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Soil Moisture Calculator Using IOT Sensors

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Abstract - *Water is an essential useful resource in agriculture and to manipulate these is a key assignment. The main intention of this paper is to-constructed a clever irrigation machine which is reasonably-priced worth-wile so that every operating class farmer can find the money for it. Right here, we're providing an automatic irrigation device to lesser water utilization in cultivation by using uniting internet of things (IoT), Cloud computing, solar Panel and Optimization tools. It's going to now not most effective offer comfort but additionally reduces strength, efficiency and time-saving. The aim of this paper is to command water motor robotically and pick the direction of go with the flow of water in pipe with the assist of soil moisture sensor. Using soil moisture sensor is to restrict the water content in specific areas. We accumulate facts like (soil moisture, soil dryness stage, type of the soil) for a specific vicinity. The statistics is saved in Things peak cloud provider to maintain tune of facts garage. The field information is transferred to the cloud the use of Wi-Fi modem and the usage of GSM mobile networks. It could also be send through cell message and g-mail account of the consumer.*

Key Words: **Smart Irrigation, Sensors, Solar Panel, Bluetooth Communication, IOT**

1.INTRODUCTION

In India Agriculture is obligatory for the food production so that the developing call for of large wide variety of human population will fulfill. Innovation is very vital inside the Agriculture gadget. So that it makes Agriculture gadget value powerful and time saving [1]. In our India Agriculture make contributions very essential function. Total 20% of GDP (Gross domestic Product) is depending on agriculture. Our Agriculture maintaining agriculture productiveness, guarantee of food safety and financial increase. In step with the survey extra than 60% of our country population is dependent on agriculture or work associated with this, like in nowadays online agriculture commercial enterprise is also taking place some humans also doing this. Nowadays farmers are using vintage methods for irrigation. In those methods we dropping plenty of water, time and man electricity.

To minimize all the ones things we need to do clever irrigation. In smart irrigation we can shop water wastage, time and man power involvement throughout irrigation. Generally, farmers visit their fields time to time for the checking of required water degree for the vegetation. On this method they devour their masses of time. In recent times in India unemployment is hastily increasing and our farmer does now not wants to depend handiest on farming in order that they need to do their very own side commercial enterprise or other works. In the computerized irrigation device they are able to operate irrigation procedure very easily.

In this paper we want to make our irrigation machine completely automated and it could be function from everywhere (home, field, workplace, commercial enterprise sites).

We also are the usage of sun strength for going for walks of our clever irrigation gadget that is environment ecofriendly. This smart irrigation device is water saving and time saving. It takes less human assets. This clever irrigation device irrigates flora in a proper way (not less water or now not more water). It approach that it fulfills handiest required moisture for the plants. Importance of Irrigation in Indian Agriculture: Irrigation is vital to a rustic like India because rainfall right here is seasonal in nature. Its miles restricted to four months of a year. It's also essential because a few plants require greater water than what it's far furnished by means of the rainfall, therefore we must rely upon irrigation.

METHODS OF IRRIGATION:

A. Surface Irrigation

Surface irrigation includes a huge class of irrigation techniques wherein water is distributed over the soil surface by means of gravity flow. The irrigation water is delivered into stage or graded furrows or basins, using siphons, gated pipe, or turnout systems, and is permitted to develop across the sector. Surface irrigation is quality applicable to flat land slopes, and medium to satisfactory textured soil kinds which promote the lateral spread of water down the furrow row or throughout the basin.

B. Sprinkle Irrigation

Sprinkler irrigation is a method of irrigation wherein water is sprayed, or sprinkled through the air in rain like drops. The spray and sprinkling devices can be permanently set in region (solid set), temporarily set after which moved after a

given quantity of water has been implemented (transportable set or intermittent mechanical move), or they can be set up on booms and pipelines that continuously journey across the land surface (wheel roll, linear move, center pivot).

C. Trickle Irrigation

Trickle irrigation systems are techniques of micro-irrigation wherein water is implemented thru emitters to the soil surface as drops or small streams. The release fee of the emitters is low so this irrigation method can be used on all soil sorts.

D. Smart Irrigation System

Nowadays smart irrigation machine is a completely smooth way of irrigation. This is both water as well as time saving. On this irrigation device we use exceptional forms of additives and sensors. We can make clever irrigation machine extra smart through the use of solar strength. Smart irrigation device is fully computerized and it is treated through itself.

COMPONENTS USED IN SMART IRRIGATION SYSTEM

A. ARDUINO UNO

The ARDUINO UNO is the quality board to get started out with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can begin playing with. The UNO is the most used and documented board of the entire ARDUINO family. ARDUINO UNO is a microcontroller board based totally at the ATmega328P (datasheet). It has 14 virtual input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a sixteen MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It includes the whole thing had to help the microcontroller; truly join it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You may tinker together with your Uno without worrying an excessive amount of about doing something incorrect, worst case scenario you may update the chip for a few greenbacks and begin over again. "Uno" approach one in Italian and became chosen to mark the release of ARDUINO software program (IDE) 1.0. The Uno board and model 1.zero of ARDUINO software program (IDE) have been the reference versions of ARDUINO, now evolved to more recent releases. The Uno board is the first in a chain of USB ARDUINO boards, and the reference version for the ARDUINO platform; for an extensive listing of present day, past or old boards see the ARDUINO index of forums.

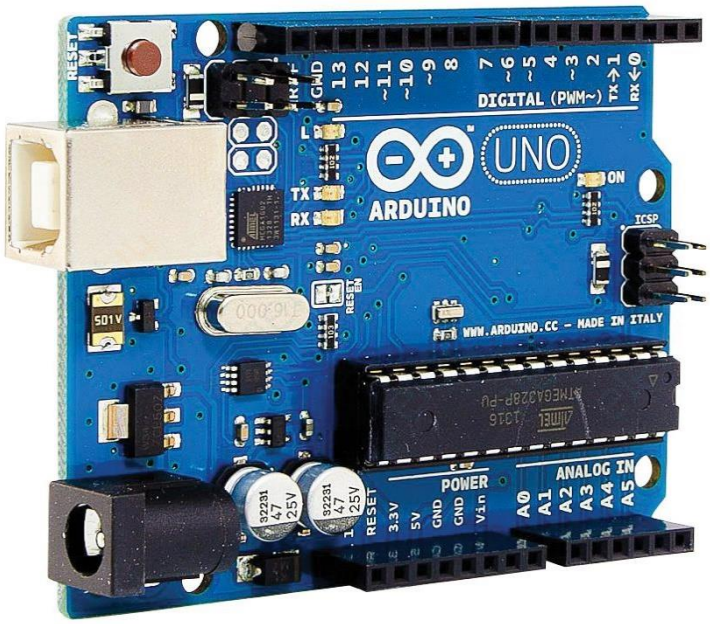


Fig. 2 ARDUINO

HOW IT WORKS

The ARDUINO reads the reputation of the soil the use of Soil Moisture Sensor. If the Soil is DRY it does the following Operations.

1) Assessments for the provision of water the use of water degree sensor.

2) If the water is Unavailable, the Pump is turned ON and is mechanically turned OFF while sufficient amount of water is supplied.

B. Soil Moisture Sensor

Soil moisture sensor tells the water degree of the soil. By getting the correct moisture of the soil will enhance the increase of the plant life and vegetation. Soil moisture sensor is hooked up to the ARDUINO UNO when the water level for the plants is reached it senses and offers the signal for the off of water. Its miles useful to prevent inside the water wastage.

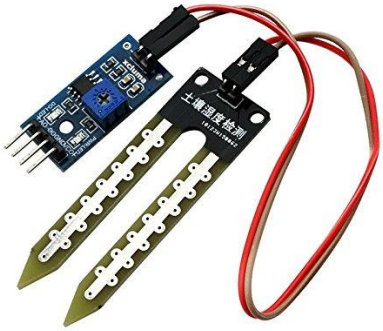


Fig. 3 Soil moisture sensor

C. Light Dependent Resistor

Maximum of the flowers increase within the presence of the unique mild degree. LDR is beneficial to degree the mild stage. Its miles a light sensitive tool. LDR perceive the presence and lack of the light depth.

Fig. 4 Light dependent resistor

D. Relay Module

ARDUINO UNO cannot control the high voltage and current. The relay module is an electrically operated transfer that lets in the excessive voltage and modern-day gadget ON/OFF. It controls without problems of excessive voltage and high present day.

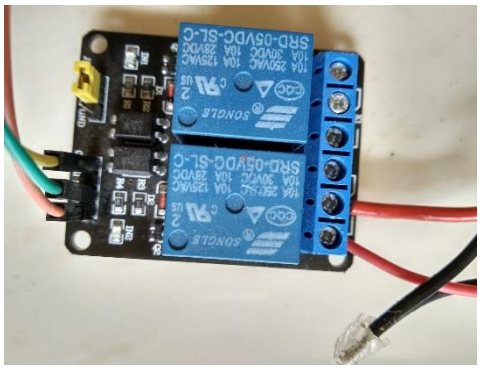


Fig. 5 Relay Module

E. Water Pump

Water Pump: As to pump water 12-volt submersible pump for this venture which has 18-watt motor that could elevate water up to one.7 meters. This pump must be operated only while it is submerged absolutely within the water for better outcomes, for that we want to preserve water within the bucket due to the fact if water pump might be operated without water than it's going to get broken.

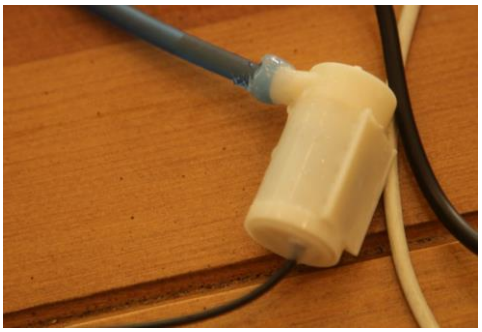


Fig. 6 Water Pump

F. Resistor

A resistor is a passive two-terminal electric aspect that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to lessen contemporary float, adjust signal levels, to divide voltages, bias energetic elements, and terminate transmission lines, among different makes use of.

Fig. 7 Resistor

G. Breadboard

A breadboard is a solder-less tool for brief prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected via putting their leads or terminals into the holes after which making connections through wires wherein appropriate.

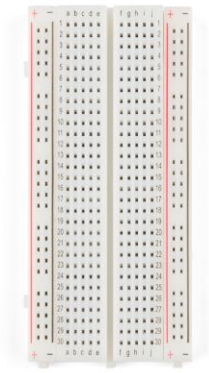


Fig. 8 Breadboard

H. Jumper Wires

A jump cable is an electrical cable, or organization of them in a cable, with a connector or pin at every end which is usually used to interconnect the components of a breadboard or other prototype or take a look at circuit, internally or with different device or components, without soldering.

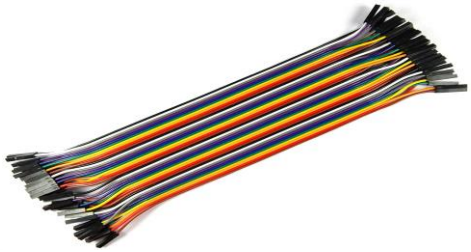


Fig. 9 Jumper Wires

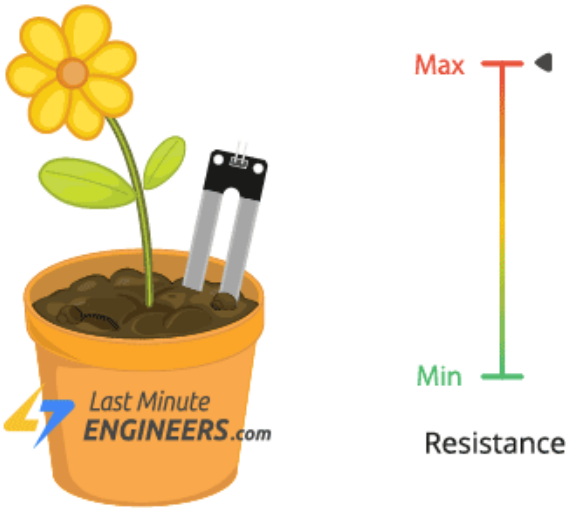
I. Solar Panel

The term solar panel is used colloquially for a photograph-voltaic (PV) module. A PV module is meeting of image-voltaic cells hooked up in a framework for installation. Photovoltaic cells use daylight as a source of energy and generate direct modern power. A collection of PV modules is called a PV Panel, and a device of Panels is an Array. Arrays of a photovoltaic system deliver solar strength to electrical gadget.

System Overview:

Soil moisture working

The working of the soil moisture sensor is quite uncomplicated. The fork-fashioned probe with two uncovered conductors, acts as a variable resistor (much like a potentiometer) whose resistance varies consistent with the water content material inside the soil.



His resistance is inversely proportional to the soil moisture:

The more water inside the soil way higher conductivity and will result in a lower resistance.

The much less water inside the soil method negative conductivity and could result in a better resistance.

The sensor produces an output voltage consistent with the resistance, which with the aid of measuring we are able to decide the moisture degree.

Calibration

To get accurate readings out of your soil moisture sensor, it's far encouraged that you first calibrate it for the precise form of soil that you plan to display. Distinct kinds of soil can have an effect on the sensor, so your sensor may be greater or much less sensitive relying at the sort of soil you use. Earlier than you start storing statistics or triggering occasions, you need to see what readings you're simply getting from your sensor.

Use the below sketch to word what values your sensor outputs while the soil is as dry as feasible -VS- while it's far absolutely saturated with moisture.

```ino
// Sensor pins
#define sensorPower 7
#define sensorPin A0

void setup() {
    pinMode(sensorPower, OUTPUT);

    // Initially keep the sensor OFF
    digitalWrite(sensorPower, LOW);

    Serial.begin(9600);
}

void loop() {
    //get the reading from the function below and print it
    Serial.print("Analog output: ");
    Serial.println(readSensor());

    delay(1000);
}

//  This function returns the analog soil moisture measurement
int readSensor() {
    digitalWrite(sensorPower, HIGH);    // Turn the sensor ON
    delay(10);                          // Allow power to settle
    int val = analogRead(sensorPin);    // Read the analog value form sensor
    digitalWrite(sensorPower, LOW);     // Turn the sensor OFF
    return val;                         // Return analog moisture value
}
```

While you run the cartoon, you'll see the close to the following readings within the serial reveal:

While the soil was dry (~850).

When the soil was absolutely wet (~400).

Status: Dry
Test Reading: ~850

Status: Completely wet
Test Reading: ~400

Final Build

Based totally on the calibration values, the program under defines the following degrees to decide the popularity of the soil:

< 500 is too wet

500-750 is the target range

> 750 is dry enough to be watered

```ino
/* Change these values based on your calibration values */
#define soilWet 500   // Define max value we consider soil 'wet'
#define soilDry 750   // Define min value we consider soil 'dry'

// Sensor pins
#define sensorPower 7
#define sensorPin A0

void setup() {
    pinMode(sensorPower, OUTPUT);

    // Initially keep the sensor OFF
    digitalWrite(sensorPower, LOW);

    Serial.begin(9600);
}

void loop() {
    //get the reading from the function below and print it
    int moisture = readSensor();
    Serial.print("Analog Output: ");
    Serial.println(moisture);

    // Determine status of our soil
    if (moisture < soilWet) {
        Serial.println("Status: Soil is too wet");
    } else if (moisture >= soilWet && moisture < soilDry) {
        Serial.println("Status: Soil moisture is perfect");
    } else {
        Serial.println("Status: Soil is too dry - time to water!");
    }

    delay(1000);    // Take a reading every second for testing
                    // Normally you should take reading perhaps once or twice a day
    Serial.println();
}

//  This function returns the analog soil moisture measurement
int readSensor() {
    digitalWrite(sensorPower, HIGH);    // Turn the sensor ON
    delay(10);                          // Allow power to settle
    int val = analogRead(sensorPin);    // Read the analog value form sensor
    digitalWrite(sensorPower, LOW);     // Turn the sensor OFF
    return val;                         // Return analog moisture value
}
```

Output

```
Analog Output: 868
Status: Soil is too dry - time to water!

Analog Output: 868
Status: Soil is too dry - time to water!

Analog Output: 568
Status: Soil moisture is perfect

Analog Output: 570
Status: Soil moisture is perfect

Analog Output: 415
Status: Soil is too wet

Analog Output: 418
Status: Soil is too wet
```

Types of Soil:

Alluvial Soils

Alluvial soils are vast within the northern plains and the river valleys. Those soil cowl approximately 40 percentage of the overall area of the country. The alluvial soils range in nature from sandy loam to clay. They are typically rich in potash however terrible in phosphorous. The sand content decreases from the west to east. The color of the alluvial soils varies from the mild gray to ash grey. Its shades rely on the depth of the deposition, the texture of the substances, and the time taken for accomplishing adulthood. Alluvial soils are intensively cultivated.

Black Soil

Black soil covers most of the Deccan Plateau which includes elements of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and a few components of Tamil Nadu. The black soils are generally clayey, deep and impermeable. They swell and come to be sticky whilst wet and decrease when dried. So, for the duration of the dry season, these soil develop wide cracks. Chemically, the black soils are rich in lime, iron, magnesia and alumina. Additionally they contain potash. But they lack in phosphorous, nitrogen and natural matter. The color of the soil levels from deep black to grey.

Red And Yellow Soil

Red soil develops on crystalline igneous rocks in areas of low rainfall inside the eastern and southern a part of the Deccan Plateau. . The soil develops a reddish shade because of a wide diffusion of iron in crystalline and metamorphic rocks. It looks yellow when it occurs in a hydrated shape. The best-grained pink and yellow soils are normally fertile, whereas coarse -grained soils observed in dry upland regions are bad in fertility. They are normally negative in nitrogen, phosphorous and humus.

Arid Soils

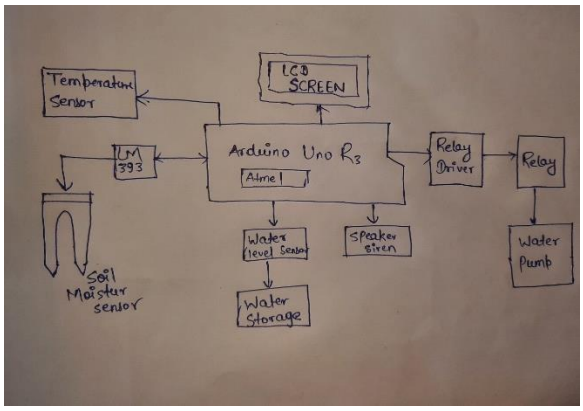
Arid soils variety from crimson to brown in shade. They are usually sandy in structure and saline in nature. Due to the dry weather, excessive temperature and improved evaporation, they lack moisture and humus. Nitrogen is insufficient and the phosphate content is normal. Those soils are negative and comprise little humus and natural rely.

Saline Soils

Saline soils contain a bigger percentage of sodium, potassium and magnesium, and accordingly, they're infertile, and do not guide any vegetative growth. They have more salts, in large part because of dry climate and terrible drainage. Their shape ranges from sandy to loamy. They lack in nitrogen and calcium. Immoderate irrigation with dry climatic conditions promotes capillary movement, which results in the deposition of salt on the top layer of the soil.

Data flow diagram basis on the soil

Block diagram



CONCLUSION

The automatic irrigation machine became implemented the use of the ARDUNIO board via interfacing sensors to the microcontroller unit. The microcontroller unit continuously monitors the sensors statistics and if the sensors data exceeds a particular threshold price then the microcontroller unit sends an alert SMS to the cell cellphone of a proprietor who is in far flung vicinity. The unique values for the DHT11 sensor is measured under extraordinary climatic conditions and set the brink price primarily based on the ones sensible values. This machine can be extended via the usage of WSN nodes for transmit statistics and also the use of information base structures to save the statistics at the field. The general system can be powered up the use of sun cells to hold the system in low cost.

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