

Soil Moisture Calculator using IoT Sensor

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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 volume of water 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.

Keywords: *Smart Irrigation, Sensors, Solar Panel, Bluetooth Communications*

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

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(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 refers to a broad range of irrigation methods that use gravity to deliver water across the soil surface. Using syphons, gated pipe, or turnout systems, irrigation water is fed into staged or graded furrows or basins and allowed to develop over the sector. Surface water system is quality pertinent to level land slants, and medium to agreeable finished soil sorts which advance the horizontal spread of water down the wrinkle line or all through the bowl.

B. Sprinkle Irrigation

Sprinkler water system is a technique of water system wherein water is showered, or sprinkled through the air in downpour like drops. The shower and sprinkling gadgets can be forever set in area (strong set), briefly set after which moved after a given amount of water has been executed (movable set or discontinuous mechanical move), or they can be set up on blasts and pipelines that consistently venture across the land surface (wheel roll, direct move, focus rotate).

C. Trickle Irrigation

Trickle irrigation frameworks are techniques of micro-irrigation wherein water is implemented thru producers to the dirt surface as drops or little streams. The delivery charge of the producers is low so this water system technique can be utilized on all dirt 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 begin out with hardware and coding. On the off chance that this is your first experience dabbling with the stage, the UNO is the most strong board you can start playing with. The UNO is the most utilized and recorded leading group of the whole ARDUINO family. ARDUINO UNO is a microcontroller board based absolutely at the ATmega328P (datasheet). It has 14 virtual info/yield pins (of which 6 can be utilized as PWM yields), 6 simple information sources, a sixteen MHz artistic resonator (CSTCE16M0V53-R0), a USB association, a force jack, an ICSP header and a reset button. It includes the whole thing had to help the microcontroller; truly join it to a PC with a USB link or force it with an AC-to-DC connector or battery to begin. You may fiddle along with your Uno without stressing an exorbitant measure of over accomplishing something erroneous, most dire outcome imaginable you may refresh the chip for a couple of greenbacks and start over once more. "Uno" approach one in Italian and got picked to check the arrival of ARDUINO programming program (IDE) 1.0. The Uno board and model 1.0 of ARDUINO programming program (IDE) have been the reference forms of ARDUINO, presently developed to later deliveries. The Uno board is the first in a chain of USB ARDUINO sheets, and the reference adaptation for the ARDUINO stage; for a broad posting of present day, past or old sheets see the ARDUINO file of gatherings.

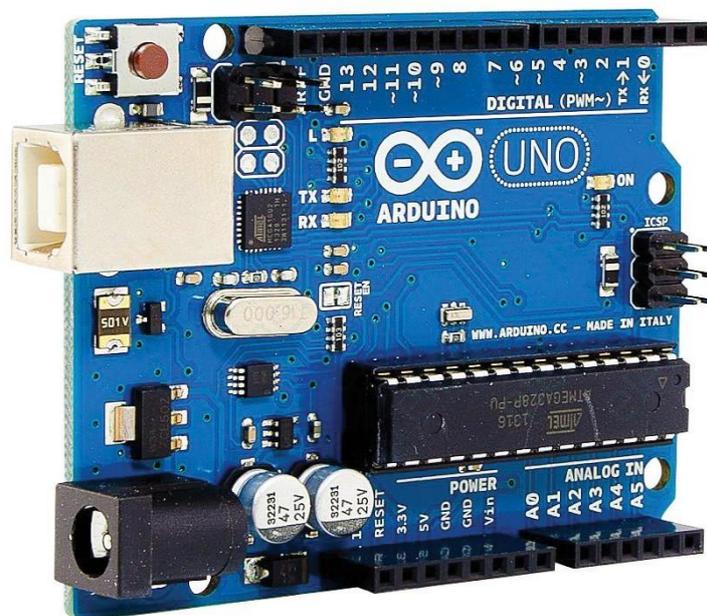


Fig. 2 ARDUINO

HOW IT WORKS

The ARDUINO peruses the standing of the dirt the utilization of Soil Moisture Sensor. On the off chance that the Soil is DRY it does the accompanying Operations.

- 1) Assessments for the provision of water the use of water degree sensor.
- 2) In the event that the water is Unavailable, the Pump is turned ON and is precisely killed while adequate measure of water is provided.

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.

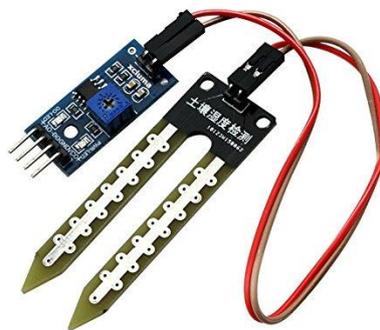


Fig. 3 Soil moisture sensor

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.

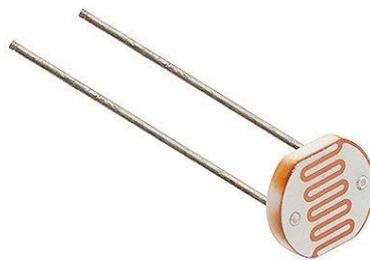


Fig. 4 Light dependent resistor

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.

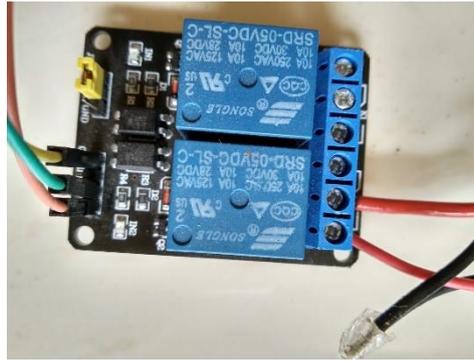


Fig. 5 Relay Module

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.

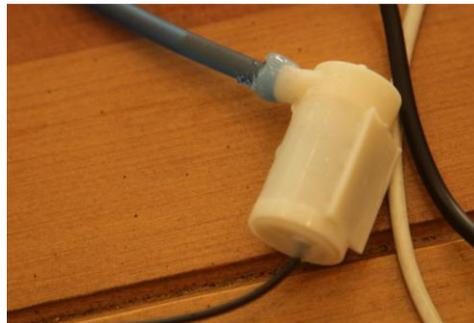


Fig. 6 Water Pump

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 bind less instrument for brief model with hardware and test circuit plans. Most electronic parts in electronic circuits can be interconnected by means of placing their leads or terminals into the openings after which making associations through wires wherein fitting.

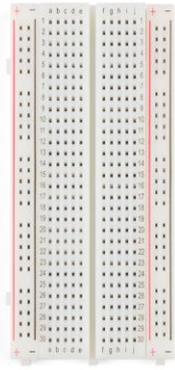


Fig. 8 Breadboard

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.

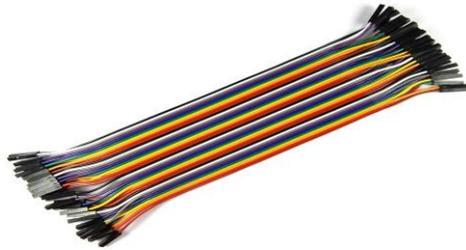


Fig. 9 Jumper Wires

I. Solar Panel

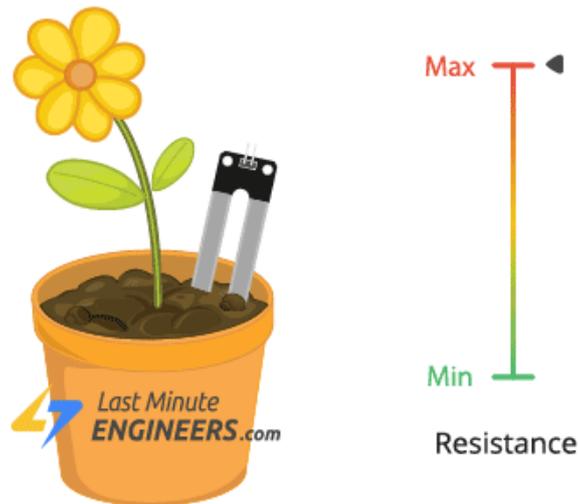
The term sun powered board is utilized casually for a photo voltaic (PV) module. A PV module is meeting of picture voltaic cells snared in a system for establishment. Photovoltaic cells use sunshine as a wellspring of energy and produce direct present day power. An assortment of PV modules is known as a PV Panel, and a gadget of Panels is an Array. Varieties of a photovoltaic framework convey sun oriented solidarity to electrical contraption.



System Overview:

Soil moisture working

The working of the dirt dampness sensor is very straightforward. The fork-formed test with two revealed conductors, goes about as a variable resistor (similar as a potentiometer) whose opposition shifts reliable with the water content material inside the dirt.



His obstruction is contrarily relative to the dirt dampness:

The more water inside the dirt way higher conductivity and will bring about a lower opposition.

The considerably less water inside the dirt strategy negative conductivity and could bring about a superior obstruction.

The sensor delivers a yield voltage predictable with the obstruction, which with the guide of estimating we can choose the dampness degree.

Calibration

To get exact readings out of your dirt dampness sensor, it's far energized that you initially align it for the exact type of soil that you intend to show. Unmistakable sorts of soil can affect the sensor, so your sensor might be more noteworthy or significantly less delicate depending at the kind of soil you use. Sooner than you begin putting away insights or setting off events, you need to perceive what readings you're just getting from your sensor.

Utilize the underneath sketch to word what esteems your sensor yields while the dirt is pretty much as dry as plausible - VS-while it's far totally soaked with dampness.

```
1 // Sensor pins
2 #define sensorPower 7
3 #define sensorPin A0
4
5 void setup() {
6   pinMode(sensorPower, OUTPUT);
7
8   // Initially keep the sensor OFF
9   digitalWrite(sensorPower, LOW);
10
11   Serial.begin(9600);
12 }
13
14 void loop() {
15   //get the reading from the function below and print it
16   Serial.print("Analog output: ");
17   Serial.println(readSensor());
18   delay(1000);
19 }
20
21
22 // This function returns the analog soil moisture measurement
23 int readSensor() {
24   digitalWrite(sensorPower, HIGH); // Turn the sensor ON
25   delay(10); // Allow power to settle
26   int val = analogRead(sensorPin); // Read the analog value form sensor
27   digitalWrite(sensorPower, LOW); // Turn the sensor OFF
28   return val; // Return analog moisture value
29 }
```

While you run the animation, you'll see the near the accompanying readings inside the sequential uncover:

While the dirt was arid (~850).

When the dirt was completely damp (~400).



Status: Dry
Test Reading: ~850



Status: Completely wet
Test Reading: ~400

Final Build

In light of on the adjustment esteems, the program under characterizes the accompanying degrees to choose the prevalence of the dirt:

< 500 is excessively damp

500-750 is the prey radius

> 750 is arid sufficient to be sprinkled

```

1  /* Change these values based on your calibration values */
2  #define soilWet 500 // Define max value we consider soil 'wet'
3  #define soilDry 750 // Define min value we consider soil 'dry'
4
5  // Sensor pins
6  #define sensorPower 7
7  #define sensorPin A0
8
9  void setup() {
10     pinMode(sensorPower, OUTPUT);
11
12     // Initially keep the sensor OFF
13     digitalWrite(sensorPower, LOW);
14
15     Serial.begin(9600);
16 }
17
18 void loop() {
19     //get the reading from the function below and print it
20     int moisture = readSensor();
21     Serial.print("Analog Output: ");
22     Serial.println(moisture);
23
24     // Determine status of our soil
25     if (moisture < soilWet) {
26         Serial.println("Status: Soil is too wet");
27     } else if (moisture >= soilWet && moisture < soilDry) {
28         Serial.println("Status: Soil moisture is perfect");
29     } else {
30         Serial.println("Status: Soil is too dry - time to water!");
31     }
32
33     delay(1000); // Take a reading every second for testing

```

```
33 delay(1000); // Take a reading every second for testing
34 // Normally you should take reading perhaps once or twice a day
35 Serial.println();
36 }
37
38 // This function returns the analog soil moisture measurement
39 int readSensor() {
40   digitalWrite(sensorPower, HIGH); // Turn the sensor ON
41   delay(10); // Allow power to settle
42   int val = analogRead(sensorPin); // Read the analog value from sensor
43   digitalWrite(sensorPower, LOW); // Turn the sensor OFF
44   return val; // Return analog moisture value
45 }
```

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 huge inside the northern fields and the waterway valleys. Those dirt cover roughly 40 level of the general space of the country. The alluvial soils range in nature from sandy topsoil to mud. They are commonly wealthy in potash anyway horrible in phosphorous. The sand content declines from the west to east. The shade of the alluvial soils shifts from the gentle dim to debris dark. Its shades depend on the profundity of the affidavit, the surface of the substances, and the time taken for achieving adulthood. Alluvial soils are seriously developed.

Black Soil

Dark soil covers a large portion of the Deccan Plateau which incorporates components of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and a couple of segments of Tamil Nadu. The dark soils are by and large clayey, profound and impermeable. They swell and come to be tacky while wet and reduction when dried. In this way, for the span of the dry season, these dirt foster wide breaks. Artificially, the dark soils are wealthy in lime, iron, magnesia and alumina. Furthermore they contain potash. However, they need phosphorous, nitrogen and common matter. The shade of the dirt levels from profound dark to dim.

Red And Yellow Soil

Red soil creates on translucent molten rocks in spaces of low precipitation inside the eastern and southern a piece of the Deccan Plateau. . The dirt fosters a ruddy shade on account of a wide dispersion of iron in translucent and transformative rocks. It looks yellow when it happens in a hydrated shape. The best-grained pink and yellow soils are typically prolific, though coarse - grained soils saw in dry upland locales are awful in ripeness. They are regularly negative in nitrogen, phosphorous and humus.

Arid Soils

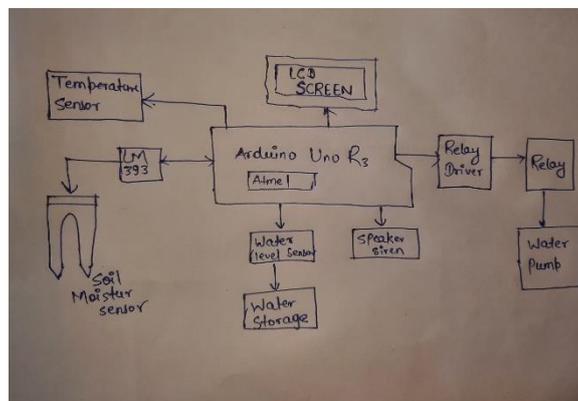
Dry soils assortment from ruby to brown in conceal. They are generally sandy in construction and saline in nature. Because of the dry climate, unnecessary temperature and improved dissipation, they need dampness and humus. Nitrogen is deficient and the phosphate content is typical. Those dirts are negative and contain little humus and characteristic depend.

Saline Soils

Saline soils contain a greater level of sodium, potassium and magnesium, and in like manner, they're barren, and don't manage any vegetative development. They have more salts, in huge part in light of dry environment and awful waste. Their shape goes from sandy to loamy. They need nitrogen and calcium. Extreme water system with dry climatic conditions advances narrow development, which brings about the affidavit of salt on the top layer of the dirt.

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.

References

1. <https://nrcca.cals.cornell.edu/soil/CA3/CA0324.php>
2. <https://create.arduino.cc/projecthub/narangraahulrahul8/implementation-of-ml-in-iot-smart-irrigation-system-941913>
3. <https://store.arduino.cc/usa/arduino-uno-rev3>
4. <https://www.instructables.com/Automatic-Irrigation-System-for-Indoor-Gardening-U/#:~:text=The%20Arduino%20reads%20the%20status,amount%20of%20water%20is%20s,applied>
5. https://www.google.com/search?q=relay+module+used+in+smart+irrigation+system&sxsrf=ALeKk01ecqRkSt8yuMa5S-_aceNG-DjXQ%3A1617952900523&ei=hABwYPTAH7Sa4-EPg5m1-AU&oq=relay+module+used+in+smart+irrigation+system&gs_lcp=Cgdnd3Mtd2l6EAMyBQghEKABOgcIABBHELADogcIABCwAxBDogQIABBDOgcIABDJAxBDogIIADoHCAAQhwIQFDoGCAAQFhAeOggIIRAWEB0QHjoHCCEQChCgAVCZbFjW3AFguN8BaAJwAngCgAGdDIgBm1eSARAwLjkuMTQuMy4zLjQuOC0xmAEAoAEBqgEHZ3dzLXdpesgBCsABAQ&sclient=gws-wiz&ved=0ahUKEwj0kpif0PDvAhU0zTgGHYNMDV8Q4dUDCA0&uact=5
6. <https://www.google.com/search?q=Resistor&oq=Resistor+&aqs=chrome..69i57j0i67j0i67i433j0i20i263j0i67i433j0i131i433j0i433j0l2j0i433.3675j0j7&sourceid=chrome&ie=UTF-8>
7. https://en.wikipedia.org/wiki/Jump_wire
8. <https://lastminuteengineers.com/soil-moisture-sensor-arduino-tutorial>