

# Integrated MSc(IT)

## Second Year



*Faculty of Computer Applications  
& Information Technology*

### *Irrigation, Soil Moisture and Temperature Scrutinizing System.*

#### *Guide*

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## **DESCRIPTION**

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Irrigation, Soil Moisture and Temperature Scrutinizing System is a system that checks the soil moisture and temperature and irrigate it accordingly. The System consists of Soil Moisture and Temperature Sensors which measure the water level and the temperature of the soil and sends signals to the water pump which on certain level starts the irrigation and stops after few seconds.

With the use of this system the farmers don't have to strain about irrigating the crops and since there is no need of them for irrigation, they can invest that time in other activities. The crop health will also be maintained as the soil temperature and moisture are checked every now and then. The stabilized moisture and temperature ensure the better growth of the crops hence better product and selling price.

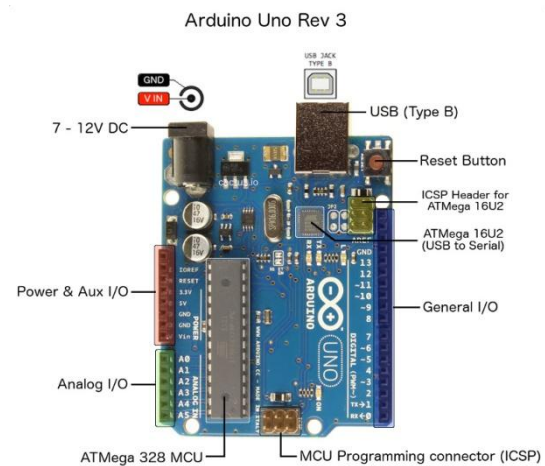
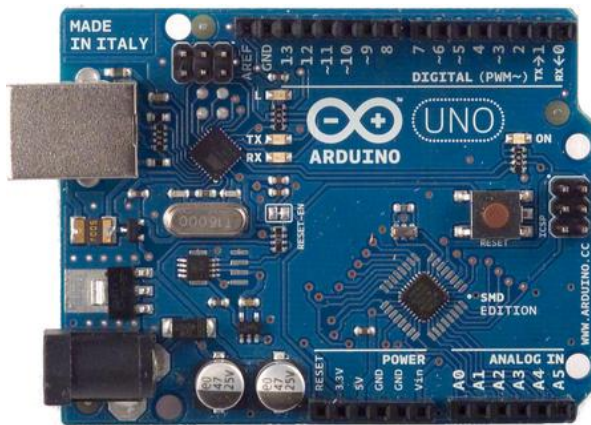
## ***HARDWARE COMPONENTS***

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- I. Arduino Uno Board**
- II. Soil Moisture Sensor [FC-28]**
- III. Soil Temperature Sensor [DS18B20]**
- IV. Water Pump Motor [12V]**
- V. 4.7 K Resistor**
- VI. Single 10A Relay Module**
- VII. Jumper Wires**
- VIII. BreadBoard**
- IX. ESP-32 Module**
- X. Plastic Water Tubes**
- XI. 9V Battery**
- XII. Bluetooth XBee USB Adapter FT232RL**

# COMPONENTS

## 1) Arduino UNO Board:



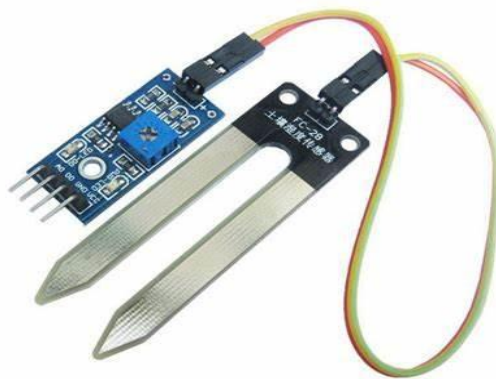
The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins, 6 analog I/O pins, and is programmable with the Arduino IDE, via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

## 2) SOIL MOISTURE SENSOR [FC-28]:

This is an easy to use digital soil moisture sensor. Just insert the sensor in the soil and it can measure moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil.

The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures more moisture than the set threshold, the digital output goes high and an LED indicates the output. When the moisture in the soil is less than the set threshold, the output remains low. The digital output can be connected to a micro controller to sense the moisture level. The sensor also outputs an analog output which can be connected to the ADC of a micro controller to get the exact moisture level in the soil.

This sensor is great for making water gardening projects, water sensing, etc.



### 3) Soil Temperature Sensor [DS18B20]

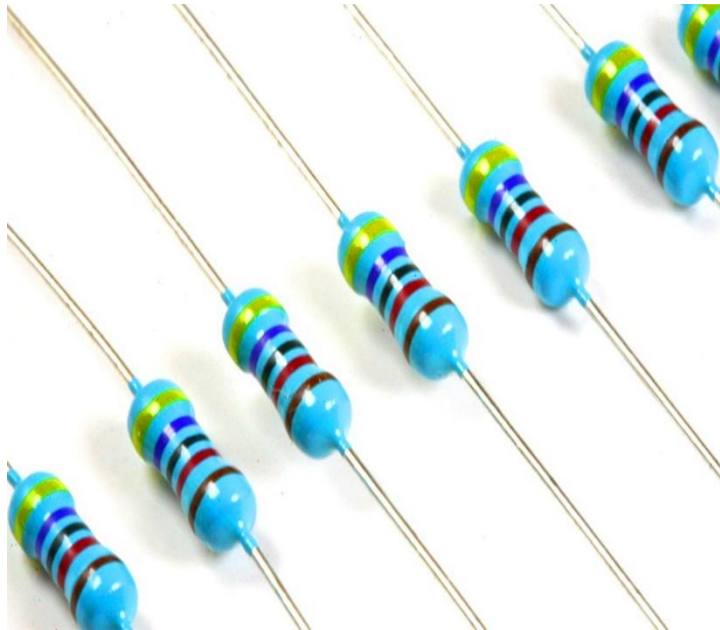


It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The construction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from  $-55^{\circ}\text{C}$  to  $+125^{\circ}$  with a decent accuracy of  $\pm 5^{\circ}\text{C}$ .

The DS18B20 is a 1-wire programmable temperature sensor from Maxim Integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The construction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy.

#### 4) 4.7 Resistor

Resistor As the name suggests, resistors resist the flow of electricity and the higher the value of the resistor, the more it resists and the less electrical current will flow through it.





## 5) Water Pump Motor [12V]



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These pumps use AC power otherwise DC power for energizing the motor of the water pump whereas others can be energized other kinds of drivers like gasoline engines otherwise diesel. ... These pumps are used for pumping the huge amount of water from one place to another. The main purpose of a water pump is versatile.

## 6) Single 10A Relay Module :



Relay boards are computer boards with an array of relays and switches. They have input and output terminals and are designed to control the voltage supply. Relay boards provide independently programmable, real-time control for each of several onboard relay channels.

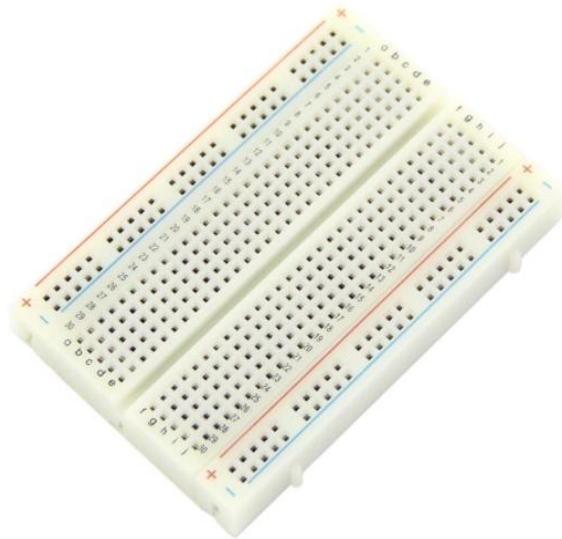
## 7) Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

Though jumper wires come in a variety of colours but the colours don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colours can be used to your advantage in order to differentiate between types of connections, such as ground or power.



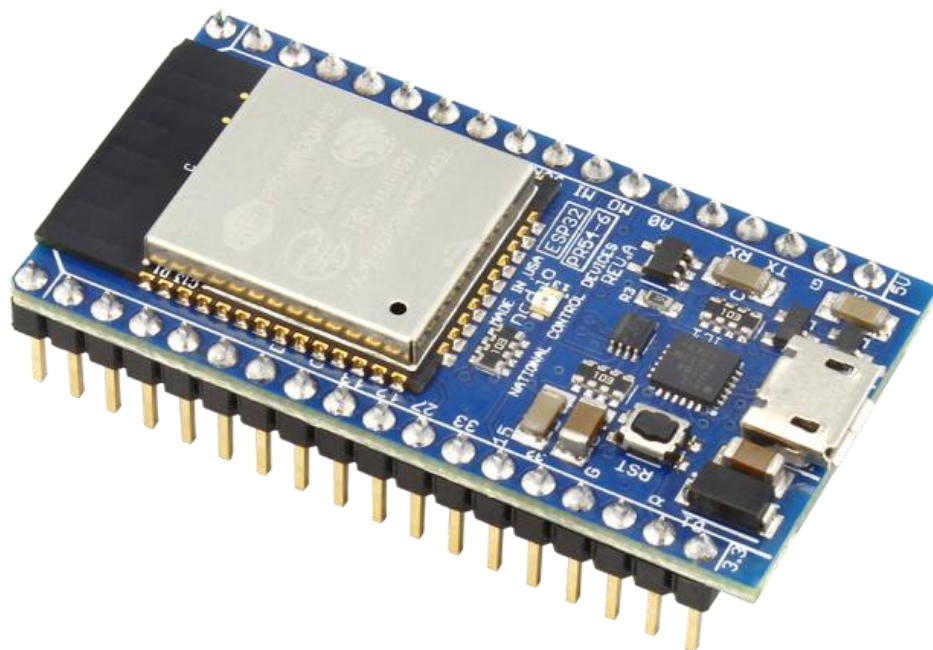
## 8) BreadBoard :



A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

## 9) ESP-32 Module :

ESP-32 is a series of low-cost and low-power system-on-chip (SoC) microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The microcontroller is cheap with low-power consumption and a great number of pins. Evidently, with its varied features, IoT becomes easier when it comes to ESP-32



## 10) Plastic Water Tubes :

Plastic pipe is a tubular section, or hollow cylinder, made of plastic. It is usually, but not necessarily, of circular cross-section, used mainly to convey substances which can flow—liquids and gases (fluids), slurries, powders and masses of small solids.



## 11) 9V Battery :



The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

## 12) Bluetooth XBee USB Adapter FT232RL :



The Bluetooth XBee USB Adapter FT232RL for Arduino + Micro USB Cable is a compact USB with serial adapter equipped with BEE (20pin 2.0mm) sockets. With integrated FT232RL IC, It can be used for programming or communicate with the board which basic Arduino but without USB interface, like Sniffer Nano.





## Working of the System

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So Basically, the sensors check through the electricity and the voltage. The Soil Moisture Sensor gets the reading through the concept of electricity conductivity. As we all know that the water is a good conductor of electricity and the dry soil conducts electricity poorly. Hence when the water level in the soil is sufficient it will conduct electricity and when it dries up it becomes a poor conductor and therefore the electricity passing through sensor decreases so the readings.

As for the Soil Temperature Sensor, it is made up of different mixers of metals. When the temperature of soil changes, it alters the voltage through the sensors hence the shift in the readings. The metals are good conductor of heat hence when the soil temperature changes it affects the metal through voltage change.

So judging the readings the system will operate the pump and irrigate the soil and maintains it for the optimum growth of the crops.

## *Code of the Program*

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```
#include <Keyboard.h>

#include <OneWire.h>

#include <DallasTemperature.h>

#define ONE_WIRE_BUS 8

OneWire oneWire(ONE_WIRE_BUS);

DallasTemperature sensors(&oneWire);

int digitalSensor = 2;

int pumpPin = 7; //relay pin

float Celsius = 0;

float Fahrenheit = 0;

void setup()
{
    sensors.begin();

    Serial.println("2");

    delay(1000);

    Serial.println("3");

    Serial.begin(9600);

    Serial.println("4");

    delay(1000);
```

```
Serial.println("5");
pinMode(digitalSensor, INPUT);
Serial.println("6");
pinMode(pumpPin, OUTPUT);
Serial.println("7");
}

void loop()
{
  sensors.requestTemperatures();
  int sensorValue = digitalRead(digitalSensor);
  Celsius = sensors.getTempCByIndex(0);
  Fahrenheit = sensors.toFahrenheit(Celsius);

  Serial.print(Celsius);
  Serial.print(" C ");
  Serial.print(Fahrenheit);
  Serial.println(" F");
  Serial.println("Sensor value : ");
  Serial.print(sensorValue);
  delay(1000);
}
```

## Future Objectives

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The Features that can be added in near Future are:

The Readings that are measured can be uploaded online every few second so that farmers can keep an eye on that whenever and wherever they want.

pH Sensor: The Sensor will check the pH level of the soil to check the acidity of the soil.

NPK Sensor: This Sensor will scrutinize the Sodium, Phosphorous and Potassium level in soil which are the most important nutrients required by plants.

A system to check the level of water in the Storage Tank. That way the farmers will get notified when the water is Overflowed or Underflowed. This will save the time of farmers and water which usually get wasted while filling the Tanks.

## Conclusion

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So far we have accomplished to maintain the water level and temperature level of the soil and irrigate it as required.

And for providing better service to the farmers through this system we also intend to add more features to save time and other resources.

## **Bibliography**

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Arduino DS18B20 temperature sensor tutorial - YouTube

<https://youtu.be/llpgGru2Wv0>

Arduino plant watering system (simple) - YouTube

<https://youtu.be/Y73twlAdcLs>

THANK YOU

