**University Parking Automation System**

**Problem Definition**   
One of the biggest issues in university parking lots is that students and academic staff have to spend a long time searching for an available parking spot. During peak hours, parking lots become highly congested, and drivers waste valuable time looking for a space, often resulting in delays for classes or meetings.

Currently, there is no real-time information available about the occupancy status of the parking lot. As a result, drivers randomly circulate within the parking area in search of a spot, leading to unnecessary time loss and internal traffic congestion. Additionally, some parking spaces remain empty while drivers are unaware of their availability, preventing the parking lot from being utilized to its full capacity.

The **Vehicle Parking Automation System** proposed in this project aims to solve this issue by using sensors to detect real-time parking occupancy and share this information with drivers. The system will provide drivers with real-time updates on available parking spaces through a mobile application or digital displays, reducing time loss and optimizing parking management efficiency.

**Background Information**   
This project is being undertaken to address the growing issue of parking space scarcity and inefficiency, particularly in university parking lots where students and staff frequently waste significant time searching for available parking spots. This results in unnecessary traffic congestion, delays, and increased stress for drivers. By implementing an automated parking system using sensors to track real-time occupancy, the project aims to optimize parking lot usage, reduce the time spent searching for spaces, minimize fuel consumption, and ultimately enhance the overall parking experience. This solution not only addresses current inefficiencies but also improves the functionality of university parking areas, ensuring better space utilization and smoother traffic flow.

Additionally, the system will be integrated with a **mobile application**, allowing drivers to register their university IDs and vehicle license plates, making entry and payment processes more seamless. With the implementation of **Automatic Number Plate Recognition (ANPR) technology**, only authorized university members will be granted access to the parking facility.

The **real-time parking detection system** will use multiple sensor technologies, such as **ultrasonic, magnetic field, and LiDAR sensors**, to accurately identify available parking spots. This data will be displayed on both the **mobile application and digital screens within the parking lot**, providing clear and immediate guidance for drivers.

Through the **ANPR system**, vehicles will be automatically recognized upon entry, and the system will assign the most suitable parking space based on availability. **Digital navigation screens** located at the entrance and throughout the parking lot will display customized directions for each driver, indicating the specific **parking block and slot number** assigned to their vehicle. Additionally, real-time navigation through the mobile app will help drivers reach their designated spot more efficiently.

**Incorrect parking behaviors** (such as occupying two spaces with one vehicle) will be detected through sensors and AI-powered cameras. Violators will be automatically subject to penalties to ensure proper usage of parking spaces.

To maintain accurate parking space tracking, drivers will also need to check out through the **mobile application** when exiting. This will update the system in real-time, marking the previously occupied parking space as available, thereby ensuring **efficient space management and optimal utilization of the parking lot.**

**Objectives**

* **1- Real-Time Occupancy Detection: Detect available and occupied parking spaces in real-time using sensors installed in the parking area.**
* **2- User Information System: Provide users with real-time data on parking occupancy and available spaces through a mobile application or digital displays.**
* **3- Time and Fuel Savings: Reduce time loss and unnecessary fuel consumption by helping users find suitable parking spots more quickly.**
* **4- Data Storage and Reporting: Store parking usage data to analyze the efficiency of the parking lot and provide improvement recommendations.**
* **5- Maximizing Parking Capacity Utilization and Preventing Incorrect Parking: Ensure the parking lot is used at its maximum capacity by detecting and making available empty parking spaces while preventing incorrect parking behaviors that reduce capacity.**

**Approval Signatures and GitHub Accounts**

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