SMART FARMING

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Abstract: The project describes how to monitor and document changes in soil moisture more easily by using the appropriate soil moisture sensors. Temperature, moisture, and light-dependent resistor sensors are all used with an Arduino Mega microcontroller to detect and analyse temperature. The soil gives information about its moisture state after a specific amount of time. The data gathered and processed by the Arduino Mega comes from the sensors. The water supply will adjust when the soil reaches a certain threshold moisture level. This is critical because proper yields need the plant to get water at specific times. By doing away with traditional or manual methods, this initiative is very helpful to farmers and nursery specialists.

Keywords: Soil Moisture Sensor, Microcontroller, Arduino Uno

1. INTRODUCTION

The soil's moisture content is crucial for both plant gardens and irrigation fields. Just as soil nutrients provide plants the nourishment they need to develop. In order to alter the temperature of the plants, water must be supplied. Water may be used to modify a plant's temperature through a process similar to transpiration. Additionally, as plants grow in damp soil, their root systems develop more effectively. Abnormally high soil moisture content can lead to anaerobic conditions that can promote the growth of soil pathogens and plants. An overview of the functions and uses of the soil moisture
Sensor.

Among the types of sensors used to measure the volumetric soil moisture sensors are one type of sensor that is used to measure the amount of water in the soil by volume. As the soil moisture straight gravimetric dimension has to be eliminated, dried, and sample weighted. These sensors use the dielectric constant, electrical resistance, and other soil laws to estimate the volumetric water content instead of directly otherwise replenishment of the moisture content and contact with neutrons. In light of ecological variables like temperature, soil type, and electric conductivity, the relationship between the computed property and soil moisture should be modified and may alter. In addition to being primarily utilised in agriculture and remote sensing within hydrology, the reflected microwave emission can be affected by the moisture content of the soil. A different set of sensors determines a new moisture attribute in soils called water potential, while these sensors are often employed to measure the volumetric water content. These sensors, which comprise tensiometers and gypsum blocks, are generally referred to as soil water potential sensors.

2. Literature survey

In order to minimise human intervention, SrishtiRawal's study suggests an Internet of Things (IoT)-based smart irrigation system that employs soil moisture sensors to autonomously water plants when soil moisture falls below a threshold. The system notifies the user by mobile SMS when sensor data is sent to an Arduino microcontroller, which uploads it to the cloud. To start the water pump for the ideal amount of time, the soil moisture and humidity readings are compared to predetermined set points. By optimising irrigation depending on current soil conditions, this automated method seeks to save farmers money, energy, time, and water. IoT technologies are utilised by the system[1].

In [2] Gori and Mangles suggest an Internet of Things (IoT)-based smart irrigation system that minimises water waste and farmer labour by using soil moisture sensors to autonomously operate a water pump depending on soil moisture levels. Sensors are used by the system to continually monitor soil moisture, temperature, and humidity. Data is sent to an Arduino microcontroller. The Arduino turns on the water pump by activating a relay when the moisture content of the soil falls below a certain threshold. Through Wi-Fi, the sensor data is also sent to an Android app, giving the farmer the ability to remotely check on the state of the pump and circumstances. This automated, Internet of Things-enabled method seeks to maximise irrigation efficiency by offering farmers remote vision and control and distributing the appropriate quantity of water to crops depending on current soil moisture levels.

Dr. S. JothiMuneeswari's study "Smart Irrigation System using IoT approach," which was released in March 2017 by the International Journal of Engineering Research & Science, offers a creative way to increase agricultural productivity via automation. In order to gather and manage data in real-time, the study highlights the integration of IoT technology to monitor temperature, humidity, and soil moisture. Through the use of many sensors that are linked to a microcontroller, the system automatically modifies irrigation according to the moisture content of the soil, maximising water efficiency and minimising waste. The suggested irrigation method increases productivity and convenience by reducing human labour while also enabling farmers to remotely monitor and manage their irrigation operations using mobile applications [3].

In October 2017, V. Vinoth Kumar, R. Ramasamy, S. Janarthanan, and M. VasimBabu published a paper titled "Implementation of IoT in Smart Irrigation System using Arduino Processor" in the International Journal of Civil Engineering and Technology. The paper discusses the creation of an automated irrigation system that utilises IoT technology to improve agricultural productivity. In order to monitor environmental conditions in real-time, the authors describe how an Arduino microcontroller is integrated with many sensors, including soil moisture sensors. The irrigation system is engineered to initiate watering automatically in response to soil moisture levels, therefore optimising water use and reducing waste. The study also highlights how crucial it is to have remote monitoring capabilities that let farmers manage irrigation schedules using a smartphone app [4].

3. Proposed system

The suggested smart irrigation system optimises water use and boosts convenience by combining cutting-edge technologies with conventional grass sprinkling techniques. The system's key component is an intelligent irrigation controller that automatically modifies watering schedules by integrating soil moisture levels and meteorological data. Installed at different locations across the garden, soil moisture sensors continually check soil conditions and give the controller data in real time. This information enables the system to make exact changes, saving water use by 20–40% when compared to traditional techniques. It also combines local weather updates from internet sources. The irrigation system's smart sprinkler valves regulate water flow to various zones in accordance with controller commands.

Through the use of a mobile app and WiFi connectivity, customers can remotely operate the system and establish, modify, and keep an eye on watering schedules from their smart devices without having to be in person. By doing away with the necessity for manual intervention, this automation not only saves water and electricity costs but also provides a great deal of ease. During system installation, smart technology is added to the existing components, user preferences are configured, and performance is tested to ensure optimal performance. The intelligent irrigation system offers effective water management, financial savings, and user-friendliness together with the bonus of real-time monitoring and alarms, all of which contribute to a landscape that is healthier and better-kept overall.

4. METHODOLOGY

A sensor module that acts as an interface between the Arduino microcontroller and the soil moisture probe is a feature of the suggested smart irrigation system. The resistance of the probe, which is accessible via an Analogue Output (AO) pin, provides the basis for the analogue output voltage generated by this module. After being supplied to an LM393 High Precision Comparator, the same signal is digitalised and made available via a Digital Output (DO) pin. The module has a potentiometer that allows the digital output (DO) sensitivity to be adjusted, which enables the moisture detection threshold to be precisely calibrated.

The system's capacity to define a moisture threshold is one of its important characteristics. The module outputs HIGH unless the soil moisture level falls below this threshold, in which case it outputs LOW. This configuration is excellent for setting off an event when a certain threshold is met. For instance, you can start watering the plant by activating a relay whenever the soil's moisture content rises over a certain level.

Additionally, the module has two LEDs:

- LED Power: When the module is powered on, this LED turns on to show that the system is working.
- The status LED is a clear indicator of the current moisture condition; it glows when the soil moisture level rises beyond the threshold amount.

Apart from monitoring and controlling in real time, the suggested system also includes analytics and data storage features. For the purposes of pattern identification, historical research, and future planning, the gathered data is retained. Through data analysis, users may discern patterns in soil moisture, plant development, and water consumption, enabling them to enhance system efficiency and make knowledgeable choices on irrigation schedules and tactics.

4.1 Scope of Project

- Integration of Groundwater: The model may be used to analyse variations in groundwater levels by integrating it with models of groundwater.

- A Effect of Climate Change: It may be used to examine how climate change will affect water systems in the long run.

- Crop Development Models: To evaluate the model's effects on agricultural production, it may be coupled with other crop growth models.

- Analysis of Hydropowder and Environment: It may be used to research energy needs, pollution monitoring, ecological requirements, hydropower generation, and benefit-cost analysis of projects.
- The Accounting of Water Balance: Water rights and allocation, supply and demand balancing, groundwater and stream flow simulations, and other related concerns are supported by the model for both simple sub-basins and intricate river systems.

- The assessment of future trends pertaining to demand management on water systems under different scenarios, such as population growth, groundwater depletion, water conservation strategies, effective irrigation techniques, cropping pattern modifications, crop shifts, and the effects of climate change on hydrology, is made easier with the aid of scenario analysis.

BLOCK DIAGRAM

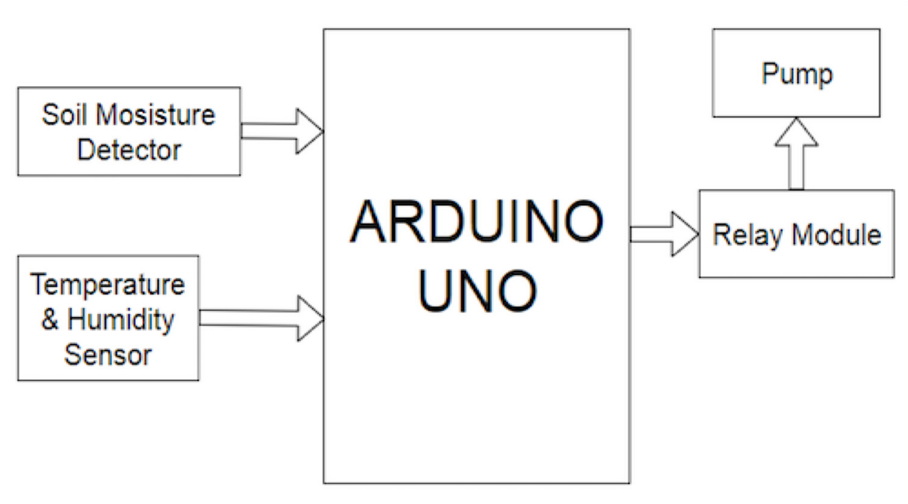

Fig. 1: Block Diagram

The intelligent irrigation system makes use of sensors to collect vital information about the properties of the soil, such as temperature, moisture content, and predetermined threshold values. The system can assess soil health and pinpoint the precise nutrient requirements thanks to the sensors' continual monitoring of these data. The device can determine the ideal water need by analysing the soil's water demands based on this study. This gives the system the ability to use cutting-edge techniques for targeted watering, guaranteeing that the soil gets the right quantity of nutrients and water. Thus, the data-driven and effective watering solutions offered by the smart irrigation system maximise soil health and water efficiency.

Circuit Diagram

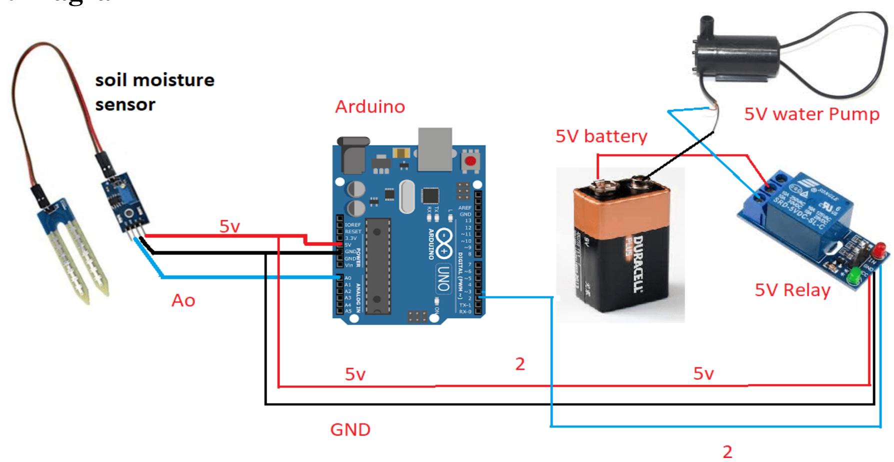

Fig 2: circuit diagram

First, power the circuit with an external 9V or 12V battery to get it started. Attach the battery's positive connection to the Arduino'sVin pin and its negative terminal to the Ground pin. Next, connect the motor to the battery via a relay so that its functioning may be controlled. To measure the moisture content, attach the moisture sensor's output to one of the Arduino's Analogue pins. The 5V pin on the Arduino is used to supply power to the sensor. To connect the relay module, attach its Ground pin to the Arduino's Ground pin and its VCC pin to the 5V pin for power. Lastly, connect any accessible Digital pin on the Arduino to the Signal pin of the relay module, avoidingpin 13. This configuration ensures that the Arduino is powered, the moisture sensor accurately measures soil conditions, and the relay effectively controls the motor based on the sensor's data.

5. Components Required

5.1 ArduinoUno

Fig.No. 3:Arduino Uno

The Arduino UNO is one of the most used microcontrollers in the industry. It is very easy tohandle, convenient, and use. The coding of this microcontroller is very simple. The programof this microcontroller is considered as unstable due to the flash memory technology. Theapplications of this microcontroller involve a wide range of applications like security, homeappliances, remote sensors, and industrial automation. This microcontroller has the ability tobejoined on the internetand perform as a servertoo.

5.2 Soil Moisture Sensor

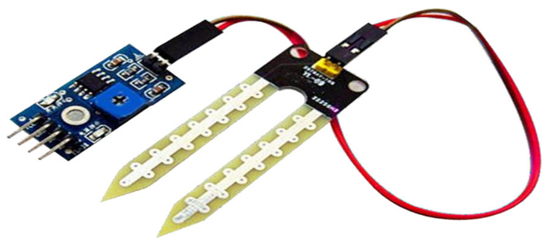

Fig.No.4: Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil.[1] Sincethedirect gravimetric measurement of free soil moisture requires removing, drying, andweighing of a sample, soil moisture sensors measure the volumetric water contentindirectly by using some other property of thesoil, such aselectricalresistance,dielectric

5.3 Relay Module

Fig.No.5: Relay Module

The relay module is an electrically operated switch that allows you to turn ON or OFF a circuit using voltage and/or current much higher than a Microcontroller could handle. There is no connection between the low voltage and circuit operated by the Microcontroller and the high power circuit. The relay protectseach circuit from the other. Each channel in the module has three connections namedNC, COM, and NO. Depending on the input signal trigger mode, the jumper cap can be placed at high level effective mode which closes "the normally open(NO) switch at high level input and at low level effective mode which operates the same but atlowlevel input.

5.4 Water Pump and Pipe

Fig.No.6:Water Pump and Pipe

An Arduino cannot directly power a bigger pump, which is required to water a garden. To operate the pump and supply the required current, use a relay. You may use a 5V relay for a 5V DC pump. In the event that the pump is supplied by AC, switch out the DC power input for AC power in the relay and use a separate DC source to power the Arduino. Just make sure the pump and Arduino are connected to electricity properly. The configuration stays the same.

6. RESULT

Fig. No.7: Initial Stage of the Project

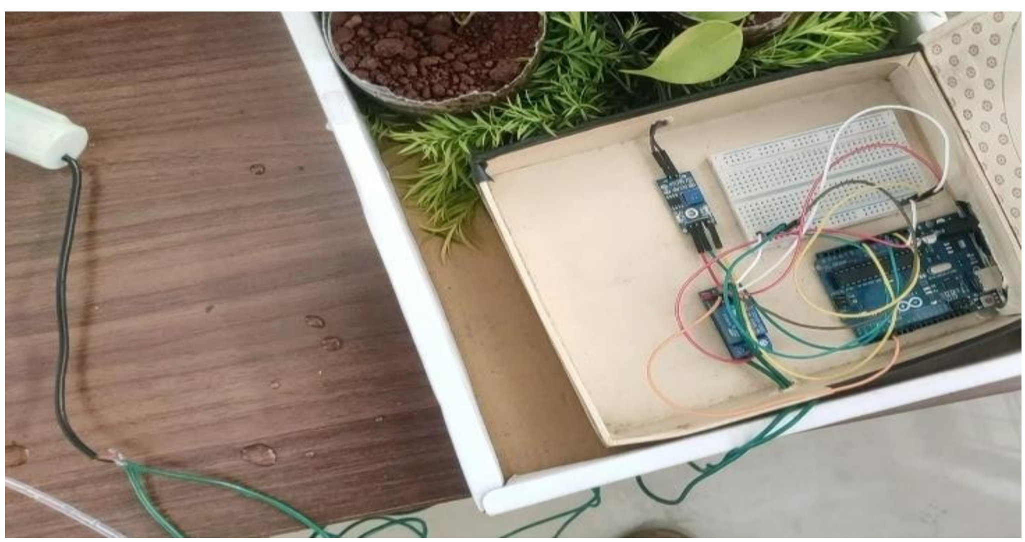

Fig.No.8: Working of project

The soil's water content is measured using the Soil Moisture Sensor. It is used in this project to provide real-time data on soil moisture levels, which improves irrigation system efficiency. As a result, irrigation can be managed more precisely and promptly, guaranteeing that the soil gets the ideal amount of water for healthy plant growth.

7. Conclusion

A system that uses the Internet of Things to track and analyse rainfall patterns, soil moisture, temperature, and humidity is covered in this study. It controls the water pumping process using a DC motor with the usage of a NodeMCU. Rain management and water use may be made more effective by the technology, which uses Wi-Fi to send these data points to a smartphone. Farmers using smartphones may use the Blynk app to get real-time information on temperature, humidity, and soil moisture along with the status of the DC motor from anywhere in the globe.

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