**PHASE 1 – PROBLEM DEFINITION AND DESIGN THINKING**

**Project Definition:**

**Project Name: Enhancing Public Restroom Management with IoT Sensors**

**Project Goal: The project aims to revolutionize public restroom management by implementing IoT sensors to monitor restroom occupancy and maintenance needs. The primary objective is to provide real-time data on restroom availability and cleanliness to the public through a user-friendly platform or mobile app. This initiative seeks to enhance user experience, promote efficient restroom usage, and ensure cleanliness.**

**Key Objectives:**

**Real-time Restroom Availability Information: Provide the public with up-to-the-minute data on restroom availability to reduce waiting times and improve convenience.**

**Cleanliness Monitoring: Implement sensors to detect cleanliness levels in restrooms and offer real-time feedback to maintain high hygiene standards.**

**Improved User Experience: Enhance the overall restroom experience for the public by reducing wait times and ensuring clean facilities.**

**Efficient Restroom Management: Enable restroom operators to optimize maintenance schedules and resource allocation based on real-time data.**

**Design Thinking:**

**1. IoT Sensor Design:**

**Objective: The IoT sensor deployment is critical to collecting accurate and real-time data for restroom management.**

**Steps:**

**Identify Sensor Types: Determine the types of IoT sensors required, including occupancy sensors and cleanliness sensors. These sensors will be responsible for collecting data on restroom occupancy and cleanliness.**

**Placement Strategy: Plan the strategic placement of sensors within each public restroom to ensure accurate data collection. Consider factors such as high-traffic areas, entry/exit points, and sensor coverage areas.**

**Power and Connectivity: Select suitable power sources (e.g., batteries or wired connections) and communication protocols (e.g., Wi-Fi, Bluetooth, or cellular) for the sensors. Ensure they are energy-efficient and reliable.**

**2. Real-Time Transit Information Platform:**

**Objective: Design a user-friendly web-based platform and mobile app to provide real-time restroom information to the public.**

**Steps:**

**User Interface Design: Create an intuitive and visually appealing user interface for both the web platform and mobile app. Prioritize ease of use and accessibility.**

**Data Integration: Establish a robust data integration pipeline to receive and process data from IoT sensors. Use secure data transmission methods to protect user privacy.**

**Real-time Data Display: Implement features to display real-time restroom availability and cleanliness data, including user-friendly icons, colors, and textual information.**

**User Feedback Mechanism: Include a mechanism for users to provide feedback on restroom conditions and submit maintenance requests directly through the platform or app.**

**3. Integration Approach:**

**Objective: Develop a seamless integration between IoT sensors and the restroom information platform.**

**Steps:**

**Data Transmission Protocol: Define a communication protocol that ensures data from IoT sensors is reliably and securely transmitted to the platform. Consider using MQTT or HTTPS for data transfer.**

**Data Processing and Storage: Implement a data processing pipeline to filter, validate, and store sensor data efficiently. Use cloud-based storage solutions for scalability and accessibility.**

**Real-time Updates: Ensure that the platform and mobile app receive real-time updates from the IoT sensors. Implement push notifications to notify users of changes in restroom availability and cleanliness.**

**API Development: Create robust APIs to facilitate communication between IoT sensors and the platform. This will enable seamless data exchange and integration.**

**By following these design thinking principles and objectives, we aim to create an innovative solution that enhances public restroom management, improves user experiences, and promotes efficient resource allocation. This project will utilize IoT technology and Python programming to achieve its goals and create a more comfortable and hygienic environment for the public.**