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Automated Irrigation System Based on Soil Moisture Sensor

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Abstract: ***In most regions of the world, population growth has resulted in water scarcity. Agriculture wastes a significant amount of water. Water logging during irrigation is the leading cause of water waste in this area. As a result, there is a need to convert to alternate irrigation methods. The Arduino board and a microcontroller are used in this study to suggest an autonomous plant irrigation system. It detects the moisture content of the soil and determines whether or not irrigation is required. It gives appropriate water to the crop after assessing the parameters. When the soil is dry, the pump automatically turns on and distributes water. Similarly, when the soil is wet, the pump shuts down and the crop receives no water. This not only saves water that would otherwise be wasted, but it also ensures that the crop receives only the amount of water it requires. The development of automation technologies has made life simpler and easier in every way. In the modern world, automatic systems are favoured over manual ones. A expanding system of ordinary objects called automatic systems While you're busy, an industrial machine may produce consumer products with additional activities.***

Keyword: Arduino Uno, Moisture Sensor, Sensors, Microcontroller

I. INTRODUCTION

Irrigation is a fictitious method of watering crops. It's utilised in places where there's a lot of sunshine but not a lot of rain.It aids in the growth and health of the crops. It is critical to support the agriculture sector in order to avert food scarcity. Sprinkler systems, water buckets, and cans can all be used for physical irrigation. One of the most significant disadvantages of a manual irrigation system is that the amount of water required by the crop is unknown. A lot of water is wasted as a result of this. The growth of the crops is severely hampered as a result of this. As a result, some adjustments to the existing technology are required. This study proposes a solution that reduces water waste while also eliminating the need for manpower. This device works by employing probes to detect the moisture content in the soil and then deciding whether or not to pump the water, saving time. As the world's population grows, so do our natural resources, which are rapidly depleting. As the world's population grows, so do our natural resources, which are rapidly depleting. As the world's population grows, so do our natural resources, which are rapidly depleting. As individuals, we have a responsibility to help and save our natural resources. In today's world, the biggest conundrum is water scarcity. The agriculture industry is quickly expanding, necessitating a large amount of water for irrigation. Due to water logging, a huge amount of water is wasted unnecessarily while irrigating the crops. The crop's growth has also slowed as a sufficient amount of water has not been provided to it. As a result an automatic plant irrigation system will help to save a lot of water while also ensuring the crop grows vigorously. This eliminates the need for field employees and saves a significant amount of time. It's crucial to quickly advance food production technology due to the continuously rising demand and declining availability of food essentials. The only source for this is agriculture. This is a key element in human cultures that contributes to a rising and dynamic demand for food production. In countries like India, agriculture is crucial to economic growth. Farmers employ irrigation since there is less water on earth due to a lack of water and a shortage of water on the land. Irrigation is the science of applying water artificially to soil or land so that plants can receive water based on the type of soil present.

II. LITERATURE SURVEY

This research paper by V. R. Balaji and M.Sudha [8], Photovoltaic cells were used that converted sunlight into electricity. This mechanism isn't reliant on ele0ctricity. The soil moisture sensor was employed in this experiment. and a PIC microcontroller depending on the sensed values used to turn the motor pump on and off.

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This research paper by Sonali D. Gainwar and Dinesh V. Rojatkar [7], for a high yield from the soil, the authors developed a fully automated system in which soil characteristics such as pH, , humidity, wetness, and temperature are measured. The motor pump in this system turns on and off depending on the moisture content in the soil.

This research paper by P. Archana and R. Priya [6],The authors devised a method that involves placing humidity and soil moisture sensors in the plant's root zone. The microcontroller is utilized to control the supply of the water to the field based on the measured values. Their approach, on the other hand, does not inform the farmer about the status of the land.

This research paper by the Chandan Kumar Sahu and Pramitee Behra, the authors describe a prototype for fully automated irrigation motor access, which incorporates a number of sensors positioned in various directions throughout the agricultural area. Each sensor is connected to a wireless networking device, and the data is received by an ARDUINO-UNO development board with a "ATMEGA-328" microcontroller. The RASPBERRY-Pi is used to deliver messages to the microcontroller process via internet correspondence. The goal of this work was to use a soil moisture sensor to automatically control the water motor and select the direction of water flow in a pipe. The information, which includes the motor's operation and the farm field's water direction, is finally delivered to the user by mobile messaging and e-mail account.

This research paper by Authors A. N. Arvindan and D. Keerthika [1], the Arduino-based automatic irrigation system was made easy to use and cost effective by using an Android smartphone as a remote control. A soil moisture sensor delivers a voltage signal proportional to the moisture content in the soil, which is compared to a specified threshold value in this system's design.The necessary data is given to the Arduino Uno processor, which is linked to an Android phone through the HC-05 module, based on the comparison result. The user can easily turn on the irrigation system and the drive motor using an Android smartphone. The technology has the capability of being employed in real-time precision agriculture applications. This research paper by Purnima, S.R.N Reddy, “Design of Remote Monitoring and Control System with Automatic Irrigation System using GSM-Bluetooth” ,proposed artificially supplying water to land where crops are cultivated. Traditionally hand pumps, canal water and rainfall were a major source of water supply for irrigation. This method has led to severe drawbacks like under irrigation, over-irrigation which in turn causes leaching and loss of nutrient content of soil. Changing environmental conditions and shortage of water have led to the need for a system which efficiently manages irrigation of fields. Automated irrigation system is a machine based system, which automates the irrigation of land by combining various software and hardware approaches together for field irrigation. This paper deals with a detailed survey of various GSM based automated farm irrigation systems. GSM serves as an important part since it is responsible for controlling the irrigation facility and sends them to receiver through coded signal. Our study is concentrated on comparison of various GSM approaches [4].

III. HARDWARE IMPLEMENTATION

Hardware implementation consists of an Arduino Uno board, which is used to control everything that happens in the system. The paper makes use of a tiny model that may be expanded by adding more sensors. The pump in question is a 12v DC motor pump that can quickly provide water to the plant.Arduino Uno is connected to the soil moisture sensor which sends the data collected by it to the Arduino Uno board and the data can be monitored with the serial monitor present.Relay switch is used to turn ON/OFF the water pump,it is connected to the soil moisture sensor and the battery and works on the data provided by the soil moisture sensor.

A. Block Diagram

Soil moisture probe is kept in the soil which is being tested for the moisture content and the data collected is sent to the Arduino Uno Board which is programmed to turn ON/OFF the relay based on the threshold values given by the programmer.Water Pump is automatically turned ON/OFF by the relay switch as required.

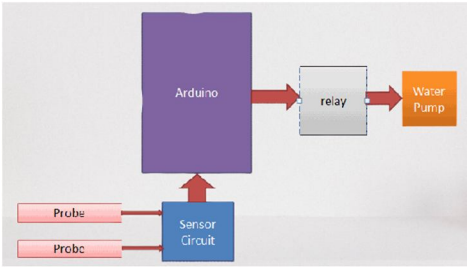


Fig 1:Automatic irrigation system based on soil moisture sensor using arduino uno

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IV. SOIL MOISTURE SENSOR CIRCUIT

It consists of two conducting metal probes that are used to detect soil moisture content. Sensor used to determine the volumetric content of water in the soil is the soil moisture sensor. Drying, sample weighting, and elimination of the straight gravimetric dimension of soil moisture are required. These sensors measure the volumetric water content indirectly using the electrical resistance, neutron interaction, dielectric constant, and other soil laws as well as replacement of the moisture content.

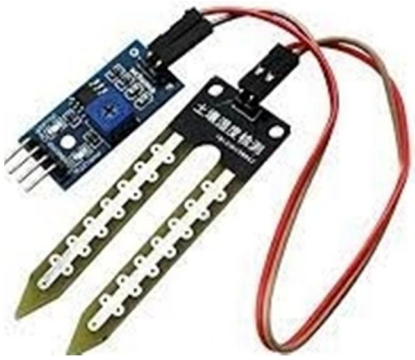


Fig 2:Soil moisture sensor

V. RELAY

Relays are electromechanical devices that move a pair of moveable contacts from an open to a closed position using an electromagnet. It is used to turn on and off the pump.



Fig 3:Relay

VI. ARDUINO UNO

The Arduino UNO is the brain of this whole project. It controls the motor pump according to the moisture in the soil which is given by the moisture sensor. Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



Fig 4:Arduino Uno Board

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VII. WATER PUMP

The pump is powered by a 12v dc motor. With the help of the relay, the pump is turned on and off automatically. The Arduino board reads the moisture content readings and compares them to the reference value, which activates the motor driver circuit. A water pump's operation relies mostly on the positive displacement principle and kinetic energy to move the water. While other pumps can be powered by different types of drivers like gasoline engines or diesel, these pumps employ AC power or DC electricity to energize the water pump's motor.



Fig 5:Water Pump

VIII. SOFTWARE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board.

It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board.

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

Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms.

Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.

IX. RESULT

The model of automatic plant irrigation system is tested on two different soils. Both soils moisture content is measured by the soil moisture sensor and it is compared to the threshold values which are set by the user in the code. Moisture level sensed by the probes in the first soil is lower than the threshold value so the pump automatically feeds water to the crop until it meets the limit. When it comes to the second soil, it is already wet , indicating that the moisture content is significant. The pump remains turned off in this situation. Mositure content is monitored in the serial monitor in Arduino software.



Fig 6:Circuit Connection

Moisture content of the soil is measured by the soil moisture sensor and it is monitored through the Serial Monitor present in the Arduino Software.As the moisture content of the soil reaches a certain threshold value , the pump is turned on/off based on the values.If the moisture content is less than the threshold value pump is turned on and if moisture content is more than the threshold value pump remains in off state.

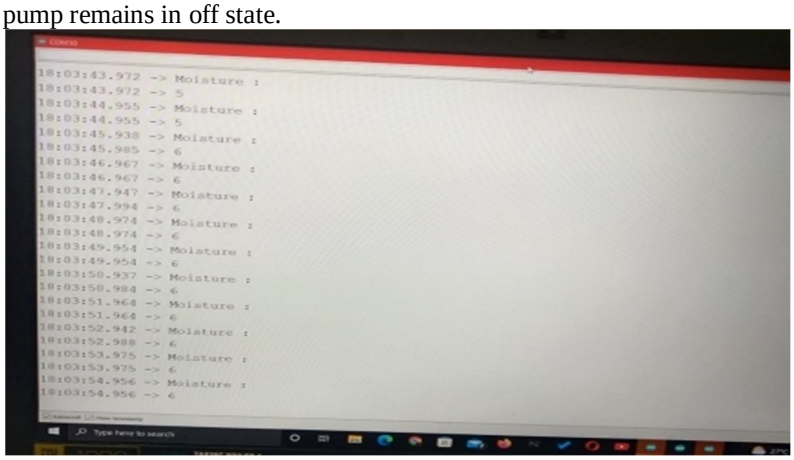


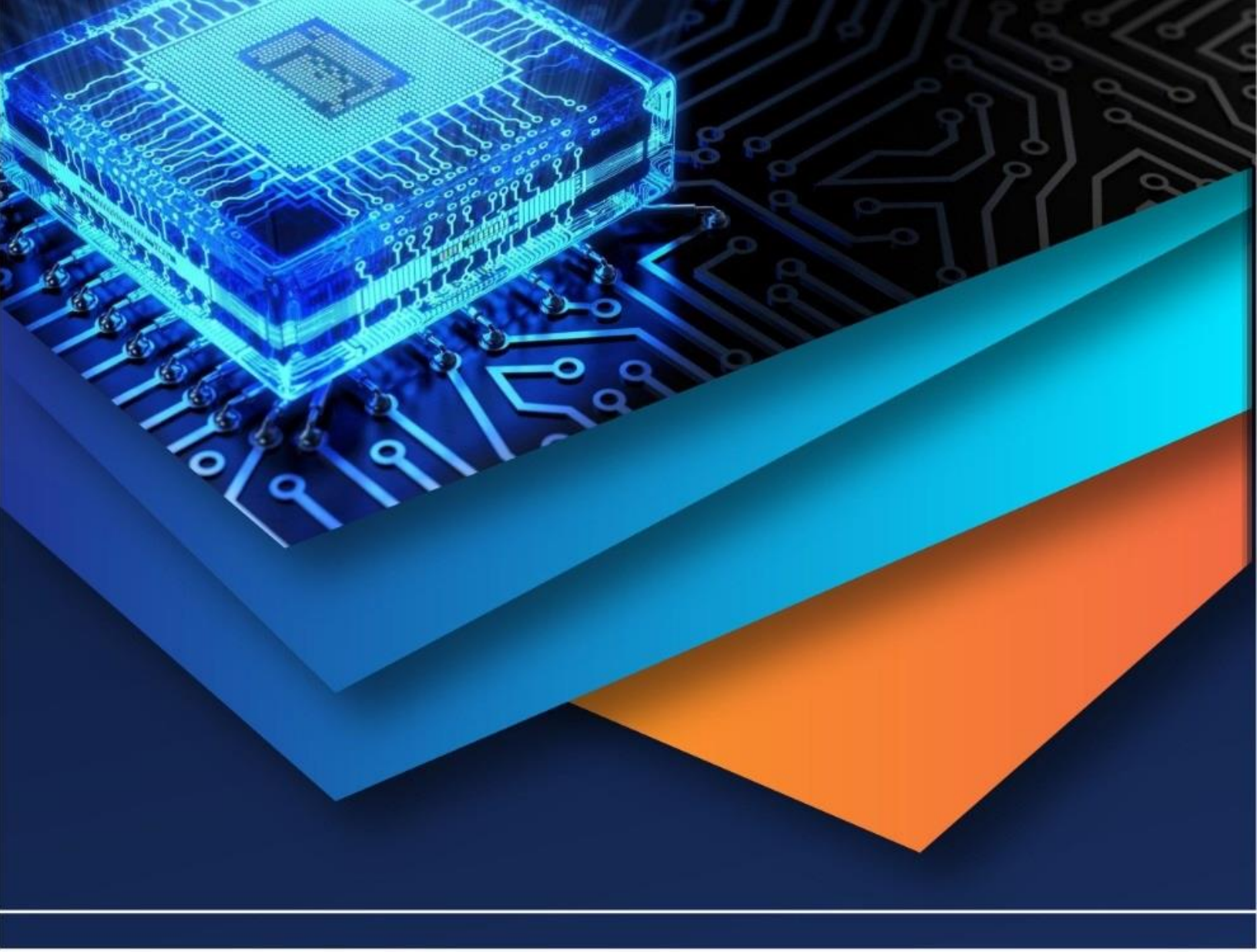
Fig 7:Serial Monitor Interface of Arduino Software

X. CONCLUSION

This proposed method creates an Arduino-based automatic plant irrigation system. The components we employ in the system are easily accessible and simple to use. As a result, this system is an effective irrigation system. It is significantly superior to the manual irrigation method, which necessitates a significant amount of manpower and time. This time can be better spent by the farmer on other important tasks. In addition, the major issue of water scarcity is addressed. During the irrigation procedure, no water is wasted. As a result, this technique can be extremely beneficial in locations where water is scarce. This project's main users will be farmers and gardeners who lack the time to water their plants and crops. Additionally, it includes farmers who misuse irrigation water. There is a need to irrigate efficiently because water supplies are becoming depleted and contaminated. Compared to conventional methods, water use can be reduced by as much as 70%.

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