PROJECT TITLE: SMART PARKING USING IoT

INTRODUCTION:

This document outlines the problem statement, project objectives, and the design thinking approach for integrating IoT sensors into public transportation vehicles to monitor ridership, track locations, and predict arrival times. The ultimate aim is to provide real-time transit information to the public via a public platform, thereby improving the efficiency and quality of public transportation services. The project entails defining specific objectives, planning IoT sensor system design, developing the real-time transit information platform, and integrating them using IoT technology and Python.

PROBLEM STATEMENT:

The project addresses the challenge of enhancing public transportation services by integrating IoT sensors into public transportation vehicles and transit hubs to monitor ridership, track locations, and predict arrival times. The existing lack of real-time transit information often leads to inconvenience and inefficiency for commuters. The project's primary objective is to provide accurate and timely transit information to the public through a user-friendly mobile app, ultimately improving the quality and efficiency of public transportation services.

ABSTRACT

In our busy lives, finding parking can be a big hassle. It is a big task to find the space for parking and it wastes people's time. We can overcome this problem with the help of Smart Parking system using IoT (Internet of Things). The primary objective is to provide real-time transit information to the public through a user-friendly platform, enhancing the efficiency and quality of public transportation services. We can access real-time parking information through an app. With the help of Smart sensors placed in the parking spaces, the data are collected and sent to the central hub. Those data are analyzed in the cloud and the available free spaces for parking slot are made available in the app. This makes parking more efficient, reduces congestion, and is better for the environment. In addition to that, it helps businesses and city planners.

DESIGN THINKING:

1. **Project Objectives:**
   - **Location Tracking:** Implement GPS-based location tracking for public transportation vehicles, allowing passengers to track the real-time location of buses or trains.
   - **Parking Space Monitoring:** Deploy IoT sensors in parking spaces at transit hubs to detect occupancy and availability of parking spots.
   - **Mobile App for real time access:** Design and develop a user-friendly mobile application that presents real-time transit information to commuters, including ridership data, vehicle locations, arrival predictions, and parking availability.
   - **Arrival Time Prediction:** Utilize historical data and real-time information to predict the arrival times of public transportation vehicles with accuracy.
   - **Efficient Parking Guidance:** Integrate the parking availability data into the mobile app to provide commuters with guidance on available parking spaces at transit hubs.

2. **IoT Sensor Design:**
   - **Sensor Selection:** Choose appropriate sensor technologies, such as ultrasonic or magnetic sensors, for detecting the presence or absence of vehicles in parking spaces.
   - **Sensor Placement:** Determine the optimal placement of sensors within parking spaces to ensure accurate detection while minimizing interference.

- **Data Transmission:** Develop a reliable data transmission mechanism for IoT sensors to communicate occupancy and availability information to a central data processing system.
- **Sensor Identified:** For our parking system we can use sensors like Infrared, Passive Infrared(PIR) and Ultrasonic Sensors. The work of these sensors is the same i.e. to sense the parking area and determine whether a parking slot is vacant or not. Using the ESP8266 chip, the raspberry pi is wirelessly connected to the ultrasonic sensors. A self-contained SOC with an integrated TCP/IP protocol stack makes up an ESP8266 WiFi chip, which enables any microcontroller to connect to a WiFi network. The Raspberry Pi or an external source of 5V power is used to power the sensors.

3. **Real-Time Transit Information Platform:**
   - **User Interface Design:** Create an intuitive and user-friendly mobile app interface for both iOS and Android platforms.
   - **Real-Time Parking Availability**: Incorporate a dedicated section or feature within the app that displays real-time parking space availability at transit hubs, providing users with up-to-date information.
   - **User Accessibility:** Ensure the app is accessible to a broad range of users, including those with disabilities, by following accessibility guidelines and standards.
   - **Integration of Parking Data:** Integrate the data from IoT sensors deployed in parking spaces to provide accurate and real-time parking availability information to users.
   - **Map-Based Visualization:** Utilize maps or visual representations to display parking availability, making it easy for users to understand and navigate to available spaces.
   - **User Notifications:** Implement push notifications or alerts within the app to inform users about changes in parking availability and provide guidance on parking options.
   - **Predictive Features:** Consider adding predictive features that estimate parking availability at specific times of the day, helping users plan their trips more effectively.

4. **Integration Approach:**
   - **Raspberry Pi Deployment:** Deploy Raspberry Pi devices at transit hubs to serve as data collection and processing units.
   - **Sensor Data Retrieval:** Configure Raspberry Pi devices to collect data from IoT sensors installed in parking spaces, including information on occupancy and availability.
   - **Data Preprocessing:** Implement data preprocessing on Raspberry Pi to clean, format, and organize the sensor data for efficient transmission and storage.
   - **Secure Data Transmission:** Establish secure data transmission protocols to send the preprocessed sensor data from Raspberry Pi devices to a central server for further processing.
   - **Real-Time Updates:** Set up a communication mechanism between the central server and the mobile app to enable real-time updates of parking availability information.
   - **Mobile App Integration:** Ensure that the mobile app can access and retrieve data from the central server, providing users with seamless access to real-time parking availability information.
   - **Scalability:** Design the integration approach to be scalable, allowing for the addition of more Raspberry Pi devices and sensors as needed to cover larger areas or accommodate increased demand.