SMART PUBLIC RESTROOM USING IOT

Team member

610821106307:PRAVEENKUMAR S

Phase 3 Submission Document

Project : 223930_Team_1_6108_Smart Public Restroom

Project Definition: The project aims to enhance public restroom management byinstalling IoT sensors to monitor occupancy and maintenance needs. The goal is to provide real-time data on restroom availability and cleanliness to the public through a platform or mobile app. This project includes defining objectives, designing the IoT sensor system, developing the restroom information platform, and integrating them using IoT technology and Python

Phase 3 load and preprocess the dataset

load and preprocess such a dataset:

Define Data Objectives: Before collecting data, clearly define the objectives of your smart public restroom project. What aspects do you want to monitor and optimize? This could include occupancy, cleanliness, water usage, or other parameters.

Data Collection:

a. Sensors: Install sensors and data collection devices. For example, occupancy sensors (PIR or ultrasonic), water flow sensors, air quality sensors, and temperature sensors.

b. CCTV Cameras: Install cameras to monitor cleanliness and occupancy.

c. User Feedback: Collect user feedback through touchscreen kiosks or mobile apps.

d. Maintenance Logs: Record maintenance activities and schedules.

Data Storage:

a. Set up a database system to store the collected data. Use a relational database (e.g., MySQL) or NoSQL database (e.g., MongoDB) depending on the data type.

b. Create tables/collections to store data from different sources.

Data Preprocessing:

a. **Data Cleaning:** Remove duplicates, correct inaccuracies, and handle missing data.

b. **Data Integration:** Merge data from various sources into a single dataset.

c. **Data Transformation:** Convert data into a usable format, e.g., timestamps to datetime objects.

d. **Aggregation:** Create summary statistics, aggregating data into time intervals (hourly, daily, etc.).

e. **Feature Engineering:** Create new features that might be useful for analysis.

Data Security and Privacy:

a. Ensure that you follow best practices for data security and comply with relevant privacy regulations.

b. Anonymize or pseudonymize sensitive data.

Data Analysis:

a. Analyze the preprocessed data to gain insights into restroom usage patterns, cleanliness, and other relevant metrics.

b. Use tools like Python with libraries such as Pandas and NumPy for data analysis.

Data Visualization:

a. Create visualizations (e.g., bar charts, line graphs, heatmaps) to better understand the data and communicate findings.

b. Tools like Matplotlib and Seaborn can be helpful.

Machine Learning (Optional):

If your dataset is large and diverse enough, you can build machine learning models for predictive maintenance, occupancy prediction, or other applications.

Monitoring and Real-time Updates:

Implement real-time monitoring of restroom conditions using the collected data. This can involve setting up alerts and dashboards.

Feedback Loop:

Continuously use the insights from the data to make improvements in the restroom's operation and maintenance.

Deploying IoT sensors in public restrooms to collect data, such as occupancy sensors and cleanliness sensors, can offer several benefits, including improved maintenance, resource efficiency, and user experience. Here are the steps can take to set up this system:

Define Objectives:

Clearly define the objectives of deploying IoT sensors in public restrooms. Determine what data you want to collect and how you plan to use that data. For example, you may want to monitor restroom occupancy, cleanliness, and usage patterns to optimize cleaning schedules and resources.

Select Appropriate Sensors:

Choose the right sensors for your specific needs. For occupancy sensing, you can use infrared or ultrasonic motion sensors, or even more advanced technologies like camera-based systems. For cleanliness, consider sensors that can detect conditions such as trash levels, soap and sanitizer levels, or even air quality.

Connectivity and Data Storage:

Ensure that the sensors are equipped with the necessary connectivity options, such as Wi-Fi, Bluetooth, or LoRa, to transmit data to a central system. Decide where and how the data will be stored and processed. Cloud-based solutions are common for IoT deployments.

Power Supply:

Determine the power supply for your sensors. Battery-powered sensors may require regular maintenance to replace batteries, while hardwired sensors can be more reliable but may require additional installation work.

Installation:

Install the sensors in strategic locations within the restrooms. For occupancy sensors, they could be placed above the restroom entrance or inside each stall. Cleanliness sensors may be installed in trash cans, soap dispensers, or air quality monitoring systems.

Data Processing and Analysis:

Develop or use software to process and analyze the data collected by the sensors. Create alerts or notifications for specific events, such as when a restroom needs cleaning or when it's at full occupancy.

User Privacy and Data Security:

Ensure that you have mechanisms in place to protect user privacy and data security. Anonymize data where possible and implement security protocols to prevent unauthorized access to the sensor network.

Maintenance and Calibration:

Regularly maintain and calibrate the sensors to ensure they are working accurately. Replace batteries as needed, clean sensor lenses, and update software to fix bugs or improve performance.

Integration with Existing Systems:

If your organization already uses facility management software, integrate the restroom sensor data with these systems to streamline operations.

User Feedback and Transparency:

Collect user feedback and be transparent about the purpose and use of the sensors. This can help build trust and improve the overall user experience.

Compliance with Regulations:

Ensure that your IoT sensor deployment complies with local regulations and privacy laws, especially if it involves video or audio recording.

Data Visualization and Reporting:

Implement a data visualization platform to create dashboards and reports that make it easy for facility managers to interpret and act on the collected data.

Develop a Python script on the IoT sensors to send real-time occupancy and cleanliness data to the restroom information platform.

```python
import requests
import time
import random


# Simulated data collection - replace with actual sensor code
def collect_occupancy_data():
    # Simulated occupancy data, replace with your sensor logic
    return random.choice([0, 1])


def collect_cleanliness_data():
    # Simulated cleanliness data, replace with your sensor logic
    return random.uniform(0, 1)


# RESTroom Information Platform URL
platform_url = "https://your-restroom-platform.com/api/update"


# Replace with your authentication or API key if required
headers = {
    'Authorization': 'Bearer YOUR_API_KEY'
}


# Main loop for data collection and transmission
while True:
    # Collect occupancy and cleanliness data
    occupancy_data = collect_occupancy_data()
    cleanliness_data = collect_cleanliness_data()
```

```python
    # Prepare the data to send to the platform
    data = {
        'occupancy': occupancy_data,
        'cleanliness': cleanliness_data,
        'timestamp': int(time.time())
    }

    # Send data to the platform
    response = requests.post(platform_url, json=data, headers=headers)

    if response.status_code == 200:
        print(f"Data sent successfully: {data}")
    else:
        print(f"Failed to send data. Status code: {response.status_code}, Response: {response.text}")

    # Adjust the interval to match your data collection frequency
    time.sleep(60)  # Sleep for 60 seconds (1 minute)
```