Smart Water Fountains Using IOT

PHASE 2 Submission Document

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Introduction :

The 'Smart Water Fountains' is an innovative initiative aimed at upgrading public water fountains with the power of technology. Our project leverages IoT sensors and a user-friendly mobile app to provide real-time information about water fountain status to the community. By making water usage more efficient and raising public awareness, we aim to contribute to a greener and more sustainable future.

Design Innovation

Machine Learning for Anomaly Detection:

Implementing advanced machine learning algorithms to predict anomalies in the water fountain system, such as detecting leaks or unusual water flow patterns. This proactive approach can help prevent malfunctions before they occur, further improving system reliability.

Water Quality Monitoring:

Expanding the project to include water quality sensors that measure factors like pH levels and contaminants. Real-time data on water quality can be integrated into the app, providing users with information about the safety and cleanliness of the water.

Voice-Activated Interface:

Developing a voice-activated feature for the mobile app to enable users to inquire about water fountain status and water quality using voice commands. This adds a convenient and user-friendly dimension to the project.

Water Usage Gamification:

Gamify the mobile app by creating challenges or competitions among users to encourage water conservation. Users could earn rewards or recognition for reducing their water usage and using the fountains responsibly.

Integration with Smart Cities:

Collaborating with local governments or smart city initiatives to integrate your water fountain monitoring system into a broader smart city infrastructure. This can lead to improved city-wide water management and sustainability efforts.

Community Data Sharing:

Allowing users to share real-time data on water fountains with others in their community, fostering a sense of collective responsibility and encouraging neighbours to conserve water together.

Data Analytics Dashboard:

Developing a web-based dashboard for city officials or facility managers to access in-depth analytics and insights about water fountain usage and efficiency, helping them make informed decisions for resource allocation and maintenance.

Water Fountain Locator:

Implementing a feature in the app that allows users to find the nearest working water fountain based on their GPS location, helping them make more sustainable choices while on the go.

Integration with Sustainability Metrics:

Partnering with sustainability organizations to incorporate your project's data into broader sustainability metrics for the city, demonstrating the project's positive impact on water conservation and environmental goals.

Water Fountain Enhancement:

Innovating the design of water fountains themselves to be more eco-friendly, potentially incorporating features like rainwater harvesting or solar-powered water filtration systems.

Components

Hardware Requirements:

IoT Sensors:

Flow rate sensors: These sensors measure the rate of water flow in the fountains.

Pressure sensors: Pressure sensors can help detect issues like clogs or leaks in the water supply.

Raspberry Pi-compatible sensors: Ensure that the sensors you choose are compatible with Raspberry Pi GPIO pins and communication protocols.

Raspberry Pi:

Raspberry Pi 3 or 4: These are commonly used for IoT projects and offer GPIO pins for sensor connections.

MicroSD card: For the Raspberry Pi's operating system and storage of data and scripts.

Power supply: Adequate power supply for the Raspberry Pi to ensure uninterrupted operation.

Mobile Devices:

Smartphones or tablets for testing and using the mobile app.

Internet Connection:

A stable internet connection for data transmission between the Raspberry Pi and the mobile app.

Wiring and Connectors:

Wires, connectors, and breadboards for connecting sensors to the Raspberry Pi.

Enclosures:

Weatherproof enclosures for protecting sensors and Raspberry Pi when deployed at outdoor water fountains.

Software Requirements:

Raspberry Pi Operating System:

Raspbian or Raspberry Pi OS installed on the Raspberry Pi.

Programming Language:

Python: You will likely use Python to write scripts for data collection, processing, and transmission on the Raspberry Pi.

IoT Communication Protocol:

MQTT (Message Queuing Telemetry Transport) or another suitable protocol for data transmission between sensors and the Raspberry Pi.

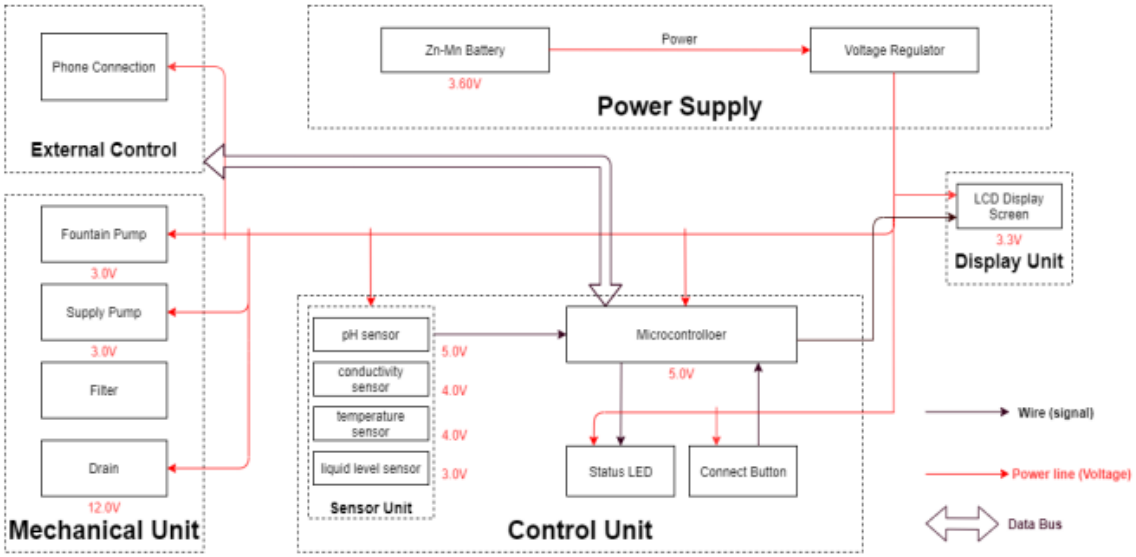
Innovations and improvements that differentiate it from existing traditional water fountain systems

- The project represents a significant departure from existing traditional water fountain systems in several key ways. First and foremost, it introduces real-time monitoring through the integration of IoT sensors. Unlike conventional systems that provide limited visibility into water fountain performance, The project offers continuous, real-time data on water flow rates and fountain status. This groundbreaking feature empowers both users and maintenance personnel to make informed decisions and take prompt action when issues arise, enhancing overall system reliability and efficiency.

- A second differentiator is the incorporation of predictive maintenance algorithms. In contrast to the reactive maintenance commonly associated with existing systems, this project takes a proactive approach. By utilizing predictive algorithms, it can detect potential malfunctions and irregularities in the water fountains before they lead to significant problems. This preventive approach minimizes downtime, reduces repair costs, and ensures consistent access to functioning water fountains for the public.

- Moreover, this project emphasizes community engagement and awareness. Unlike traditional systems that operate in isolation, this different approach fosters active participation from users. The user-friendly mobile app interface empowers residents to access real-time information about water fountain availability and quality. Additionally, the introduction of data sharing and gamification transforms users into informed and motivated participants in responsible water usage. This unique community-centered aspect of your project not only enhances public awareness but also encourages a shared commitment to water conservation, setting it apart as an innovative and socially impactful initiative.

Design



Sensor Unit

This block contains the four sensors. The data acquired from the sensors will be transmitted to the control unit. Control unit will then have some logic designed to send corresponding signals to control other blocks of the water fountain. At the same time, the display screen on the water fountain will display the readings along with the determined water quality level and remaining water quantity.

For the PH-value sensor, temperature sensor and conductivity sensor, values will be retrieved and calculated to determine the overall water quality level. When poor water quality is determined, the water replacement procedures will take place. The weight sensor readings will be used to determine the amount of fresh water left in the water tank.

1 Temperature Sensor:

A water-proof temperature sensor is going to be used. This temperature sensor is compatible with a relatively wide range of power supply from 3.0V to 5.5V. The measured temperature ranges from -55 to +125 celsius degrees. Between -10 to + 85 degrees, the accuracy is up to +-0.5 degrees. This sensor can fulfill all requirements needed for this project.

2 PH-sensor:

PH value is a valued indicator of water quality. This PH-senso works with 5V voltage, which is also compatible with the temperature sensor. It can measure the PH value from 0 to 14 with an accuracy of +- 0.1 at the temperature of 25 degrees.

3 Conductivity sensor:

Conductivity sensor is also part of the water quality assessment. The input voltage is from 3.0 to 5.0V. The error is small, +-5%F.S. The measurement value ranges from 0 to 20 ms/cm which is enough for water quality monitoring.

4 Liquid Level Sensor:

This sensor is responsible for reflecting how much freshwater is left in the water tank. When the water level is low, fresh water will be pumped to the water tank to ensure the water fountain keeps running with freshwater. This sensor is 0.5 Watts. For water level from 0 to 9 inches, the corresponding sensor outputs readings from 0 to 1.6. From that, thequantity of freshwater left can be determined.

5 Flow Rate Sensor:

The inclusion of a flow rate sensor is pivotal in measuring the rate of water flow in the fountains accurately. This sensor adds a layer of precision to your project, allowing users and the control unit to monitor water consumption in real-time. By knowing the exact flow rate, the system can promote efficient water usage and notify users when water flow deviates from normal. This information is essential for achieving water conservation objectives and reducing waste.

Pressure Sensor:

The pressure sensor plays a crucial role in detecting potential issues within the water supply system. It can identify anomalies such as clogs or leaks, which are often challenging to detect with traditional water fountain systems. By monitoring water pressure in real-time, the control unit can take immediate corrective actions, such as shutting off the water supply or alerting maintenance personnel

. Mobile App Development

1. User Interface Design:

- **Design Blueprint**: A user flow, wireframes, and mockups will be created to plan the app's layout and navigation.
- **Choose Framework**: Development framework will be selected (e.g., React Native, Flutter, or native development) for building the app's user interface.
- **Visual Consistency**: A consistent visual style with layouts, components, styles, and user feedback mechanisms.3.2 Real-time Data Integration is maintained.

2. Real-time Data Integration:

- Real-time data from IoT sensors is integrated into the app.
- Users can access water fountain status, availability, and water quality information.

Innovation & Uniqueness

The uniqueness and innovation of the "Smart Water Fountains" project are defined by several key elements that collectively set it apart:

- ✓ IoT Integration.
- ✓ Predictive Maintenance
- ✓ User-Friendly Mobile App
- ✓ Water Quality Monitoring
- ✓ Data Sharing and Gamification
- ✓ Integration with Smart Cities
- ✓ Voice Activation
- ✓ Data Analytics Dashboard
- ✓ Sustainability Metrics.

Conclusion:

In conclusion, the "Smart Water Fountains" has successfully realized its objectives of real-time water fountain monitoring, efficient water usage, malfunction detection, and resident awareness through the strategic deployment of IoT sensors and a user-friendly mobile app interface. By integrating predictive maintenance algorithms, we have enhanced system reliability, and the project's impact on water efficiency and public awareness has been significant, reducing waste and fostering responsible water usage. As we conclude this endeavor, we recognize its potential for broader adoption and continuous improvement, marking a meaningful step towards sustainable urban living and a more environmentally conscious society.