Internet of Things

SMART WATER MANAGEMENT

NAAN MUTHALVAN

PHASE 5 PROJECT

SUBMITTED BY

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CONTENT

1. ABSTRACT:

The Smart Water System Design Project is a multifaceted endeavour aimed at implementing advanced Internet of Things (IoT) sensors to comprehensively monitor and manage water consumption in public areas, with a particular focus on parks and gardens. This ambitious initiative is driven by the overarching goal of promoting sustainable water management and conservation by making real-time water consumption data easily accessible to the general public and relevant authorities. The project comprises several pivotal components, including the establishment of clear objectives, meticulous planning and execution of the IoT sensor system, the development of an intuitive and user-centric data-sharing platform, and the seamless integration of these components through cutting-edge IoT technology and Python.

2. INTRODUCTION:

Smart irrigation system uses weather data or soil moisture data to determine the irrigation need of the landscape. Smart irrigation technology includes: These products maximize irrigation efficiency by reducing water waste, while maintaining plant health and quality.

3. OBJECTIVE:

- To reduce the wastage of water.
- Tailor watering schedules and run times automatically to meet specific landscape needs.
- These controllers significantly improve outdoor water use efficiencies.

1) Real-time Water Consumption Monitoring

a. The cornerstone of the project is to establish a highly responsive real-time water consumption monitoring system capable of continuous data collection.

b. This system will facilitate the immediate identification of unusual consumption patterns, early detection of leaks, and precise tracking of water usage trends, thereby enhancing overall resource management.

2) Public Awareness

a. A fundamental objective is to cultivate a heightened sense of responsibility and awareness among the general public regarding the importance of water conservation.

b. The project will actively engage in educational campaigns, leveraging interactive platforms to disseminate vital information about water conservation and its far-reaching environmental impacts.

3) Water Conservation

a. The project seeks to empower individuals, businesses, and municipalities with data-driven insights that promote responsible water use.

b. By providing easy access to real-time consumption data, the initiative aims to enable informed decision-making that optimizes water consumption and minimizes waste.

4) Sustainable Resource Management

a. A critical aspect of the project's mission is to contribute to the sustainable management of water resources within public areas.
b. By supplying city planners and officials with a wealth of accurate and timely data, the project facilitates evidence-based resource allocation decisions that enhance long-term sustainability.

4. IOT SENSOR DESIGN

1) **Comprehensive Sensor Deployment:** The project will meticulously strategize and execute the widespread deployment of IoT sensors across diverse public locations, ensuring comprehensive coverage and data collection.
2) **Smart Water Meters:** Beyond public areas, the initiative will encompass the installation of smart water meters in residential and commercial properties, thereby establishing an extensive network for monitoring water consumption at various scales.
3) **Integration with Infrastructure:** The seamless integration of IoT sensors into existing water mains, pipes, and irrigation systems is paramount to maximize data collection efficiency and minimize disruption.
4) **Precision Irrigation:** Leveraging state-of-the-art smart connected sensors in conjunction with IoT-controlled sprinkler systems will enable the precise delivery of water required for optimal plant growth. This approach minimizes water wastage while nurturing green spaces.

5. REAL-TIME TRANSIT INFORMATION PLATFORM

- User-centric Mobile App: To ensure accessibility for all, the project will prioritize the development of a user-friendly mobile app interface that provides seamless access to real-time water consumption data.
- Immediate Alerts: An integral component of the app will be a sophisticated alert system capable of promptly notifying users in the event of water leaks or abnormal consumption patterns. These timely alerts empower users to take swift corrective actions, thus preventing wastage.

6. INTEGRATION APPROACH

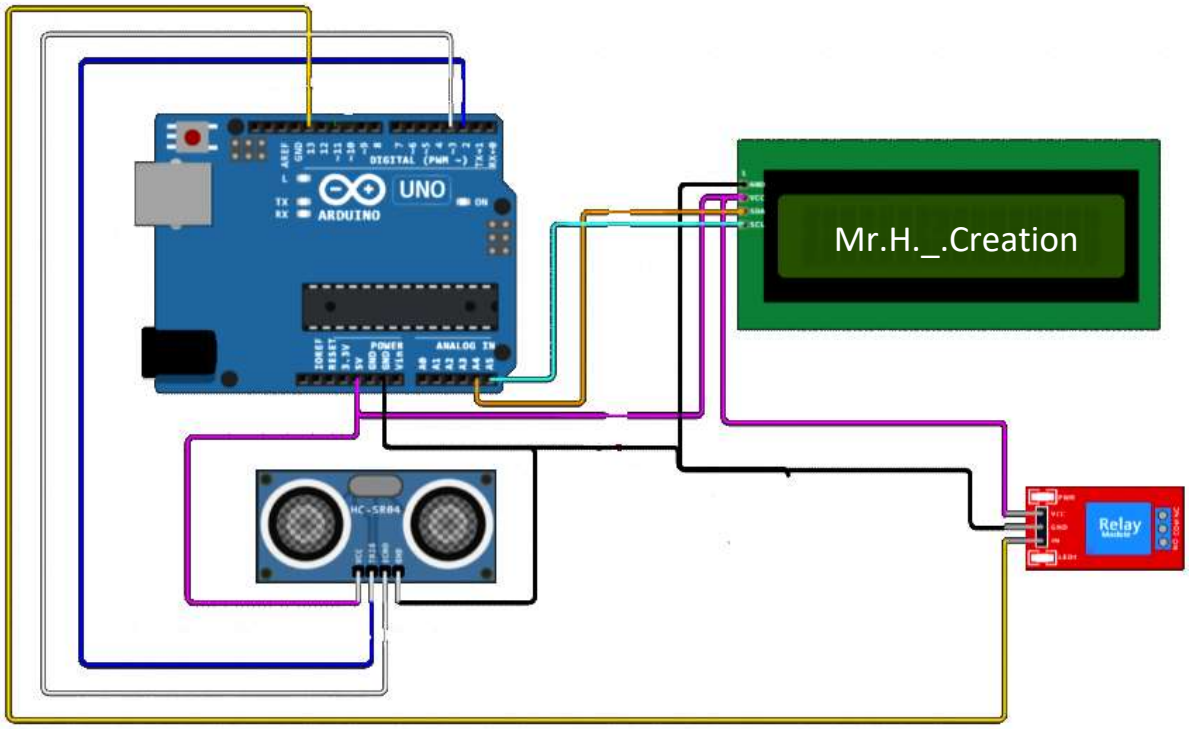
a. **Efficient Data Transmission:** The project will conduct rigorous evaluations to select the most reliable and efficient communication protocols for IoT sensors to transmit data to the data-sharing platform. Options such as MQTT and HTTP will be considered, with a strong emphasis on reliability, security, and data integrity.
b. **Automated Operations:** IoT-based smart water management systems will be implemented to automate a spectrum of functions, including real-time leak detection, remote valve control, and sophisticated data analysis. Automation enhances efficiency and responsiveness.

c. **Diverse Sensor Types:** A diverse array of water sensors, encompassing smart water meters, IoT water flow meters, smart irrigation controllers, and IoT water valves, will be deployed across the network. These sensors will operate continuously, monitoring vital parameters including water pressure, level, temperature, flow rate, and water quality in real-time.

d. **Enhanced Water Quality:** The project will harness IoT data sourced from advanced water sensor devices endowed with the capability to measure dynamic changes in water quality. By utilizing this data, the project not only improves water quality but also enhances overall water usage efficiency, thus contributing significantly to sustainable resource management.

7. MOBILE APP DELELOPMENT

8. BLOCK DIAGRAM:



Block diagram of smart irrigation system

9. CODING

```
#include <EEPROM.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x3F, 16, 2);

long duration, inches;
int set_val,percentage;
bool state,pump;

void setup()
{

 lcd.init();                  // initialize the lcd
 lcd.backlight();
 lcd.print("WATER LEVEL:");
 lcd.setCursor(0, 1);
 lcd.print("PUMP:OFF MANUAL");

 pinMode(2, OUTPUT);
```

```
  pinMode(3, INPUT);
  pinMode(10, INPUT_PULLUP);
  pinMode(11, INPUT_PULLUP);
  pinMode(13, OUTPUT);

   set_val=EEPROM.read(0);
   if(set_val>20)set_val=20 ;
}
void loop() {
   digitalWrite(2, HIGH);
   delayMicroseconds(10);
   digitalWrite(2, LOW);
   duration = pulseIn(3, HIGH);
   inches = microsecondsToInches(duration);

   percentage=(set_val-inches)*110/set_val;

   lcd.setCursor(12, 0);
   if(percentage<0)percentage=0;
   lcd.print(percentage);
   lcd.print("%   ");

   if(percentage<30&digitalRead(11))pump=1;
   if(percentage>85)pump=0;
   digitalWrite(13,!pump);

   lcd.setCursor(5, 1);
   if(pump==1)lcd.print("ON ");
   else if(pump==0) lcd.print("OFF");

   lcd.setCursor(9, 1);
   if(!digitalRead(11))lcd.print("MANUAL ");
   lcd.print("AUTO   ");

    if(!digitalRead(10)&!state&digitalRead(11)){
      state=1;
      set_val=inches;
      EEPROM.write(0, set_val);
      }
     if(!digitalRead(10)&!state&!digitalRead(11)){
       state=1;
       pump=!pump;
      }
```

```
    if(digitalRead(10))state=0;
    delay(500);
}
long microsecondsToInches(long microseconds) {
  return microseconds / 29 / 2;
}
```

10. PROBLEM STATEMENTS:

a. The main conclusions drawn from this study can be summarized as follows:
b. The lack of consensus in the definition and architecture of a smart water system and metrics of intelligent water system assessment is hindering the process of Smart techniques entering the water sector.
c. The implemented system was very basic in nature consisting of IoT devices using Sensors for water level monitoring in a smart home. In 2017, Malche etal. Presented an IoT based system for water level monitoring for the smart village. The main objective of the proposed system was to monitor the real-time water Level from a distant location.
d. Water management is possible primarily by real-time monitoring of water
e. Level And quality. Real-time water level monitoring can significantly reduce wastage of Water due to overflow from tanks. The water management system can also help Detect water leaks in a smart home by analyzing water levels during different Hours of the day.
f. The main problem is the storage system. A typical IoT device can
g. Accumulate thousands of data, thus a large storage systems needed. Notification on how to use push is also a topic of discussion. When to alert user based on the water status is also a problem that needs to be solved.

11. METHODOLOGY:

1) Sensor and Data Acquisition

This stage consists of the ultrasonic sensor. The ultrasonic sensor measures the distance of water level by sending out a sound wave at a frequency above the range of human hearing, converting water depth in the reservoir (distance of water surface from sensor) into electronic signals sent to the micro controller (Arduino). It must be noted however that the electronic signals from the sensors is digital signal.

2) Control

The controller used in this study is an Atmega 382 microcontroller on Arduino Uno. Its work is to coordinate all the activities of the smart water system. It then computes the appropriate control scheme meant to implement the irrigation based on the level of water in the reservoir. The controller output is sent as a digital control to the water pumps via the relays. The status of the system

including the water level, the pumps activated status are displayed on a Liquid Crystal Display (LCD) connected to the micro-controller. The controller derives its power from a 9 volts DC source. In this work, algorithm was developed in the Arduino Integrated Development Environment (IDE) using the Arduino script programming language and uploaded to the microcontroller.

The algorithm enables the system to automatically start/stop pumps when the water level reaches Percentage (30%-80%)

3) Water Optimization

This stage ensures that water is adequately managed in the process of irrigation. It uses the ultrasonic sensor to measure the level of water in the reservoir and sends this to the microcontroller. Based on this the microcontroller decides the pumps to be deployed for irrigation at a particular time. It comprises of relays, pumps that release water on the irrigation. This is a way of avoiding water wastage and maintaining continuous availability of water for irrigation purposes. The power for the relay and the pumps are derived from a 9 volts DC supply.

4) SMS System

By Using NodeMCU or GSM Module to Share the Information about the Status of water level present in the field or water tank in percentage and pump Status either pump is ON or pump is OFF to the respective person who is taking responsibility to the system and the pump and also Owner of the field and house.

12. COMPONENTS

- **Arduino**
- **Ultrasonic Sensor**
- **LCD Display (16x2)**
- **I2C Module**
- **Relay**
- **9V Battery**
- **DC Motor**

13. EXPECTED OUTCOME:

- Save water, time, and money. Studies show that up to 50% of water usage for landscape irrigation can be saved with cloud-based Smart Irrigation systems.
- This will be very useful for reducing wastage of water.
- Automatic function is used human to reduce our time to turning ON and OFF motor everyday

14. BUDGET

Sl. No	**Particulars**	**Justification**	**Quantity**	**Price (INR)**
1.	Arduino microcontroller	Master controller	1	650
2.	Ultrasonic Sensor	Measures the distance by ultrasonic sound waves	1	170
3.	LCD 16x2	Used to display the water level and pump status	1	200
4.	I2C Module	Parallel to serial converter	1	110
5.	Relay	To either open or close an electrical circuit	1	70
6.	9v Battery	Power source for motor	1	40
			Total (Rs)	**1240**
Rupees One thousand two hundred and forty only				