SMART WATER MANAGEMENT

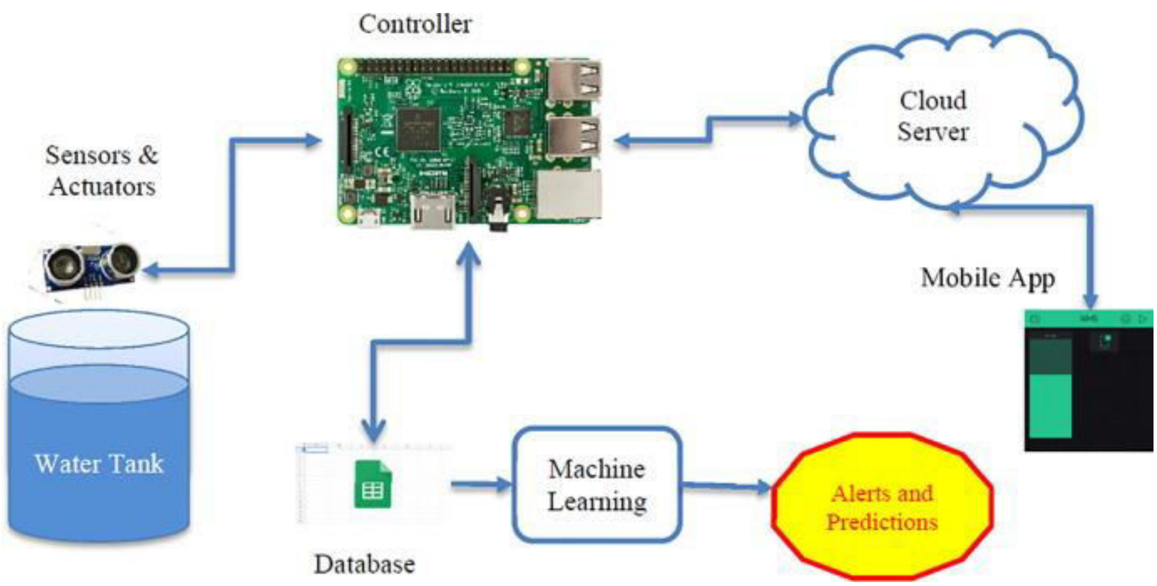
Phase 3 Project Submission

Document

Project Title: Smart Water Management

Phase 3: Development Part 1

Topic: IOT based smart water management



DESCRIPTION:

The project involves implemending IoT sensors to monitor water consumption in public places such as parks and gardens. The objective is to promote water conservation by making real time water consumption data publicly available. This project includes defining objectives, designing theIoT sensor system,developing the data sharing platform and integrating them using IoT technology and python.

DESIGN THINKING :

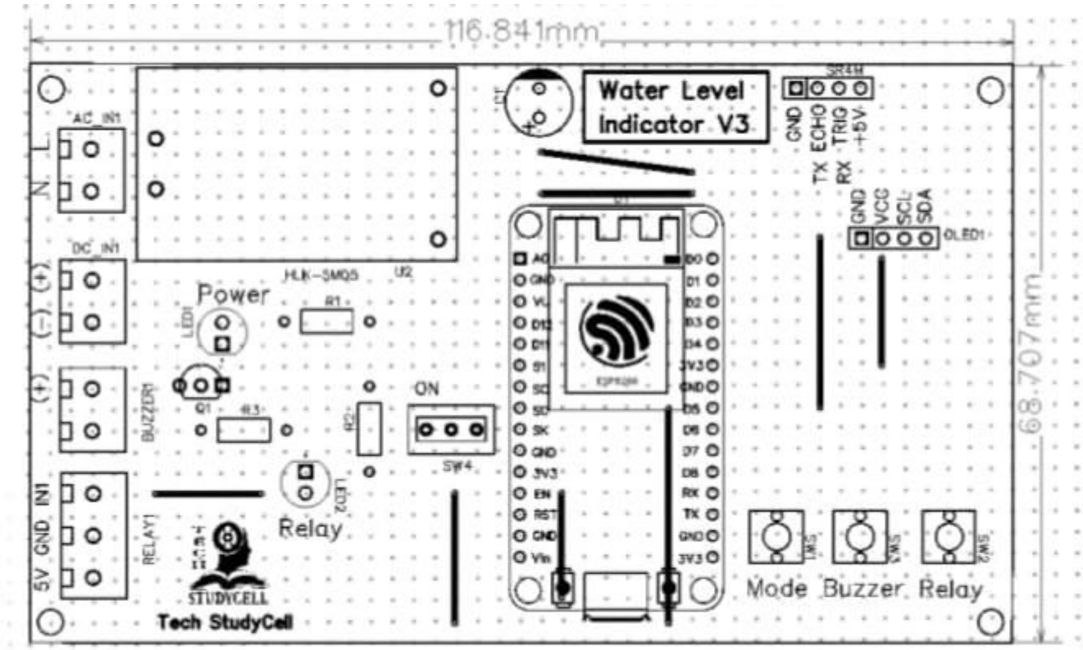
1.Project Objectives: Define Objectives such as real time waterconsumptionmonitorin,public awareness, water conservation and sustainable resource management.

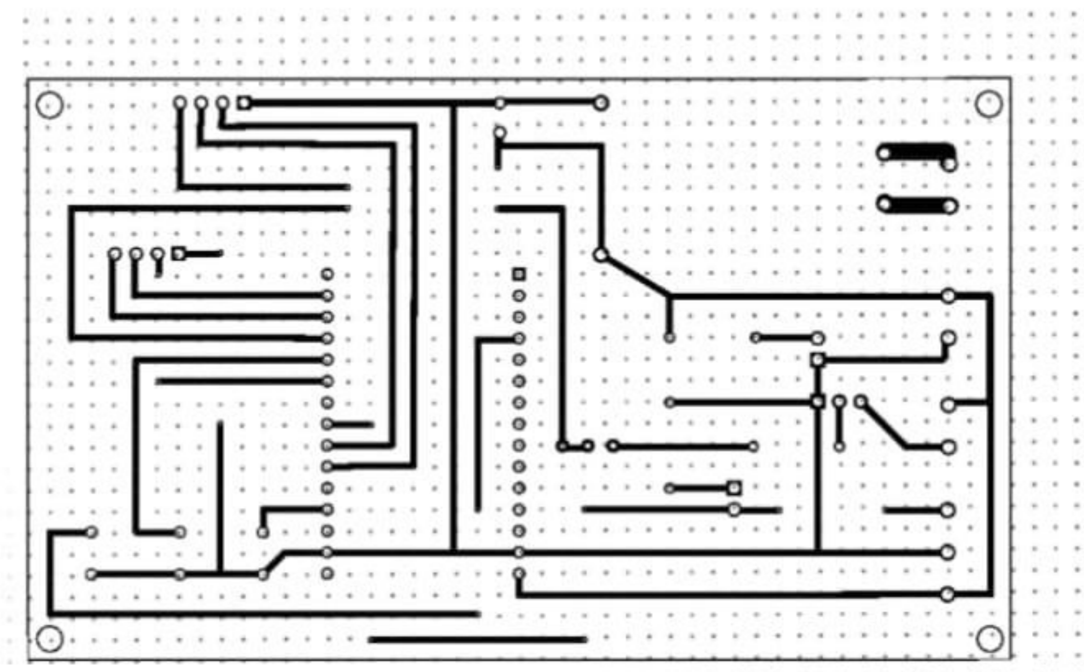
2.IoT sensor Design: Plan the design and deployment of IoT sensors to monitor water consumption in public places.

3.Real timeTransit Information platform: Design a mobile app interface that displays real time parking availability to users.

4.Integration Approach : Determine how to IoT sensors will send data to the sharing platform.

ARCHITECTURE DESIGN FLOW:





DESCRIPTION OF COMPONENTS :

• NodeMCU ESP8266

● SR04M waterproof ultrasonic sensor

OR HC-SR04 sensor .0.96" OLED Display

- 1k 0.25watt Resistors - 3 no
- BC547 NPN Transistor
- LED 5mm - 2no

2-pin Push Button - 3no

- SPDT slider switch
- 220uF 25V DC Capacitor

2-pin Terminal connectors (3 no)

3-pin Terminal connectors (1 no)

- 5V DC Buzzer
- AC to DC converter HLK-5M05 5V (Optional)

HC-SR04 ULTRASONIC SENSOR FUNCTION :

The sensor has 4 pins. VCC and GND go to 5V and GND pins on the Arduino, and the Trig and Echo go to any digital Arduino pin. Using the Trig pin we send the ultrasound wave from the transmitter, and with the Echo pin we listen for the reflected signal.

INNOVATIVE IDEA USE:

1. Reducing waste of water -intensive industries.

2.Monitoring water quality to fight pollution and diseases.

3.Improving the efficiency of water systems.

4.Creating awareness of household water use thanks to smart meters.

5.providing running water through innovative solutions all around the world.

BENEFITS:

1) Real-time Analysis of Water Consumption

IoT-based systems are advanced versions of technology inclusion in the water industry. The solutions are equipped with quality sensor devices that capture accurate information from the assets and transfer it to the user's dashboard in real-time. This benefits the users in massive ways, identifying the water consumption patterns and analysing the judicious use of water in all aspects.

2) Reduced Maintenance Costs

The water industry consists of huge storage tanks and machinery requiring frequent monitoring to avoid bulky maintenances. IoT-based systems enhance the efficiency of industrial equipment like water collectors, treatment plants, distribution mains, and wastewater recycling centres. Hence, the technology-based functionality helps reduce maintenance costs with automated techniques and scheduled monitoring.

3) Better Communication among stakeholders

The Internet of Things is a technology that creates a link between industrial assets and the users for quick responses. With IoT, lighting frameworks benefit from sending messages to purchasers, like turning off the electric machines in void rooms. One more illustration of better client correspondence is in the food and beverages business, as they could tell purchasers about the expiry of their food. The use of IoT provides better communication through real-time insights, and then the managers can take effective decisions to raise their production quality.

4) Predicting Potential Failures

Whenever pipe breaks or line blasts occur, a water utility is compelled to spend its restricted financial plan on crisis fixes and related costs. Yet, these expenses can be alleviated through an adaptable guidelines-based stage that screens your whole water framework through IoT technology. It combines the entire water business and corresponds to information gathered from various hotspots for an incorporated view that empowers quickly organized activity, empowering the understanding and command over each aspect of the water sector.

5) Remote Monitoring

IoT strengthens the real-time insight gathering and enables remote monitoring for the water authorities. Even when there is a shortage of staff or anyone is travelling, they can check on their business's performance through an interconnected system, which is well-structured with the help of IoT technology. It provides an accurate response to the industrialists in providing remote valve control, real-time insights on their connected gadgets, and much more.

6) End-to-End Services

A smart water management system provides endless services according to business requirements. From installing the devices on the industrial assets to deducing the insights and suggestive measures for improving the business, the IoT-based water management system is a complete package that deals effectively in the water sector. It renders end-to-end services, is customizable and ensures productivity to better the business quality. Upon installing the IoT-based solution, the authorities can leverage the advantages of automated processing, user-friendly interactions, accurate results, and better productivity.

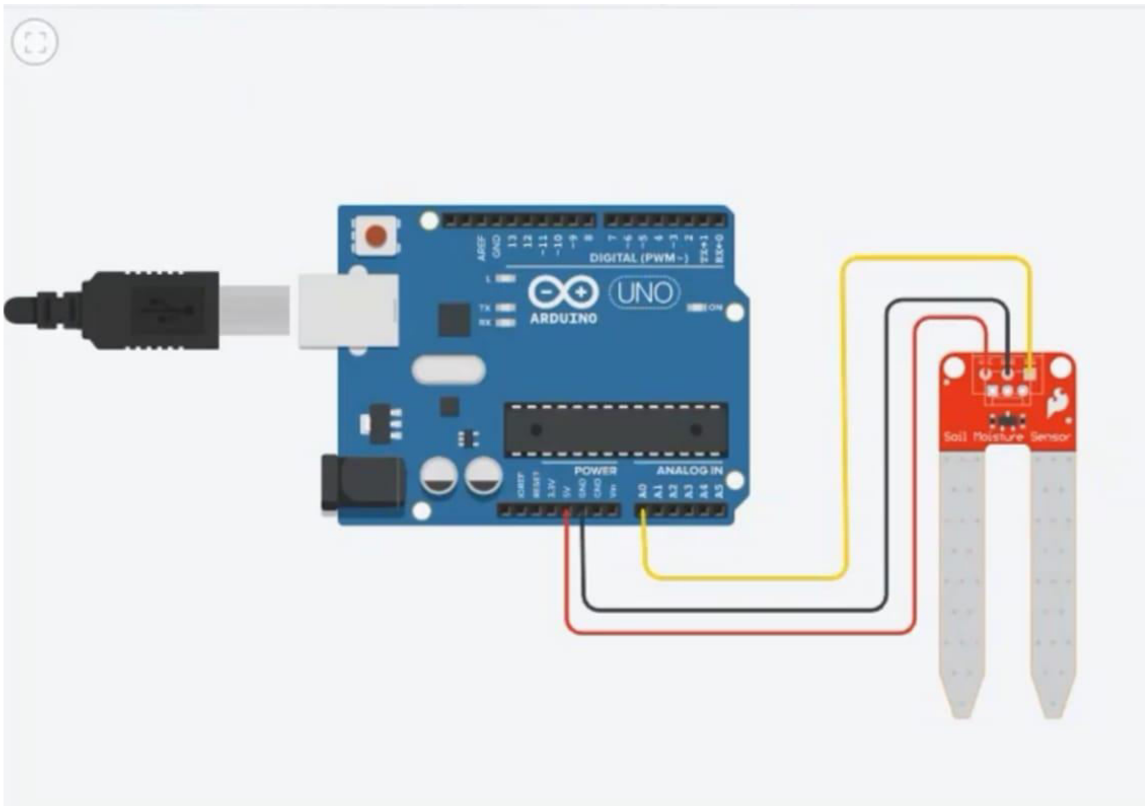
7) Interactive Reports

IoT prepares suggestive reports for the authorities responsible for a good interaction during business meetings. The authorities can easily count upon the data shared by the advanced sensors as it gets converted into a user-friendly format. The reports generated are shareable and interactive, illustrating all the details about the industry. This helps the authorities to execute their plans well and make appropriate decisions based on facts and well-researched analysis.

IoT, with its high-level benefits and abilities, permits water utilities to supply the necessary measure of consumable and safe water to end buyers, streamline water treatment processes, and work on the capacities of their water conveyance framework. IoT technology is a Holy Grail for utilities. The authorities can utilize it to convey continuous water to individuals in remote and segregated places in these water-scant times. As per future times, the innovation in the water business will support the creation pace of water that will help in working with the stockpile among the increasing population.

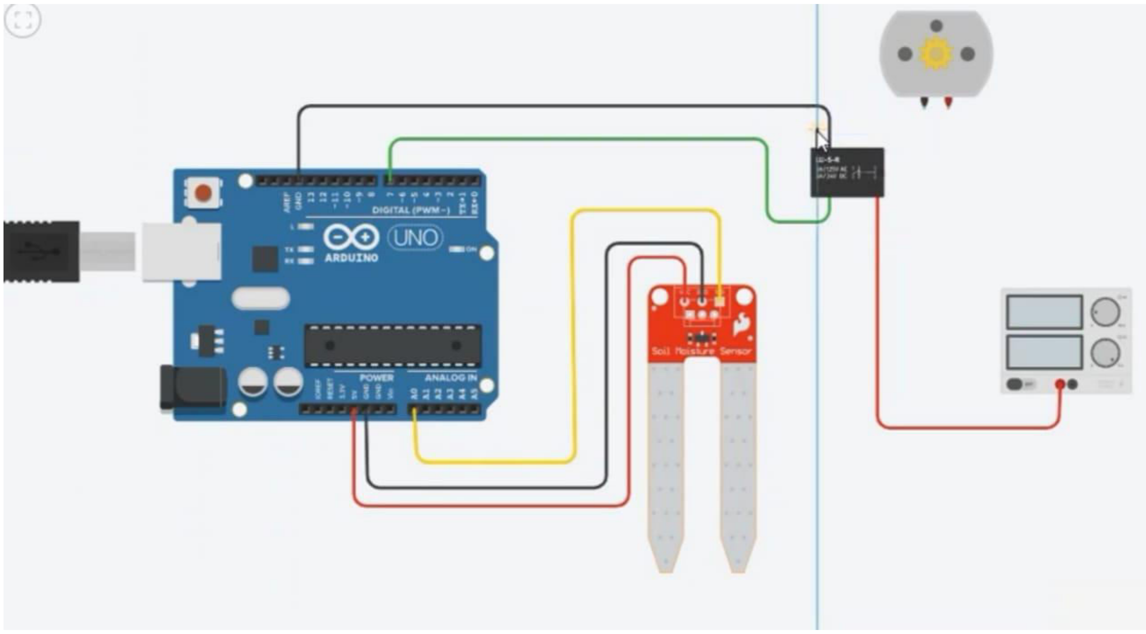
Implementation of Smart Water Management System in Tinkercad Software:

Step 1:



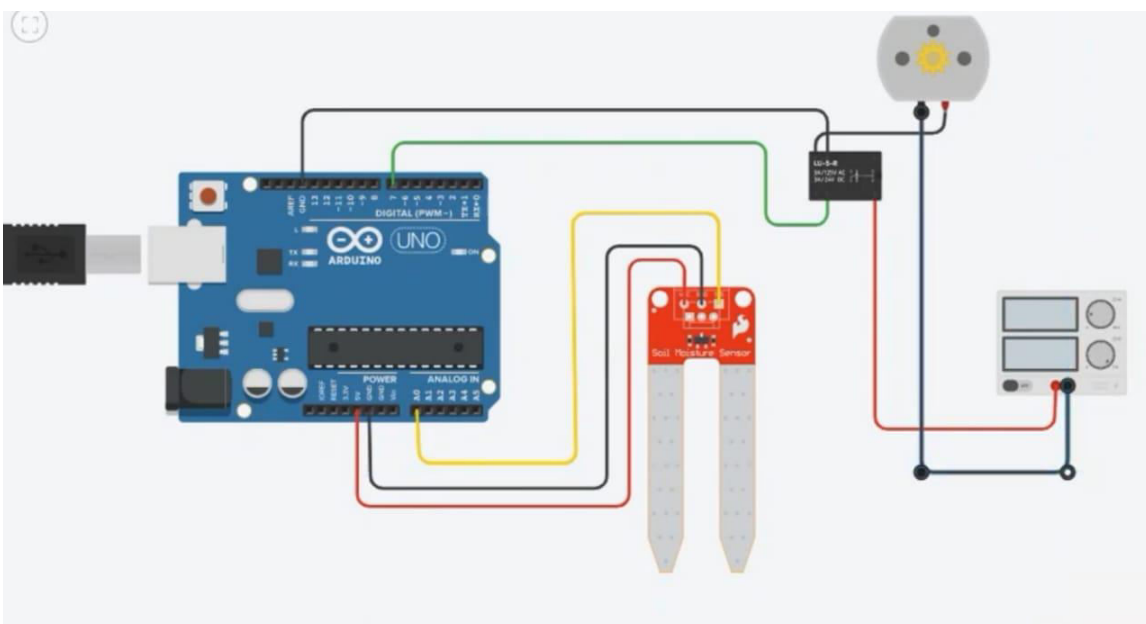
Arduino chip connect to soil sensor first VCC pin connect to 5V pin pink colour line.GND pin to GND pin blue colour line and next signal pin connect to the A0 pin.

step 2:



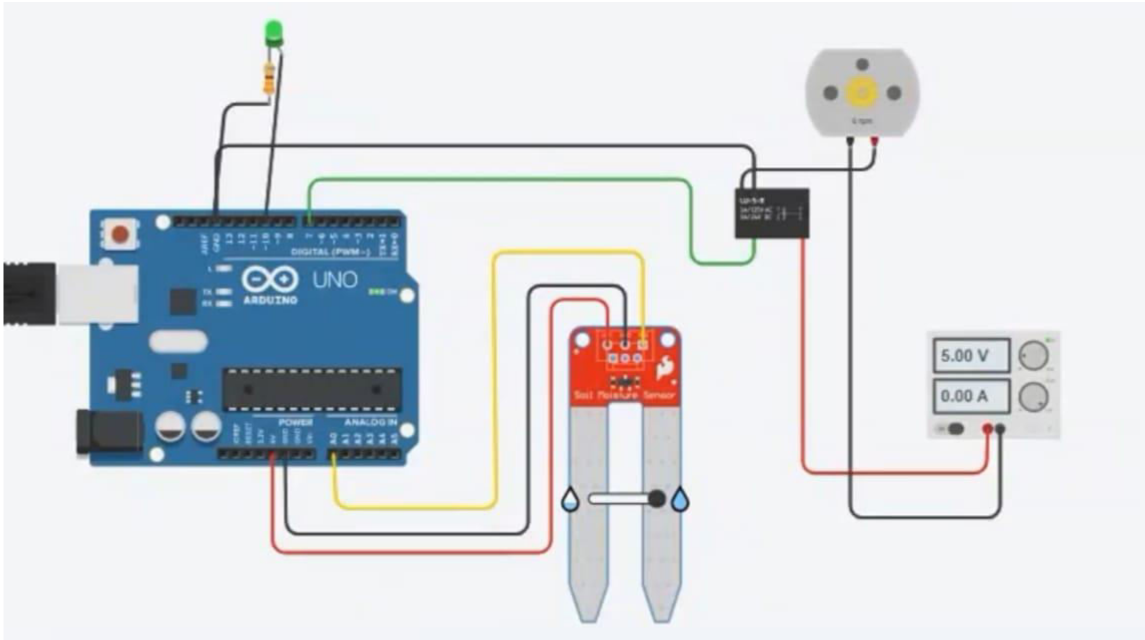
Relay terminal 8 pin connect to the arduino 7 pin green line. Terminal 12 pin connect the supply positive point connect red colour line. Relay terminal 5 connect to arduino GND pin.

step 3:



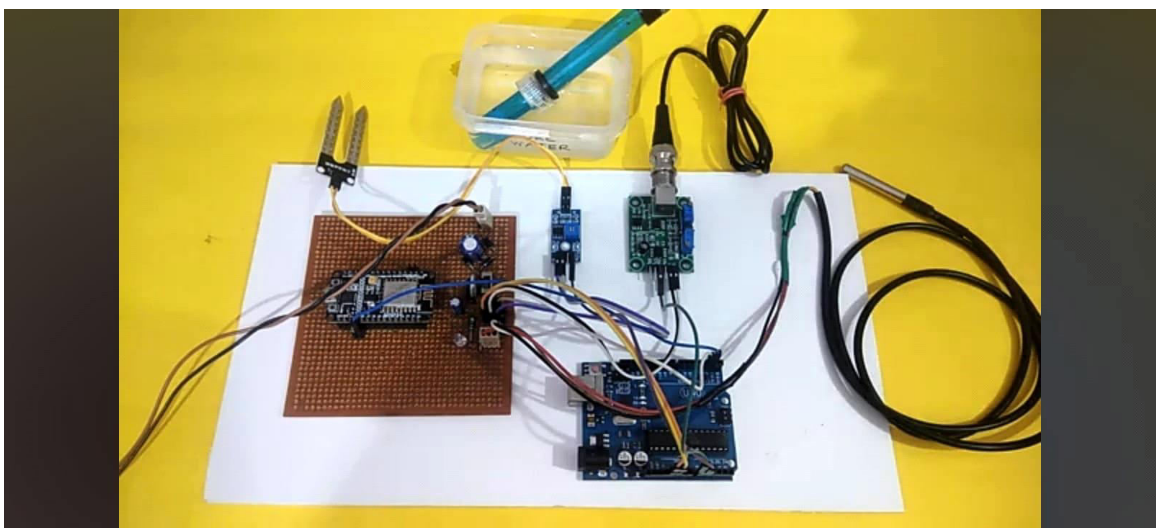
Relay terminal 6 pin connect to motor terminal 2 pin and motor terminal 1 connect the supply negative pin.

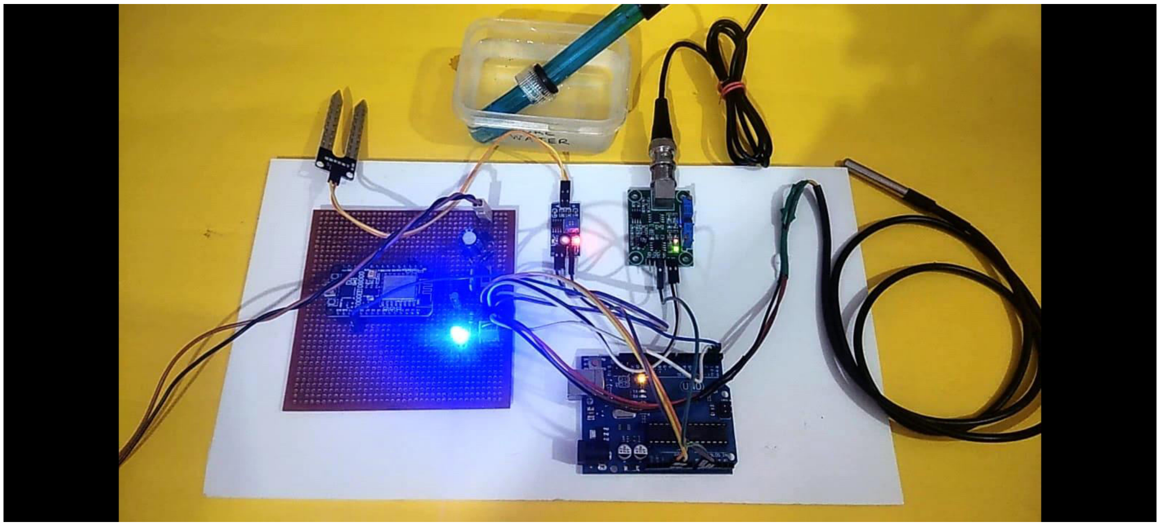
step 4:

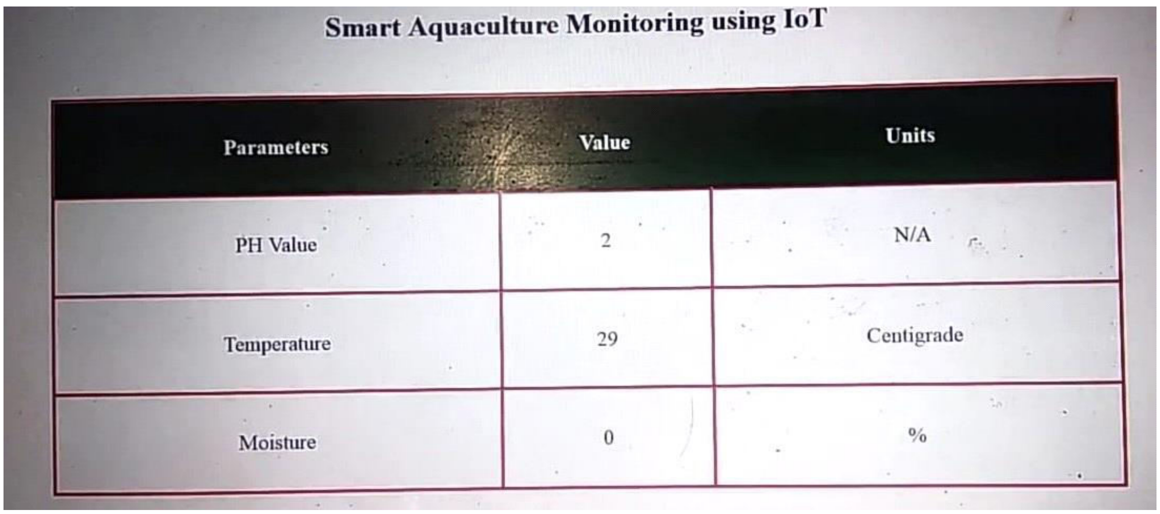


LED to Resistor interconnect to arduino GND pin and anode point connect to the arduino D10 pin. Next change the resistance value 330 ohm.

CONNECTION AND FUNCTION:

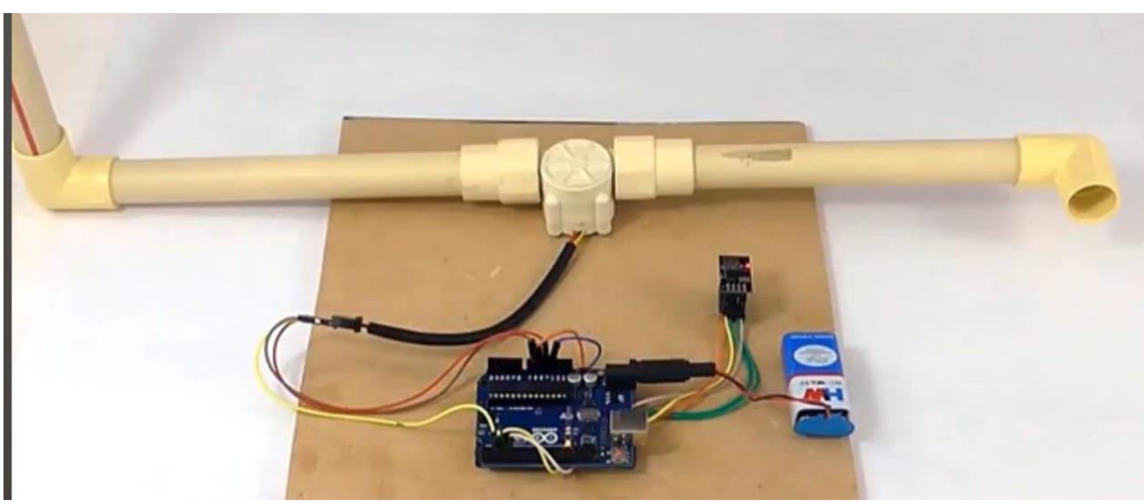




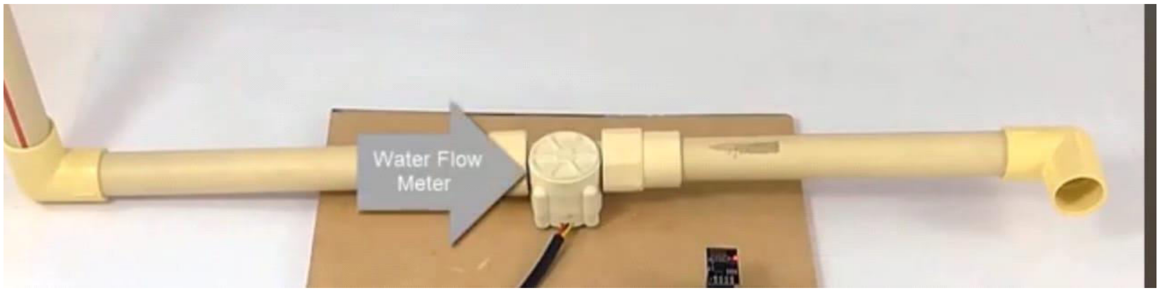


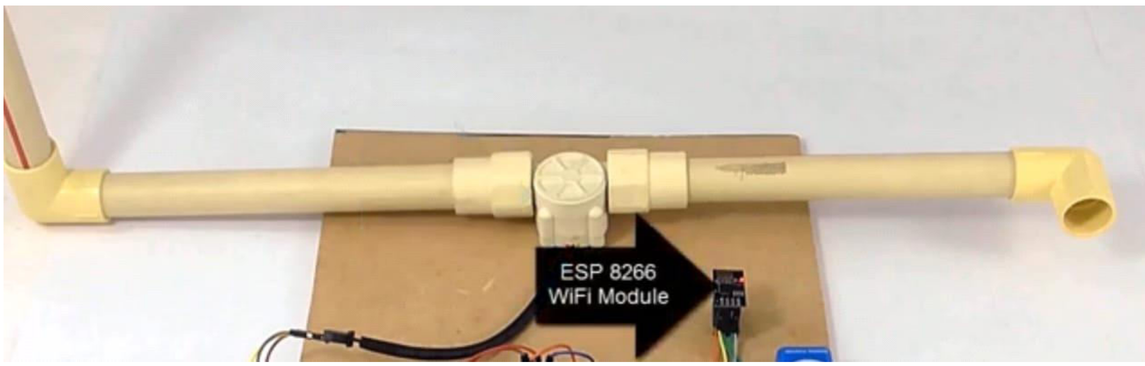
Smart Aquaculture Monitoring using IoT

Parameters	Value	Units
PH Value	2	N/A
Temperature	29	Centigrade
Moisture	0	%



In this course you will build an IOT based smart water monitoring system that collects data about how much water is being consumed and send the data to the cloud for storage and analysis.





As a part of this course you will use a water flow meter to collect data on water flowing through a pipe and ESP8266 WiFi module will send the data to the cloud.

You will also an arduino board and program it to coordinate between the flowmeter and ESP8266 you will then use thinkspeak IOT analysis platform to analyse the data to show result in visual format.

COMPONENTS PROGRAMMING:

SOURCE CODE FOR ESP8266:

float pH;

```
  float waterTurbidity;

  int waterLevel;

  bool manual_mode;

  bool waterPump;

  Variables which are marked as READ/WRITE in the Cloud Thing will also have functions

  which are called when their values are changed from the Dashboard.

  These functions are generated with the Thing and added at the end of this sketch.

*/

#include <ESP8266WiFi.h>;

#include <WiFiClient.h>;

#include "thingProperties.h"

#define Turbidity 16

//#define pH A0

#define pump 15

#define trig 4

#define echo 5

#define wLevel 0

#define sensorPower 14

int lowerThreshold = 420;

int upperThreshold = 520;

int val = 0; // Value for storing water level
```

```
unsigned long int avgValue; // Store the average value of the sensor feedback

long duration;

int distCM;

float b;

int buf[10], temp;

float volt;

float ntu;

int height=100;

void setup() {

  // Initialize serial and wait for port to open:

  Serial.begin(9600);

  // This delay gives the chance to wait for a Serial Monitor without blocking if
none

is found

  delay(1500);

  // Defined in thingProperties.h

  initProperties();

  //pinMode(13, OUTPUT);

  Serial.begin(9600);

  Serial.println("Ready"); // Test the serial monitor

  pinMode(pump, OUTPUT);

  pinMode(echo, INPUT);

  pinMode(trig, OUTPUT);
```

```
  pinMode(sensorPower, OUTPUT);
  digitalWrite(sensorPower, LOW);
  pinMode(wLevel,INPUT);
  pinMode(Turbidity, INPUT);

  WiFi.begin(ssid, password);
  // Connect to Arduino IoT Cloud
  ArduinoCloud.begin(ArduinoIoTPreferredConnection);

  /*
  The following function allows you to obtain more information
  related to the state of network and IoT Cloud connection and errors
  the higher number the more granular information youâ€™ll get.
  The default is 0 (only errors).
  Maximum is 4
*/
  setDebugMessageLevel(2);
  ArduinoCloud.printDebugInfo();
}
void loop() {
  ArduinoCloud.update();
  // Your code here
```

```
  onManualModeChange();


delay(100);
}
/*
  Since ManualMode is READ_WRITE variable, onManualModeChange() is
  executed every time a new value is received from IoT Cloud.
*/
void onManualModeChange() {
  // Add your code here to act upon ManualMode change
  if(manual_mode){
  onWaterPumpChange();
  }
  else{
  automate();
  }
}
/*
  Since WaterPump is READ_WRITE variable, onWaterPumpChange() is
  executed every time a new value is received from IoT Cloud.
*/
void onWaterPumpChange() {
```

```
  // Add your code here to act upon WaterPump change
if(waterPump){
  digitalWrite(pump, LOW);
  }
  else{
  digitalWrite(pump, HIGH);
  }
}
void automate()
{
  //Automatic or manual
  // digitalWrite(RelayPin,LOW);
  // ULTRASONIC SENSOR
  digitalWrite(pump, LOW);
  digitalWrite(trig, LOW);
  digitalWrite(trig, HIGH);
  digitalWrite(trig, LOW);
  duration = pulseIn(echo, HIGH);
  distCM = duration * 0.034 / 2;

  //waterLevel=distCM;
  if (distCM <= 20 && distCM >= 15){
```

```
  Serial.println("Sufficient water");
  Serial.println(distCM);
  }

  else if (distCM <= 15 && distCM >= 10){
  Serial.println("Tank only half filled");
  Serial.println(distCM);
  }
  else if (distCM < 7){
  Serial.println("Refill tank");
  Serial.println(distCM);
  }
  else if (distCM < 3){
  Serial.println("Tank Empty");
  Serial.println(distCM);
  digitalWrite(pump, HIGH);
  }
  // pH SENSOR

for (int i = 0; i < 10; i++) //Get 10 sample value from the sensor for smooth the
value
  {
  buf[i] = analogRead(pH);
```

```
  delay(10);
  }
  for (int i = 0; i < 9; i++) // sort the analog from small to large{
  for (int j = i + 1; j < 10; j++){
  if (buf[i] > buf[j]){
  temp = buf[i];
  buf[i] = buf[j];
  buf[j] = temp;
  }
  }
  }
avgValue = 0;
  for (int i = 2; i < 8; i++) // take the average value of 6 center sample
  avgValue += buf[i];
  float phValue = (float)avgValue * 5.0 / 1024 / 6; // convert the analog int
o millivolt
  phValue = 3.5 * phValue;// convert the millivolt into pH value
  pH=phValue
  Serial.print(" pH:");
  Serial.print(phValue, 2);
  Serial.println(" ");
  //digitalWrite(13, HIGH);
```

```
delay(800);

//digitalWrite(13, LOW);

if (phValue > 8.5 || phValue < 6.5){

Serial.print("WARNING: pH level - Exterme");

digitalWrite(pump, LOW);


}

// TURBIDITY SENSOR

volt = 0;

for (int i = 0; i < 800; i++){

volt += ((float)analogRead(Turbidity) / 1023) * 5;

}

volt = volt / 800;

volt = round_to_dp(volt, 2);

if (volt < 2.5) {

ntu =0.5;

}

else{

ntu = (-1120.4 * sq(volt) + 5742.3 * volt - 4353.8);

}

Serial.print(ntu);

Serial.println(" NTU");
```

```
waterTurbidity=ntu;

delay(100);

if (ntu >= 1){

Serial.println("Warning: turbity level- Harmful ");

digitalWrite(pump, HIGH);

}

// Water level Sensor

digitalWrite(sensorPower, HIGH);

delay(100);

val = analogRead(wLevel);

digitalWrite(sensorPower, LOW);

int level = val;

waterLevel=level;

if (level == 0){

Serial.println("Water Level: Empty");

Serial.println(level);

}

else if (level > 0 && level <= lowerThreshold){

Serial.println("Water Level: Low");

Serial.println(level);

}

else if (level > lowerThreshold && level <= upperThreshold){
```

```
  Serial.println("Water Level: Medium");
  Serial.println(level);
  }
  else if (level > upperThreshold){
Serial.println("Water Level: High");
  Serial.println(level);
  }
  Serial.println("");
  delay(3000);
}
float round_to_dp(float in_value, int decimal_place){
  float multiplier = powf(10.0f, decimal_place);
  in_value = roundf(in_value * multiplier) / multiplier;
  return in_value;
}
```

HC-SRO4 ULTRASONIC SENSOR PROGRAM

```
// defines pins numbers
const int trigPin = 9;
const int echoPin = 10;
// defines variables
long duration;
int distance;
```

```
void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  Serial.begin(9600); // Starts the serial communication
}
void loop() {
  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
  distance = duration * 0.034 / 2;
  // Prints the distance on the Serial Monitor
  Serial.print("Distance: ");
  Serial.println(distance);
}
```

Conclusion:

A water management system is the need of the hour for smart cities and campuses. The use of IoT devices for the water management system is becoming increasingly prominent. The availability of low-cost sensors connected to IoT devices has fixed the challenges of measuring water quality. In this paper, various components of IoT based water management systems were presented along with the in-depth survey of all existing smart water management systems. Various measurement parameters such as water.