using operational amplifier and timer; and the pumping subsystem consisting of a submersible low-noise micro water pump was constructed using a small dc-operated motor. The results obtained showed that sandy soils require less water than loamy soils and clay soils require the most water for irrigation.

Applications:

- It can be agriculture fields, lawns, and as drip irrigation systems.
- It can be used for cultivation purposes.

- It can be used to provide water in nursery planting arena.
- It can be used for wide range of crops.
- Pond water management.
- Irrigation in gardens, parks.

Advantages:

- Increase in productivity.
- Reduced water consumption.
- Safe
- No man power required.
- Reduce soil erosion and nutrient leaching.

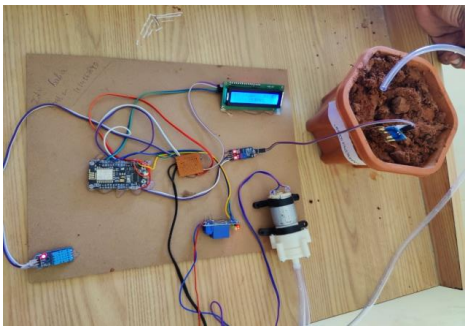

Fig. 1. Hardware setup

3. Conclusion

The problem of irrigation-induced salinity warrants greater attention than it is getting today. The technologies exist to ameliorate or eliminate the problem and delays in taking action will only escalate the economic, social, and environmental damage and the cost of repairing such damage. Because of the nature of the agricultural sector and most irrigation schemes in developing countries, it is often the small farmer, who can least afford it, who has to bear the burden of the cost associated with salinity. In light of the externalities associated with corrective measures, governments will have to play a major role in correcting or alleviating salinity problems. Donor agencies will also have an important role in enhancing the capacities of governments to do so.

Future Scope:

In our project Irrigation to the field is automatically controlled based on the moisture of the soil and temperature of the weather. In future, the regular crops can be monitored with the help of camera placed in the drown. The growth of these crop is compared with the green house crops. Based on this, we can find the deficiency in crop. This technique applies to all types of crops.

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