AUTOMATED IRRIGATION SYSTEM USING ARDUINO

TERM PROJECT REPORT
BATCH : B
GROUP : 3

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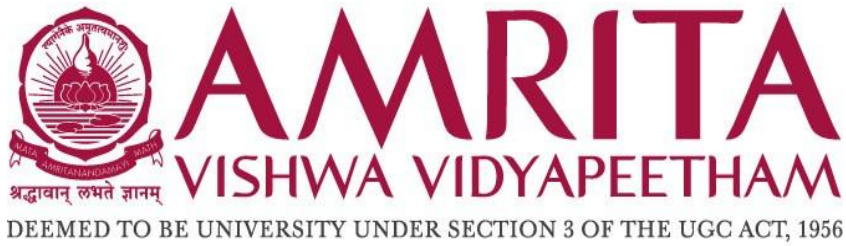
21AIE114 - PRINCIPLES OF MEASUREMENTS AND SENSORS



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We'd want to express our gratitude to our friends and family members who have helped us with the project.

Abstract

This project on "automated Irrigation System using arduino " is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF by detecting the dampness/moisture content of the soil. In the domain of farming, utilization of appropriate means of irrigation is significant. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation.

The proposed model consists of three stages: Firstly, sensing the land's moisture levels. Second stage is the determination of its status: dry or wet. The last and third stage is Motor control.

This project proposes the development of automated irrigation system using arduino capable of detecting moisture content in soil using the soil moisture sensor. Specifically, automated irrigation system using arduino utilizes the Soil Moisture Sensor to detect water content level in soil and give appropriate responses to the system based on detected condition. Using this response, automated irrigation system determines whether the soil needs to be irrigated or not . In the current version, smart irrigation system using arduino is capable of detecting and irrigating a small area that can be considered to be under a single pump's coverage. Smart irrigation system using arduino uses live input data to determine the conditions. Smart irrigation system using arduino represents our most basic step towards automated farming to improve turnover and reduce the impact of draught or loss due to irrigation issues.

Introduction

By using the concept of automated irrigation system a farmer can save water up to 50%. This concept depends on two irrigation methods those are: conventional irrigation methods like overhead sprinklers, flood type feeding systems i.e. wet the lower leaves and stem of the plants. The area between the crop rows become dry as the large amount of water is consumed by the flood type methods, in which case the farmer depends only on the incidental rainfalls. The crops are been infected by the leaf mold fungi as the soil surface often stays wet and is saturated after irrigation is completed.

Overcoming these drawbacks new techniques are been adopted in the irrigation techniques, through which small amounts of water applies to the parts of root zone of a plant. The plant soil moisture stress is prevented by providing required amount of water resources frequently or often daily by which the moisture condition of the soil will retain well. Even more precise amounts of water can be supplied for plants. As far as the foliage is dry the plant damage due to disease and insects will be reduced, which further reduces the operating cost.

The dry rows between plants will leads to continuous federations during the irrigation process. The soil characteristics will define the form of the dripping nature in the root zone of a plant which receives moisture. As the method of dripping will reduce huge water losses it became a popular method by reducing the labor cost and increasing the yields. When the components are activated, all the components will read and gives the output signal to the controller,

This project on "automated Irrigation System using arduino " is to create an automated irrigation mechanism which turns the pumping motor ON and OFF by detecting the dampness/moisture content of the earth.

It is capable of detecting loss of moisture in soil using the soil moisture sensor. Specifically, smart irrigation system using arduino utilizes the Soil Moisture Sensor to detect water content level in soil and give appropriate responses to the system based on detected condition.

Objective

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer"s side. With the recent advancement of technology it has become necessary to increase the annual crop production output entirely agro-centric economy.

The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country.

To save farmers effort, water and time. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives.

If the farmer is far from the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.

Hardware requirements :-

1. Arduino UNO
2. Spark fun soil moisture sensor
3. Water pump
4. Jumper wires
5. Arduino to USB cable

Software requirements :-

1. Arduino IDE
2. Tinker cad

Implementation

In this project we made a Arduino circuit which waters the plants when water is necessary or there is no enough moisture content in the soil . We'll be using - **Arduino UNO, Spark fun soil moisture sensor, Water pump, Jumper wires, Arduino to USB cable.**

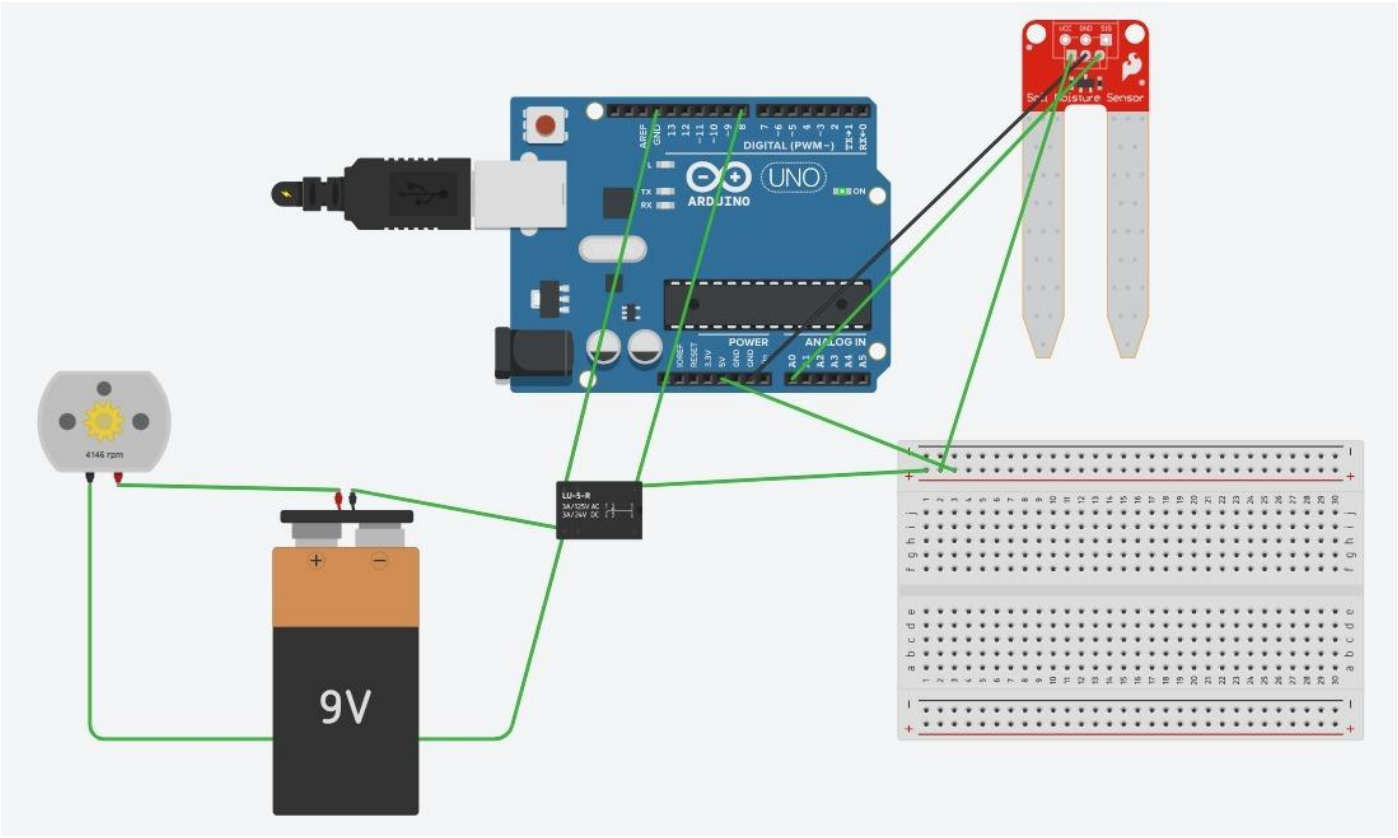
Soil moisture sensor have 4 pins when connected to its specific comparator, these four pins are analog input, digital input, ground and input voltage. We will now connect input voltage pin to the breadboard. Then we must connect analog pin to the A0 pin in the Arduino and digital pin to digital13 . Ground will be connected to ground pin in Arduino (I.e, on power side).

Relay sensor has 3 pins, Ground, Input voltage, digital . We will be connecting ground to ground pin in Arduino (I.e, on power side), Input voltage pin to the breadboard, Digital is used for output. We will connect it to the digital 08 pin. On the other side of relay we will connect 1 terminal of motor to the C- pin in relay sensor. One terminal of battery will be connected to NC pin in relay sensor.

We connected 2 pins in breadboard, one from relay and soil moisture sensor. We will be taking another jumper wire (M-M), connecting it from breadboard to 5V pin in Arduino. These three pins lie on same line.

When relay sensor is on, then power supply will be enabled between NC and C pin.

CIRCUIT SETUP:



Theory

Arduino :

It is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

Soil moisture sensor:

The soil moisture sensor consists of two probes that are used to measure the volumetric content of water. The two probes allow the current to pass through the soil, which gives the resistance value to measure the moisture value.

Relay:

A relay basically allows a relatively low voltage to easily control higher power circuits. A relay accomplishes this by using the 5V outputted from an Arduino pin to energize the electromagnet which in turn closes an internal, physical switch to turn on or off a higher power circuit.

Breadboard:

A breadboard is a solderless construction base used for developing an electronic circuit and wiring for projects with microcontroller boards like Arduino. As common as it seems, it may be daunting when first getting started with using one.

Soil moisture sensor Comparator:

This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance).

Water motor:

This is used to pump out the water connected along with relay.

Jumper Wires:

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins. Use them to wire up all your circuits

Water Depth Level Sensor:

This Sensor has 10 traces, 5 are Sense traces and 5 are Power traces. This allows the sensor to detect the depth of water level by passing the current through Power traces

Soil moisture sensor can,

- Sense the moisture content in the soil,
- Send this data to the Arduino that we are using

The soil moisture sensor consists of two leads that are used to measure volume of water content in soil. These leads allow the current to pass through the soil and in return calculates the resistance value to measure the moisture level. If there is more water in soil then soil will conduct more electricity, means less resistance value along with elevated level of moisture. In the same manner if there is less water in soil then soil will conduct less electricity, means high resistance value along with low level of moisture.

Soil moisture sensors can send data in both analog as well as in digital, but we are using the analog data here to get the accuracy in the project.

We insert the soil moisture sensor in the soil and connect it to the Arduino and the sensor sends the data to the Arduino about the moisture inside the soil. It makes the **smart irrigation controller**. The Arduino will get the action on the data.

According to the condition given in the program, if the soil moisture sensor detects no moisture or truly little moisture then the pump will get started and water the plants.
An extended version of this project which we have attempted is the pumping motor could water the plants automatically using the moisture content available in the soil. With the help of relay, when moisture is there relay is off, which wont switch on the motor and when there is no moisture, relay is on, which automatically switches on the water motor and there is a tube attached along with the motor, which pumps out the water.

Water Depth Level Sensor can

Detect the amount of water present and send the information to Arduino

This sensor has 10 traces in its body, 5 are power traces and 5 are sense traces. These are arranged one by one in alignment on the sensor.
It will calculate the amount of water present by conducting electricity through power traces. These 5 power traces act like a resistor. If the water content is more, it will conduct good electricity, which means low resistance. If the water content is less, it will conduct low electricity, which means high resistance.

CODE:

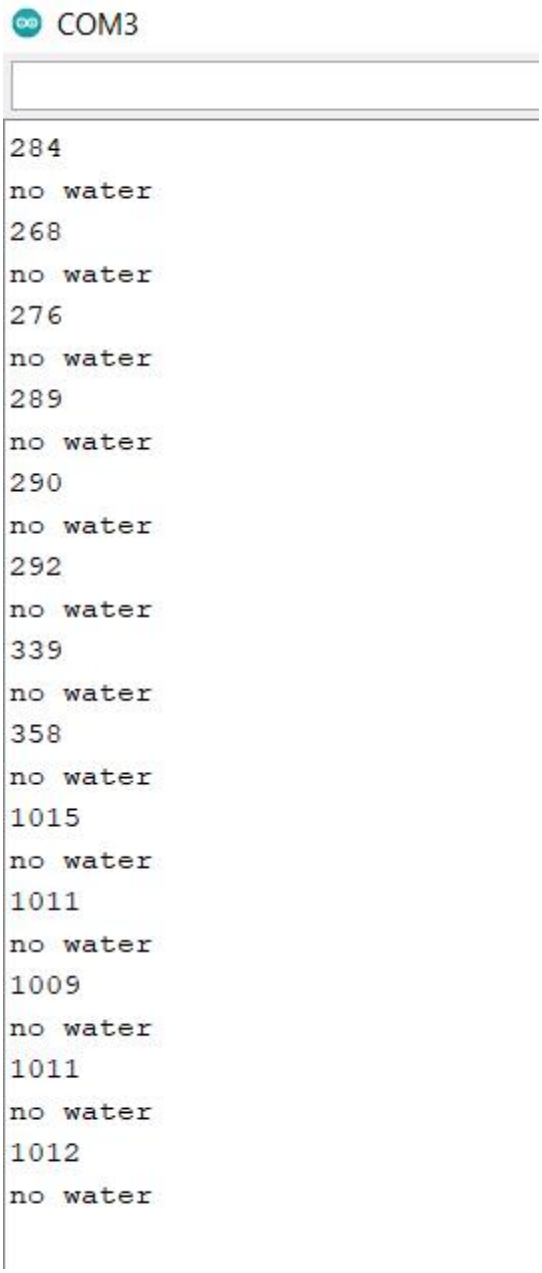
```
int m=0; // Taking a variable for soil moisture sensor
int red=2;// taking digital pin 2 for output
int blue=3;// taking digital pin 3 for output
const int buzzer = 9; //buzzer to arduino pin 9
void setup() {
  // put your setcode here, to run once:
pinMode(A0, INPUT_PULLUP); //Giving input through Analog pin
pinMode(8,OUTPUT);// And output to the relay
pinMode (red,OUTPUT);
pinMode (blue,OUTPUT);
pinMode(buzzer, OUTPUT);
Serial.begin(9600);
}

void loop() {
  // put your main code here, to run repeatedly:s
int value = analogRead(A1);// read the signal of water depth sensor
int m= analogRead(A0); //Read the signal
Serial.println(m);
delay(200);
  if (m>=800)
{
  digitalWrite(8, HIGH);//MOTOR ON

  }


else if (m<800)
{
  digitalWrite(8, LOW);//MOTOR OFF
  }
 if (value > 500) {
    Serial.println("water there");//water in container is ok
    digitalWrite (red,HIGH);//red light will glow
    digitalWrite(blue,LOW);//blue light will not glow
 }
else{
    Serial.println("no water");//water in container is about to finish
    digitalWrite (blue,HIGH);//blue light will glow
    digitalWrite (red,LOW);//red light will not glow
    tone(buzzer, 1000); // Send 1KHz sound signal...
  delay(1000);        // ...for 1 sec
  noTone(buzzer);
  delay(100);
  }
  }
```

OUTPUT:


COM3
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Pros

1. Relatively simple to design

2. Its the safest system and no man power is required

3. The system helps to farmer when irrigation is taking place as only the area between the plants are wet

4. Reduce soil erosion , nutrient leaching

5. The system needs smaller water sources , as it consumes less than half of the water

6. Fertilizers can also be provided by using this system

7. PH content of the soil is maintained through the suggestions which help for healthy plant growth

Cons

1. The system doesn't have weather forecasting system for the water level prediction of the soil

2. It doesn't calculate nutrient content of the soil

Probable further extensions

1. The application certainly is much more advantageous than the manual system.

2. There will be no bias in the regions being covered and the delay is kept as minimal as it can be.

3. The operator does not require any previous training because of its user friendliness. The operator is free from any technical issues.

4. Extremely simple design makes the circuit easy to implement and maintain. Alterations in the system can be done easily if the process of the working changes in future.

5. In future according to the user's requirement it can be updated to meet the user requirements.

6. Smart Wifi Irrigation Controllers are next generation controllers that adjust your irrigation system automatically using real-time weather information. Moreover, you can control it from anywhere, anytime.

Conclusion

Irrigation becomes easy, accurate and practical with the idea above shared and can be implemented in agricultural fields in future to promote agriculture to next level. The output from moisture sensor and level system plays major role in producing the output.

Thus the “AUTOMATED IRRIGTAION SYSTEM USING THE ARDUNIO” has been designed and tested successfully. It has been developed by integrating all the features of all the hardware components used. Presence of every module has been reasoned above and placed carefully in order to contribute to the best working of the unit. The system has been tested to function automatically, and to the best of its ability. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the operational amplifier which triggers the DC Motor pump to turn ON and supply the water to respective field area. When the desired moisture level is reached, the system halts on its own and the DC Motor pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully

REFERENCES

[1] Klute, A. (ed.), 1986: Methods of Soil Analysis, Part 1: Physical a nd MineralogicalMethods. American Society of Agronomy, Madison, Wisconsin, United States, 1188 pp.

[2] Knight, J.H., 1992: Sensitivity of time domain reflectometry measurements to lateral variations in soil water content. Water Resources Research, 28, pp. 2345–2352

.

[3] Magagi, R.D., Kerr, Y.H., 1997. Retrieval of soil moisture and vegetation characteristics by use of ERS-1 wind scatterometer over arid and semi-arid areas. Journalof Hydrology 188-189, 361–384.

[4] Marthaler, H.P., W. Vogelsanger, F. Richard and J.P. Wierenga,1983: A pressure transducer for field tensiometers. SoilScience Society of America Journal, 47, pp. 624– 627.

[5] How Drought and Extreme Heat Are Killing the World's Crops - Justin Worlan

[6] Bircher, S., Skou, N., Jensen, K.H., Walker, J.P., & Rasmussen, L.(2011). A soil moisture and temperature network forSMOS validation in Western Denmark. Hydrol. Earth Syst. Sci. Discuss.,8, 9961-10006.