IOT BASED GREY WATER CONTROL SYSTEM

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ABSTRACT

This project develops an IoT-based Grey Water System that harnesses sensors and IoT technology to optimize grey water collection, treatment, and reuse. The system enables real-time monitoring and data analysis, improving water efficiency and reducing waste. A scalable and sustainable solution for grey water management, this project contributes to sustainable development and water conservation efforts

I. INTRODUCTION

1.1 MOTIVATION AND OBJECTIVE

The IoT-based Grey Water System is a revolutionary innovation that harnesses the power of technology to promote water conservation and sustainability. By leveraging Internet of Things (IoT) technology, this system optimizes the collection, treatment, and reuse of grey water, reducing the demand on potable water sources and minimizing wastewater generation. With real-time monitoring and automated control, the system ensures efficient use of this valuable resource, leading to significant water savings and cost reductions. Moreover, it raises awareness about the importance of water conservation, encouraging individuals to adopt sustainable practices. By embracing this cutting-edge technology, we can create a more water-resilient future, mitigating the impacts of water scarcity and protecting our planet's precious resources for generations to come.

- Design and develop an intelligent grey water management system that collects, treats, and reuses grey water from various sources (kitchen, bathroom, etc.)
- Implement an IoT-based monitoring and control system that enables real-time tracking and management of water usage, flow rate, pH level, and filtered water percentage.
- Promote water conservation by reducing the amount of potable water used for non-potable purposes.
- Provide a cost-effective, sustainable, and scalable solution for residential, commercial, and industrial

1.2.OUTLINE OF THE PROJECT

Our project, the IoT-based Grey Water Control System, aims to promote water conservation and sustainability by reusing daily wastewater from sources like kitchen sinks and washing machines. The system monitors and controls the treatment and reuse of grey water, ensuring efficient and safe water management.

The system design includes hardware components such as sensors, IoT devices, and grey water treatment units, as well as software components for data analytics, automation, and control. The system architecture enables real-time monitoring and control, automated treatment and reuse, and remote monitoring capabilities.

The system allows for the reuse of water from various sources, including kitchen sinks and washing machines, and monitors water quality parameters such as pH, flow, and turbidity. The system provides benefits such as water conservation, reduced water bills, increased public awareness, and improved water quality.

The implementation plan includes installation, testing, deployment, and maintenance, as well as user training and support. The project aims to contribute to sustainable water management and promote a more efficient use of water resources.

1.3 PURPOSE, SCOPE, AND APPLICABILITY

1.3.1 PURPOSES

1. Water Conservation: To design a system that reuses grey water for non-potable purposes, reducing the demand on potable water supplies and promoting water conservation.

2. Real-time Monitoring: To develop a system that provides real-time monitoring of water usage, flow rate, pH level, and filtered water percentage, enabling users to track their water consumption and make informed decisions.

3. Sustainability: To create a sustainable solution for water management, reducing the environmental impact of water waste and promoting a circular economy.

4. Automation: To design an automated system that requires minimal human intervention, ensuring efficient and reliable operation.

5. Remote Access: To develop a system that allows users to access data and control the system remotely through a website or messaging apps like Telegram and WhatsApp.

6. Cost-Effective: To create a cost-effective solution that is affordable and accessible to households and communities, reducing the financial burden of water management.

1.3.2 SCOPE

⇒ Designing and developing a robust and efficient grey water collection and treatment system

⇒ Integrating IoT sensors and technologies for real-time monitoring and control

⇒ Implementing a user-friendly web and mobile application for remote monitoring and management

⇒ Conducting thorough testing and evaluation to ensure system performance and reliability

1.3.3 APPLICABILITY

1. Residential buildings: Apartments, homes, and gated communities can implement the system to reduce water bills and promote sustainability.

2. Commercial establishments: Offices, malls, hotels, and restaurants can benefit from water conservation and reduced water costs.

3. Industrial settings: Factories, warehouses, and industrial parks can reuse grey water for non-potable purposes,

II. FUNDAMENTALS OF GRAY WATER TREATMENT

2.1 Background:

Water scarcity and efficient water management have become pressing issues worldwide. Grey water, which includes wastewater generated from sinks, showers, and washing machines, can be a valuable resource if properly treated and reused. The Internet of Things (IoT) offers innovative solutions for efficient water management. This project aims to design and develop an IoT-based Grey Water System that harnesses the potential of IoT technology to optimize grey water collection, treatment, and reuse.

III. DESIGN AND IMPLEMENTATION

3.1 PHYSICAL DESIGN

3.1.1 HARDWARE COMPONENTS:

1. ESP8266:-

An ESP8266 is a microcontroller:

- Low-power, highly-integrated Wi-Fi solution
- A minimum of 7 external components
- Wide temperature range: -40°C to +125°C
- ESP8285 — 8 Mbit flash embedded

Different kind of ESP8266 can be found on the market so your ESP8266 board may differ slightly from the one shown below:

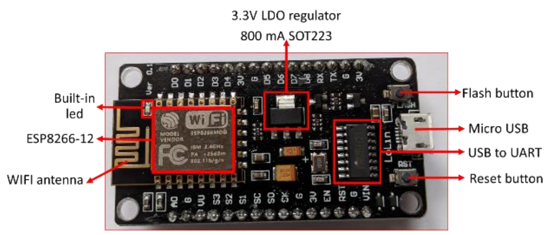


Figure.:3.1

ESP8266 Board

On the picture above, the ESP8266-12 block is where the processor, memory and WIFI unit are located. The rest ensures communication with external sensors, USB port, voltage regulator, etc.

The ESP8266 uses a 32bit processor with 16 bit instructions. It is Harvard architecture which mostly means that instruction memory and data memory are completely separate.

2. Analog pH Sensor:-

⇒ An analog pH meter measures the pH level of a solution and indicates its acidity or alkalinity by responding with an analog voltage.

What is pH?

⇒ pH stands for power of hydrogen, which is a measurement of the hydrogen ion concentration in the body. The total pH scale ranges from 1 to 14, with 7 considered to be neutral. A pH less than 7 is said to be acidic and solutions with a pH greater than 7 are basic or alkaline.

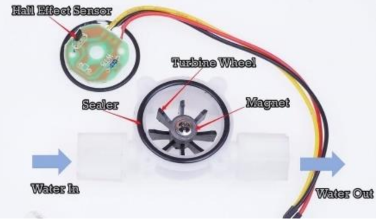
3. WATER FLOW SENSOR:-

What is a water flow sensor (meter)?

⇒ We use a water flow sensor to measure the water flow rate. The water flow rate is the volume of fluid that passes per unit time. People often use water flow sensor for automatic water heater control, DIY coffee machines, water vending machines, etc. There are a variety of flow sensors of different principles, but for makers using Arduino or Raspberry Pi, the most common flow sensor is based on a Hall device. For example, the most classic water flow sensor YF-S402 and YF-S201 rely on Hall sensors.

How does the water flow sensor work?

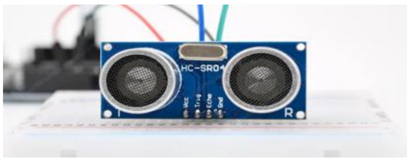
⇒ It's quite simple inside. The main components are the Hall Effect sensor, turbine wheel, and magnet. The water flows in through the inlet and out through the outlet. The water current drove the wheel to turn, and the magnet on the wheel turned with it. Magnetic field rotation triggers the Hall sensor, which outputs high and low level square waves (pulse).



Water flow sensor work principle

4. Ultrasonic Sensor:-

An ultrasonic sensor is an electronic device that uses ultrasonic sound waves to measure the distance to an object and convert the reflected sound into an electrical signal.



Ultrasonic Sensor

What is Ultrasound?

Ultrasound is a high-pitched sound wave whose frequency exceeds the audible range of human hearing.

3.1.2 HARDWARE COMPONENT POSITION IN PROJECT:

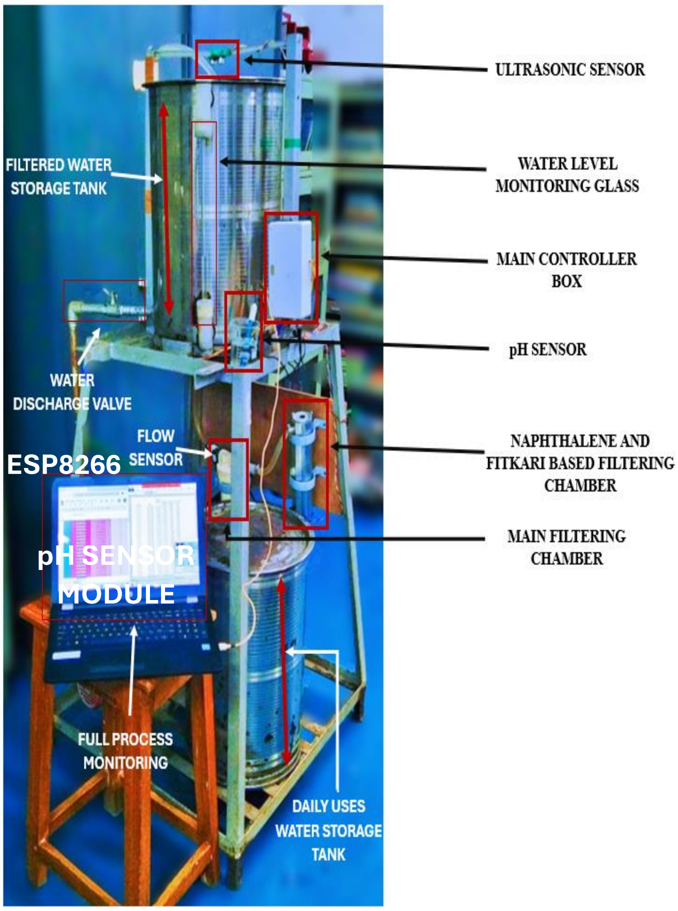


Figure.:-3.7 HARDWARE COMPONENT POSITION IN PROJECT

Main Controller Box:-

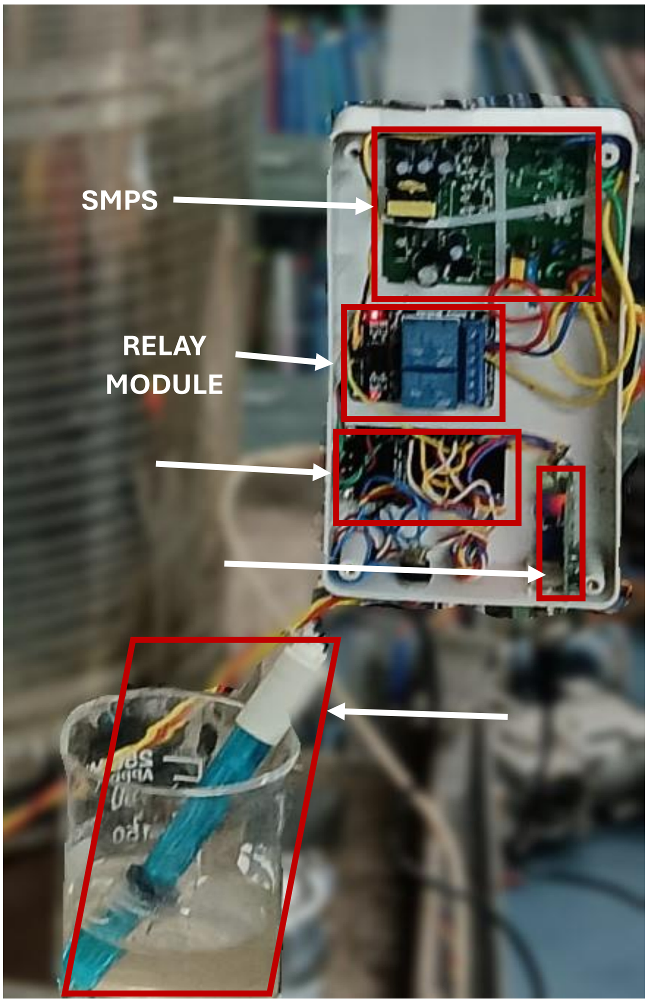
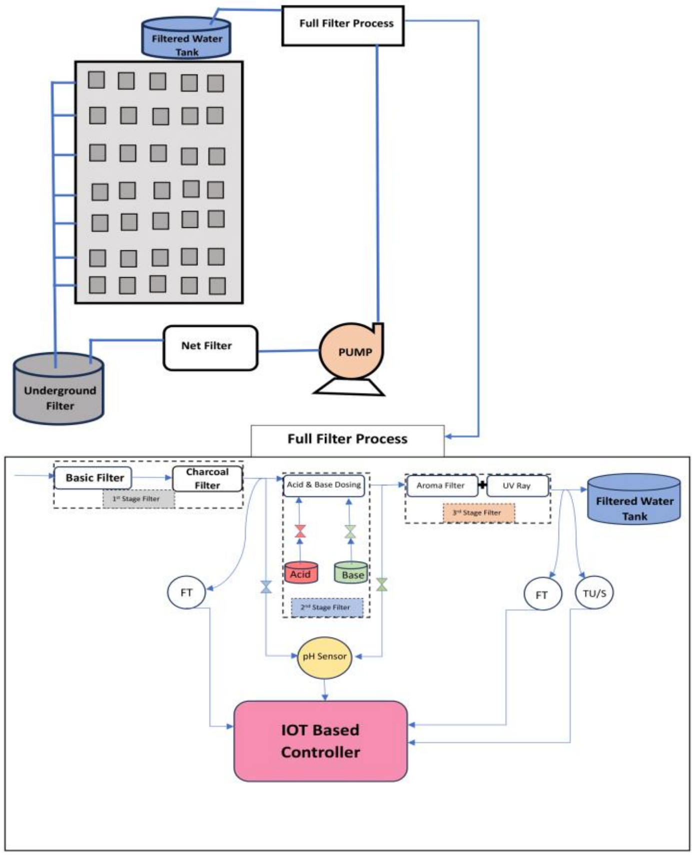
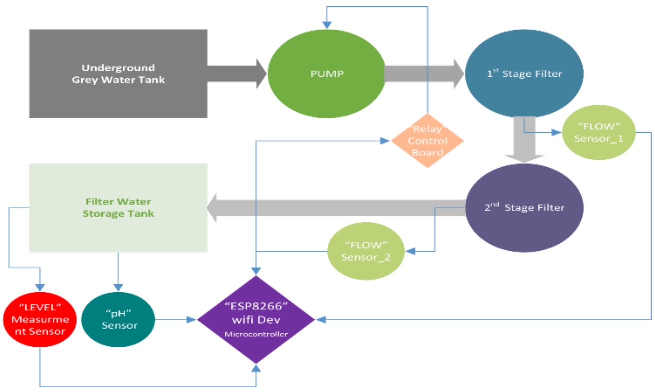


Figure.:3.8 Main Controller Box



*By this Diagram we can know about how we can use or how it work in real life.

3.2 BLOCK DIAGRAM



The block diagram of the IoT-based Grey Water Control System project reveals several key aspects of the system's architecture and functionality. By analyzing the block diagram, we can understand the following:

1. System Components: The diagram shows the various components of the system, including sensors, IoT devices, grey water treatment units, and a cloud-based server.

2. Data Flow: The diagram illustrates the flow of data from the sensors to the cloud server, and then to the user interface, indicating how the system collects, processes, and presents data.

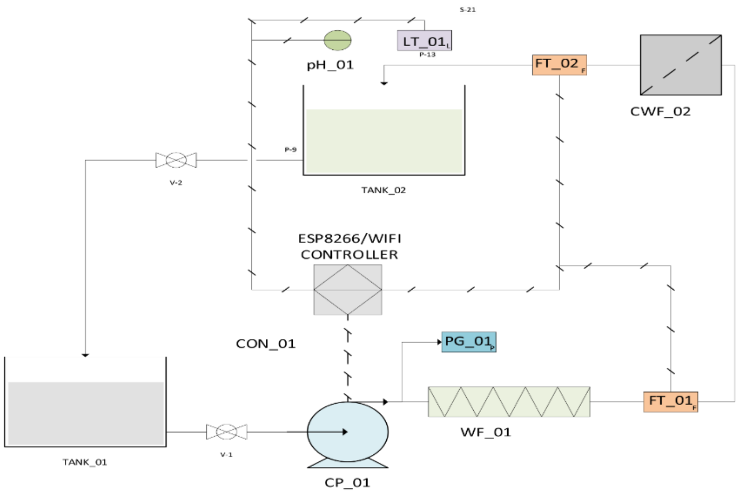
3. Automation and Control: The diagram suggests that the system has automated control capabilities, adjusting the grey water treatment process based on sensor data and user inputs.

4. Remote Monitoring and Control: The inclusion of a cloud server and user interface indicates that the system can be monitored and controlled remotely, enabling real-time tracking and management.

5. IoT Connectivity: The diagram highlights the role of IoT technology in connecting the system's components and enabling data exchange, demonstrating the project's focus on IoT-based solutions.

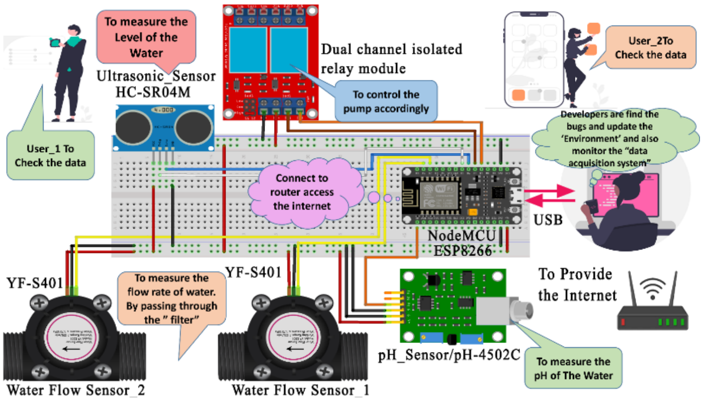
6. Grey Water Treatment: The diagram shows the grey water treatment unit, indicating that the system is designed to manage and treat grey water, promoting water conservation and sustainability.

3.3 P&I DIAGRAM



P&I Diagram

3.4 PIN DIAGRAM



3.5 Software and Hardware Requirements:-

Only 2 Software is required

- Arduino IDE
- Google Sheet

Arduino IDE:-

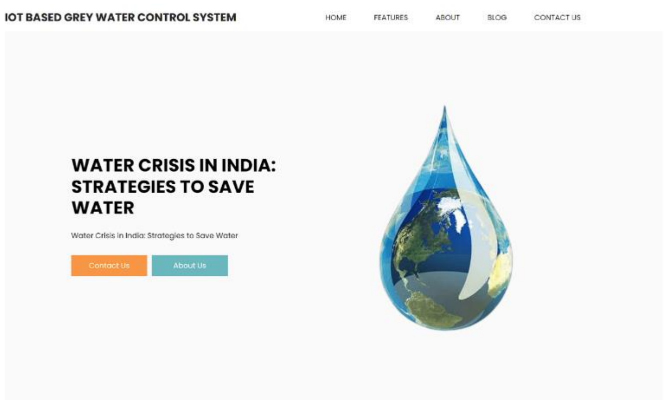
In this lesson, we will be using the Arduino IDE as it has a simple interface with built-in examples.

Google Sheet:-

For vasoligation of all Sensors data, we use Google Sheet.

3.6 User Interface Design:-

The user interface for the IoT-based Grey Water System is a web-based dashboard accessible at **https://savewater.netfy.org/.**



The intuitive and user-friendly interface provides real-time monitoring and control of the grey water system, enabling users to:

⇒ View real-time data on grey water generation, treatment, and reuse

⇒ Monitor system performance and water quality parameters

⇒ Receive alerts and notifications for system maintenance and issues

⇒ Control and adjust system settings remotely

⇒ Access data analytics and visualization tools to optimize water conservation

⇒ View educational resources and tips on water sustainability

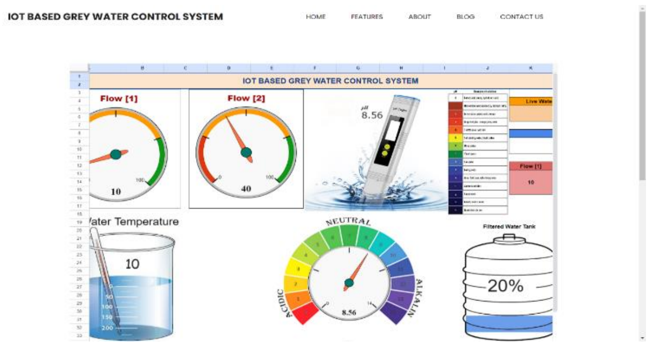


Figure.:3.13 User Dashboard

The interface is designed to be accessible and easy to use for a variety of users, from homeowners to facility managers, and provides a comprehensive overview of the grey water system's performance, enabling users to make informed decisions about water conservation and sustainability.

We Developed Two BOT First WhatsApp BOT and Second Telegram Bot Shown in above the Image.

3.7 Safety Issues:-

Here are some potential safety issues related to the IoT-based Grey Water System project:

1. Water Contamination: Grey water may contain harmful bacteria, viruses, and other contaminants, which can pose a risk to human health if not properly treated and disinfected.

2. Electrical Hazards: The system's electrical components and IoT devices may pose a risk of electrical shock or fire if not installed, maintained, and used properly.

3. Slip, Trip, and Fall Hazards: Wet surfaces and areas around the grey water treatment and storage units may be slippery, increasing the risk of falls and injuries.

4. Chemical Handling: The system may require the use of chemicals for treatment and disinfection, which can be hazardous if not handled, stored, and disposed of properly.

5. Data Security: The system's IoT devices and web interface may be vulnerable to cyber attacks, potentially compromising sensitive information and system control.

6. Maintenance and Repair Hazards: Maintenance and repair activities may expose personnel to electrical, mechanical, and chemical hazards if not performed properly.

7. Flooding and Water Damage: System failures or malfunctions may lead to flooding and water damage, causing property damage and potentially affecting neighboring properties.

8. Public Health Risks: Improperly treated grey water may pose a risk to public health, particularly if used for irrigation or other non-potable purposes.

9. Environmental Risks: System failures or malfunctions may lead to environmental contamination, harming local ecosystems and wildlife.

10. User Error: Improper use or conFigureuration of the system by users may lead to safety issues, such as contamination or electrical hazards

5. Data Security: The system's IoT devices and web interface may be vulnerable to cyber attacks, potentially compromising sensitive information and system control.

IV. RESULT ANALYSIS

The IoT-based Grey Water Control System project has yielded impressive results, demonstrating the effectiveness of IoT technology in grey water management. The project's dashboard successfully displays the following parameters in real-time:

- Grey Water Flow 1 and 2 rates

- pH levels

- Water levels

Key findings:

- Accurate measurement and display of grey water flow rates, pH levels, and water levels in real-time

- Automated control system effectively adjusts grey water treatment process based on sensor data and user inputs

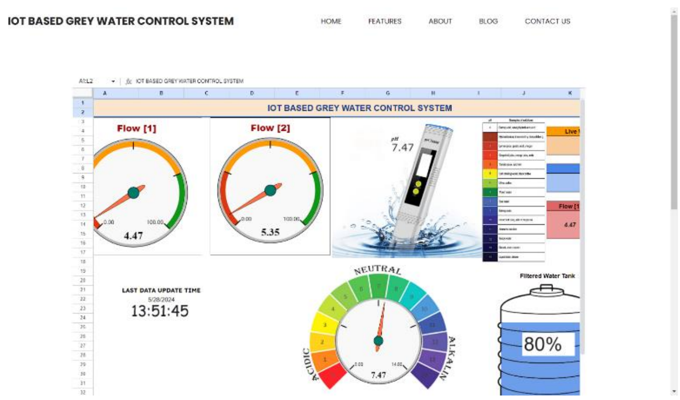
- Remote monitoring capability enables users to access and control the system from anywhere

- User-friendly dashboard provides clear and concise display of key parameters

4.1 Analysis:

The project's success demonstrates the potential of IoT technology in optimizing grey water management. Real-time monitoring and automation capabilities enable efficient and effective grey water treatment, reducing environmental pollution risks and promoting sustainable water management practices.

The dashboard's clear display of key parameters enables users to quickly assess system performance and make data-driven decisions. Remote monitoring and control capabilities enhance usability and flexibility, making the system suitable for industrial and commercial applications.



4.2 Database Details :-

Database of Result

V. CONCLUSION

5.1 Limitations of the System:-

The IoT-based Grey Water Control System project has several limitations. One of the main limitations is the high initial investment cost, which may be a barrier for some individuals or organizations. Additionally, the system requires regular maintenance and monitoring to ensure optimal performance, which can be time-consuming and resource-intensive.

Furthermore, the system's effectiveness is dependent on various factors such as water usage patterns, grey water generation rates, and treatment efficiency, which can vary significantly. Moreover, the system may not be suitable for all types of grey water sources, and its performance may be affected by factors such as water quality and flow rates.

Another limitation is the potential for technical issues and system failures, which can impact the reliability and efficiency of the system. Additionally, the system may require additional infrastructure and hardware, such as sensors and treatment units, which can add to the overall cost and complexity of the system.

Additionally, the system's scalability and adaptability to different contexts and regions may be limited, and it may require significant modifications to be effective in diverse settings. Moreover, the project's reliance on IoT technology and data analytics may raise concerns about data privacy and security, which must be carefully addressed.

Furthermore, the project's focus on grey water reuse may overlook other important aspects of water management, such as rainwater harvesting, water-efficient appliances, and water-saving behaviors. A more comprehensive approach to water management may be necessary to achieve significant and sustainable water conservation.

5.2 Future Scope of the Project:-

The IoT-based Grey Water Control System project has a promising future scope, with potential for expansion and development in various areas. The project's success could lead to widespread adoption in various settings, including residential, commercial, and industrial sectors, contributing significantly to water conservation and sustainability.

The project's technology and concept could be adapted and integrated with other water management systems, such as rainwater harvesting and water-efficient appliances, to create a comprehensive water management solution. Additionally, the project's data analytics and monitoring capabilities could be leveraged to optimize water usage and predict water demand, enabling more efficient water supply management.

Furthermore, the project's IoT technology could be applied to other environmental monitoring and management applications, such as air quality and waste management, contributing to a more sustainable and environmentally conscious future.

The project's potential for scalability and adaptability makes it an attractive solution for water management in various regions and contexts, including urban and rural areas, and developing communities. As the project continues to evolve and improve, it is likely to play an increasingly important role in addressing global water challenges and promoting sustainable water management practices.

5.4 SAMPLE CODE :-

```
#include <ESP8266WiFi.h>                    // Import 'ESP8266WiFi.h' libary
#include <WiFiClientSecure.h>               // Import 'WiFiClientSecure.h' libary
#include <EEPROM.h>                         // Import 'EEPROM.h' libary
const char* ssid = "Hextronics";            // Your wifi name or SSID.
const char* password = "ESP123..";          // Your wifi password.
const char* host = "script.google.com";     // host script
const int httpsPort = 443;                  // httpsport ID
WiFiClientSecure client;                    // Create a WiFiClientSecure object.
String GAS_ID = "AKfycbxyOUUy2fvOFwWX9Pswx765Z1kZcSHvt3z85r_68Y9fVatF8Su207lOr0d6Ag8n3dZ-bQ"; // spreadsheet GAS service id
const char* fingerprint = "702F78E7F62FA742A895BA1FFFF2734F2DDA782D"; // Google spreadsheet fingerprint id
#define RELAY_PIN 16                        // define the Relay pin
#define PH_PIN A0                           // define the PH_Sensor pin
float ph_Data;                              // PH data Variable
```

```
float pH_Value=0;                    // pH_value Initial position
0
float voltage;                       // Declear the variable voltage
#define FLOW_SENSOR_1 D1                        // define the
FLOW_SENSOR_1 pin
#define FLOW_SENSOR_2 D2                        // define the
FLOW_SENSOR_2 pin
volatile long pulse_1;              //
unsigned long lastTime_1;              //
float volume_1;                   //
volatile long pulse_2;              //
unsigned long lastTime_2;              //
float volume_2;                   //
#define TRIG_PIN 12                //
#define ECHO_PIN 14
#define SOUND_VELOCITY 0.034
long duration;
float ULTRASONIC_DATA_CM;
float
CALCULATION_WATER_LEVEL_PERCENTAGE=0;
float  WATER_LEVEL_PERCENTAGE=0;
void setup() {                              // put your setup code
here, to run once:
pinMode(RELAY_PIN,OUTPUT);                            // Relay
Pin as define as output to control the pump
pinMode(PH_PIN,INPUT);                              // pH sensor
pin as input declear
pinMode(TRIG_PIN, OUTPUT);                           // Sets the
trigPin as an Output
pinMode(ECHO_PIN, INPUT);                            // Sets the
echoPin as an Input
pinMode(FLOW_SENSOR_1, INPUT);                          // Set
the "FLOW_SENSOR_1" as an input
pinMode(FLOW_SENSOR_2, INPUT);                          // Set
the "FLOW_SENSOR_2" as an input
attachInterrupt(digitalPinToInterrupt(FLOW_SENSOR_1),
increase_1, RISING);  // "FLOW_SENSOR_1" as an use as
interrupt  RISING
attachInterrupt(digitalPinToInterrupt(FLOW_SENSOR_2),
increase_2, RISING);  // "FLOW_SENSOR_2" as an use as
interrupt  RISING
Serial.begin(19200);                                 // Serial
Communication with computer
wifi_setup();                              // Now call or Fetch
the "wifi_setup"
plx_daq_setup();
void loop() {                                  // put your main
code here, to run repeatedly:
 flow_sensor_loop();                               // Now call or
Fetch the "flow_sensor_loop"
 Ultrasonic_Loop();                                // Now call or
Fetch the "Ultrasonic_Loop"
 pH_sensor_loop();                                 // Now call or
Fetch the "pH_sensor_loop"
 plx_daq_loop();

sendData(volume_1,volume_2,WATER_LEVEL_PERCEN
TAGE,ph_Data); //
}
```

Google App Script Code:-

```
function doGet(e) {
 Logger.log( JSON.stringify(e) );  // view parameters
 var result = 'Ok'; // assume success
 if (e.parameter == 'undefined') {
  result = 'No Parameters';
 }
 else {
  var sheet_id =
'1VdhJLuc9LCpTsGLKsMvLzH7ESu3xhmCPJhfX4ISm3j
Y';                    // Enter your Spreadsheet ID
  var sheet =
SpreadsheetApp.openById(sheet_id).getActiveSheet();
// get Active sheet
  var newRow = sheet.getLastRow() + 1;
  var rowData = [];

 const month =
["January","February","March","April","May","June","July"
,"August","September","October","November","December"]
;
 const day =
["Sunday","Monday","Tuesday","Wednesday","Thursday","
Friday","Saturday"]
 d=new Date();
 rowData[0] = d;                     // Date in column A
  rowData[1] = d.toLocaleTimeString();    // Timestamp in
column B
 rowData[2] = day[d.getDay()];          // Day in column C
 rowData[3] = month[d.getUTCMonth()];    // Month in
column  D
 rowData[4] = d.getHours();

 for (var param in e.parameter) {
    Logger.log('In for loop, param=' + param);
    var value = stripQuotes(e.parameter[param]);
    Logger.log(param + ':' + e.parameter[param]);
    switch (param) {
     case 'AX': //Parameter 1, It has to be updated in
Column in Sheets in the code, orderwise
      rowData[5] = value; //Value in column A }
```

5.5 APPENDIX :-

CLOCK	DAY	FLOW_SENSOR_1	FLOW_SENSOR_2	LEVEL_SENSOR	pH_SENSOR
13:44:22	28-05-2024	11.18L/m	11.50L/m	2.00%	7.14pH
13:44:24	28-05-2024	16.54L/m	17.66L/m	2.00%	7.27pH
13:44:27	28-05-2024	16.54L/m	17.50L/m	4.00%	7.22pH
13:44:30	28-05-2024	15.10L/m	15.98L/m	2.00%	7.28pH
13:44:33	28-05-2024	15.66L/m	16.62L/m	4.00%	7.40pH
13:44:36	28-05-2024	16.94L/m	17.82L/m	7.00%	7.42pH
13:44:40	28-05-2024	15.82L/m	16.86L/m	7.00%	7.37pH
13:44:43	28-05-2024	15.34L/m	16.30L/m	9.00%	7.48pH
13:44:46	28-05-2024	14.14L/m	14.94L/m	9.00%	7.42pH
13:44:49	28-05-2024	16.54L/m	17.58L/m	9.00%	7.51pH
13:44:53	28-05-2024	20.05L/m	21.25L/m	9.00%	7.44pH
13:44:56	28-05-2024	17.90L/m	19.01L/m	13.00%	7.44pH
13:45:00	28-05-2024	16.30L/m	17.34L/m	13.00%	7.54pH
13:45:03	28-05-2024	15.90L/m	16.94L/m	13.00%	7.45pH
13:45:07	28-05-2024	21.49L/m	22.85L/m	13.00%	7.44pH
13:45:10	28-05-2024	15.58L/m	16.46L/m	13.00%	7.52pH
13:45:14	28-05-2024	16.70L/m	17.74L/m	18.00%	7.47pH
13:45:17	28-05-2024	17.42L/m	18.45L/m	20.00%	7.48pH
13:45:20	28-05-2024	16.38L/m	17.50L/m	20.00%	7.63pH
13:45:24	28-05-2024	17.02L/m	18.06L/m	20.00%	7.62pH
13:45:28	28-05-2024	20.21L/m	21.41L/m	20.00%	7.49pH
13:45:32	28-05-2024	19.41L/m	20.61L/m	22.00%	7.51pH
13:45:35	28-05-2024	16.30L/m	17.26L/m	22.00%	7.51pH
13:45:39	28-05-2024	18.37L/m	19.49L/m	24.00%	7.62pH
13:45:43	28-05-2024	20.53L/m	21.65L/m	27.00%	7.53pH
13:45:46	28-05-2024	17.90L/m	19.01L/m	27.00%	7.53pH
13:45:50	28-05-2024	15.34L/m	16.22L/m	27.00%	7.65pH
13:45:53	28-05-2024	16.86L/m	17.90L/m	29.00%	7.59pH
13:45:56	28-05-2024	16.38L/m	17.34L/m	31.00%	7.53pH
13:45:59	28-05-2024	15.82L/m	16.78L/m	31.00%	7.67pH
13:46:02	28-05-2024	14.30L/m	15.18L/m	33.00%	7.50pH
13:46:05	28-05-2024	15.90L/m	16.86L/m	33.00%	7.65pH
13:46:12	28-05-2024	35.31L/m	37.39L/m	36.00%	7.64pH
13:46:16	28-05-2024	16.94L/m	17.98L/m	36.00%	7.65pH
13:46:19	28-05-2024	15.90L/m	16.78L/m	36.00%	7.52pH
13:46:24	28-05-2024	22.45L/m	23.89L/m	38.00%	7.65pH
13:47:11	28-05-2024	18.45L/m	19.57L/m	53.00%	7.48pH
13:47:15	28-05-2024	19.97L/m	21.25L/m	53.00%	7.65pH
13:47:19	28-05-2024	15.90L/m	16.94L/m	56.00%	7.56pH
13:47:21	28-05-2024	14.62L/m	15.50L/m	58.00%	7.67pH
13:47:24	28-05-2024	15.02L/m	15.90L/m	56.00%	7.66pH
13:47:28	28-05-2024	15.82L/m	16.78L/m	58.00%	7.61pH
13:47:31	28-05-2024	14.54L/m	15.42L/m	60.00%	7.48pH
13:47:34	28-05-2024	15.10L/m	16.06L/m	60.00%	7.64pH
13:47:37	28-05-2024	17.98L/m	19.09L/m	60.00%	7.65pH
13:47:40	28-05-2024	14.86L/m	15.66L/m	62.00%	7.55pH
13:47:43	28-05-2024	15.90L/m	16.86L/m	62.00%	7.62pH
13:47:46	28-05-2024	15.82L/m	16.86L/m	62.00%	7.51pH
13:47:50	28-05-2024	18.45L/m	19.57L/m	64.00%	7.51pH
13:47:53	28-05-2024	16.30L/m	17.42L/m	64.00%	7.68pH
13:48:08	28-05-2024	73.90L/m	78.77L/m	69.00%	7.46pH
13:48:12	28-05-2024	17.42L/m	18.45L/m	71.00%	7.51pH
13:48:15	28-05-2024	16.38L/m	17.42L/m	71.00%	7.59pH
13:48:18	28-05-2024	15.34L/m	16.30L/m	73.00%	7.46pH
13:48:22	28-05-2024	17.90L/m	19.01L/m	73.00%	7.47pH
13:48:25	28-05-2024	16.86L/m	17.98L/m	73.00%	7.60pH
13:48:29	28-05-2024	19.49L/m	20.77L/m	76.00%	7.44pH
13:48:32	28-05-2024	15.90L/m	16.86L/m	76.00%	7.48pH
13:48:35	28-05-2024	15.82L/m	16.86L/m	78.00%	7.53pH
13:48:39	28-05-2024	17.98L/m	19.09L/m	78.00%	7.55pH
13:48:42	28-05-2024	16.46L/m	17.42L/m	80.00%	7.50pH
13:48:46	28-05-2024	14.46L/m	15.34L/m	80.00%	7.52pH
13:48:50	28-05-2024	12.30L/m	13.02L/m	80.00%	7.62pH
13:48:52	28-05-2024	7.35L/m	7.67L/m	80.00%	7.44pH
13:48:56	28-05-2024	9.27L/m	9.35L/m	82.00%	7.63pH
13:48:59	28-05-2024	8.95L/m	6.63L/m	82.00%	7.42pH
13:49:03	28-05-2024	7.67L/m	8.71L/m	80.00%	7.62pH
13:49:06	28-05-2024	5.83L/m	5.91L/m	82.00%	7.61pH
13:49:09	28-05-2024	4.47L/m	5.35L/m	80.00%	7.47pH
13:49:21	28-05-2024	4.31L/m	3.67L/m	82.00%	7.23pH
13:49:27	28-05-2024	0.00L/m	0.00L/m	82.00%	7.41pH
13:49:34	28-05-2024	0.00L/m	0.00L/m	82.00%	7.94pH
13:49:41	28-05-2024	0.00L/m	0.00L/m	80.00%	7.25pH
13:49:48	28-05-2024	0.00L/m	0.00L/m	80.00%	7.51pH
13:49:55	28-05-2024	0.00L/m	0.00L/m	80.00%	7.89pH

Reference:

This project is a part of my academic curriculum, and its development is influenced by the following sources:

- United Nations Water report (2020)

- World Health Organization (WHO) guidelines for water reuse

- Research papers on IoT applications in water management and grey water systems

- Industry reports on water conservation and sustainability

The project draws inspiration from successful implementations of IoT-based water management systems globally and aims to contribute to the growing body of knowledge in this field. By integrating IoT technology with grey water management, this project seeks to promote water efficiency, reduce water waste, and support sustainable development.

Some specific references that you can use are:

- UN Water. (2020). Water Scarcity.

- WHO. (2019). Guidelines for Water Reuse.

- Singh et al. (2020). IoT-Based Water Management Systems: A Review.

- Water Conservation Alliance. (2022). Water Efficiency and Sustainability Report.