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Smart Irrigation System

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ABSTRACT
With the water requirements in irrigation being large, there is a need for a smart irrigation system that can save about 80% of the water. This prototype aims at saving time and avoiding problems like constant vigilance. It also helps in water conservation by automatically providing water to the plants/gardens depending on their water requirements. It can also prove to be efficient in Agricultural fields, Lawns & Parks. As technology is advancing, there is always a chance of reducing risks and making work simpler. Embedded and micro controller systems provide solutions for many problems. This application precisely controls water system for gardens by using a sensor micro controller system. It is achieved by installing sensors in the field to monitor the soil temperature and soil moisture which transmits the data to the microcontroller for estimation of water demands of plants.

Keywords: Soil Moisture sensor, Motor Driver, Relay, Microcontroller, TFT Screen

I. INTRODUCTION

Agriculture is the major source of income for the largest population in India and is a major contributor to the Indian economy. However, technological involvement and its usability have to be grown still and cultivated for the agriculture sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agriculture vendor's information to farmers. The agriculture must overcome expanding water deficiencies, restricted availability of lands while meeting the expanding consumption needs of a world population. New innovative IoT applications are addressing these issues and increase the quality, quantity, sustainability, and cost-effectiveness of agricultural production. Agriculture is the backbone of the Indian Economy. In today's world, as we see rapid growth in the global population, agriculture becomes more important to meet the needs of the human race. However, agriculture requires irrigation and with every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield. But in the present era, the farmers have been using irrigation techniques through the manual control in which they irrigate the land at the regular interval. According to statistics, agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial and institutional improvements. Agricultural irrigation based on Internet technology is based on crop water requirement rules. By using Internet technology and sensor network technology we can control water wastage and maximize the scientific technologies in irrigation methods. Hence it can greatly improve the utilization of water and can increase water productivity. The Internet of Things (IoT) is a technology wherein a mobile device can be used to monitor the function of a device. The Internet of Things (IoT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things (IoT) is a type of network technology, which senses the information from different sensors and makes anything to join the Internet to exchange information. It can also be used to modify the status of the device. The central processing unit will also include a communication device to receive data from the sensors and to be relayed to the user's device. The data processed by the central module is converted to meaningful data and relayed to the user. The user can view the data with the help of a screen. Nowadays water scarcity is a big concern for farming. This project helps the farmers to irrigate the farmland efficiently with a Smart irrigation system based on soil moisture. The proposed system has been designed to overcome the unnecessary water flow into the agricultural lands. Once

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the soil moisture values are exceeded the particular limit then the relay, which is connected to the Arduino microcontroller controls the Automation of irrigation system using IoT 79 motor.

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II. WHY WE NEED THIS SYSTEM

Until quite recently, India enjoyed abundant water resources. But population growth and overexploitation has led to a situation where the demand for water is exceeding supply.

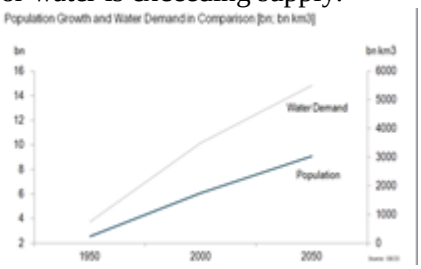

Fig1: The graph shows exponential decrease of water per capita.

From the graph we currently notice that the water availability is in stress. If this rate continues, then we would face severe water scarcity. So there is an urgent need to conserve water. During manual irrigation, the water requirement of plants/crops is not monitored. Even when the soil is moist enough, water is still provided. This water is not absorbed by the plants and thus is wasted. Hence a system is to monitor the water requirements of the plant is needed. Also Smart Irrigation System installation means decreased operating expense by maintenance personnel.

III. SYSTEM OVERVIEW

This prototype monitors the amount of soil moisture and temperature. A predefined range of soil moisture is set, and can be varied with soil type or crop type. In case the moisture of the soil deviates from the specified range, the watering system is turned on/off. In case of dry soil, it will activate the irrigation system, pumping water for watering the plants or in case of wet soil, it will halt the pumping water for plants.

The block diagram of smart irrigation system is represented in Fig1. It consists of a microcontroller (Arduino mega board 2560) which is the brain of the system. The moisture sensor are connected to the input pins of the controller. The water pump and the motor driver are coupled with the output pins. If the sensors depart from the predefined range, the controller turns on the pump. The motor driver is used to control the water pipe, which ensures equal distribution of water to the soil. An user interface TFT screen is attached to the micro controller that shows the current activity of the system.

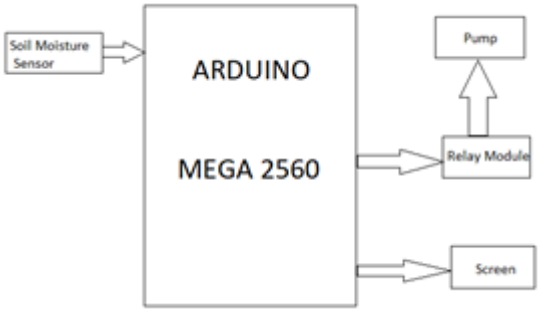

Fig2: block diagram of smart irrigation system

This system can be implemented on a large scale for farming purposes, which can further prove to be more advantageous. Owing to prevailing conditions and water shortages, the optimum irrigation schedules should be determined especially in farms to conserve water.

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IV. PROJECT DESCRIPTION

Hardware Components:

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1) Arduino - It is showing an Arduino board is an open source platform used for building electronics projects. Arduino is a programmable circuit's board which we can write a program based on your projects. Arduino program will be uploading with IDE (Integrated Development Environment) software that runs on your computer, it is used to write and upload computer code to the Arduino physical board. Arduino language is merely a set of C/C++ functions that can be called from your code. It is a micro controller which has 5 digital pins 16 analog pins and a 8 bit microprocessor. This is used as a general purpose for input and output to perform various tasks. In this project, this board is used to transfer data to the moisture sensor, TFT screen and DC Pump motor.

Figure 1. Arduino Mega Board

2) Soil Moisture Sensor- soil moisture sensors estimates the soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content. It consists of a pair of electrodes to measure the resistance of the soil. Greater the resistance, lower the moisture content of the soil.

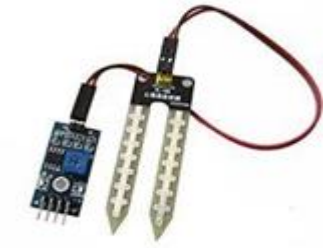

Fig3: Soil Moisture Sensor

2) Motor Driver L293D: L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that we can control more than two DC motor with a single L293D IC at same time.

Fig4: Motor Driver L293D smart Irrigation System

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3) TFT Screen: Short for thin film transistor, a type of LCD flat-panel display screen, in which each pixel is controlled by from one to four transistors. The TFT technology provides the best resolution of all the flat-panel techniques, but it is also the most expensive. TFT screens are sometimes called active-matrix LCDs. This TFT Screen is used as a user interface.

This screen displays the operation that is going to happen according to the values. This is directly connected to the Arduino board where it can get the information that is to be displayed.

Figure 5: TFT Screen

HARDWARE DESIGN:

In our model, we are demonstrating watering of only one pot, so a single moisture sensor and temperature sensor is used. Depending on the number of pots, the number of moisture sensor and temperature sensor to be interfaced with the board will vary. When the soil moisture sensor is interfaced with the board , the sensor reports values of resistances of the soil in which it is immersed into. As soil moisture sensor is analog, an inbuilt ADC in Arduino is used to convert into its digital form (0-1023), which represents resistance. Dry soil will have the maximum resistance and wet soil will have least resistance. It has a DC pump motor and does require driver. The rotating platform is attached on the motor to provide a base for the movement of the pipe. If the soil is dry, moisture sensor values will be high, so the pump is turned on using a relay and switched off when the values reach a threshold. The vice versa is applicable for moist soil.

SOFTWARE DESIGN:

The software used in our project is Arduino. It provides a number of libraries to make programming simple. In our prototype, the controller Mega2560 is programmed in Arduino. The program in Arduino designates a present range of resistance value in digital format (ranging from 0 to 1023) for both the moisture sensor. Any aberration from the set range switches on/off the pump, to water the plants.

V. ADVANTAGES OF THE SYSTEM

This technology is recommended for efficient automated irrigation systems and it may provide a valuable tool for conserving water planning and irrigation scheduling which is extendable to other similar agricultural crops. Maximum absorption of the water by the plant is ensured by spreading the water uniformly using motor. So, there is minimal wastage of water. This system also allows controlling the amount of water delivered to the plants when it is needed based on types of plants by monitoring soil moisture. This project can be used in large agricultural area where human effort needs to be minimized. Many aspects of the system can be customized and fine-tuned through software for a plant requirement.

VI. RESULT

The smart irrigation system was tested on a garden plant. The plant's water requirement is 600-800mm a day. In the Arduino code, the moisture range were set as 300-700 respectively (which delineates the corresponding resistance value in digital format). Moreover, this system proves to be cost effective and proficient in conserving water and reducing its wastage.

VII. CONCLUSION

In the present era, the farmers use irrigation technique through the manual control, in which the farmers irrigate the land at regular intervals. This process seems to consume more water and results in water wastage. Moreover, in dry areas where there is inadequate rainfall, irrigation becomes difficult. Hence, we require an automatic system that will precisely monitor and control the water requirements in the field. Installing Smart

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irrigation system saves time and ensures judicious usage of water. Moreover, this architecture uses microcontroller which promises an increase in system life by reducing power consumption.

VIII. FUTURE SCOPE

Our project can be improvised by adding a Webscaper which can predict the weather and water the plants/crops accordingly. If rain is forecasted, less water is let out for the plants. Also, a GSM module can be included so that the user can control the system via smart phone. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation. A solenoid valve can be used for varying the volume of water flow. Furthermore, Wireless sensors can also be used.

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