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#27, Thayanur, Tiruchirappalli - 620009

COLLEGE CODE: 8107

COURSE: INTERNET OF THINGS

PHASE I: PROJECT SUBMISSION PART I

PROJECT TITLE: Smart Water Fountains

TEAM MEMBERS DETAILS:

ABISHEK. C

HARISH. S

NAVEEN KUMAR. S

NAVAJEEVAN. S

VIJAY. V.S

Smart Water Fountains

Problem Definition:

The project aim to enhance public water fountains by implementing IOT sensor to control water flow and detect malfunction. The primary objectives to provide real time information about water fountain status to residents through a public platform. This project includes defining objectives during the IOT sensor system, developing water fountain status platform, and integrating them using IOT technology and python.

Understanding the problem:

They aim to encourage use of reusable bottles, reduce plastic waste, ensure clean drinking water, and insights for efficient management of public spaces. Smart fountains align with environmental sustainability goals, contributing to water conservation efforts while enhancing the overall appeal and functionality of public areas.

Design Thinking:

- Objectives:
  - Implement a system for real-time monitoring of water fountains.

  Rationale: Enable continuous surveillance of water quality, usage patterns, and operational status. Real-time monitoring ensures that the water quality is consistently safe and helps in addressing any issues promptly.
  - Optimize water usage in public spaces through intelligent dispensing mechanisms.

  Rationale: Promote water conservation by controlling the volume of water dispensed based on user needs. Implement sensors and algorithms to prevent wastage and encourage responsible usage.
  - Develop a system to detect malfunctions in water fountains and enable predictive maintenance.

Rationale: Minimize downtime by proactively identifying issues. Implement sensors to detect anomalies in water pressure, temperature, or dispensing mechanisms. Utilize predictive analytics to schedule maintenance before major malfunctions occur.

- Raise awareness among residents about the benefits of using smart water fountains and encourage their active engagement.

Rationale: Educate the community about the environmental impact of single-use plastics and the importance of using refillable bottles. Implement digital displays or notifications to inform users about water quality, usage statistics, and the environmental benefits of using the fountains.

- IOT sensor design:

  - Identify Sensor Types: Determine the specific IoT sensors needed, such as flow rate sensors to measure water consumption and pressure sensors to monitor water pressure.
    Define Objectives: Clearly define the objectives of sensor deployment, such as real-time monitoring, water conservation, and predictive maintenance.
  - Choose Suitable Sensors: Select high-quality flow rate sensors and pressure sensors compatible with IoT systems.
    Integration with IoT Platform: Integrate sensors with an IoT platform or a cloud-based system to collect and analyse data in real time.
    Data Transmission: Set up secure and reliable communication protocols for data transmission from sensors to the IoT platform.
  - Sensor Placement: Modify the fountain design to accommodate sensors, ensuring they are placed at appropriate locations for accurate measurements.
    Power Supply: Arrange for power sources, such as batteries or solar panels, to ensure continuous sensor operation.
    Weatherproofing: Weatherproof the sensors and associated electronics to protect them from environmental factors.
  - Data Processing Algorithms: Develop algorithms to process sensor data in real time, calculating flow rates and detecting pressure variations.

Data Storage: Implement a secure and scalable database system to store sensor data for historical analysis and future reference. Visualization Tools: Utilize visualization tools to create intuitive dashboards for real-time monitoring and analysis.

- Threshold Setting: Define thresholds for flow rates and pressure levels. If values deviate from these thresholds, generate alerts.
  Alert Mechanisms: Implement alert mechanisms, such as emails, SMS, or mobile app notifications, to inform maintenance teams and administrators about anomalies.
- User-Friendly Interface: Develop a user interface accessible via web or mobile applications, allowing users to view water fountain status, water quality, and conservation statistics.
  Education and Awareness: Include sections on the interface to educate users about water conservation and the environmental benefits of using the smart fountains.
- Sensor Calibration: Calibrate sensors to ensure accuracy and reliability in data measurements.
  Field Testing: Conduct extensive field testing to validate sensor data and system functionality in real-world conditions.
- Installation: Deploy sensors in public water fountains according to the planned locations.
  Regular Maintenance: Establish a maintenance schedule for sensor calibration checks, battery replacements, and overall system health assessments.
  User Support: Provide user support and training for fountain users to encourage active engagement and proper usage of the smart water fountains.
- Data Analysis: Regularly analyse the collected data to derive insights, monitor usage patterns, and identify areas for improvement. Iterative Improvement: Use insights from data analysis to iteratively improve the system, enhance user experience, and optimize water conservation efforts.

- Real time transmit information platform:

  - Homepage:
    - App logo and user profile icon.

- Enter destination or location for parking search.
- Interactive map displaying nearby parking spots and their availability status (color-coded markers).
- Allows users to filter parking options based on price, distance, and other preferences. ○

○ Parking Spot Details:

- Displays the number of available spots and total capacity.
- Indicates if it's regular, accessible, or reserved for specific users.
- Shows hourly or daily rates.
- Enables users to book a spot in advance if available.
- Directs users to the spot using a navigation app.

○ User Profile:

- Allows users to upload their photo.
- Shows past parking bookings with details.
- Displays favourite parking spots saved by the user.
- Access to app settings, notifications, and preferences.

○ Booking Process:

- After choosing a spot, users can click on it to view details.
- Users can confirm the booking by selecting the desired duration and providing payment information.
- Displays booking details and a QR code for scanning at the parking facility. ○ Notifications:
- Notifications about parking availability, booking confirmation, and payment receipts.
- Use intuitive icons, clear typography, and a colour scheme that indicates availability (green for available spots, red for occupied).
- Keep the navigation simple and intuitive with minimal steps required to find, select, and book a parking spot.
- Incorporate user reviews and ratings for parking spots to enhance user trust.
- Ensure the app is accessible to all users, including those with disabilities, by following accessibility guidelines.

- Integration Approach:
  - Flow Rate Sensors: These sensors can be placed in the water supply line of the fountain. They measure the rate of water flow, providing data on how much water is being dispensed.

    Pressure Sensors: Pressure sensors can be placed within the fountain's plumbing system. They measure water pressure and detect variations, ensuring consistent water flow.
  - Flow Rate Sensing: The flow rate sensors continuously monitor the flow of water. They calculate the volume of water dispensed over time.

    Pressure Sensing: Pressure sensors detect changes in water pressure. Sudden drops might indicate leaks or malfunctions.
  - On board Processing: Some IoT sensors have on board processors that can process data locally, such as calculating average flow rates or detecting pressure anomalies.

    Data Aggregation: Processed data is aggregated over short intervals (e.g., every few seconds) to provide accurate real-time information.
  - Wireless Connectivity: IoT sensors are equipped with wireless modules (Wi-Fi, Bluetooth, LoRa, etc.) to transmit data wirelessly.

    Secure Protocols: Data transmission is encrypted using secure protocols to prevent tampering or unauthorized access.

    Data Packets: Sensor data is sent in packets, including sensor ID, timestamp, and sensed values, to maintain context and accuracy.
  - IoT Gateway: An IoT gateway receives data packets from multiple sensors within its range.

    Cloud-Based Storage: Data is sent to a cloud-based storage system (like AWS, Azure, or a custom server) for secure storage and easy accessibility.

    Database: In the cloud, the data is stored in databases, ensuring scalability and efficient querying.
  - Dashboard: The water fountain status platform features a user friendly dashboard displaying real-time data. It includes information such as flow rates, pressure, usage patterns, and anomalies.

    Alerts: The system is programmed to send alerts (via email, SMS, or app notifications) when certain thresholds (e.g., low pressure, excessive flow) are crossed.

Analytics: Historical data is used for analytics, helping in understanding usage trends, predicting maintenance needs, and optimizing water usage.

- Mobile/Web App: Users access the water fountain status platform through a mobile or web application. The interface provides real-time information, historical data, and user controls.
  Interactive Maps: For public spaces with multiple fountains, an interactive map can show fountain locations and their real-time statuses, aiding users in finding available fountains.