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Soil Moisture Detection with Automatic Water Pump Control

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Abstract: In India irrigation is mostly dependent on the monsoon which is not a reliable source of water. Depending upon the type of crop different water requirements will be there. The water retention capacity is also dependent on the type of soil present at that location. Due to this most of the crops are destroying due to non-availability of water resources and not supplying water to the crops at the right time. Also, in India farmers are not able to grow more than one crop in the same agricultural field as different crops need different requirement of water. Hence in order to solve all these problems our system will able to supply water to more than one crop whenever the soil moisture content is low for a particular crop.

Keywords: Moisture, Soil, Crop, Water pump, Moisture sensor.

I. INTRODUCTION

In a country like India, much of the economy is based on agriculture. The steady increasing requirement for food requires rapid development in food production technology. Various crops and plants have different requirements for water, fertilizers and sunlight. They might be having problems in farming during natural hazards and the scheduled watering of the crops can get hampered. So, there must be continuous monitoring of these factors in order to maintain the productivity of the crops. Hence, we came up with a project which will monitor the moisture level of the soil and sends a message immediately when there is a shortage of water in the soil.

In this project the soil moisture sensor will be monitoring the soil moisture content of the soil of more than one crop. Whenever the sensor detects that the soil moisture content of the soil is below the threshold value of the soil, the system will automatically turn ON the water pump and water will flow through that crop only. It will also inform the user by sending the SMS to their mobile stating that the motor has been turned ON. When the system detects that the soil moisture content is above the threshold value of that crop, it will automatically turn OFF the water pump and stop the water flowing through that crop. In this way it also prevents the wastage of water. Farmer can use this and can grow multiple crops in their agricultural field. Here we are using Arduino as the microcontroller and GSM module to send SMS.

II. LITERATURE SURVEY

Farmers usually do not grow food plants in the dry season for fear that it will not grow well. The farmer's dependence on the season causes the production to decline and becomes an obstacle in the success of the food self-sufficiency program. An information and communication technology-based agricultural device is needed to overcome the problem. The research aimed to design a programmed microcontroller chip to control watering automatically based on soil moisture detected using a domestic soil moisture sensor. This device detects whether the soil is dry or not. The farmers do not need to do watering manually. In addition to helping farmers, the device can also be installed on plantations, seedbed nurseries, urban parks, hotels, offices, and in homes that have parks or plants that need regular watering.[1]

The soil moisture sensor works on electrical resistivity. As the moisture content of the soil increases, the electrical resistivity of the soil decreases. The value of resistivity changes in to volumetric water content of soil. The sensor sends command to irrigation controller at 1 hour interval. If soil moisture goes down to the threshold value of moisture content, then controller starts the pump. While, moisture content reaches at threshold value then system off automatically by micro controller. The results shows that when resistance of soil increases the voltage on controller output port was equal or more than 24 VAC which shows starting command for pump. When resistance of soil decreases then sensor indicates optimum moisture availability at that time output voltage of controller was nearly to zero voltage. Which indicate command for system off [2]

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The study aims to develop an irrigation water management system that controls the volume and frequency of irrigation water applied to the soil and to develop a system that measures the soil moisture level using a low-cost sensor. Controlling the applied irrigation water to the soil regarding the measurement of the sensor to reduces excess water.[3]

Automatic irrigation is the use of a device to operate irrigation structures so the change of flow of water from one bay, or set of bays, to another can occur in the absence of the irrigator. In this work, automatic control system of solar irrigation implemented practically using Arduino board. This photovoltaic (PV) system is applied in the garden of Engineering Technical College- Mosul (city in Iraq). PV system can be adjusted by many regions in Iraq where it planned to connect on small part of land. Irrigation process is controlled depending on moisture sensor that connected to sense the soil moisture and giving data to Arduino read pin. According to the program that uploaded to Arduino, DC pump can be controlled as ON-state or OFF-state as respect to the soil moisture percentage ratio. Finally, the practical results are approximately similar to that obtained from proteus Arduino simulator. [4]

A low-cost Arduino based Automatic Irrigation system using Soil moisture sensor is presented in this paper in which the soil moisture sensor gives its output depending on the conditions of the soil and later with the help of Arduino it gets worked. As agriculture is given higher priority in the life of an economy so for the better agricultural growth, water is essential factor. Lack of enough water and excess of water leads to damage of plants. So, we need an effective and efficient technology for better farming. Thus, the usage of a low-cost Arduino based automatic irrigation system using soil moisture sensor is expected to be useful to for the irrigation process in agriculture. This system requires an Arduino-UNO which contains ADC converter in it. A soil moisture sensor is the main component in this system which is used to measure the conditions of the soil like whether the soil is dry or wet. For displaying the conditions of the soil, 16×2 LCD display is the better choice to display and at last a motor is used to pump the water to the plant or crops. [5]

The advanced sensor node handles the sensor information and causes the actuators based on the programmed microcontroller's (Arduino-based) with a threshold algorithm. The gateway gets data from the sensor and controls data via Blink and sends the data to the remote monitoring Web application. Moreover, this proposed work is simulated by thinker CAD software for initial analyzation of the soil moisture level, temperature, humidity, and light intensity. The controller's codes have been written in the programming language Arduino, debugs, compiled and uploaded into the microcontroller using Arduino's IDE. The system was constructed and tested for a scaled-down prototype. Greenhouse automation provides effective microclimatic parameter acquisition and controls. The work engaged in maintaining it also considerably decreases, making it beneficial for rural farmers, gardeners, and agriculture researchers. [6]

In this paper, Arduino based Smart Irrigation System using GSM Module and Sun Tracking Solar system has been explored. This system is hoped to be very convenient and affordable for the people of rural areas. The module being targeted for the large population of the rural sector is hoped to be a huge contribution to the community. To meet the demand of efficient irrigation system, this paper presents the design and implementation of a low cost yet flexible smart irrigation system where with the help of cell phone the status of the submersible pump can be observed. The design is based on a standalone Arduino UNO board where the communication between the cell phone and the Arduino UNO board is wireless. The system is designed to be low cost and scalable allowing variety of devices to be controlled with minimum changes to its core. Thus, the System is hoped to outperform current smart irrigation systems. It is believed that this paper will play a vital role for the rural people of the under developed and developing countries. [7]

The scarcity of clean water resources around the globe has generated a need for their optimum utilization. Internet of Things (IoT) solutions, based on the application specific sensors' data acquisition and intelligent processing, are bridging the gaps between the cyber and physical worlds. IoT based smart irrigation systems can help in achieving optimum water-resource utilization in the precision farming landscape. This paper presents an open-source technology based smart system to predict the irrigation requirements of a field using the sensing of ground parameter like soil moisture, soil temperature, and environmental conditions along with the weather forecast data from the Internet. The intelligence of the proposed system is based on a smart algorithm, which considers sensed data along with the weather forecast parameters like precipitation, air temperature, humidity, and UV for the near future. The complete system has been developed and deployed on a pilot scale, where the sensor node data is wirelessly collected over the cloud using web-services and a web-based information visualization and decision support system provides the real-time information insights based on the analysis of sensors data and weather forecast data. [8]

An ample amount of water quantity is vital for a plant to grow. People are unable to water the plants when they go on vacations or regularly fail to remember to water plants, which results into damaging the plants. Giving water to plants is one of the most significant practices and overall, a labour demanding work. Automatic watering systems lessen the responsibility of watering the plants when there is a requirement. The two major part of watering method is to know when

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and how much to water the plants. In this paper, a system is implemented such that it will sense the soil moisture content of the plant and turn the motor ON to water the plant when needed. This system makes the plant more self-reliant by watering itself. [9]

Nowadays, farmers in the agriculture field facing a lot of problems in pouring the water into their field to keep their crops green especially in summer season. Thus, we need effective technologies to overcome these problems in order to make the work of users easier. This work proposes an automatic plant watering system taking into consideration the technical aspect. Where, solar power is used as the source of power to control the overall system. This embedded system uses the PIC18F452 microcontroller, it depends on the analysis of soil humidity and ambient temperature. When the moisture content of the soil is reduced then the sensor sends detected value to the microcontroller, which activates the corresponding valve. Then the water pump is automatically ON according to the moisture level. The main aim of this paper is to reduce the human intervention for farmers, to give a considerable saving of time and effort with a very low initial. [10]

III. GAP ANALYSIS

Paper Number	Description
Paper 1	In this project the sensor will only detect whether the soil is dry or not. It cannot be used to grow crops but used for only plants for office and some nurseries etc.
Paper 2	This system will automatically turn on the water pump when the soil moisture content is low and turn off when high, but this system will not inform the farmer whether the water pump is turned on or off.
Paper 3	This system will try to control the flow of water through irrigation, but this system will not automatically turn ON the water pump when soil moisture content is low.
Paper 4	This project works on solar irrigation where system is charged by solar panels. This system will not automatically turn ON water pump instead it will change the flow of water from one crop to another crop based on its soil moisture level.
Paper 5	This project will display whether the soil moisture content is low of high, but it will not control the water pump automatically.

IV. PROPOSED SYSTEM

- This system will control the soil moisture content of the different crops by using the resistive value of the specific crop.
- This system will automatically inform the user that the water pump is turned on.
- This system will automatically turn ON the water pump whenever the controller detects the soil moisture content is low at the specific crop.
- This system will automatically turn on the water pump of that particular crop so that water flows only through that crop.
- This system will detect the exact soil moisture content of a crop so that it can be monitored correctly.

V. BLOCK DIAGRAM

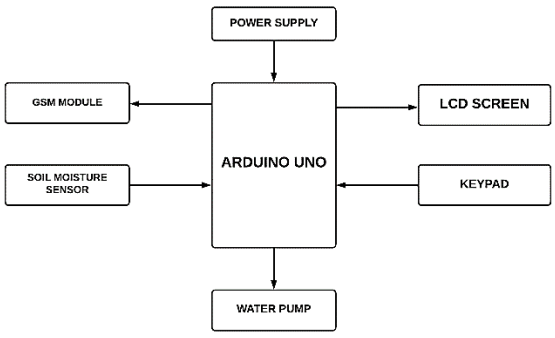

Fig. 1 Block Diagram

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VI. APPLICATIONS

- It is used to maintain moisture content of the soil in agricultural land from remote areas.
- Wastage of water can be minimized.
- It saves time of the farmers.
- Destruction of crops can be controlled.

VII. CONCLUSION

Soil moisture detection with automatic water pump control can be an effective way to ensure that plants receive the optimal amount of water for their growth and development. By using sensors to measure the moisture content of the soil, a control system can automatically turn on a water pump to provide irrigation when the soil moisture falls below a certain threshold. This can help to conserve water and reduce the risk of over- or under-watering, leading to healthier plants and potentially higher yields.

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