SMART UNIVERSITY PARKING SYSTEM (SUP)

Group 2
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Executive Summary:

The goal of this project is to address the limited information available to users regarding the availability of on-campus parking spaces. The project name is **Smart University Parking System.** In response to the growing need for efficient campus parking management, our System Analysis Project presents a comprehensive solution – A real-time parking availability map. This System aims to streamline the parking experience for staff, students, and visitors by providing up-to-the-minute information on the available parking slots across the campus.
The SUP system will allow Data-Driven Decision Making for users with the benefits of

1. Providing valuable parking information in a real-time for users to make smart decisions.
2. Improving user experience by reducing frustration from search time and road congestion.

Problem Statement:

Project name:

SMART UNIVERSITY PARKING SYSTEM (SUP)

Project sponsor:

University of Texas at Dallas is the key sponsor and beneficiary of this project for the SUP System.

Business need (Symptoms):

The demand for a Smart University Parking System (SUP) arises from concerns like as parking congestion, poor space use, lost time, and a lack of real-time information, which causes student and staff irritation. The present manual methods, as well as limited insight into parking patterns and security concerns, aggravate the problem. SUP can ease these symptoms while also improving parking efficiency and user experiences and perhaps earning more cash for the institution while addressing environmental and security concerns.

Functionality (Objectives):

A Smart University Parking System (SUP)'s capabilities and goals include real-time parking availability updates, effective space usage, better security, data-driven decision-making, and environmental sustainability. SUP's goal is to improve user experiences, optimize resources, and assure safe and environmentally friendly campus parking operations.

Expected value (Cost/Benefit):

Based on student count of 30,000 at UTD, we anticipate a use count of around 10,000. Estimated cost includes hosting and housing of parking data and servers, parking sensors, hosting cost for the real time map. We estimate this to approximately $20,000 to $25,000 in cost to implement this project.

Special issues or constraints (Scope):

Budget limits, physical infrastructure improvements, and privacy considerations are examples of special challenges and constraints that may arise while establishing a Smart University Parking System (SUP). Budget restrictions may have an impact on the size and pace of system rollout. It may be difficult to adapt current infrastructure for sensors or security cameras. Concerns about privacy involve cautious treatment of user data and adherence to relevant rules. Coordination with many parties and minimizing disturbance to everyday campus operations should also be considered. Balancing these aspects is critical to ensuring that SUP is implemented successfully within the parameters stated.

Objectives:

Objectives of the proposed SUP system are as follows.

- Integrate with existing available parking garage system.
- Capture real-time parking spot availability using IoT sensors.
- Develop a user-friendly real-time map.
- Optimize parking space utilization and reduce congestion within the university campus.
- Reduce user search time frustration and abrasion costs.
- Reduce risk of loss of customer base.

Assumptions:

Assumption of the proposed SUP system are as follows.

- Applicable for only UTD for this phase.
- Access to the university's Wi-Fi or network infrastructure for IoT sensor connectivity.
- Availability of suitable power sources for the IoT sensors.
- Availability of existing Auxiliary Services for parking information.
- Access to existing select parking garage availability system.
- Total existing parking capacity is not changed by SUP.

Scope:

The scope of the SUP system will cover:

- Deployment of IoT sensors in all university parking areas.
- Development of a real-time map for users to access parking lot information.
- Integration with the university's existing infrastructure.

Out of scope items for the initial SUP system includes:

- Enhancement of the interactive map to pinpoint exact spot locations.
- Enhancement of the interactive map to allow spot reservations.
- Development of accurate dashboard for analytics and reporting
- Real-time data analysis and visualization of parking availability.
- Integration with UTD mobile application for ease of use.
- Filtering for permit tier specific available parking.

Deliverables:

The key deliverables for the SUP system will include:

- Deployment of IoT sensors and connectivity.
- Real-time map for parking management.
- Integration of real-time map with university servers and databases.
- User training and documentation.

Acceptance Criteria:

The SUP system will be considered successful when:

- IoT sensors accurately detect space availability in parking lots or garages.
- The real-time map is user-friendly, bug-free, and functional.
- Parking congestion within the university is reduced significantly.

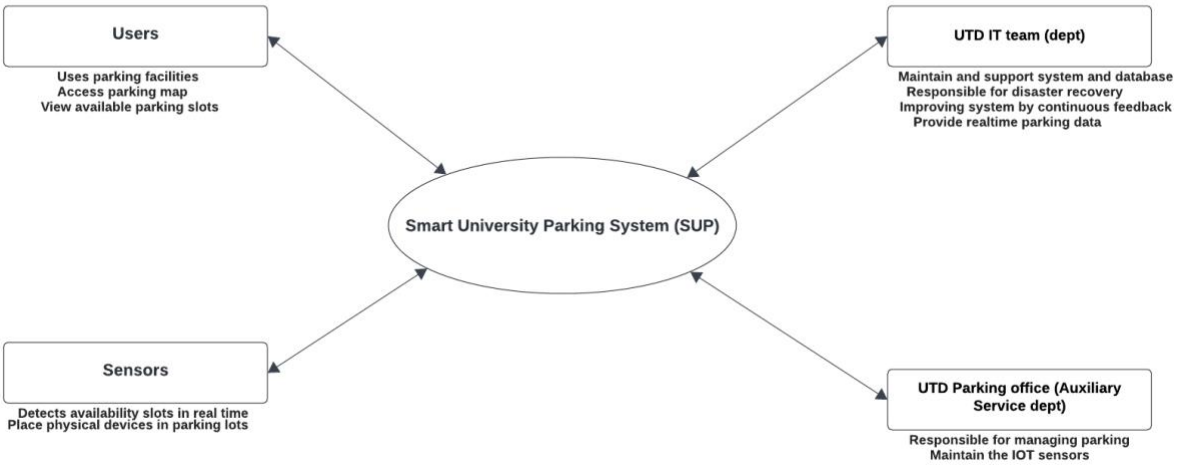
Stakeholders:

The SUP system stakeholders will include:

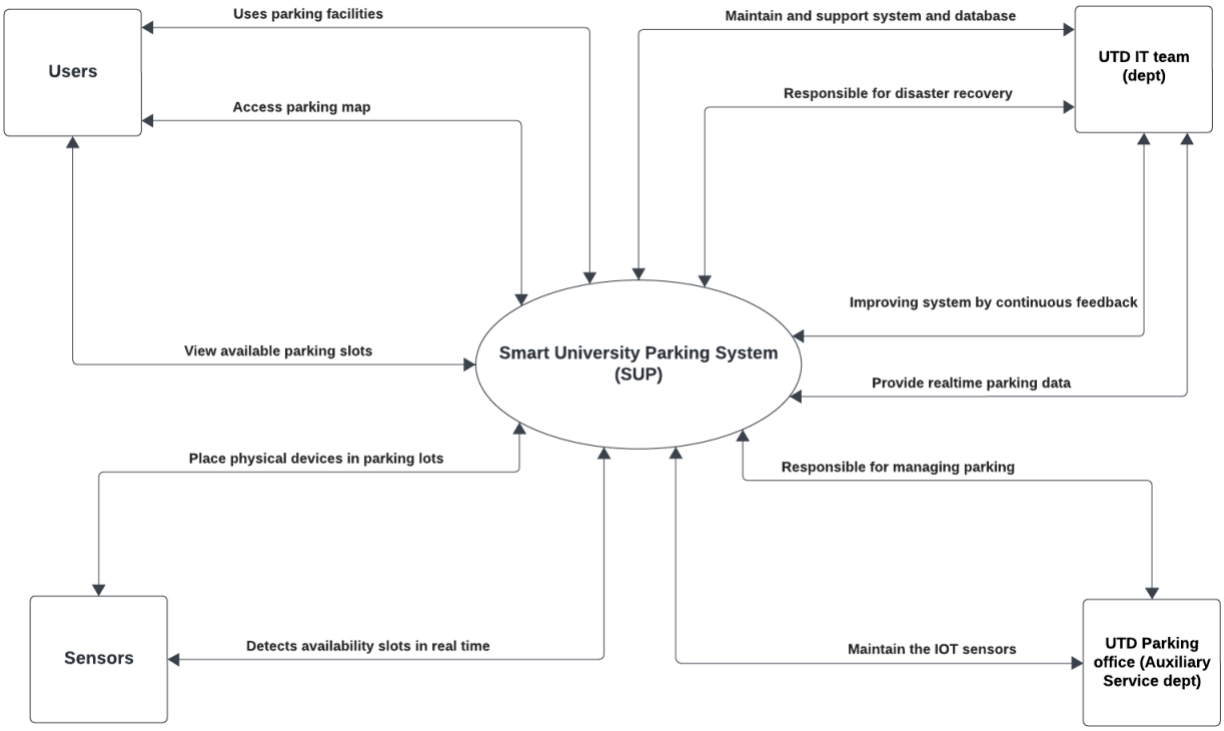
- University Administration
- Students
- Faculty and Staff
- Visitors
- UTD IT Department
- UTD Auxiliary Service Department
- Project Team

CONTEXT DIAGRAM (SMART UNIVERISTY PARKING):

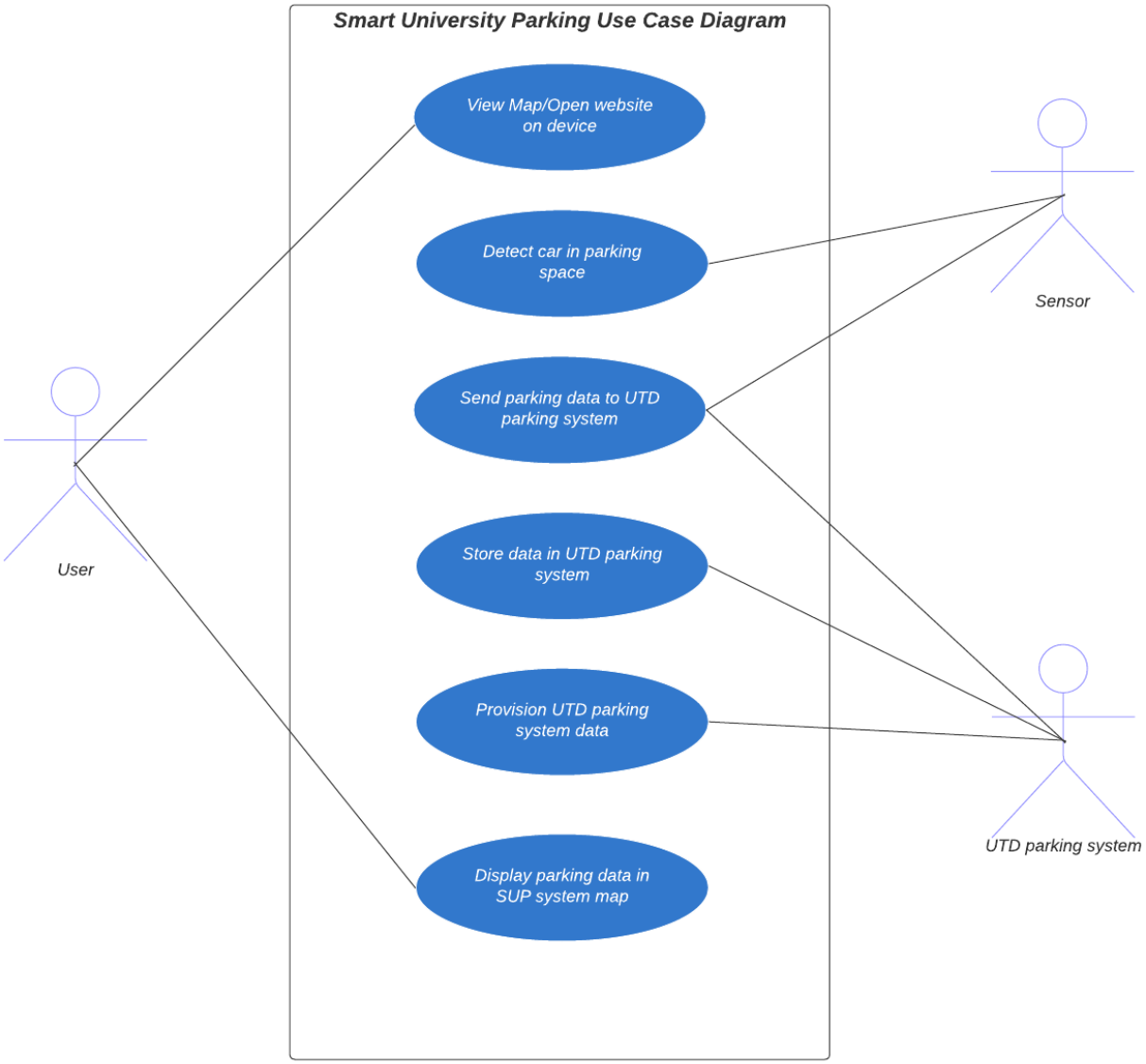
Traditional Context Diagram:



Enhanced Context Diagram:



USE CASE DIAGRAM FOR SMART UNIVERSITY PARKING (SUP) SYSTEM:



USE CASE DIAGRAM FOR SMART UNIVERSITY PARKING (SUP) SYSTEM:

Use Case Description 1:

Use Case Name: View map/Open website on device
Scenario: User wants to view the map to know the number of parking spots available.
Triggering Activity: User needs information on parking availability
Brief Description: User views the map/opens the web application on their electronic device
Actors: User
Related use cases: Display parking data in SUP System Map (Use case description 6)
Stakeholders: UTD Auxiliary Service Department, UTD ID Department, User **(Includes Students, Faculty and Staff, and Visitors)**
Preconditions: 1. User's device and internet connection is in working order. 2. UTD system and network is operational.
Postconditions: 1. User is informed of number of parking spots available. 2. Map is accurate and free of bugs.
Flow of Activities: 1. User intends on checking the number of spots available for them to park in a specific parking structure on campus 2. User opens the website on their electronic device (phone, tablet, laptop) 3. User views the map and sees how many spots are available in the parking structure of their choosing 4. User decides to which parking structure to park in depending on the availability

Exception Conditions:

1. UTD system outage
2. Data is unavailable or inaccurate
3. User's device is incompatible and they are unable to view the map

Use Case Description 2:

Use Case Name: Detect car in parking space
Primary Actor: Sensor
Stakeholder: UTD Auxiliary Service Department, UTD IT Department, User
Brief Description: Sensor detects whether a parking spot is vacant or not
Trigger: Sensor detects motion in the parking space
Normal Flow of Events: 1. Sensor detects when a vehicle is parked in the parking spot 2. Sensor light is green to indicate that a spot is available 3. User parks in an available spot and sensor detects this and the light turns red indicating that the spot is no longer vacant 4. Sensor stores status of parking spot and keeps count of how many are available

Use Case Description 3:

Use Case Name: Send parking data to UTD parking system
Primary Actor: Sensor
Stakeholder: UTD Auxiliary Service Department, UTD IT Department, User
Brief Description: The sensor sends data to UTD parking system
Trigger: Parking spot availability is changed (vacant or taken)
Normal Flow of Events: 1. Data is retrieved from the IoT sensor 2. Data is sent to UTD's parking system

Use Case Description 4:

Use Case Name: Store data in UTD parking system
Primary Actor: UTD Parking System
Stakeholder: UTD Auxiliary Service Department, UTD IT Department, User
Brief Description: Parking data from the sensor is stored in a database
Trigger: Data sent to the UTD parking system
Normal Flow of Events: 1. Data from the IoT sensor is sent to the parking system 2. IoT sensor data is stored in the parking system database

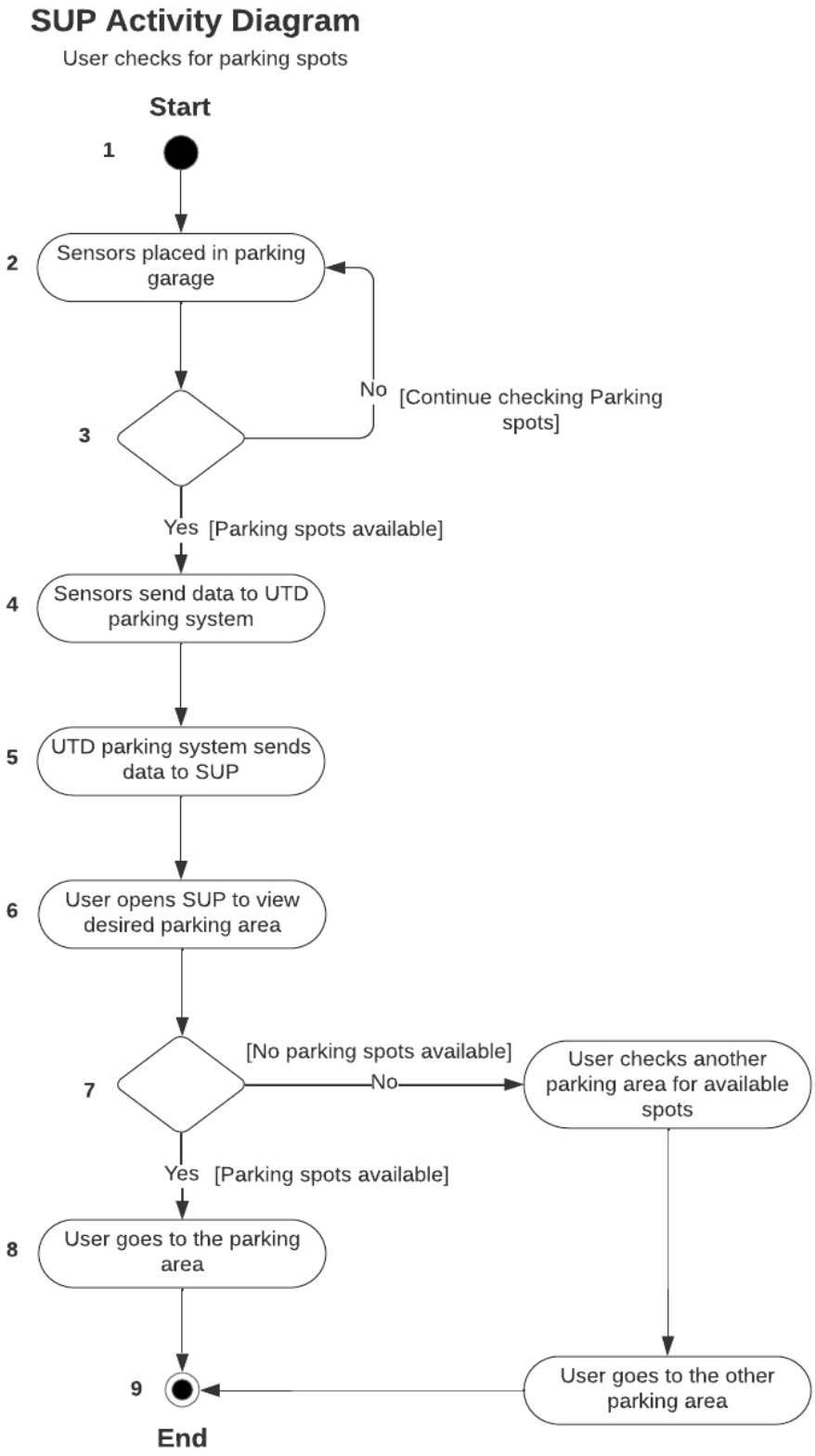
Use Case Description 5:

Use Case Name: Provision UTD parking system data
Primary Actor: UTD Parking System
Stakeholder: UTD Auxiliary Service Department, UTD IT Department, User
Brief Description: Parking data from the UTD parking system is provisioned to SUP system
Trigger: Request is made for UTD Parking system to send data to SUP system
Normal Flow of Events: 1. Request is made for data from the UTD parking system 2. UTD parking system sends the data to SUP system

Use Case Description 6:

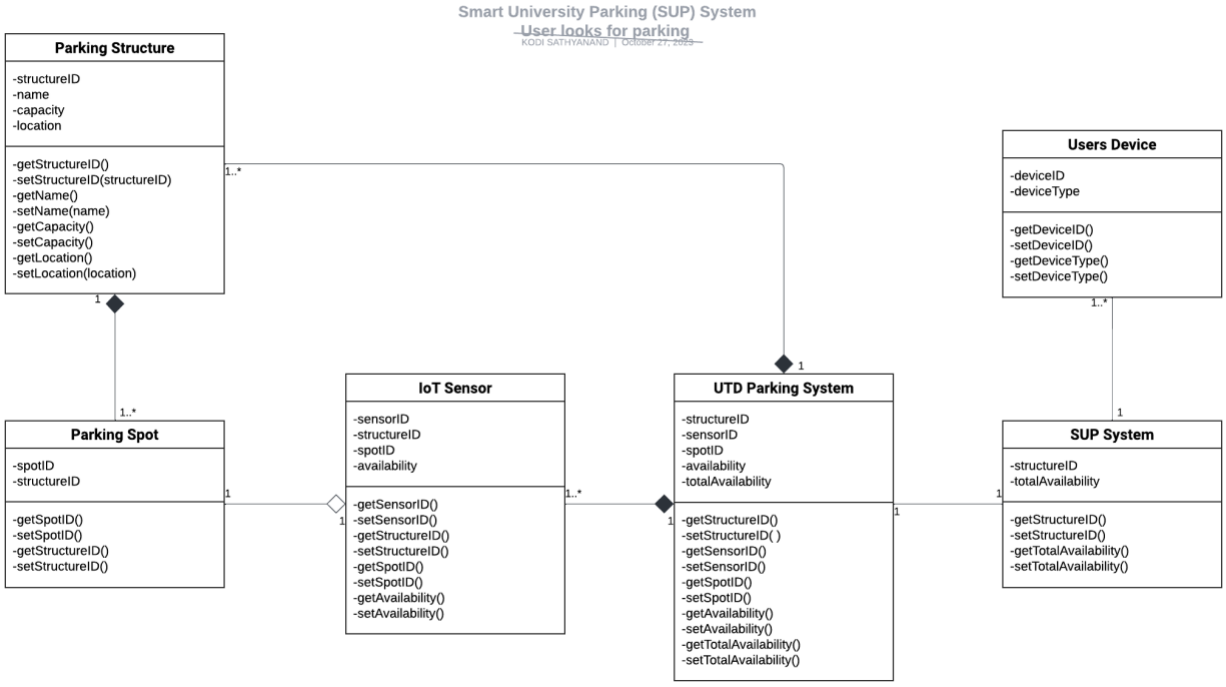
Use Case Name: Display parking data in SUP System Map
Primary Actor: User
Stakeholder: UTD Auxiliary Service Department, UTD IT Department, User
Brief Description: Parking data from the UTD parking system is displayed on the SUP System Map
Trigger: UTD Parking system responds to SUP system data request
Normal Flow of Events: 1. UTD parking system data is received by the SUP system 2. SUP system map displays the available parking spot number

PROCESS MODEL (ACTIVITY FLOW DIAGRAM):



CLASS DIAGRAM (Smart University Parking SUP System)

User looks for parking



DATA DICTIONARY FOR SMART UNIVERSITY PARKING SYSTEM (SUP):

Data Dictionary Notation:

Parking Structure = structureID + name + capacity + location

Parking Spot = spotID + structureID

IoT Sensor = sensorID + structureID + spotID + availability

availability = [Yes|No]

UTD Parking System = structureID + sensorID + spotID + availability + totalAvailability

SUP System = structureID + totalAvailability

Users Device = deviceID + (deviceType)

Description of Data Elements:

General:

Data element name: structureID,

Aliases: Structure ID

Definition: Unique ID number for parking structure identification

Format

Type: String

Length: 5

Picture: 88-888

Measurement unit: Car: 9 ft wide by 18 ft long

Control

Source: UTD parking structure construction and campus architect process

Access and update authorizations: Can be updated.

Security: The system should be able to manage parking spaces, such as reserving spots.

Metadata

The goal of this project is to address the limited information available to users regarding the availability of on-campus parking spaces. The project name is Smart University Parking System.