SMART WATER MANAGEMENT
Using IoT

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Phase 5

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ABSTRACT:

The increasing global demand for fresh water, coupled with the growing concerns of water scarcity and environmental sustainability, has necessitated the development of innovative solutions to manage water resources efficiently. This abstract introduces a comprehensive approach to address these challenges through Smart Water Management

utilizingthe Internet of Things (IoT).Smart Water Management using IoT involves the integration of sensors, data analytics, and communication technologies to monitor, control, and optimize water-related processes. These processes encompass water supply, distribution, consumption, and wastewater treatment. IoT devices, such as water quality sensors, flow meters, and smart valves, are deployed in the water infrastructure to collect real-time data.

The collected data is then transmitted to a central platform where it is analyzed and processed. Advanced algorithms and machine learning models are employed to detect anomalies, predict water demand, and optimize the allocation of water resources. This enables water utilities and authorities to make informed decisions and respond swiftly to potential issues, including leaks, contamination, or inefficient resource allocation.

The benefits of Smart Water Management using IoT are multifaceted. It leads to improved water quality, reduced water losses, lower operational costs, and enhanced sustainability. Additionally, it empowers consumers with real-time insights into their water usage, encouraging responsible water consumption.

This abstract highlights the potential of Smart Water Management using IoT as a transformative solution to address the growing challenges in water resource management. As technology continues to advance, IoT-driven approaches hold the promise of enhancing the sustainability and resilience of water systems, ensuring the availability of this precious resource for generations to come.

INTRODUCTION:

Smart water management using IoT, or the Internet of Things, represents a revolutionary approach to optimizing the way we monitor, conserve, and distribute one of our most precious resources: water. By seamlessly integrating sensors, data analytics, and communication technologies, IoT empowers us to gain real-time insights into water usage, quality, and infrastructure. This transformation holds the promise of reducing waste, enhancing water quality, and ensuring the sustainability of this vital resource for generations to come. In this discussion, we will explore the key components, benefits, and challenges of implementing IoT in water management, as well as its potential to address pressing global water concerns.

RELATED WORKS:

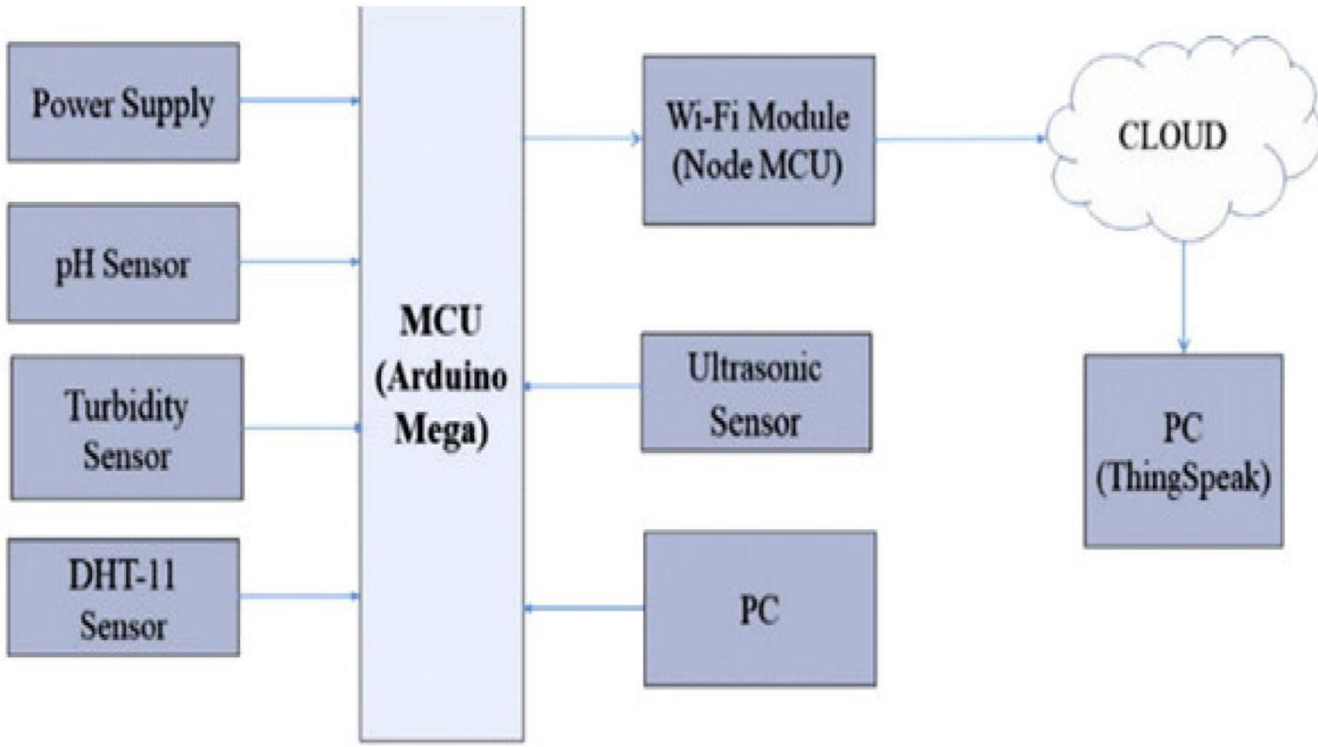
1. A Comprehensive Review on Smart Water Grids: This study provides an extensive overview of IoT-based technologies and their implementation in water management systems, discussing sensor networks, data analytics, and remote monitoring.
2. Smart Water Management for Sustainable Cities: Research on IoT-enabled solutions for urban water management, including leak detection, water quality monitoring, and demand forecasting, contributing to more efficient and sustainable urban water systems.

3. IoT-based Water Quality Monitoring: Various projects have focused on IoT sensors for real-time water quality assessment, enabling the early detection of contaminants, pollutants, or chemical imbalances. Water Leakage Detection with IoT Sensors: Research efforts have been dedicated to creating smart systems that can detect and pinpoint water leaks in distribution networks, reducing water loss and infrastructure damage.
4. IoT for Agriculture and Irrigation: IoT technologies are applied to agricultural water management, ensuring efficient irrigation practices and conserving water resources in farming.
5. Wastewater Management with IoT: Monitoring and optimizing wastewater treatment processes using

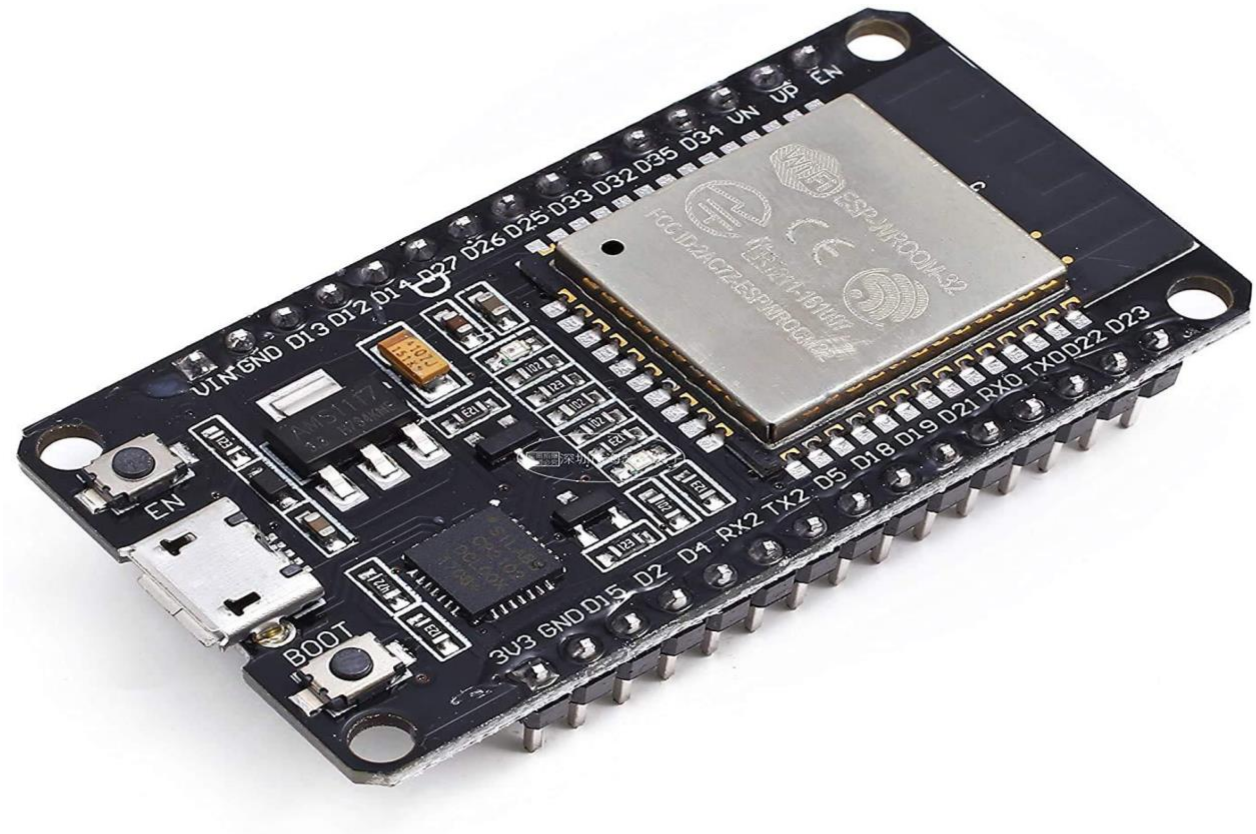
IoT sensors and data analytics to improve treatment efficiency and reduce environmental impact.

6. Consumer Water Monitoring Systems: Companies have developed consumer-friendly IoT devices that allow homeowners to track their water usage in real-time, encouraging water conservation.
7. Integrated Water Management Platforms: These platforms integrate various IoT components to provide a comprehensive view of water systems, enabling water utilities to make informed decisions and reduce operational costs.

BLOCK DIAGRAM:

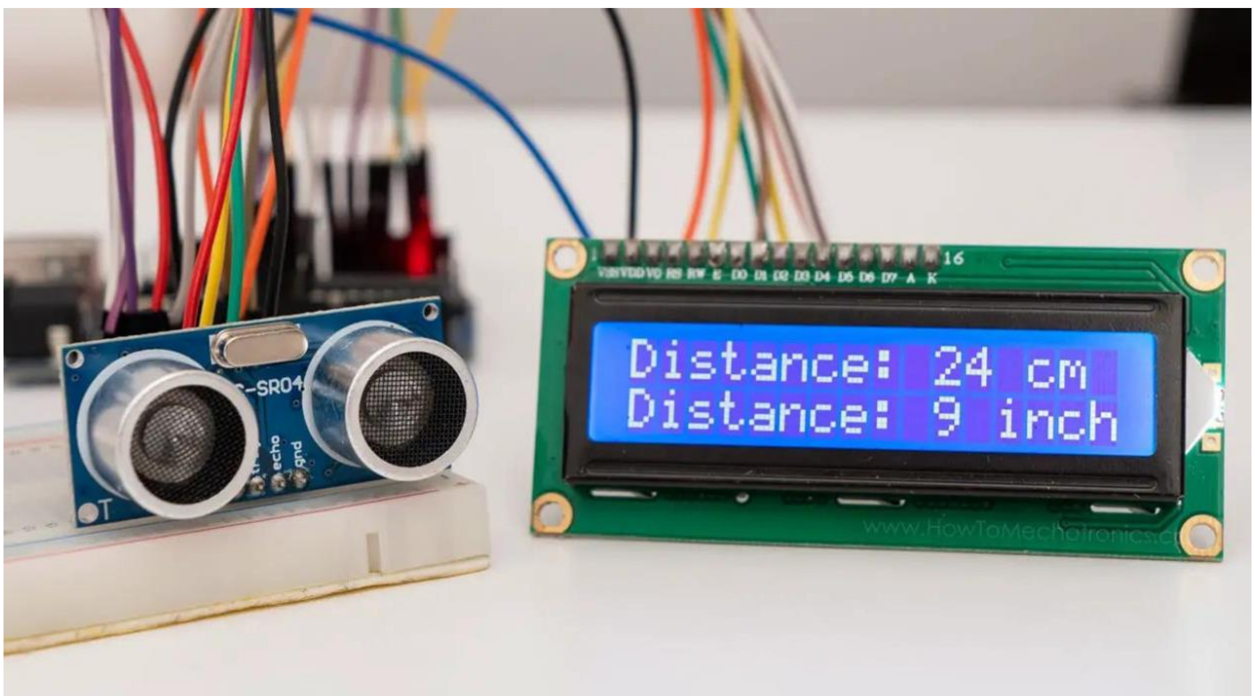

Power Supply
pH Sensor
Turbidity Sensor
DHT-11 Sensor
MCU (Arduino Mega)
Wi-Fi Module (Node MCU)
Ultrasonic Sensor
PC
CLOUD
PC (ThingSpeak)

ESP32:



The ESP32 is a versatile microcontroller suitable for a wide range of IoT applications, including home automation, sensor nodes, robotics, wearable devices, and more. Its combination of features, wireless capabilities, and a strong developer community has contributed to its popularity in the IoT and embedded systems space.

ULTRASONIC SENSOR :



An ultrasonic sensor is a device that uses high-frequency sound waves (ultrasonic waves) to detect the distance between the sensor and an object. It works on the principle of sending out ultrasonic pulses and measuring the time it takes for the sound waves to bounce back after hitting an object. By calculating the time it takes for the sound waves to return, the sensor can determine the distance to the object. Ultrasonic sensors are commonly used in various applications, such as in robotics for obstacle avoidance, in parking assist systems for cars, and in industrial automation for object detection and positioning.

CODING:

```
Int sensorpH = A0;
Int valve1 =10;
Int valve2 =11;
Int valve3 =12;
```

```
Int valve4 =13;
Int motor =9;
Int potValue;
Int pH;
Void setup()
{
 pinMode(sensorpH, INPUT);
 pinMode(valve1,OUTPUT);
 pinMode(valve2,OUTPUT);
 pinMode(valve3,OUTPUT);
 pinMode(valve4,OUTPUT);
 pinMode(motor,OUTPUT);
 Serial.begin (9600);
 For(int i=1; i<=100; i++){
 potValue = analogRead(A0) ;
 float pH = potValue * (14.0/1023.0);
 Serial.print("pH Value:");
```

```
Serial.println(pH);
digitalWrite(motor, HIGH);

if(pH<6.5){
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, LOW);
digitalWrite(valve1, HIGH);
delay(10000);
Serial.println("SAMPLE WATER 1 IS
DONE");
digitalWrite(valve1, LOW);
delay(2000);
digitalWrite(motor, HIGH);
delay (10000);
break;
}
```

```
If(pH>6.5){
digitalWrite(motor, HIGH);
}
}
For(int i=1; i<=100; i++){
potValue = analogRead(A0) ;
float pH = potValue * (14.0/1023.0);
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, HIGH);

if(pH<6.5){
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, LOW);
digitalWrite(valve2, HIGH);
delay(10000);
```

```
Serial.println("SAMPLE WATER 2 IS
DONE");
digitalWrite(valve2, LOW);
delay(2000);
digitalWrite(motor, HIGH);
delay (10000);
break;
}
If(pH>6.5){
digitalWrite(motor, HIGH);
}
}
For(int i=1; i<=100; i++){
potValue = analogRead(A0) ;
float pH = potValue * (14.0/1023.0);
Serial.print("pH Value:");
Serial.println(pH);
```

```
digitalWrite(motor, HIGH);

if(pH<6.5){
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, LOW);
digitalWrite(valve3, HIGH);
delay(10000);
Serial.println("SAMPLE WATER 3 IS
DONE");
digitalWrite(valve3, LOW);
delay(2000);
digitalWrite(motor, HIGH);
delay (10000);
break;
}
If(pH>6.5){
```

```
digitalWrite(motor, HIGH);
}
}
For(int i=1; i<=100; i++){
potValue = analogRead(A0) ;
float pH = potValue * (14.0/1023.0);
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, HIGH);

if(pH<6.5){
Serial.print("pH Value:");
Serial.println(pH);
digitalWrite(motor, LOW);
digitalWrite(valve4, HIGH);
delay(10000);
```

```
 Serial.println("SAMPLE WATER 4 IS
DONE");
 digitalWrite(valve4, LOW);
 delay(2000);
 digitalWrite(motor, HIGH);
 delay (10000);
 break;
 }
 If(pH>6.5){
 digitalWrite(motor, HIGH);
 }
 }
}
Void loop(){

 potValue = analogRead(A0) ;
 float pH = potValue * (14.0/1023.0);
```

```
Serial.print("pH Value:");
Serial.println(pH);
Delay(5000);
If(pH<6.5){
digitalWrite(motor, HIGH);
delay(10000);
}
Else{
digitalWrite(motor, HIGH);
}
}
```

PYTHON CODING:

```
Import random

Class WaterTank:
    Def __init__(self, capacity):
        Self.capacity = capacity
        Self.level = 0

    Def fill(self, amount):
        Self.level = min(self.capacity, self.level
+ amount)

    Def use(self, amount):
        If self.level >= amount:
            Self.level -= amount
            Return True
        Return False
```

```
Class SmartWaterManager:
   Def __init__(self, tank_capacity):
      Self.water_tank =
WaterTank(tank_capacity)

   Def monitor_water_level(self):
      Return self.water_tank.level

   Def simulate_water_usage(self):
      Usage = random.randint(0, 10)
      Return usage

   Def control_water_management(self):
      Current_usage =
self.simulate_water_usage()
      If self.water_tank.use(current_usage):
         Print(f"Water used:
{current_usage} units")
```

Else:

Print("Water shortage: Not enough water to meet demand.")

Self.water_tank.fill(10) # Refill the tank by 10 units

If __name__ == "__main__":

Tank_capacity = 50 # Set the tank capacity

Manager = SmartWaterManager(tank_capacity)

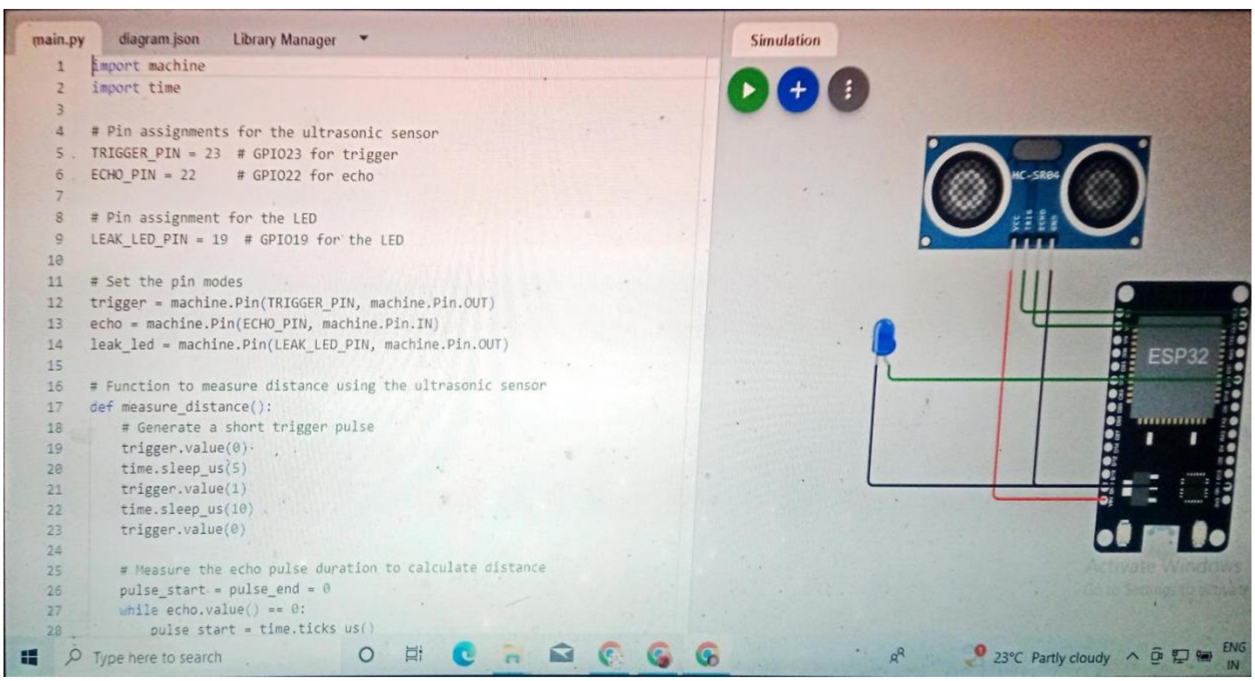
For _ in range(10): # Simulate 10 time steps

Manager.control_water_management()

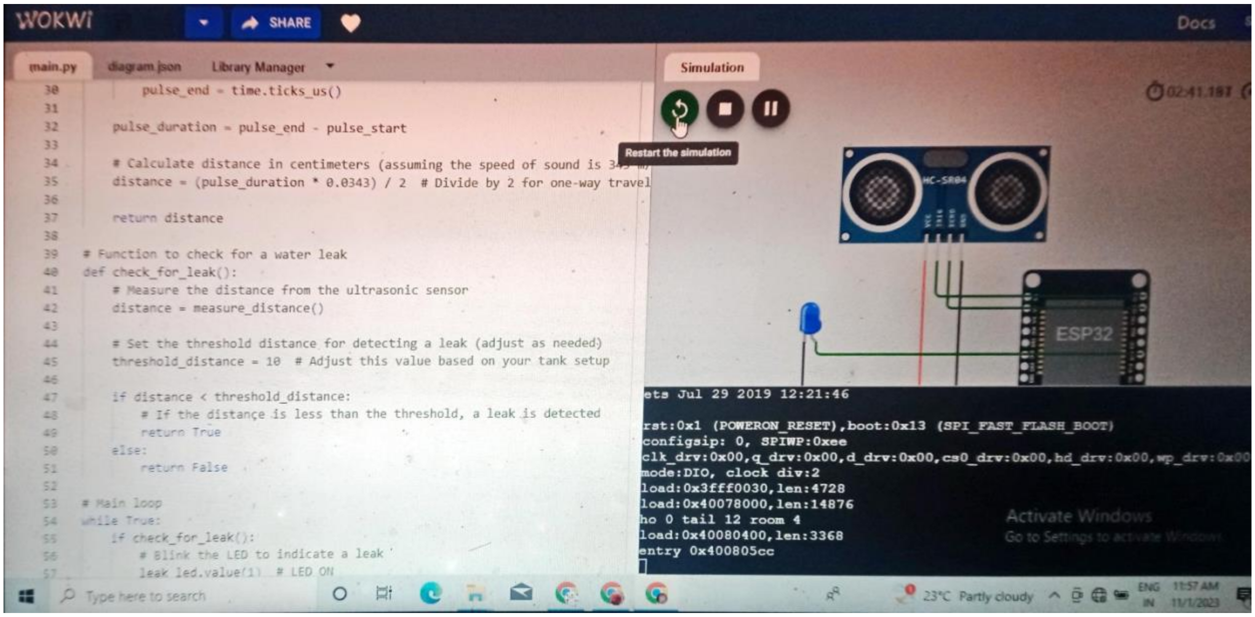
Current_level = manager.monitor_water_level()

Print(f"Current water level: {current_level} units\n")

WOKWI CONNECTION:



STIMULATION OUTPUT



CONCLUSION:

In conclusion, implementing smart water management using the ESP32 in IoT offers a promising solution for efficient and sustainable water resource management. By integrating IoT technology, real-time monitoring, data analysis, and remote control can be achieved, leading to several benefits. These include reduced water wastage, early leak detection, improved resource allocation, and enhanced environmental conservation. However, successful implementation requires careful planning, reliable sensor networks, and robust data analysis algorithms. As IoT technology continues to advance, smart water management with the ESP32 is poised to play a crucial role in ensuring the responsible use and conservation of this precious resource.

Thank you