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PROJECT 8: SMART WATER FOUNTAIN
PHASE 5

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SMART WATER FOUNTAIN

INTRODUCTION:

A smart water fountain is a water fountain that uses sensors and the Internet of Things (IoT) to monitor and control water quality, flow rate, and other factors. Smart water fountains can be used in a variety of settings, including public parks, schools, workplaces, and homes.

Some of the key features of smart water fountains include:

- **Water quality monitoring:** Smart water fountains can monitor water quality for impurities such as bacteria,viruses, and chemicals. This information can be used to alert users of any potential health risks and to ensure that the water is safe to drink.

- **Flow rate control:** Smart water fountains can control the flow rate of water to prevent waste and conserve resources. This is especially important in areas where water is scarce.
- **Remote monitoring and control:** Smart water fountains can be monitored and controlled remotely using a smartphone app or other web-based interface. This allows users to check the water quality, flow rate, and other parameters of the fountain from anywhere in the world.

Smart water fountains can also be equipped with additional features, such as:

- **Foot pedal operation:** This allows users to dispense water without touching the fountain, which can help to reduce the spread of germs.
- **UV sterilization:** This can be used to kill bacteria and viruses in the water, making it even safer to drink.
- **Water level sensors:** These sensors can alert users when the water level in the fountain is low, so that they can refill it promptly.
- **Data collection and analytics:** Smart water fountains can collect data on water usage, water quality, and other factors. This data can be used to improve the efficiency and

effectiveness of the fountain, as well as to identify potential problems.

Smart water fountains offer a number of benefits over traditional water fountains. They can help to ensure that the water is safe to drink, conserve resources, and reduce the spread of germs. Smart water fountains can also be equipped with additional features that make them more convenient and user-friendly.

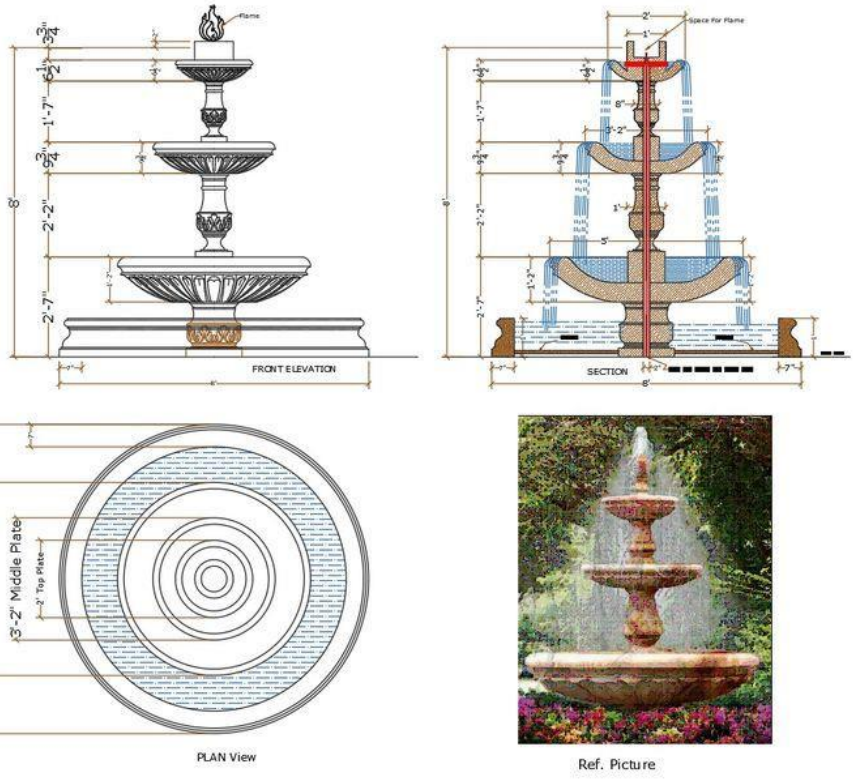
Here are some examples of how smart water fountains are being used today:

- **In public parks:** Smart water fountains can be used to provide safe and convenient drinking water to park visitors. They can also be used to collect data on water usage and water quality, which can be used to improve park management.
- **In schools:** Smart water fountains can be used to encourage students to drink more water and to reduce the risk of dehydration. They can also be used to educate students about water conservation and water quality.
- **In workplaces:** Smart water fountains can be used to provide employees with safe and convenient drinking water and to reduce the risk of waterborne illnesses. They can also be used to collect data on water usage and water quality, which can be used to reduce costs and improve sustainability.
- **In homes:** Smart water fountains can be used to provide homeowners with safe and convenient drinking water.They can also be used to monitor water quality and to identify potential problems.

Overall, smart water fountains are a promising new technology that can help to improve the safety, efficiency, and sustainability of water fountains.

CONCEPT OF SMART WATER FOUNTAIN:

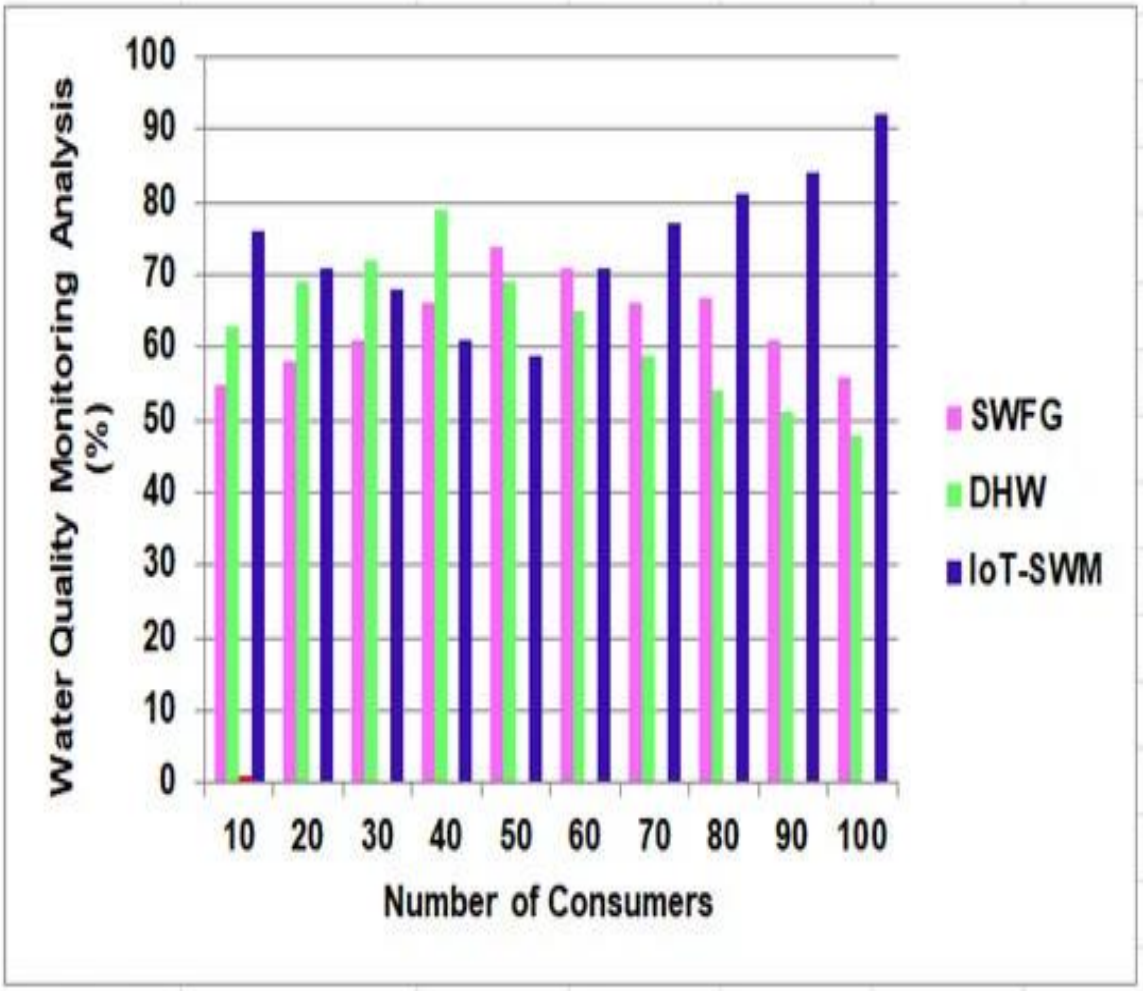
A smart water fountain is a drinking fountain that uses sensors and software to collect and analyze data about its usage,water quality, and other factors. This data can be used to improve the fountain's efficiency, reduce water waste, and ensure that users have access to clean, safe drinking water.



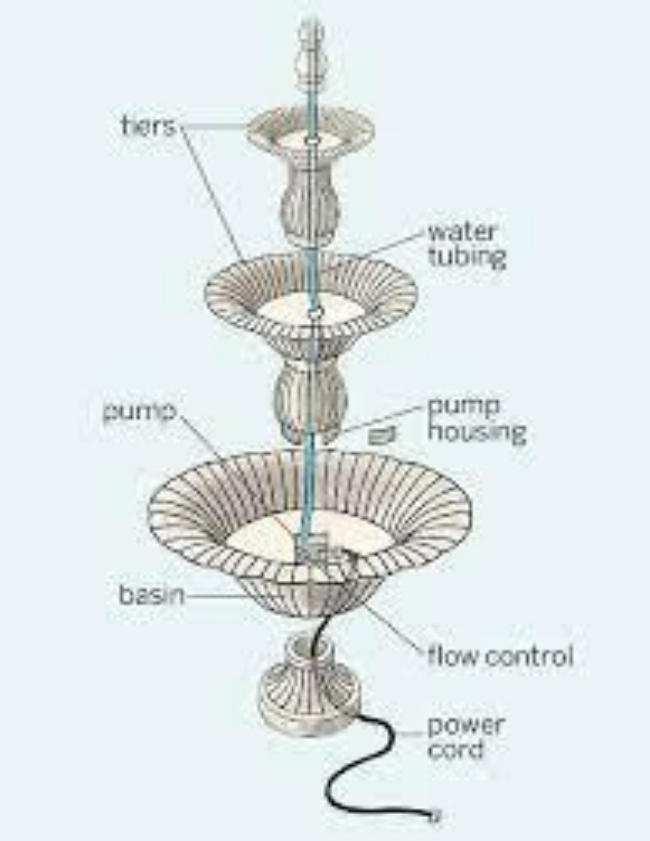
Some of the features of smart water fountains include:

- **Water quality monitoring:** Smart water fountains can use sensors to monitor the water quality in real time. This data can be used to detect contaminants and other problems, and to ensure that the water is safe to drink.

- **Usage monitoring:** Smart water fountains can also track how much water is being used.



- **Leak detection:** Smart water fountains can use sensors to detect leaks. This can help to prevent water waste and damage to the fountain itself.
- **Remote monitoring and control:** Smart water fountains can be connected to the internet, allowing them to be monitored and controlled remotely. This can be useful for managing multiple fountains or for fountains that are located in remote areas.



Smart water fountains can be used in a variety of settings, including public parks, schools, office buildings, and homes.They can also be used to provide drinking water for pets.

Here are some specific examples of how smart water fountains are being used today:

- In the city of Istanbul, Turkey, smart water fountains are being used to provide drinkable water to people in public spaces. The fountains use sensors to monitor water quality and flow rate, and they can be controlled remotely to ensure that they are operating efficiently.
- In the United States, the company Nuvation Engineering is developing smart water fountains for use in schools and other public buildings. The fountains use sensors to monitor water quality and usage, and they can be connected to the internet to provide real-time data on their performance.

- The company TESLA Smart makes a smart pet fountain that can be controlled remotely using a mobile app. The fountain uses a UV lamp to purify the water, and it has a low-water sensor that alerts users when the water level gets too low.

Smart water fountains are still a relatively new technology, but they have the potential to make a significant contribution to water conservation and public health.

CONSTRUCTION OF SMART WATER FOUNTAIN:

To construct a smart water fountain, you will need the following components:

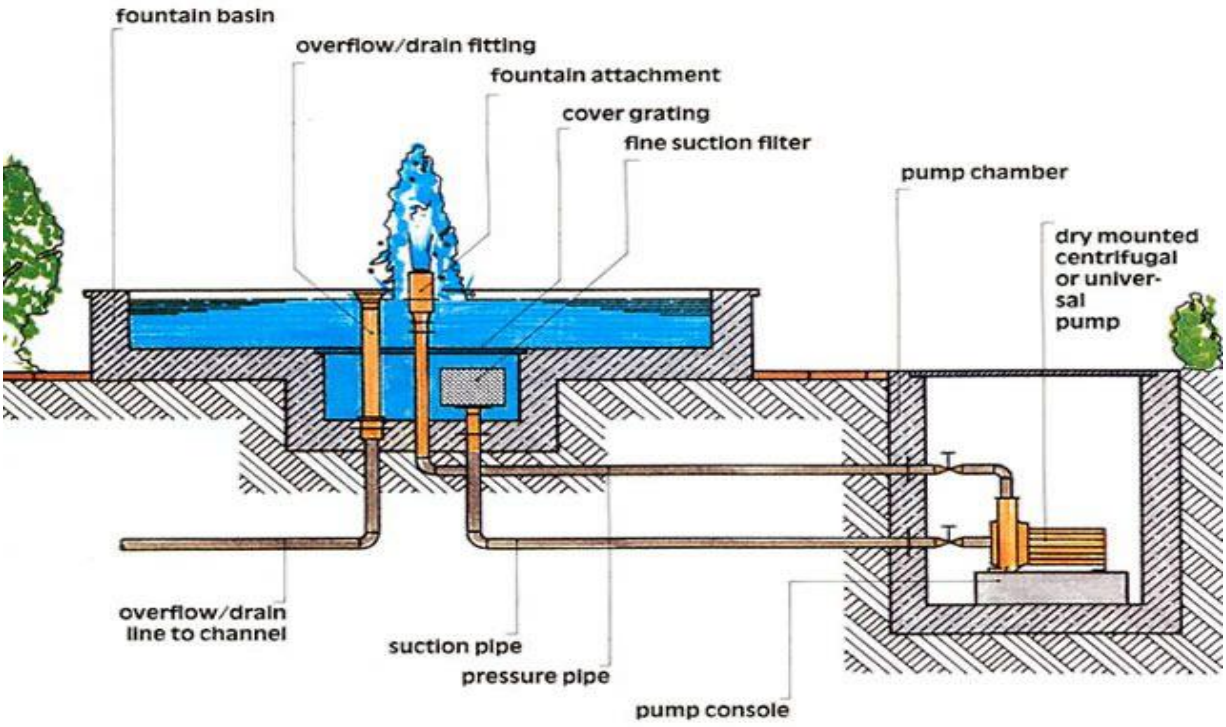
- A microcontroller, such as an Arduino or Raspberry Pi
- Water pumps
- Solenoid valves
- Water level sensors
- Flow sensors
- Temperature sensors
- Power supply
- Enclosure
- Other materials, such as PVC pipes, fittings, and electrical wire

Once you have gathered your components, you can begin assembling your smart water fountain. Here is a general overview of the steps involved:

1. **Design the fountain**. This includes deciding on the overall layout of the fountain, as well as the placement of the different components. You should also create a wiring diagram for the electrical components.

2. **Build the fountain structure**. This may involve cutting and assembling PVC pipes or using other materials to create the desired shape.
3. **Install water pumps and solenoid valves**. The water pumps will be used to circulate the water through the fountain, and the solenoid valves will be used to control the flow of water to different parts of the fountain.
4. **Install the water level sensors and flow sensors**. The water level sensors will be used to monitor the water level in the fountain and turn on the water pumps if necessary. The flow sensors will be used to monitor the flow of water through the fountain and provide data to the microcontroller.
5. **Install the temperature sensors.** The temperature sensors will be used to monitor the temperature of the water in the fountain and provide data to the microcontroller.
6. **Wire all of the components together**. This should be done according to the wiring diagram that you created in step 1.
7. **Program the microcontroller.** The microcontroller will be responsible for controlling all of the different components of the smart water fountain. You will need to write a program that tells the microcontroller how to respond to the data from the sensors and how to control the water pumps, solenoid valves, and other devices.
8. **Test the fountain**. Once the fountain is assembled and programmed, you should test it to make sure that it is working properly. This includes checking the water level sensors, flow sensors, temperature sensors, and water pumps.

Once you are satisfied with the performance of the fountain, you can install it in its desired location. You can also connect the fountain to a network to allow remote monitoring and control.



Here are some additional features that you can add to your smart water fountain:

- **RGB LED lights:** You can use RGB LED lights to create different lighting effects for your fountain. The lights can be controlled by the microcontroller to create dynamic and interesting displays.
- **Music synchronization:** You can synchronize the fountain's water displays with music. This can be done using a microphone to detect the sound of the music and then using the microcontroller to control the water pumps and solenoid valves accordingly.
- **Internet of Things (IoT) connectivity:** You can connect your smart water fountain to the internet so that you can monitor and control it remotely. This can be done using a variety of IoT protocols, such as Wi-Fi, Bluetooth, or ZigBee.

With a little creativity and effort, you can build a smart water fountain that is both beautiful and functional.

PURPOSE OF SMART WATER FOUNTAIN:

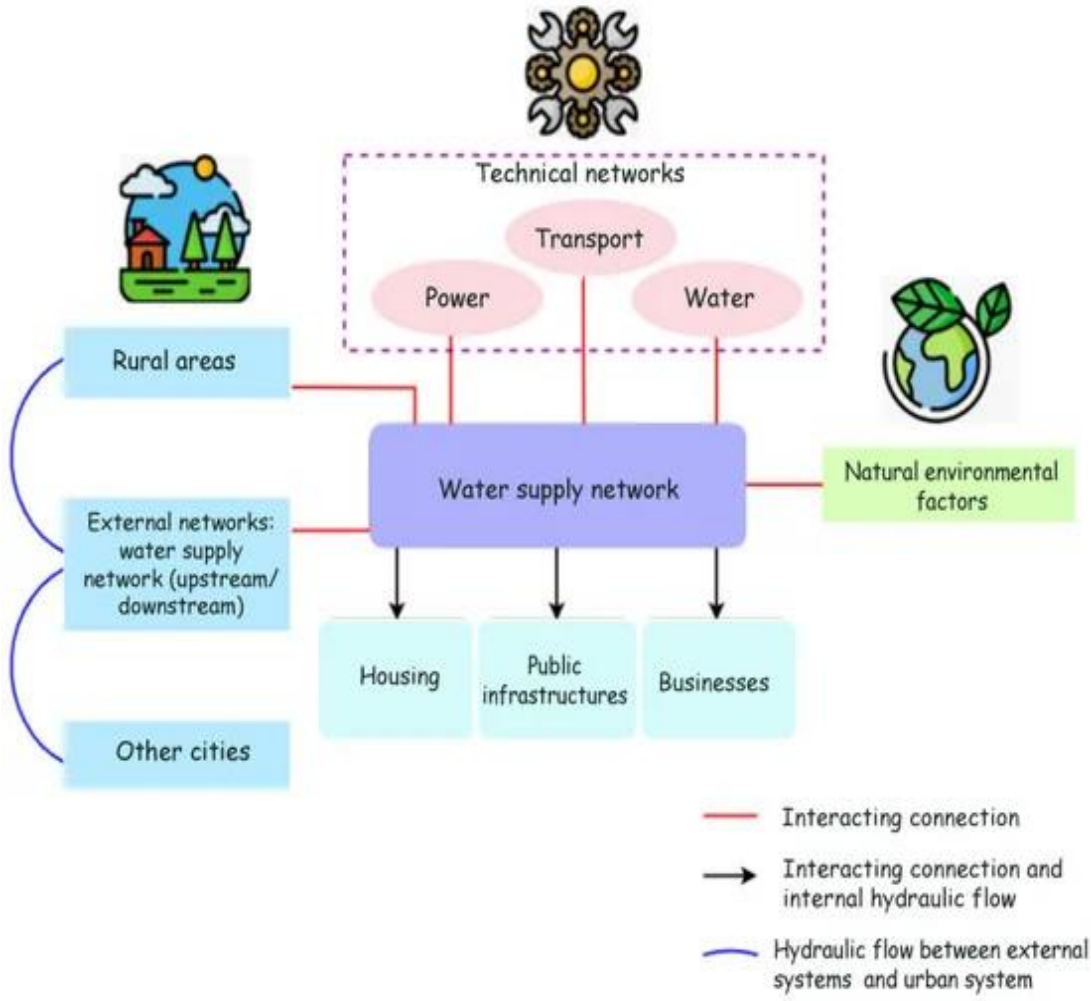
The purpose of a smart water fountain is to provide clean, fresh water to users in a convenient and sustainable way. Smart water fountains use sensors and other technologies to monitor water quality, usage, and system health. They can also be controlled remotely using a mobile app.

Some of the key benefits of smart water fountains include:

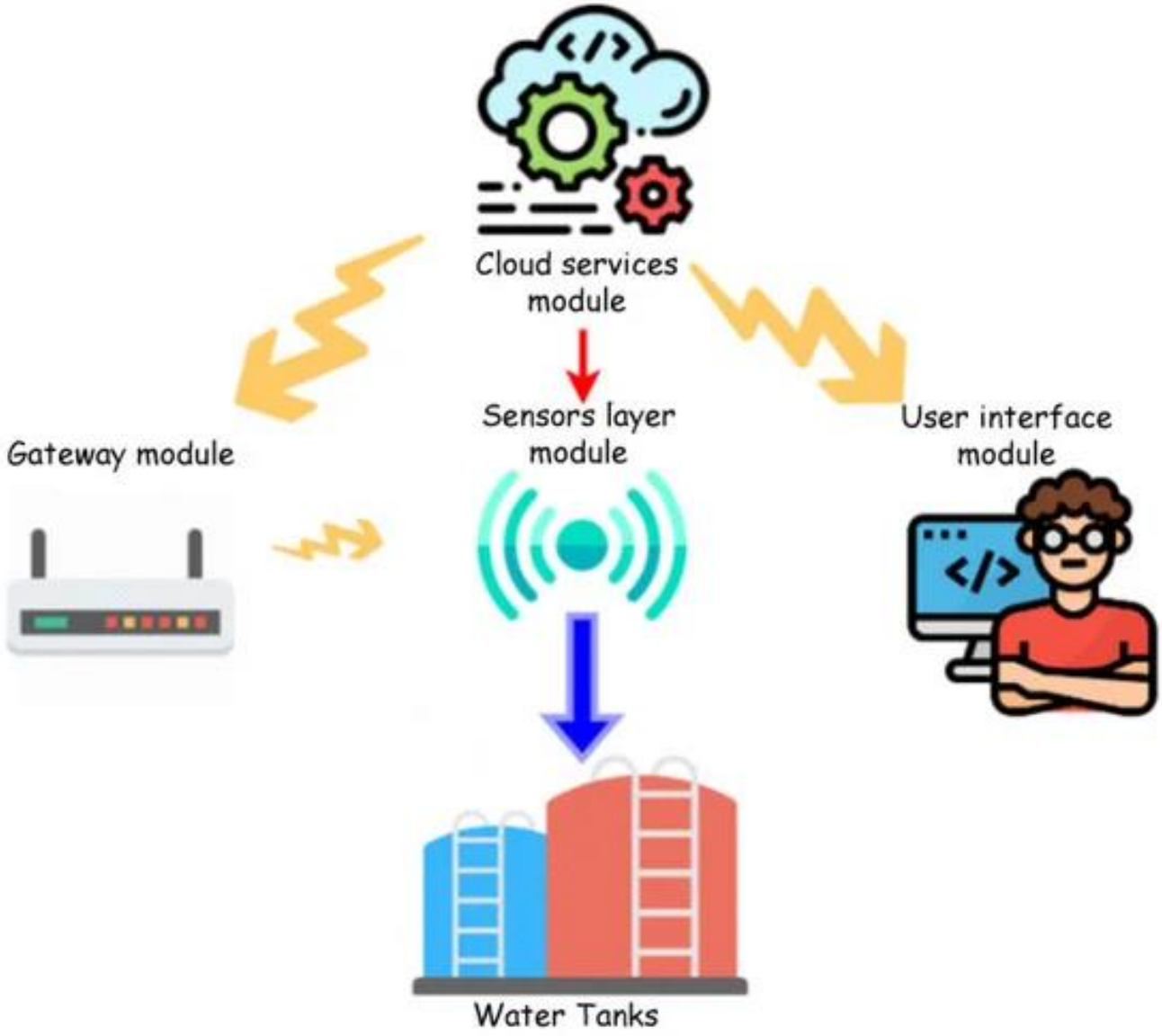
- **Improved water quality:** Smart water fountains can use multiple filtration technologies to remove impurities from the water, including sediment, chlorine, and bacteria. This ensures that users have access to clean, safe drinking water.
- **Reduced water waste:** Smart water fountains can monitor water usage and automatically adjust the flow rate to reduce waste. This is especially beneficial in areas where water resources are scarce.
- **Increased convenience:** Smart water fountains can be controlled remotely using a mobile app. This allows users to check water levels, filter status, and other information without having to physically visit the fountain.
- **Improved sustainability:** Smart water fountains can be used to collect data on water usage and trends. This data can be used to develop more sustainable water management practices.

Smart water fountains can be used in a variety of settings, including:

- **Public places:** Parks, plazas, and other public spaces can benefit from the convenience and sustainability of smart water fountains.
- **Schools and universities:** Smart water fountains can help to ensure that students have access to clean, fresh water throughout the day.



- **Businesses and offices:** Smart water fountains can provide employees with a convenient and healthy way to stay hydrated.
- **Homes:** Smart water fountains can be used in homes with pets or people who have special dietary needs.



Overall, smart water fountains are a valuable tool for improving water quality, reducing waste, and increasing convenience and sustainability. As technology continues to develop, we can expect to see smart water fountains becoming more common in a variety of settings.

APPLICATIONS OF SMART WATER FOUNTAIN:

Smart water fountains are an innovative and technology-driven approach to traditional water fountains. They incorporate various features and capabilities that make them more efficient, user-friendly, and environmentally conscious. Here are some applications of smart water fountains:

1. **Public Spaces and Parks:** Smart water fountains can be installed in public parks, recreational areas, and city streets to provide clean and safe drinking water to the public. They can include features like bottle filling stations, water quality monitoring, and touchscreen interfaces for information and entertainment.

2. **Educational Institutions:** Schools and universities can benefit from smart water fountains by offering students access to clean drinking water. These fountains can track water consumption, helping schools promote hydration among students. Some models can also display educational content or reminders.

3. **Healthcare Facilities:** In hospitals and clinics, it's essential to maintain strict hygiene standards. Smart water fountains with touchless operation and sensors for monitoring water quality can help minimize the risk of contamination.

4. **Corporate Offices:** Many modern office spaces have embraced the concept of wellness, and smart water fountains fit into this trend. They can be integrated into office designs to

provide employees with clean drinking water and track their hydration levels.

5. **Events and Festivals: Temporary** events like music festivals or outdoor fairs can benefit from smart water fountains as a sustainable and convenient way to provide water to attendees. These fountains can also be used to promote eco-friendly practices.

6. **Sports Facilities: Smart** water fountains can be installed in sports stadiums and arenas to encourage hydration among athletes and spectators. They can provide real-time data on water consumption and promote responsible water use.

7. **Environmental Monitoring:** Some smart fountains include sensors to monitor water quality, temperature, and usage. This data can be valuable for environmental research, allowing researchers to track trends in water quality and consumption.

8. **Tourist Attractions:** Water fountains at tourist destinations can incorporate interactive features, such as information screens with details about the attraction, nearby points of interest, and local history.

9. **Water Conservation:** Smart water fountains can include features like automatic shutoff to prevent water wastage. They can also help raise awareness about the importance of conserving water resources.

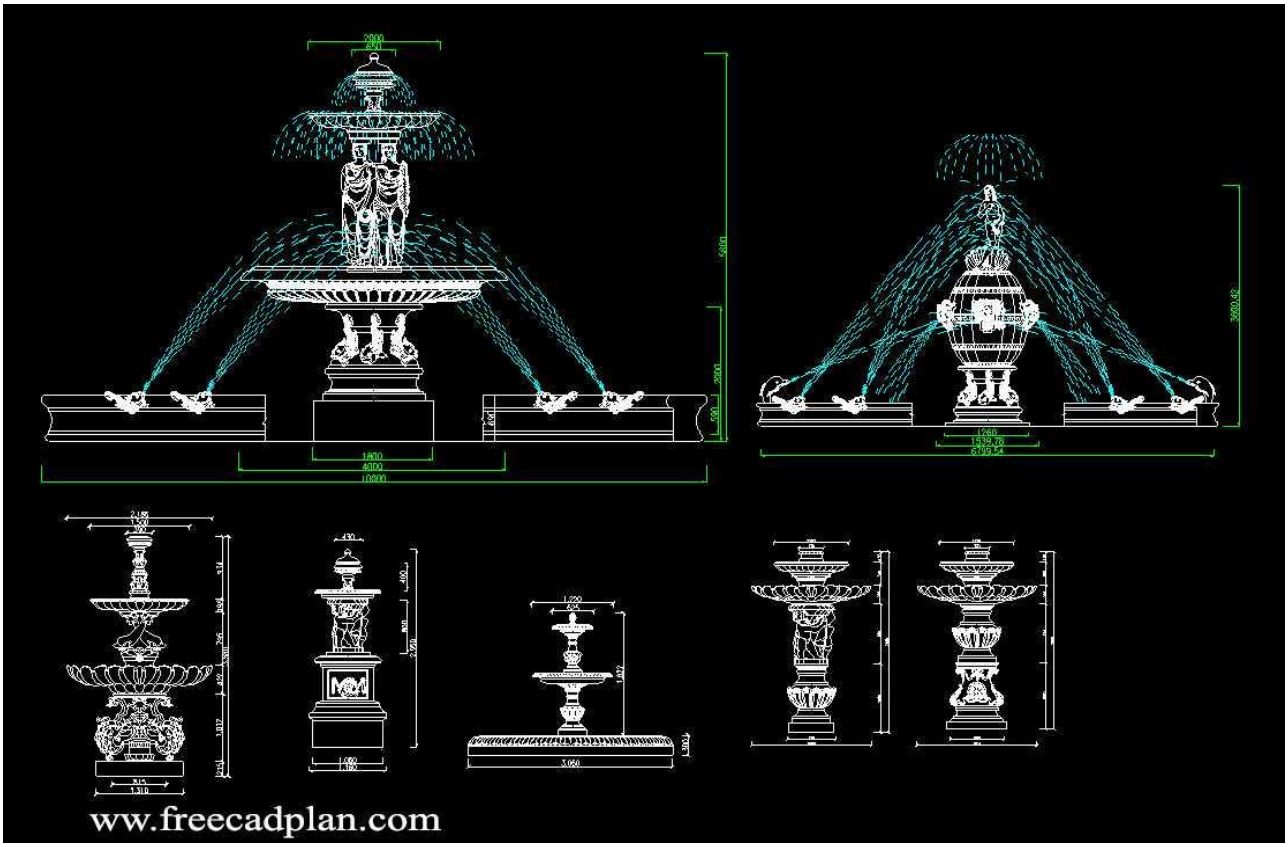
10. **Emergency Situations:** In disaster-prone areas or during emergencies, smart water fountains can be a critical resource for providing clean water to affected populations. They can include backup power sources and water purification capabilities.

11. **Data Collection and Analysis: The** data collected from smart water fountains, including usage patterns and water quality information, can be analyzed to make informed decisions about infrastructure and maintenance.

12. **Promotion of Sustainable Practices:** By displaying real-time data on water consumption and highlighting the environmental impact of bottled water, smart fountains can promote sustainable and eco-friendly practices.

Incorporating technology into traditional water fountains not only enhances user experience but also supports sustainability and the efficient use of water resources. The applications of smart water fountains are diverse and continue to expand as technology evolves.

DESIGN IN AUTOCAD:

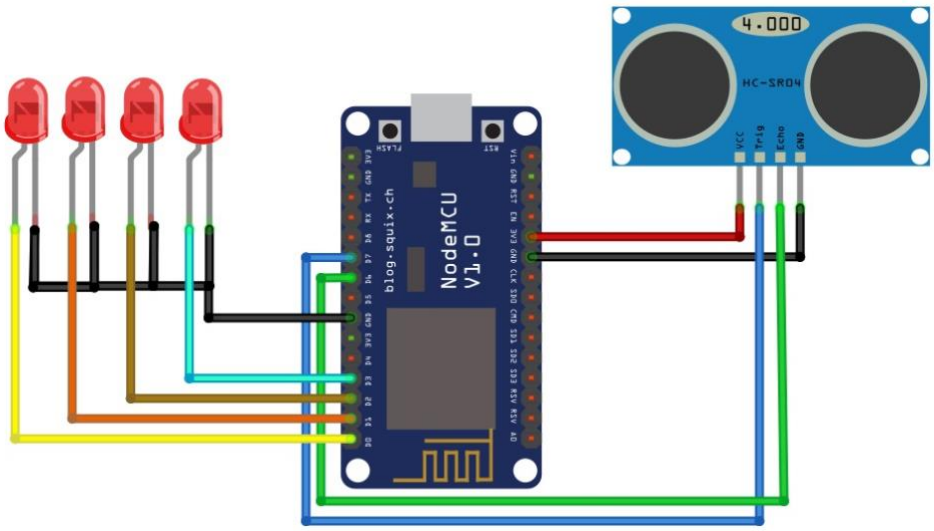


ESP 8266:

Creating a smart water fountain using an ESP8266 microcontroller can be a fun and practical project. With this setup, you can remotely control and monitor your water fountain, making it more efficient and interactive. Here's a general outline of the steps to create a smart water fountain using an ESP8266:

Components You'll Need:

1. ESP8266 (NodeMCU, Wemos D1 Mini, etc.)
2. Water pump
3. Water level sensor (e.g., ultrasonic or float switch)
4. Relay module
5. Power supply for the water pump
6. Tubing and a nozzle for water flow
7. Container for the water
8. Smartphone or computer for remote control
9. Wi-Fi network



Step 1: Hardware Setup

1. **Connect the Water Pump:** Wire the water pump to the relay module. The relay will allow the ESP8266 to control the pump's power.

2. **Install the Water Level Sensor:** Connect the water level sensor to the ESP8266. This sensor will help monitor the water level in the fountain.

3. **Assemble the Fountain:** Set up the fountain structure with the tubing and nozzle. Ensure the water pump is submerged in the water container.

Step 2: ESP8266 Programming

You will need to program your ESP8266 to control the water pump and monitor the water level. You can use the Arduino IDE with the ESP8266 libraries for this. Below are some example steps:

1. Set up the Arduino IDE with ESP8266 support.

2. Write code to control the water pump using a relay. You can create a simple web interface to start and stop the water pump. Make sure to include Wi-Fi connectivity to connect to your network.

3. Add code to read data from the water level sensor. This can be done using the GPIO pins on the ESP8266. Based on the water level, you can decide when to turn the pump on or off.

4. Implement safety features, like automatic shutoff if the water level gets too low or if there's a malfunction with the pump.

5. You can enhance your project by integrating additional features like a schedule, adjustable water flow, and notifications to your smartphone.

Step 3: Web Interface and Remote Control

Once the ESP8266 is programmed, you can access it through a web interface. You can use HTML and JavaScript to create a user-friendly interface for controlling the water fountain remotely.

1. Create a web page that allows you to start and stop the water pump, adjust settings, and view the water level.

2. Host this web page on the ESP8266 so you can access it from your smartphone or computer.

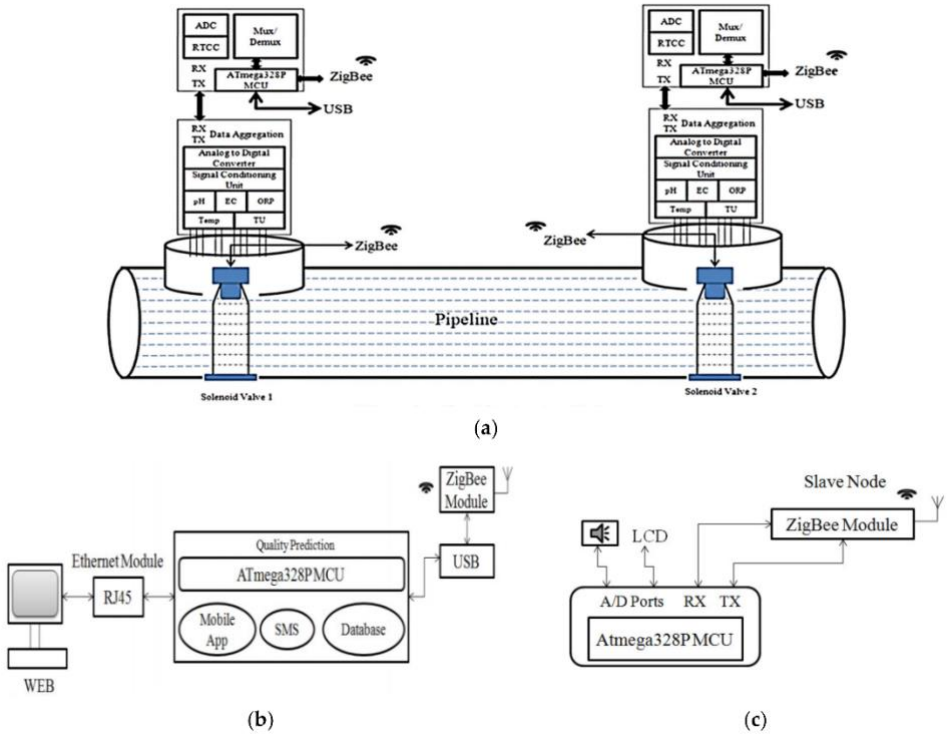
3. Secure the interface with a username and password to prevent unauthorized access.

Step 4: Testing and Troubleshooting

Test your smart water fountain thoroughly. Make sure the water pump turns on and off as expected, and the water level sensor accurately detects the water level.

Step 5: Deployment

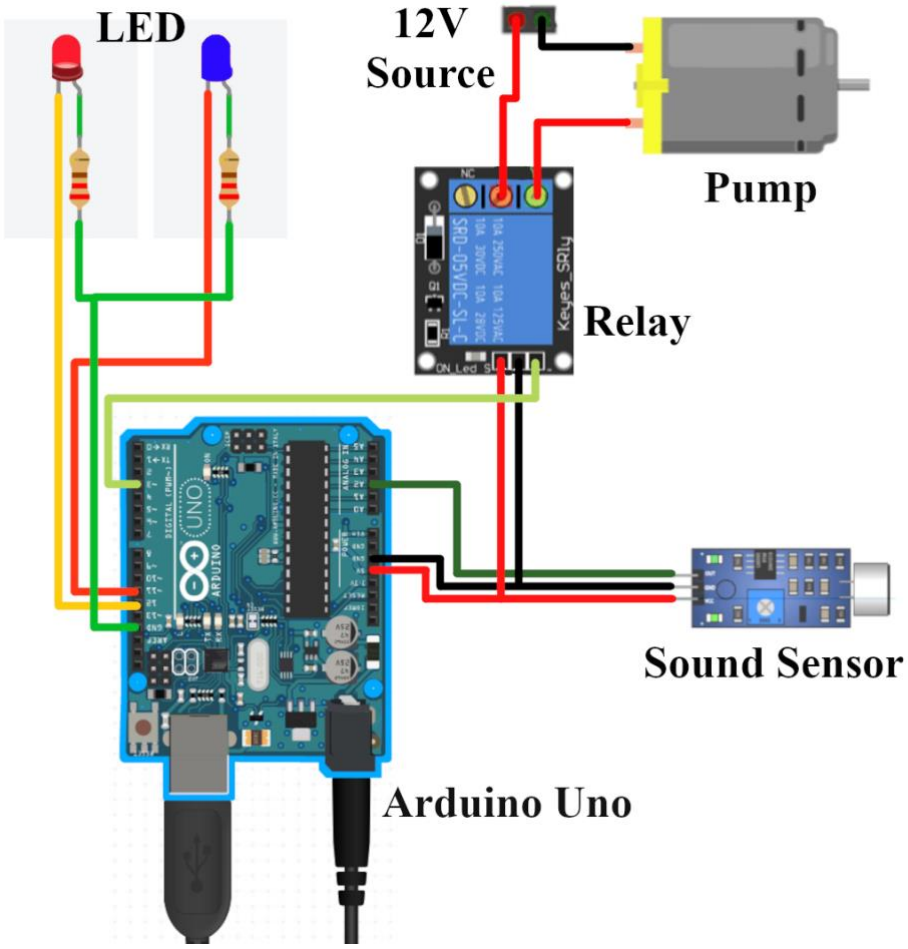
Place your smart water fountain in your desired location and connect it to a stable power source. Ensure that the ESP8266 has a reliable Wi-Fi connection.



With this setup, you can remotely control your water fountain, monitor its water level, and make it interactive and fun. You can further expand this project by adding features like automatic scheduling, voice control, or integration with home automation systems.

ARDUINO UNO AND GPS:

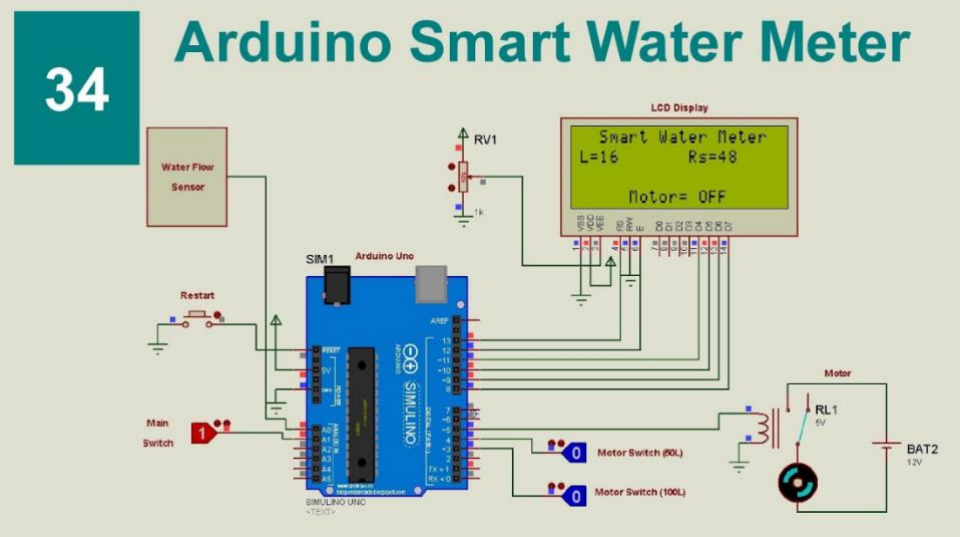
Creating a smart water fountain using an Arduino Uno and a GPS module can be a fun and educational project. Such a system could be designed to track the location of the water fountain and potentially gather data about its usage or water quality. Here's a high-level overview of how you might approach this project:



Components Needed:

1. Arduino Uno or compatible board
2. GPS module (e.g., NEO-6M or NEO-7M)
3. Water pump

4. Water reservoir
5. Water level sensor (e.g., ultrasonic sensor or float switch)
6. Enclosure for the electronics
7. Power supply (e.g., a 12V power adapter)
8. Tubing and fittings
9. Relay module (if using a high-power pump)



Step-by-Step Guide:

1. **GPS Module Setup:**

   - Connect the GPS module to the Arduino Uno using the appropriate pins (usually TX and RX pins). Be sure to connect the GPS module to 5V and GND as well.

   - Install the necessary Arduino libraries for parsing GPS data.

2. **Water Pump and Reservoir:**

- Set up the water pump inside the water reservoir.

- Ensure there's a suitable outlet for the water to flow from the pump.

3. **Water Level Sensing:**

- Install the water level sensor in the reservoir to monitor the water level.

- Connect the water level sensor to the Arduino Uno, typically using analog or digital pins.

4. **Code Implementation:**

- Write Arduino code to:

  - Initialize and read data from the GPS module.

  - Monitor the water level sensor.

  - Control the water pump based on GPS location and water level.

  - Possibly gather data, such as the time the fountain was used and its location.

Here's a simplified example of the Arduino code structure:

```cpp
#include <SoftwareSerial.h> // Library for using SoftwareSerial
#include <TinyGPS.h> // Library for parsing GPS data
```

```
SoftwareSerial gpsSerial(3, 4); // Create a SoftwareSerial object for GPS communication
TinyGPS gps; // Create a TinyGPS object to parse GPS data

const int waterLevelPin = A0; // Pin for water level sensor
const int pumpPin = 7; // Pin for controlling the water pump

void setup() {
  Serial.begin(9600); // Initialize the serial monitor
  gpsSerial.begin(9600); // Initialize GPS serial communication
  pinMode(pumpPin, OUTPUT); // Set pumpPin as an output
}

void loop() {
  // Read and parse GPS data
  while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
      // Extract GPS information (latitude and longitude)
      float latitude, longitude;
      gps.get_position(&latitude, &longitude);

      // Read water level sensor
      int waterLevel = analogRead(waterLevelPin);
```

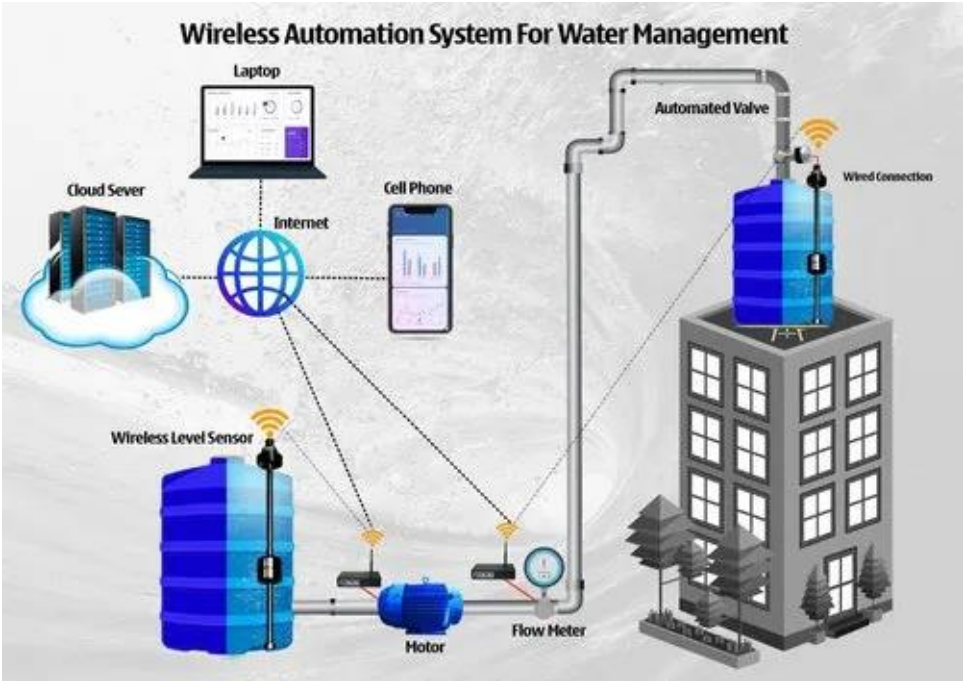
```
    // Control the water pump based on conditions (e.g., location and water level)
    if (latitude > desiredLatitude && waterLevel > desiredWaterLevel) {
      digitalWrite(pumpPin, HIGH); // Turn on the pump
    } else {
      digitalWrite(pumpPin, LOW); // Turn off the pump
    }
  }
 }
}
```

Please note that this is a simplified example. You may need to adapt the code to your specific requirements, and additional features such as data logging or remote control via a smartphone app can be implemented.

Also, remember to take safety precautions when working with water and electronics to prevent any damage or accidents.

PYTHON CODE:

Creating a smart water fountain with an ESP8266 microcontroller involves various components and programming. Here's a simplified example of Python code that you can use as a starting point to build your smart water fountain. This example assumes you have an ESP8266 module, a water pump, and some form of water level sensor.



First, make sure you have the necessary libraries installed. You can install them using pip:

```bash
pip install adafruit-io
pip install adafruit-circuitpython-mcp3xxx
```

You'll also need an Adafruit IO account for cloud integration. Make sure you create an account and set up your credentials.

Now, let's create the Python code for the smart water fountain:

```python
import time
import board
import digitalio
import busio
import adafruit_mcp3xxx.mcp3008 as MCP
from adafruit_mcp3xxx.analog_in import AnalogIn
from adafruit_io import MQTTClient

# Replace with your Adafruit IO credentials
ADAFRUIT_IO_USERNAME = 'your_username'
```

```
ADAFRUIT_IO_KEY = 'your_key'

# Define the ADAFRUIT_IO_FEED_NAME for the water level data
WATER_LEVEL_FEED = 'water-level'

# Define the pins for the water pump and water level sensor
PUMP_PIN = digitalio.DigitalInOut(board.D4)
WATER_LEVEL_SENSOR = AnalogIn(MCP.MCP3008(busio.SPI(), board.D22))

# Define water level threshold (adjust as needed)
WATER_LEVEL_THRESHOLD = 15000

# Function to control the water pump
def control_water_pump(status):
    PUMP_PIN.value = status

# Function to publish water level data to Adafruit IO
def publish_water_level(client):
    client.publish(WATER_LEVEL_FEED, str(WATER_LEVEL_SENSOR.value))

# Callback when connected to Adafruit IO
```

```
def connected(client):
    print('Connected to Adafruit IO!')
    client.subscribe(WATER_LEVEL_FEED)

# Callback when message is received from Adafruit IO
def message(client, feed_id, payload):
    if feed_id == WATER_LEVEL_FEED:
        water_level = int(payload)
        if water_level < WATER_LEVEL_THRESHOLD:
            control_water_pump(True)
        else:
            control_water_pump(False)

# Main code
if __name__ == '__main__':
    # Initialize the water pump
    PUMP_PIN.direction = digitalio.Direction.OUTPUT
    control_water_pump(False)

    # Initialize Adafruit IO MQTT client
    client = MQTTClient(ADAFRUIT_IO_USERNAME,
ADAFRUIT_IO_KEY)
    client.on_connect = connected
```

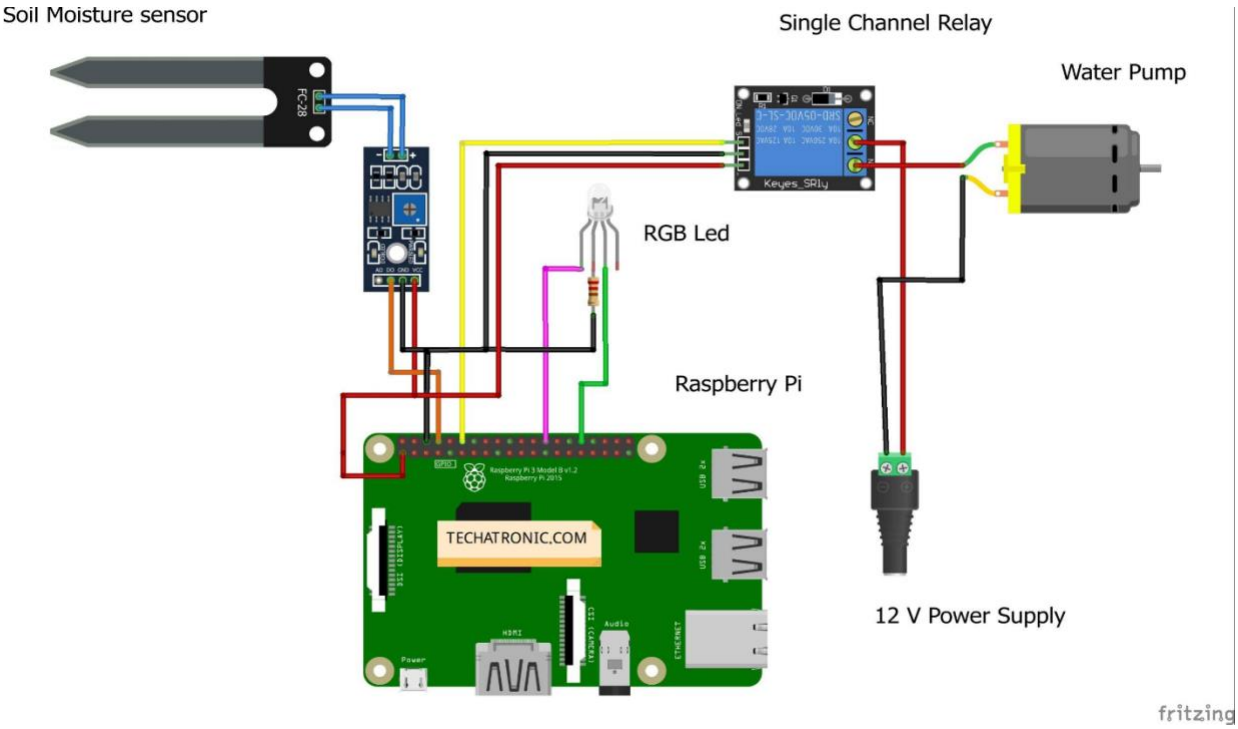
```
    client.on_message = message

    # Connect to Adafruit IO
    client.connect()

    try:
        while True:
            publish_water_level(client)
            client.loop_background()
            time.sleep(5)  # Adjust the frequency of water level checks
    except KeyboardInterrupt:
        control_water_pump(False)  # Turn off the pump on exit
```

This code reads the water level from a sensor connected to the MCP3008 analog-to-digital converter and controls a water pump based on the water level. When the water level falls below a certain threshold, the pump is turned on. When it's above the threshold, the pump is turned off. The water level data is published to Adafruit IO for monitoring and control.

Remember to adjust the `WATER_LEVEL_THRESHOLD` and other pins as per your specific hardware setup and requirements. Also, make sure your ESP8266 module is properly connected to your Wi-Fi network and that you've set up your Adafruit IO account with the appropriate credentials.



EFFECTS:

A "smart water fountain" can refer to a water fountain that incorporates technology to enhance its functionality, improve user experience, or provide additional features. Here are some potential effects and benefits of a smart water fountain:

1. **Hydration Promotion:**

Smart water fountains can encourage people to stay hydrated by making it convenient to access fresh, clean water. This can have positive effects on overall health and well-being.

2. **Reduction in Single-Use Plastic Waste:**

By providing a readily available source of drinking water, smart water fountains can help reduce the consumption of bottled water and, in turn, decrease plastic waste.

3. **Water Quality Monitoring:**

Some smart fountains are equipped with sensors that monitor water quality, ensuring that the water is safe to drink. This can have a positive impact on public health, as it helps prevent the consumption of contaminated water.

4. **Customization and Personalization:**

Smart fountains may allow users to adjust factors such as water temperature or flavorings (e.g., adding fruit or flavor packets). This personalization can make the drinking experience more enjoyable for individuals.

5. **Data Collection and Insights:**

Some smart fountains can collect data on usage patterns, such as the number of dispenses or the time of day when people use the fountain. This data can be valuable for facility management and understanding user preferences.

6. **Maintenance Efficiency:**

Smart fountains may be equipped with sensors that detect when maintenance is needed, such as filter replacements or cleaning.

This can help facility managers ensure the fountain's optimal functionality.

7. **Accessibility Features:**

Smart fountains can include features that make them more accessible to people with disabilities, such as adjustable heights, braille labels, or voice-activated controls.

8. **Water Conservation:**

Some smart fountains are designed to minimize water wastage by using sensors to dispense water only when a user is present. This can contribute to water conservation efforts.

9. **Promoting Eco-Friendly Practices:**

Some smart fountains are equipped with features like water bottle refill stations, which encourage reusable bottle use and reduce the environmental impact of disposable bottles.

10. **Integration with IoT Ecosystem:**

Smart water fountains can be integrated into larger Internet of Things (IoT) ecosystems, allowing for remote monitoring, control, and automation, enhancing user experience and operational efficiency.

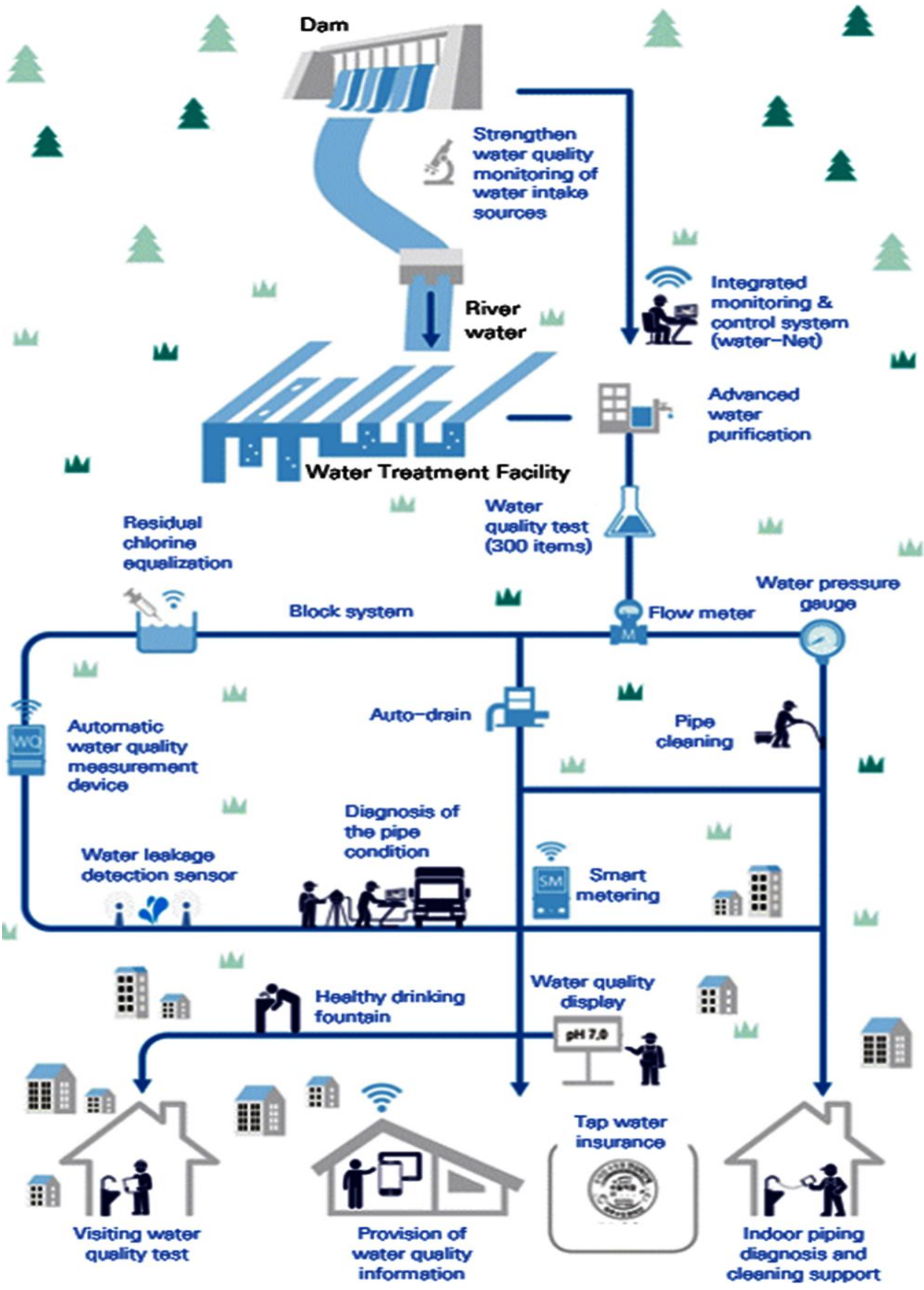
11. **Branding and Messaging:**

Smart fountains can display messages or advertisements on digital screens, promoting local businesses or important information to users.

12. **Emergency Preparedness:**

In some cases, smart water fountains can be programmed to provide emergency water access during disasters or crises, contributing to community resilience.

The effects of a smart water fountain will depend on the specific features and functionalities it offers, as well as the context in which it is deployed. In general, smart water fountains aim to improve hydration, reduce waste, and enhance user experience through technology and data-driven solutions.


Dam
Strengthen water quality monitoring of water intake sources
River water
Integrated monitoring & control system (water-Net)
Advanced water purification
Water Treatment Facility
Water quality test (300 items)
Residual chlorine equalization
Block system
Flow meter
Water pressure gauge
Automatic water quality measurement device
Auto-drain
Pipe cleaning
Diagnosis of the pipe condition
Water leakage detection sensor
Smart metering
Healthy drinking fountain
Water quality display
pH 7.0
Tap water insurance
Visiting water quality test
Provision of water quality information
Indoor piping diagnosis and cleaning support

CONCLUSION:

The smart water fountain is a modern and innovative solution designed to provide efficient and convenient access to clean drinking water. By integrating technology such as sensors, filtration systems, and touchless dispensers, it ensures a hygienic and user-friendly experience. With features like real-time monitoring and data analytics, it promotes water conservation and helps users stay hydrated while minimizing environmental impact. Overall, the smart water fountain represents a significant advancement in public hydration infrastructure, enhancing accessibility and sustainability in urban environments.