Project Documentation: Smart Parking using IoT

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1. Project Objectives:

The key objectives of this project are to:

Implement Passenger Counting with Cameras: Use cameras equipped with computer vision technology to accurately count the number of passengers boarding and exiting the vehicles.

Utilize Arduino for Data Processing: Employ Arduino microcontrollers to process data from cameras and other sensors, enabling real-time analysis and computation.

Display Information with LEDs and Seven-Segment Displays: Use LEDs for visual notifications and seven-segment displays to showcase real-time transit information such as predicted arrival times and vehicle occupancy status.

Enhance Public Awareness: Provide accurate and real-time transit information to the public, enhancing the efficiency and quality of public transportation services.

2. Camera and Arduino Integration:

Camera Installation: Install cameras in public transportation vehicles, strategically positioned to capture boarding and exiting passengers.

Computer Vision Processing: Utilize computer vision libraries (such as OpenCV) to process camera feeds on Arduino, enabling passenger counting and facial recognition for identifying unique passengers.

Arduino Data Processing: Program Arduino boards to process data from cameras, ensuring real-time analysis and computation of passenger counts.

3. LED and Seven-Segment Display Implementation:

LED Visual Notifications:Use LEDs to provide visual notifications, such as indicating when the vehicle is full or when the doors are closing, ensuring passenger safety and awareness.

Seven-Segment Displays for Real-Time Information: Implement seven-segment displays inside the vehicles to showcase real-time transit information, including predicted arrival times, current location, and vehicle occupancy status.

4. Integration Approach:

Camera Data Processing: Utilize Python on a small onboard computer (like a Raspberry Pi) to process camera feeds, extract relevant information, and send it to Arduino for further analysis.

Arduino Programming: Code Arduino microcontrollers to process data received from cameras, perform passenger counting, and control LEDs and seven-segment displays based on the analyzed data.

Real-Time Updates: Ensure real-time updates by establishing a continuous data exchange between the camera system (Python-based) and Arduino boards, enabling synchronized passenger counting and display updates.

User Interface: Develop a simple user interface for public transportation staff to monitor the real-time data and receive alerts if any issues are detected in the system.

This modified approach incorporates cameras for passenger counting, Arduino for data processing, and LEDs/seven-segment displays for visual notifications and real-time information. This setup provides an efficient and cost-effective solution for enhancing public transportation services while ensuring accurate passenger counting and timely updates for commuters.