ParkSense: Arduino Embedded Parking Management System

Project Documentation Submitted to the Faculty of the

School of Computing and Information Technologies

Asia Pacific College

In Partial Fulfillment of the Requirements for

Systems Analysis & Detailed Design for CS/IT

M/S SYADD1

By

Rchie Libudan
John Jorel Landicho
Timothy Jay Sayson
Angela Mae Tauyan

2024

Table of Contents

I. Introduction

1.1 Project Context

This project is for the client, namely the Building Maintenance Office, one of the offices in Asia Pacific College on the 10th floor of the building. Among their responsibilities are managing various facilities such as reservations, sewage, and basement parking. Upon approaching them, the client wants the developers to focus on basement parking and give them the processes and problems.

Currently, they are using a manual process in managing the basement parking. When a vehicle owner drives its way to the basement parking, upon entering it the security personnel commands it to stop and conducts an identification check to determine if the owner is an APC staff, student, guest, or an outsider. Follows the inspection of the underside of the vehicle. If the owner is an outsider, the security in charge will issue a parking ticket and will collect the parking fee. After all of that, they can proceed to the basement parking. After parking, the owner will surrender their valid ID to the security in the basement. Upon exiting the facility, the visitor will get their valid ID and hand over the parking ticket to the exit guard for verification of payment. Aside from those responsibilities, the officer in charge inspects each parking lot to determine whether they are vacant or occupied and informs the security personnel at the entrance about the status of the parking slots.

The mentioned processes take a lot of time to complete, and it is hassle for those who are in charge in both entrance and basement. With the wide space of the basement parking and having 2 levels of it, it takes a while before the officer-in-charge can update the status to the security personnel at the entrance which can cause a misinformation of the status that can possibly cause overcrowding within the basement parking.

With this automated parking tracking system, it will enhance the efficiency and accuracy of parking slot management, improving the overall experience for drivers and security personnel.

1.2 Statement of the Problem

The Building Maintenance Office identified the problems related to the basement parking at Asia Pacific College. The problems they encounter include:

1. Not fully utilized parking space.
2. Lack of visibility into available parking slots.
3. Manual and inefficient process of checking parking availability.

1.3 Objectives

1.3.1. Main Objective

ImPossible aims to automate the manual process of checking parking slot availability. By implementing this system, it will be easier to check the status in the basement parking area of Asia Pacific College, ensuring a more efficient and organized parking experience for everyone.

1.3.2. Specific Objectives

The specific objective of the project is to develop a tracking system that can help:

1. To advertise Asia Pacific College’s basement parking to the customer segments.
2. Install parking sensors and a monitoring system to provide real-time visibility of parking slot availability.
3. To reduce the reliance on manual labor for parking management tasks.

1.4 Significance of the Project

If the project is implemented, the project will eliminate the client's manual process of checking basement parking availability. By providing a monitor to display the status of each parking slot, it will significantly reduce the staff's workload and improve overall efficiency.

Furthermore, the following roles will benefit from the project:

Client

As the manager of parking operations, this project will significantly enhance efficiency by automating the process of monitoring parking space availability, thereby reducing the need for manual checks. Additionally, it will offer valuable data analytics to understand parking usage patterns, enabling better planning and resource allocation.

Vehicle Owners

Most of the school's stakeholders have their own vehicles and require parking during each visit to the campus. This project will provide them with real-time information on parking availability, significantly reducing the time spent searching for parking spots and lowering gas consumption. Additionally, it will greatly enhance their overall satisfaction with the parking experience at Asia Pacific College.

School

Since the basement parking is located at Asia Pacific College, this project will enhance the operational efficiency of the parking facility, reflecting positively on the school's infrastructure. The integration of analytics will support informed decision-making regarding campus facilities and future developments, ensuring that resources are allocated effectively, and improvements are made based on data-driven insights.

Future Developers

Future developers will benefit from this project as it provides a solid baseline for further development and identifies areas for enhancement. It offers practical experience in developing and maintaining an embedded system. Additionally, they can collaborate with the same client for continuous improvement and ensuring the project evolves to meet the client's needs effectively.

Sustainable Development Goals

The proposed project aligns with the following Sustainable Development Goal (SDG):

SDG 9: Industry, Innovation, and Infrastructure

This project contributes to building resilient and sustainable infrastructure by enhancing and improving parking management through a technology solution.

SDG 11: Sustainable Cities and Communities

It enhances parking experience, making it more efficient and organized which contributes to safer and more accessible transportation systems within the school campus community.

SDG 12: Responsible Consumption and Production

This project optimizes parking spade usage and reduces time effort in looking for parking which promotes efficient resource use and reduces unnecessary fuel consumption.

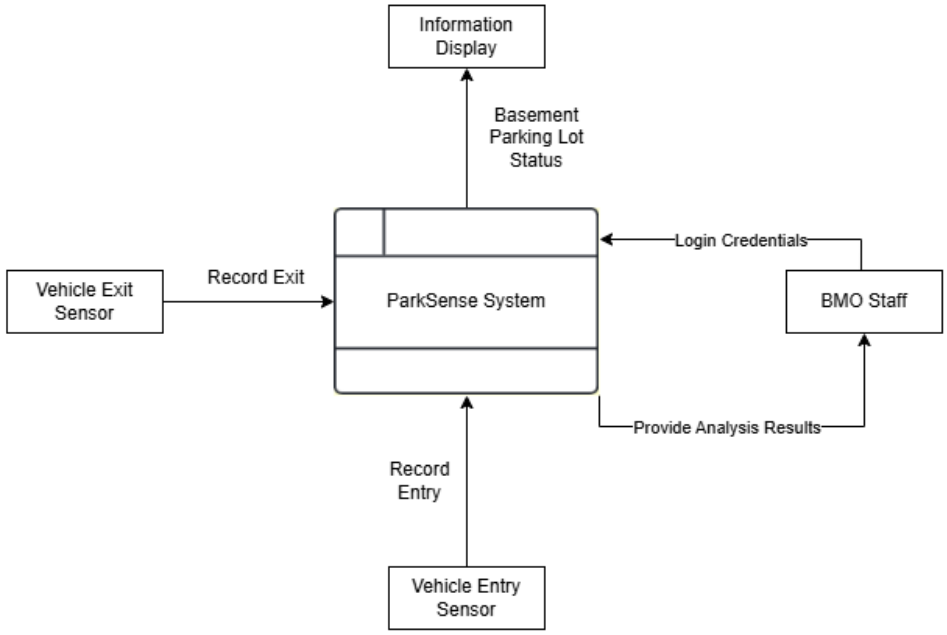
1.5 Scope and Limitations

This project intends to improve the efficiency and functionality of parking for individuals at Asia Pacific College. Our proposed solution will assist the Building Maintenance Office by developing an embedded system that will cover the basement parking with sensors per slot. These sensors will offer real-time updates to the monitor, which displays the available and occupied parking slots per basement level. The developers will also incorporate analytics into the project to establish how many spots were used on a daily, monthly, and yearly basis, allowing us to measure the effectiveness of basement parking and our project. This study's primary target includes the building maintenance office, information technology resource office, stakeholders, visitors, and students. The primary targets of this study include the building maintenance office, stakeholders, visitors, and students. The study will be conducted from the 2nd year, 3rd term to the 3rd year, 3rd term of our stay at Asia Pacific College. The project will be dependent and focused on what the developers and client agreed upon, as well as financial considerations. If further features are not agreed upon, they should be communicated to future project-based learners to improve the project and meet the client's needs

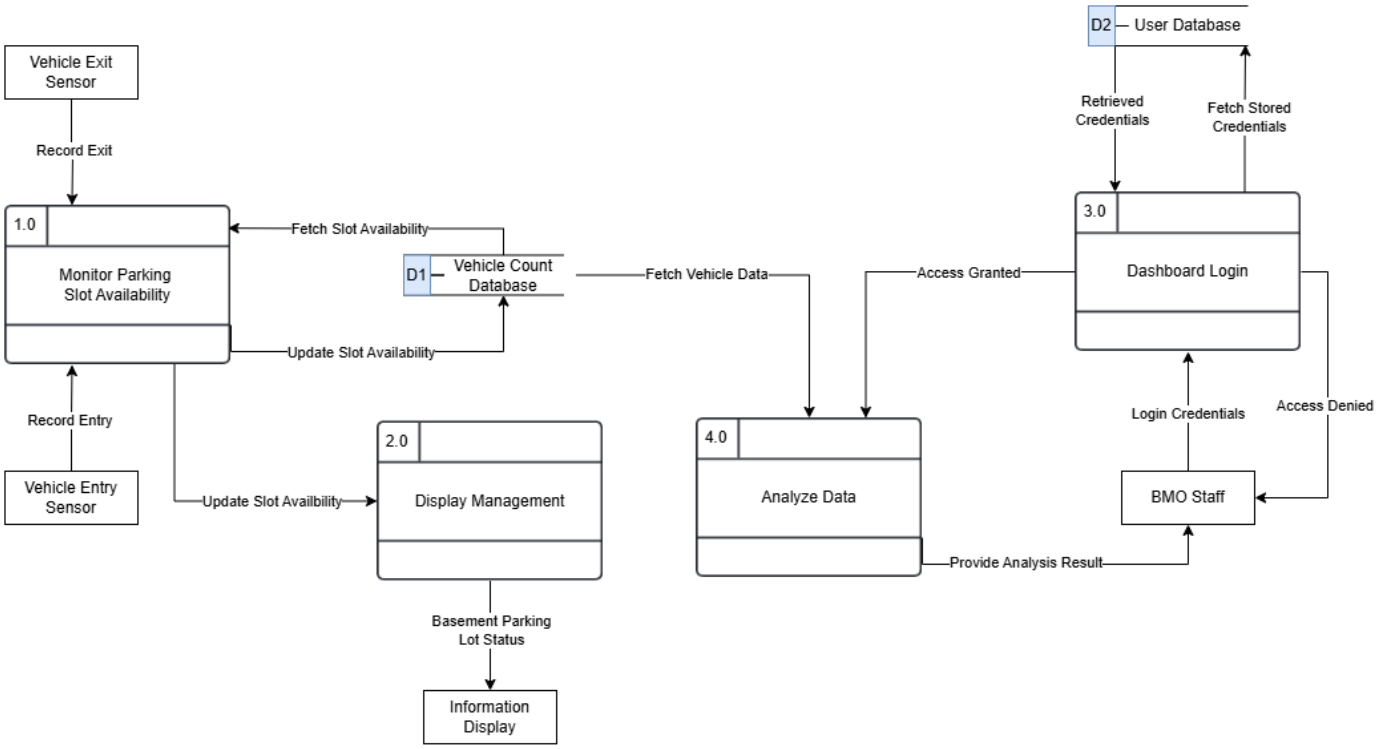
II. Requirements Analysis

2.1 Dataflow Diagram

2.1.1 Level 0

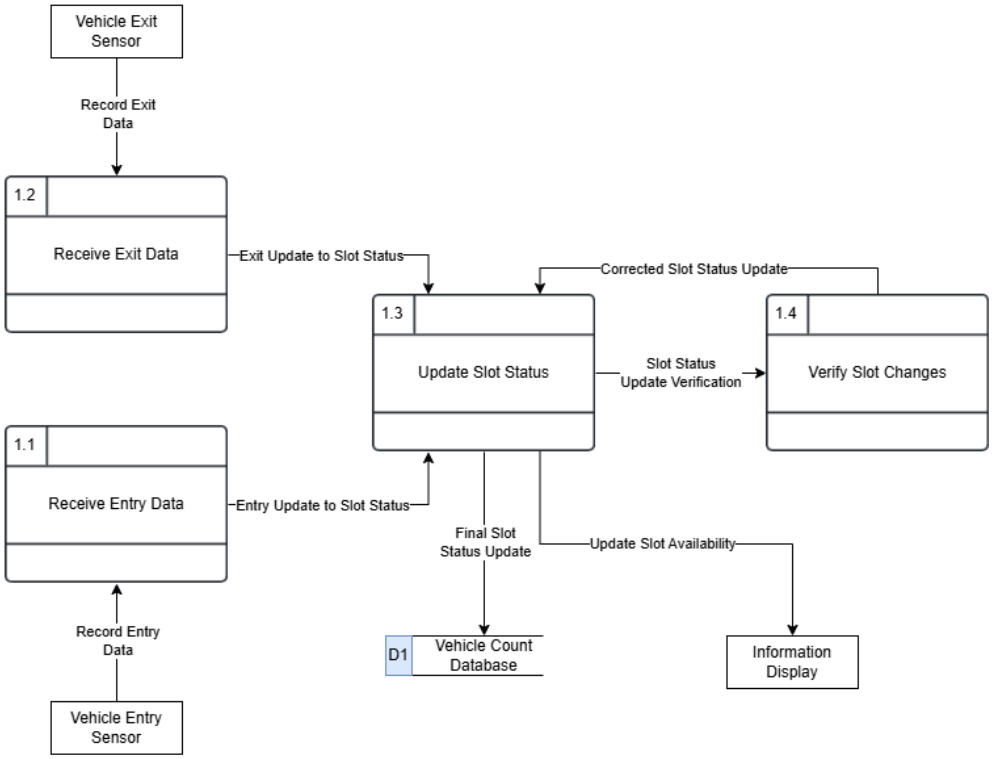


2.1.2 Level 1

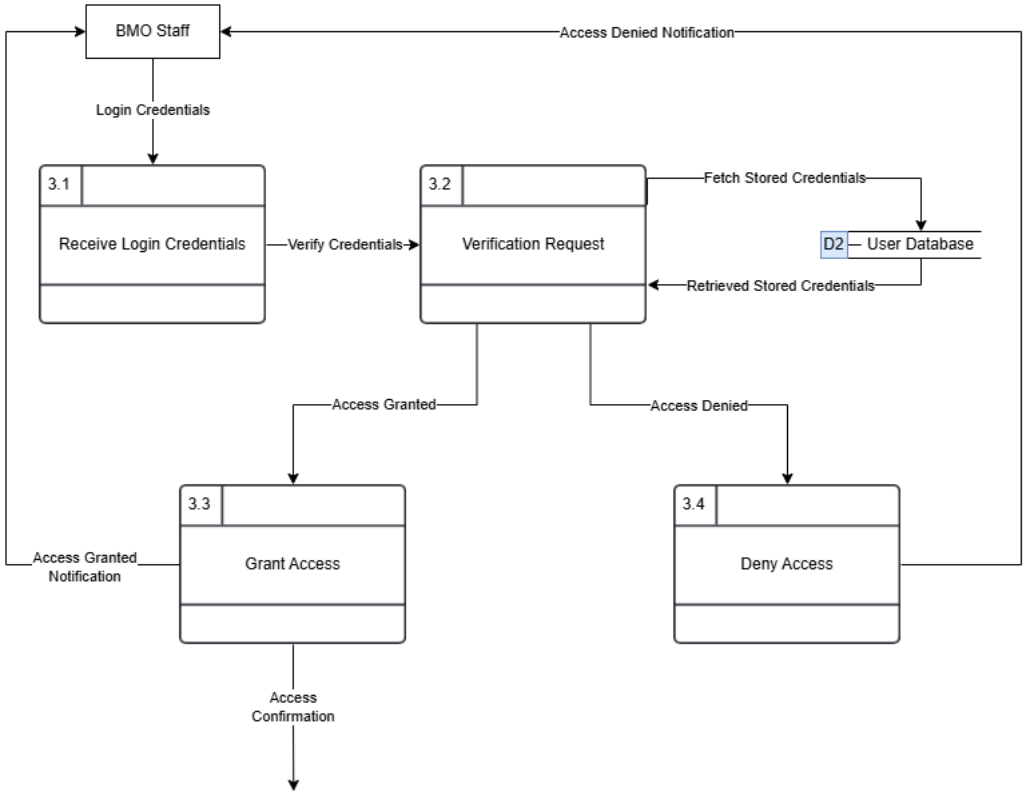


2.1.3 Level 2

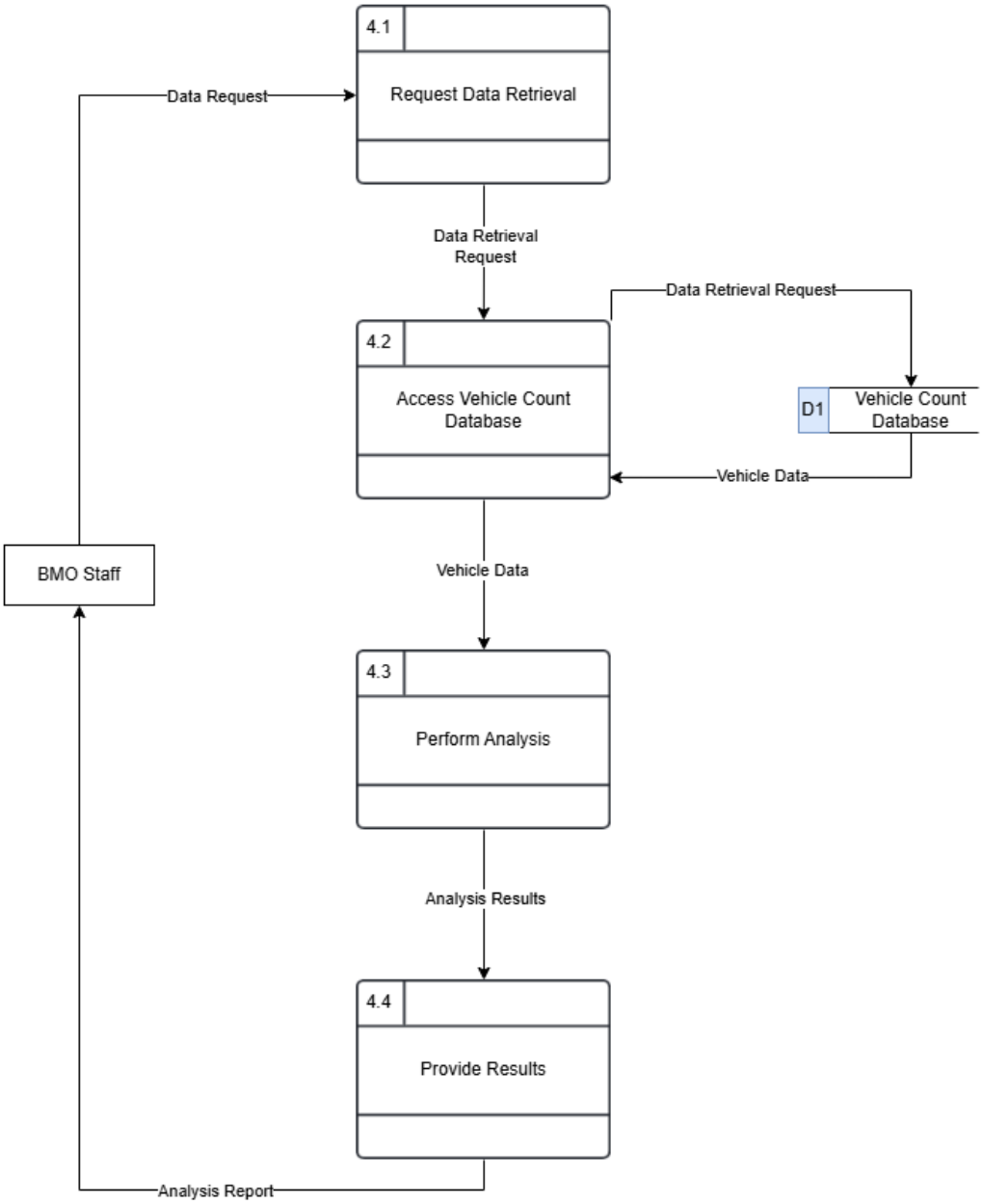
2.1.3.1 Monitor Parking Slot Availability



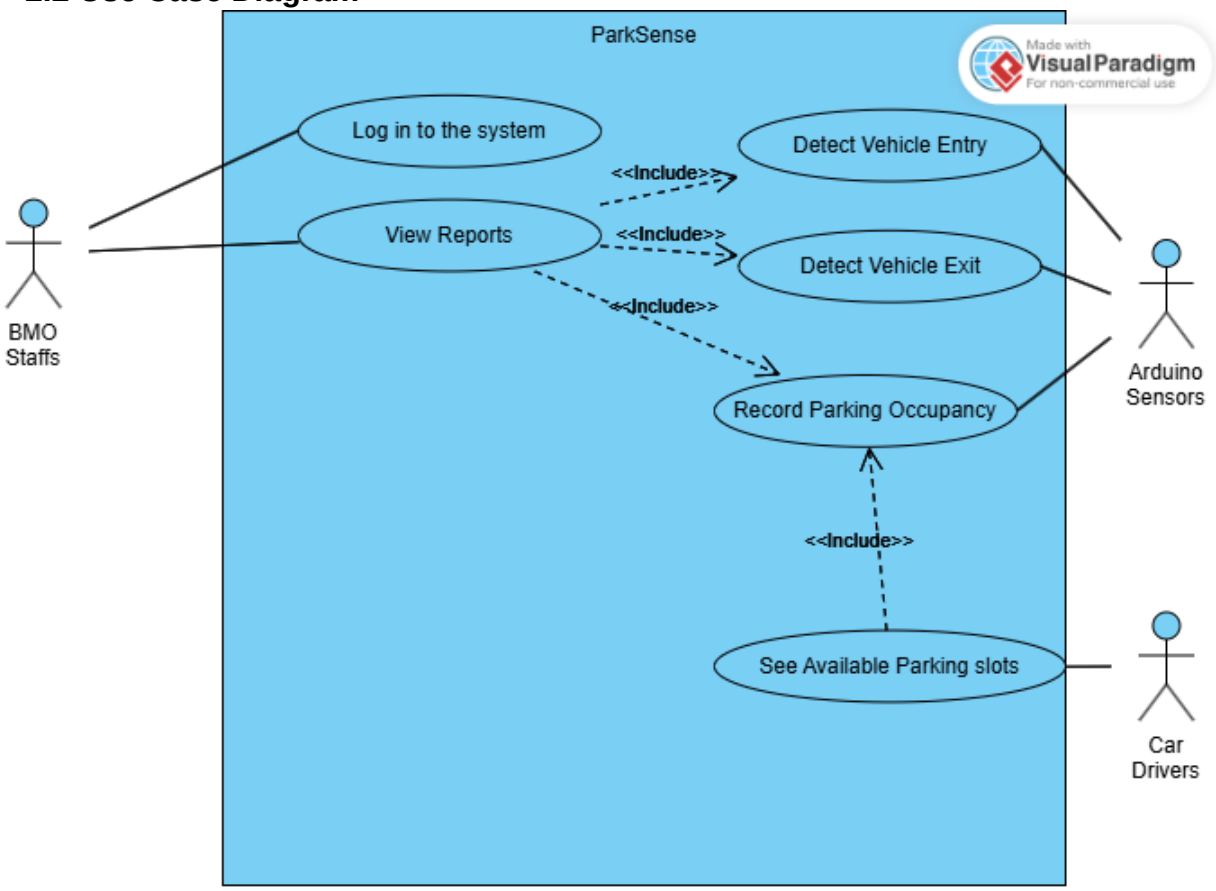
2.1.3.2 Dashboard Login



2.1.3.3 Analyze Data



2.2 Use Case Diagram



2.3 Fully Dressed Use Cases

2.3.1 Login into the System

Use Case ID	PAS_UC_1
Use Case Name	**Login in to the system**
Created By	John Jorel Landicho
Date Created	9/16/2024
Description	This use case describes the process of logging into the ParkSense system, allowing authorized users (BMO Staff) to access specific system functions after successful authentication.
Primary Actor	BMO Staff
Preconditions	**1.** The Park Sense system is operational. **2.** The user has a valid username and password.
Postconditions	**Success**: The user is logged into the system and can perform their assigned tasks. **Failure**: The system denies access, and no tasks can be performed until a successful login.
Main Success Scenario (Basic Flow)	**1.** The actor (BMO Staff) opens the ParkSense system login screen. **2.** The system displays fields for the username and password. **3.** The actor inputs their username and password. **4.** The system checks the entered credentials against its database. **5.** The system confirms that the credentials are correct and logs the actor into the system. **6.** The actor is redirected to the appropriate dashboard based on their role (e.g., BMO Staff is directed to the dashboard for analyzing data;).
Extensions (Alternate Flows)	2a. **Invalid Credentials:** • **Trigger:** The user enters an incorrect username or password. • **Action:** The system detects that the credentials do not match the database records. • **Response:** The system displays an error message ("Invalid username or password") and prompts the user to retry.

Special Requirements	**1.** Passwords should follow security protocols (e.g., minimum length, complexity requirements). **2.** The login interface should be simple and user-friendly.

2.3.2 View Reports

Use Case ID	PAS_UC_2
Use Case Name	**View Reports**
Created By	**ImPossible**: John Jorel Landicho, Rchie Libudan, Angela Mae Tauyan, Timothy Jay Sayson
Date Created	11/01/2024
Description	This use case allows BMO Staff to view reports based on parking data collected by the system.
Primary Actor	BMO Staff
Include Use Case	**1.** Detect Vehicle Entry **2.** Detect Vehicle Exit **3.** Record Parking Space Occupancy
Preconditions	1. The Park Sense system is operational and has logged sufficient data.
Postconditions	**Success:** Accurate and comprehensive reports are generated. **Failure:** Reports are missing key information or contain errors.
Main Success Scenario (Basic Flow)	**1.** BMO Staff selects the "View Reports" option. **2.** The system retrieves historical occupancy and usage data. **3.** The system displays the data in a report format.
Extensions (Alternate Flows)	2a. **Report Contains Errors or Missing Data:** • **Trigger:** The system notifies the BMO Staff that there is no data available. • **Action:** The BMO Staff adjusts the report parameters or requests system maintenance. • **Response:** A corrected report is generated.
Special Requirements	**1.** The reporting tool should support different formats (PDF, Excel).

	2. Reports should include visual aids like charts and graphs for easy interpretation.

2.3.3 Detect Vehicle Entry

Use Case ID	PAS_UC_3
Use Case Name	**Detect Vehicle Entry**
Created By	**ImPossible**: John Jorel Landicho, Rchie Libudan, Angela Mae Tauyan, Timothy Jay Sayson
Date Created	11/01/2024
Description	Detects when a vehicle enters the parking facility and updates occupancy data.
Primary Actor	Arduino Sensors
Preconditions	**1.** Arduino sensors are functional and calibrated.
Postconditions	**Success:** The system records a new vehicle entry and updates parking occupancy. **Failure:** The system fails to record new vehicle entry and not update the parking occupancy.
Main Success Scenario (Basic Flow)	**1.** A vehicle passes through the entry point. **2.** The Arduino sensor detects the vehicle's entry. **3.** The system increments the count of occupied parking slots.
Extensions (Alternate Flows)	2a. **If the sensor fails to detect a vehicle entering:** • **Trigger:** The system prompts BMO Staff to check the entry status. • **Action:** The BMO Staff check the actual device and do some maintenance. • **Response:** Updates the occupied parking slots.
Special Requirements	**1.** The system must update occupancy within 2 seconds of detection.

2.3.4 Detect Vehicle Exit

Use Case ID	PAS_UC_4
Use Case Name	**Detect Vehicle Exit**
Created By	**ImPossible**: John Jorel Landicho, Rchie Libudan, Angela Mae Tauyan, Timothy Jay Sayson
Date Created	11/01/2024
Description	Detects when a vehicle exits the parking facility and updates occupancy data.
Primary Actor	Arduino Sensors
Preconditions	**1.** Arduino sensors are functional and calibrated.
Postconditions	**Success:** The system records the vehicle exit and updates parking occupancy. **Failure:** The system fails to record vehicle exit and not update the parking occupancy.
Main Success Scenario (Basic Flow)	**1.** A vehicle passes through the exit point. **2.** The Arduino sensor detects the vehicle's exit. **3.** The system decrements the count of occupied parking slots.
Extensions (Alternate Flows)	2a. **If the sensor fails to detect a vehicle exiting:** • **Trigger:** The system prompts BMO Staff to check the exit status. • **Action:** The BMO Staff check the actual device and do some maintenance. • **Response:** Updates the occupied parking slots.
Special Requirements	**1.** The system should reflect the updated count within 2 seconds.

2.3.5 Record Parking Occupancy

Use Case ID	PAS_UC_5
Use Case Name	**Record Parking Occupancy**
Created By	**ImPossible**: John Jorel Landicho, Rchie Libudan, Angela Mae Tauyan, Timothy Jay Sayson

Date Created	11/01/2024
Description	Records current parking occupancy based on vehicle entries and exits.
Primary Actor	Arduino Sensors
Preconditions	**1.** ParkSense system is active and logging entry/exit data.
Postconditions	**Success:** The parking occupancy is accurately recorded and available for reporting. **Failure:** The system fails to accurately record the parking occupancy.
Main Success Scenario (Basic Flow)	**1.** The system tracks each vehicle entry and exit. **2.** The occupancy data is updated in real-time. **3.** The system logs the occupancy status for historical reporting.
Extensions (Alternate Flows)	1a. **If there is an inconsistency in the entry/exit count:** • **Trigger:** The system alerts BMO Staff for manual verification. • **Action:** BMO Staff logs into the system and reviews the data. • **Response:** BMO Staff performs a manual override to correct the occupancy count if necessary.
Special Requirements	**1.** Data must be stored in a secure database accessible only by authorized personnel.

2.3.6 See Available Parking Slot

Use Case ID	PAS_UC_6
Use Case Name	**See Available Parking slots**
Created By	**ImPossible**: John Jorel Landicho, Rchie Libudan, Angela Mae Tauyan, Timothy Jay Sayson
Date Created	11/01/2024
Description	Allows Car Drivers to view available parking slots displayed at the entrance.
Primary Actor	Car Drivers
Include Use Case	**1.** Record Parking Occupancy
Preconditions	**1.** ParkSense system is operational and updated in real-time.

Postconditions	**Success:** Car Drivers are informed of the number of available slots. **Failure:** The system fails to accurately record the parking occupancy, leading to inconsistent slot availability information for Car Drivers
Main Success Scenario (Basic Flow)	**4.** The system calculates the available parking slots based on occupancy data. **5.** The system updates the display board with the current count of available slots.
Extensions (Alternate Flows)	1a. **If the display board is malfunctioning:** • **Trigger:** The system detects an issue with the display board. • **Action:** The BMO Staff performs diagnostic checks or repairs to restore functionality. • **Response:** Display board is working and updated.
Special Requirements	**1.** Display visibility must meet local safety standards and be readable from at least 10 meters away.

2.4 Test Cases for Fully Dressed Use Cases

2.4.1 Login into the system

Test Case ID	TS_PAS_UC_1-1	**Test Case Description**	Verify that BMO Staff can successfully log into the ParkSense system. Prerequisites: ParkSense system is operational; valid login credentials are available.		
Created By	John Jorel Landicho	**Reviewed By**	Timothy Jay V. Sayson	**Version**	1.0

S #	Prerequisites:
1	ParkSense system is operational; valid login credentials are available.
2	The user has valid or invalid login credentials (username and password).
3	The login page is accessible.

S #	Test Data
1	BMO Email
2	BMO Password
3	No credentials entered
4	Invalid Credentials

Test Scenario BMO Staff logs into the system with valid credentials.

Step #	Step Details	Expected Results
1	Open the ParkSense login page.	The login page displays fields for username and password.
2	Enter a valid username and password.	The system accepts the input and enables the login button.
3	Enter an invalid username and/or password.	The system displays an error message, "Invalid username or password."
4	Enter no credentials and click "Login."	The system displays an error message prompting the user to fill in both fields.
5	Click on "Forgot Password" link and enter a valid email/phone number.	The system sends a password reset link/code via email/SMS and displays a message: "Password reset link sent."
6	After successful login, log out of the system.	The user is successfully logged out and redirected to the login page.

2.4.2 View Reports

Test Case ID	TS_PAS_UC_2-2	Test Case Description	Verify that BMO Staff can view historical occupancy reports based on collected data.		
Created By	Timothy Jay V. Sayson	Reviewed By	John Jorel Landicho	Version	1.0

S #	Prerequisites:
1	The Park Sense system is online and operational.
2	The dashboard is accessible by the BMO Staff.
3	Parking sensors are functional and accurately reporting space occupancy.
4	BMO Staff have logged into the system.

S #	Test Data
1	BMO Staff simply accesses existing reports

Test Scenario BMO Staff views occupancy and usage reports.

Step #	Step Details	Expected Results
1	Access the Park Sense dashboard.	The dashboard loads successfully and shows real-time parking data.
2	Navigate to the "View Reports" section.	The system opens the reports page with available report options.
3	Select parameters for the report (e.g., date range, report type).	The selected parameters are applied, and the "Generate Report" button becomes active.
4	Click "Generate Report."	The system retrieves the relevant data and displays a report, including occupancy data and visual aids (charts, graphs).

2.4.3 Detect Vehicle Entry

Test Case ID	TS_PAS_UC_3-3	Test Case Description	Verify that the ParkSense system detects a vehicle entry and updates occupancy data accurately.		
Created By	Angela Tauyan	Reviewed By	Timothy Jay V. Sayson	Version	1.0

S #	Prerequisites:
1	The Park Sense system is online and operational.
2	Arduino sensors are functional and calibrated.

S #	Test Data
1	Simulated vehicle entry

Test Scenario Simulated vehicle entry

Step #	Step Details	Expected Results
1	Simulate a vehicle passing through the entry point.	The Arduino sensor detects the vehicle.
2	The Arduino sensor detects the entry.	The system registers the vehicle entry and prepares to update occupancy.
3	Check if the system increments the occupied slot count.	The system increases the count of occupied parking slots by one within 2 seconds.

2.4.4 Detect Vehicle Exit

Test Case ID	TS_PAS_UC_4-4	Test Case Description	Verify that the ParkSense system detects a vehicle exit and updates occupancy data accurately.		
Created By	Rchie Libudan	Reviewed By	Timothy Jay V. Sayson	Version	1.0

S #	Prerequisites:
1	The Park Sense system is online and operational.
2	Arduino sensors are functional and calibrated.

S #	Test Data
1	Simulated vehicle exit

Test Scenario Vehicle exits the parking facility, and the system detects it.

Step #	Step Details	Expected Results
1	Simulate a vehicle passing through the exit point.	The Arduino sensor detects the vehicle.
2	The Arduino sensor detects the exit.	The system registers the vehicle exit and prepares to update occupancy.
3	Check if the system decrements the occupied slot count.	The system decreases the count of occupied parking slots by one within 2 seconds.

2.4.5 Record Parking Occupancy

Test Case ID	TS_PAS_UC_5-5	Test Case Description	Verify that the system logs and records real-time parking occupancy based on vehicle entries and exits.		
Created By	John Jorel Landicho	Reviewed By	Timothy Jay V. Sayson	Version	1.0

S #	Prerequisites:
1	The Park Sense system is online and operational.
2	Arduino sensors are functional and calibrated.

S #	Test Data
1	Simulated entry and exit events

Test Scenario The system logs occupancy data as vehicles enter and exit.

Step #	Step Details	Expected Results
1	Simulate multiple vehicle entries and exits.	The system accurately detects each entry and exit event.
2	Verify that the system updates occupancy data in real-time.	The occupancy count reflects the actual number of vehicles currently in the parking facility.
3	Check the system's historical log to ensure data accuracy.	The log shows a consistent and accurate record of all entries and exits, matching real-time data.

2.4.6 See Available Parking Slot

Test Case ID	TS_PAS_UC_6-6	Test Case Description	Verify that the display board shows the correct number of available slots for car drivers at the entrance.		
Created By	John Jorel Landicho	Reviewed By	Timothy Jay V. Sayson	Version	1.0

S #	Prerequisites:
1	ParkSense system is operational and real-time occupancy data is available.
2	Arduino sensors are functional and calibrated.

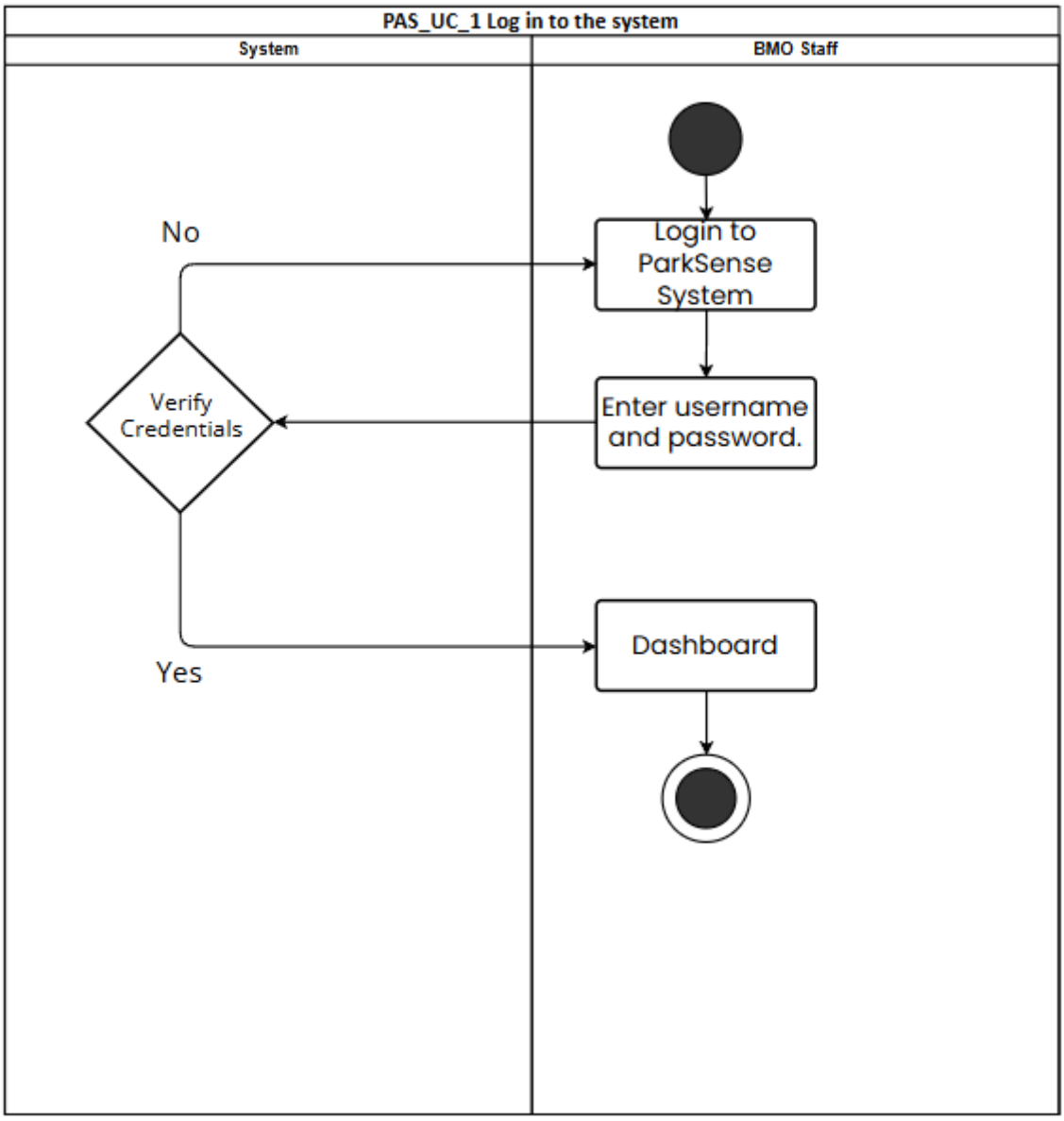
S #	Test Data
1	Simulated vehicle entry and exit events

Test Scenario Available slots are displayed on the board for car drivers to view.

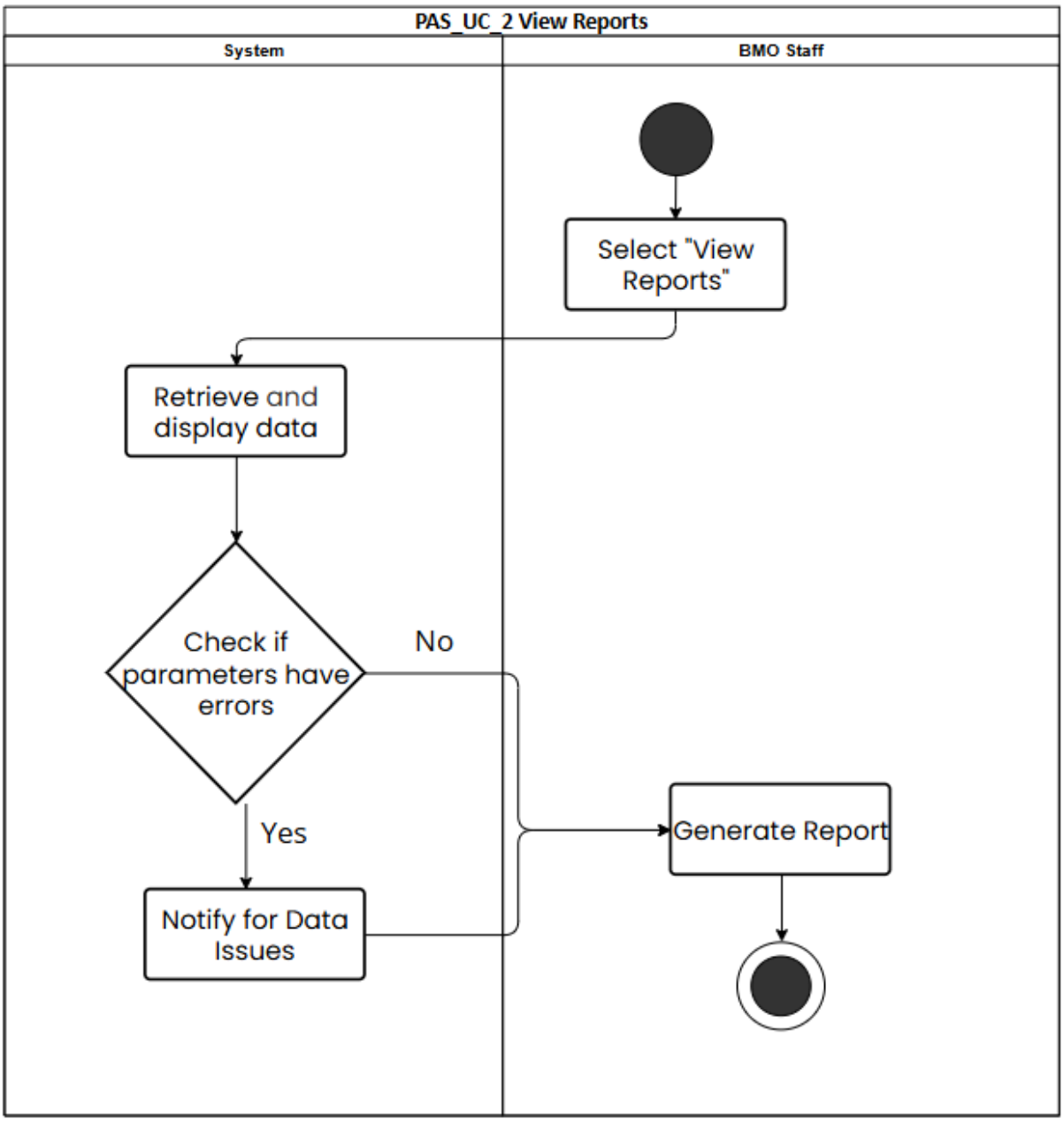
Step #	Step Details	Expected Results
1	Simulate vehicles entering and exiting the parking facility.	The system accurately updates the occupancy count based on vehicle entries and exits.
2	Check if the display board updates the count of available slots after each entry/exit event.	The display board shows the correct number of available slots and updates within 2 seconds after any entry or exit.

2.5 Activity Diagrams with Swimlane

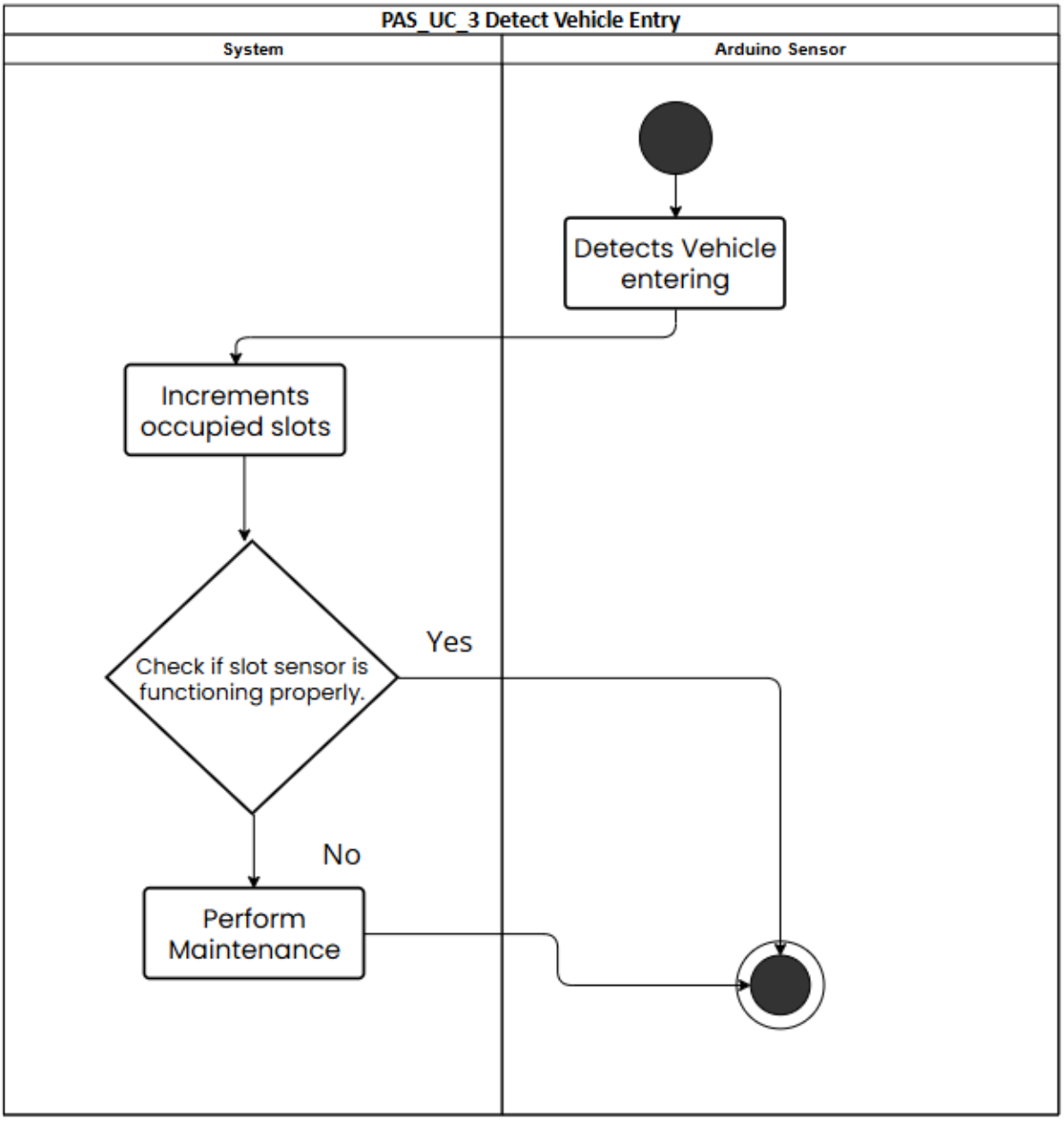
2.5.1 Log in into the system



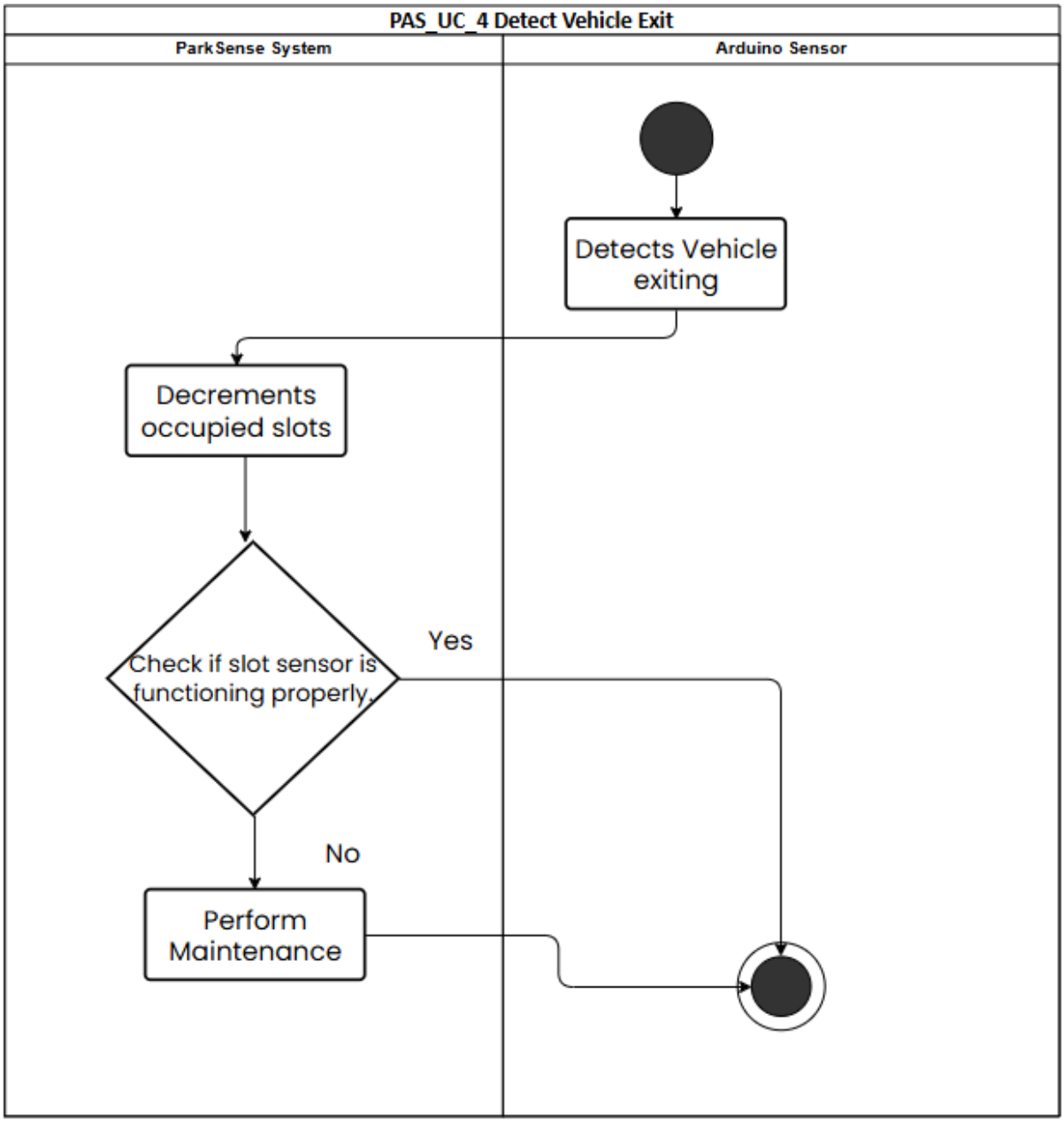
2.5.2 View Reports



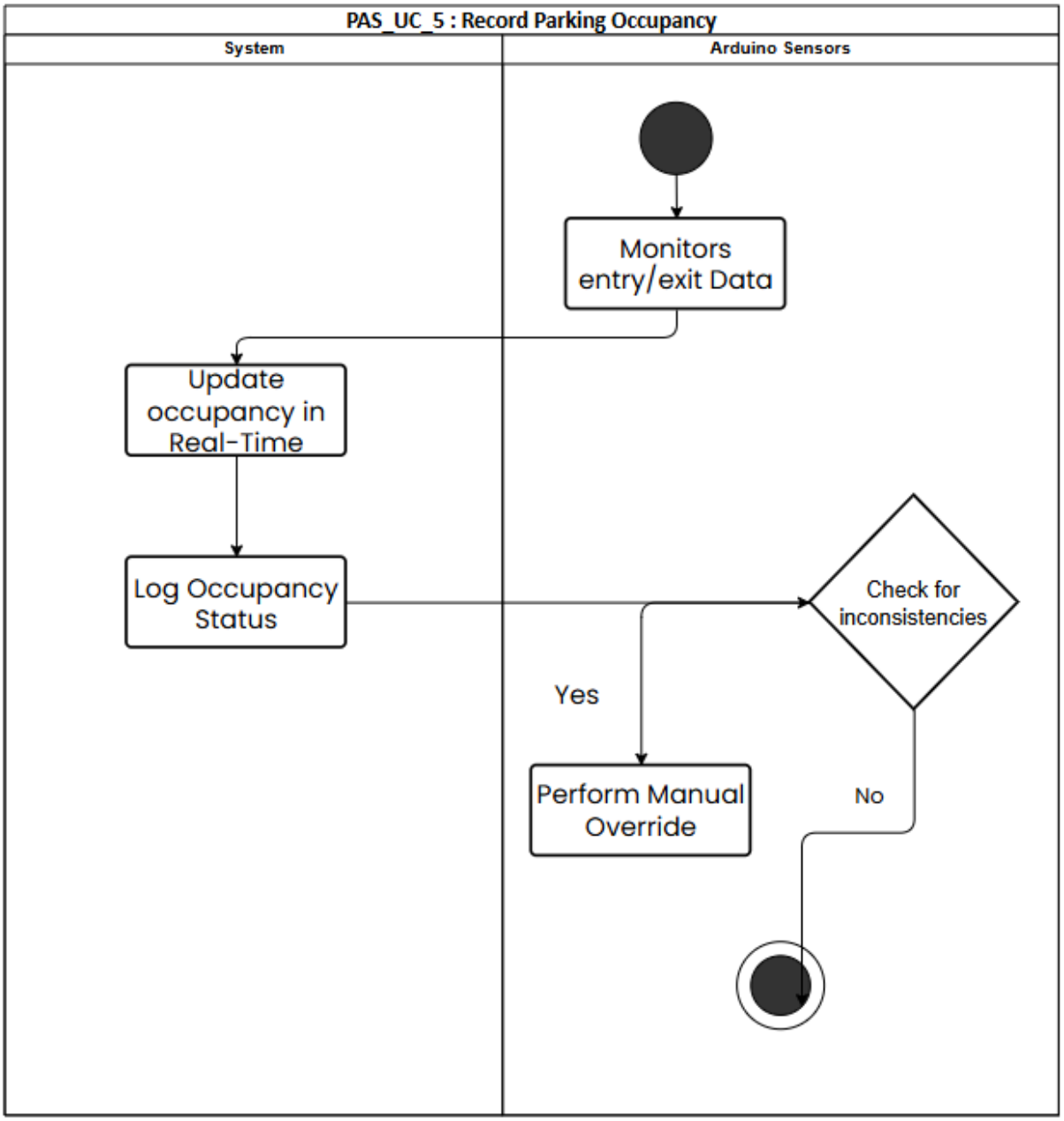
2.5.3 Detect Vehicle Entry



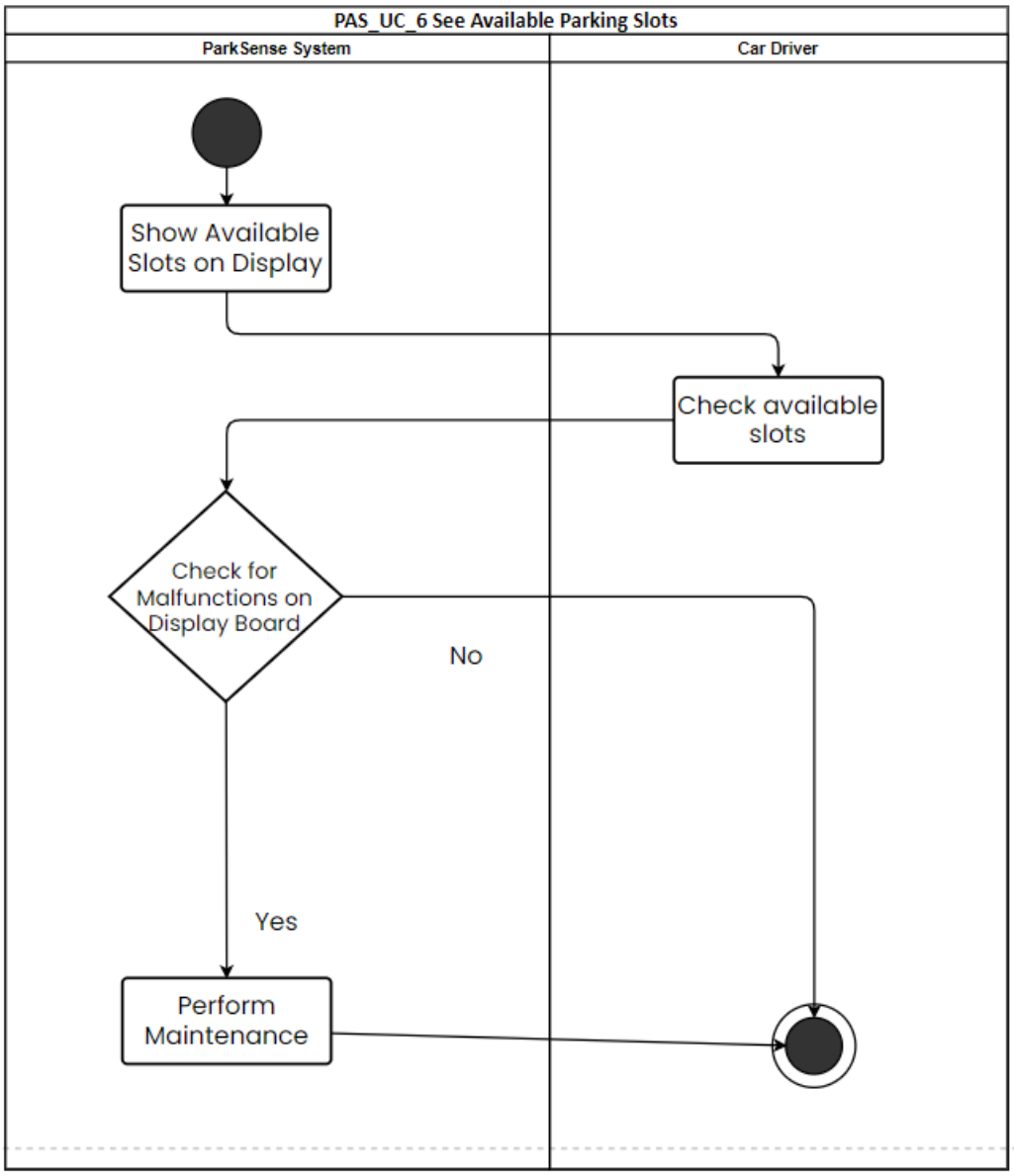
2.5.4 Detect Vehicle Exit



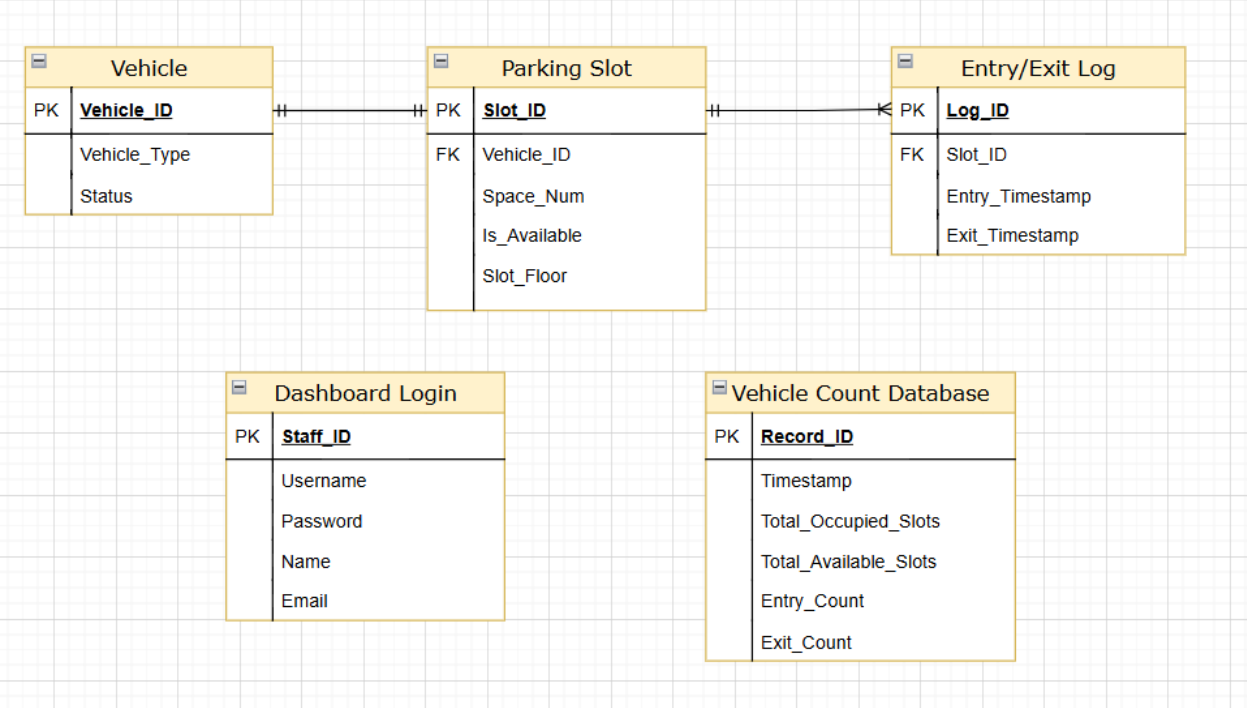
2.5.5 Record Parking Occupancy



2.5.6 See Available Parking Slot



2.6 Database Design



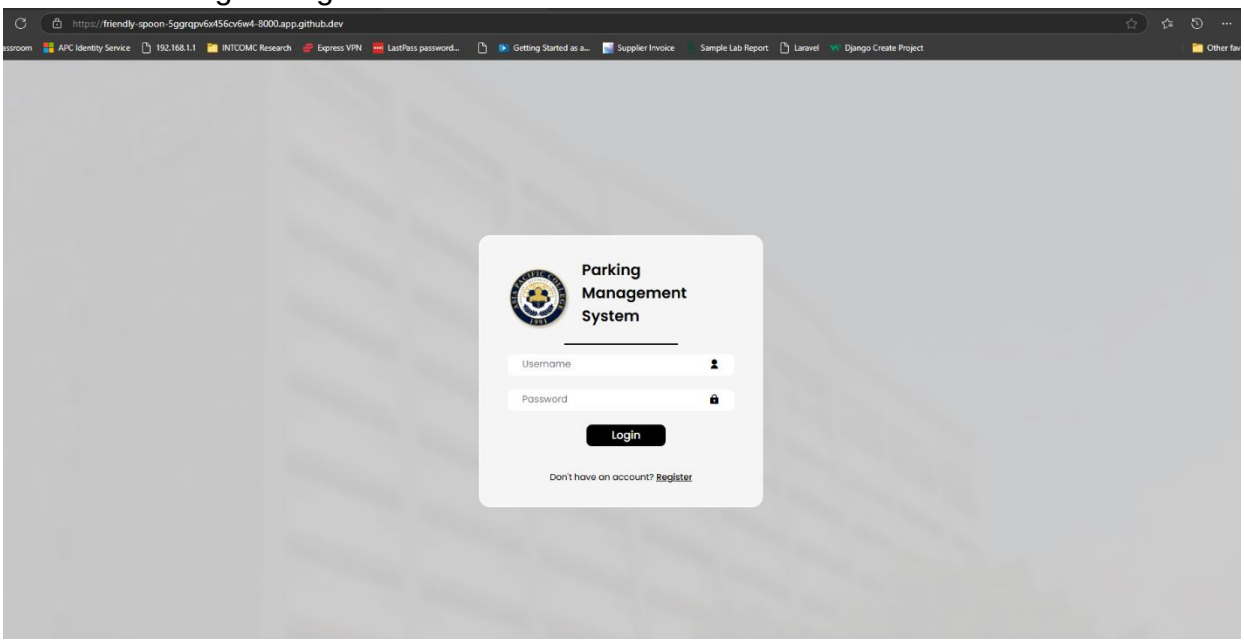
2.7 Product Backlog / User Stories

Table I Product Backlog

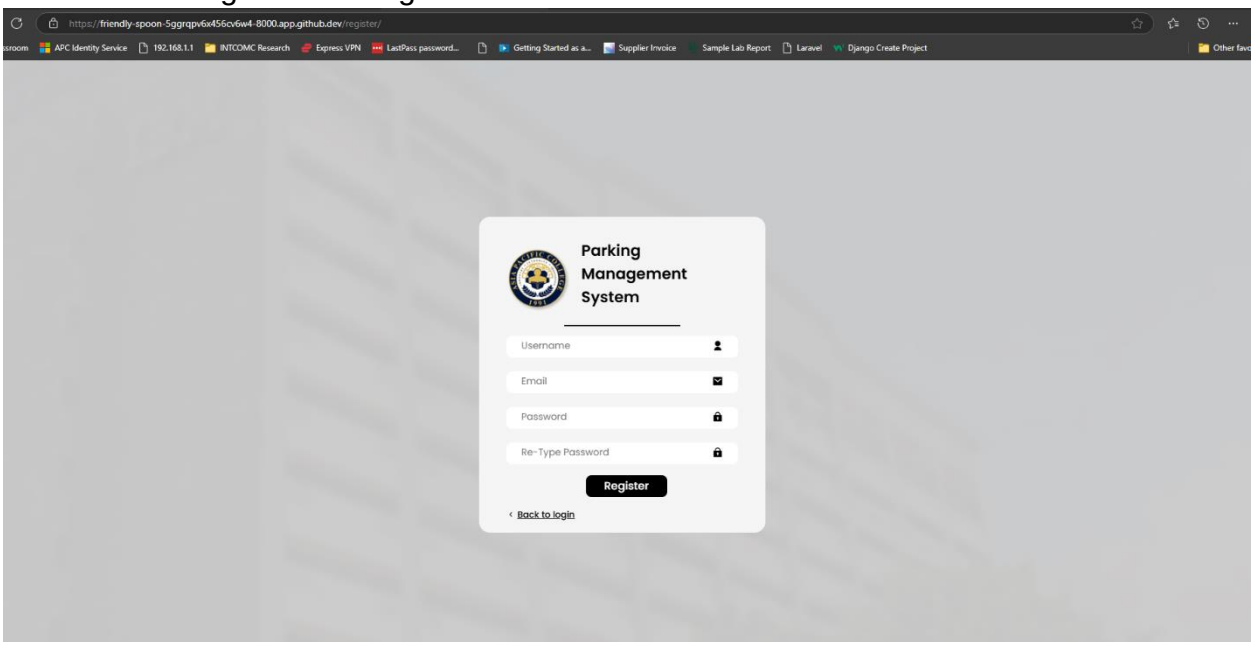
ID	As a…	I want to be able to…	So That…	Priority
1	Parking User	Use the parking facility	I can park my vehicle quickly and securely	Must
2	Parking User	Authenticate my identity	I can access the parking facility	Must
3	Parking User	Report issues	Any problems can be addressed quickly	Should
4	BMO Staff	Analyze data	I can make informed decisions based on the data given	Must
5	BMO Staff	Generate reports	I can provide detailed information to stakeholders	Should
6	BMO Staff	Oversee maintenance	The parking facility is maintained regularly and efficiently	Should

2.8 Partially Working Cloud Hosted Prototype

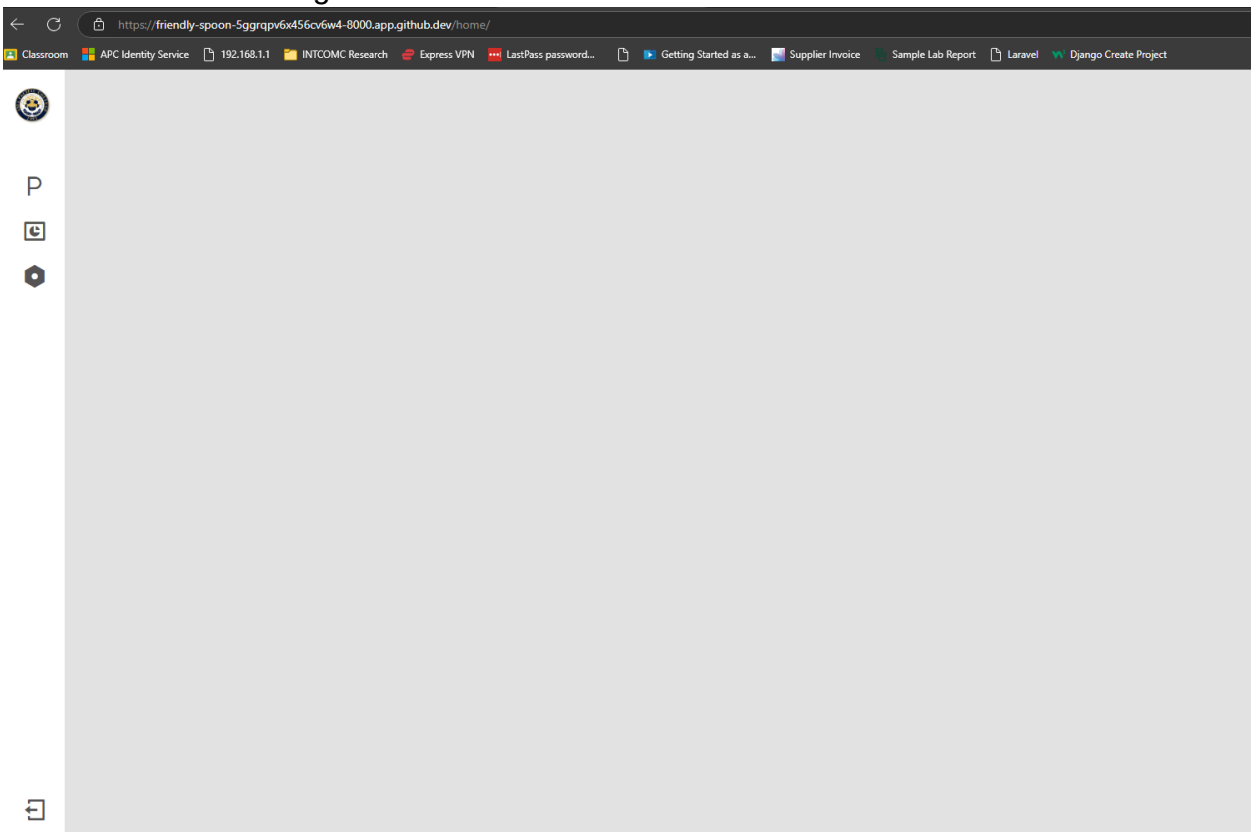
2.8.1 Log-in Page



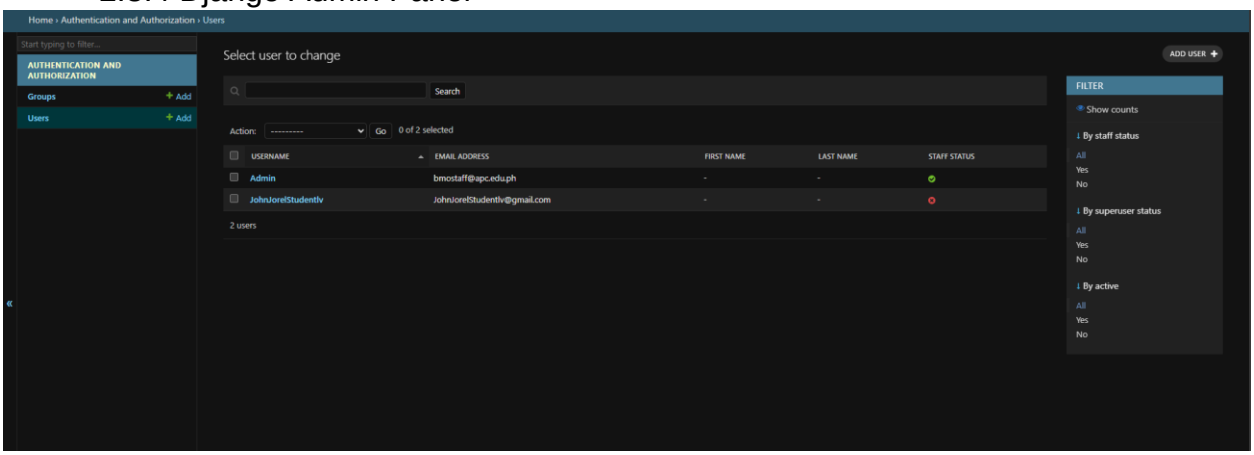
2.8.2 Registration Page



2.8.3 Home Page

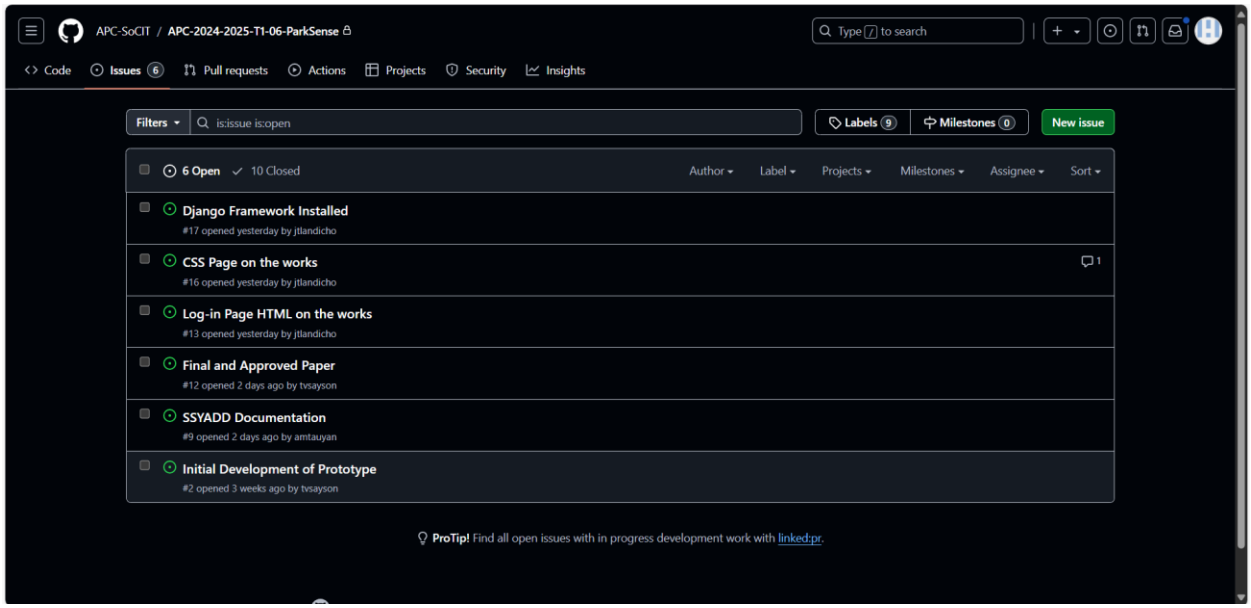


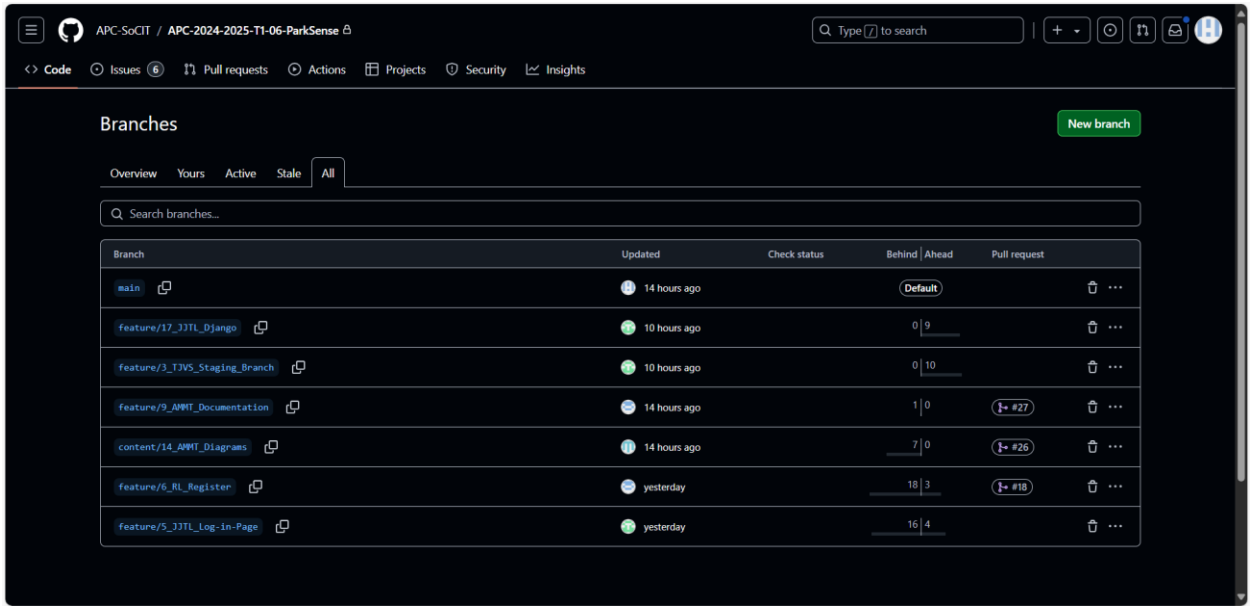
2.8.4 Django Admin Panel



2.9 Updates of Contents in Project GitHub Repository

https://github.com/APC-SoCIT/APC-2024-2025-T1-06-ParkSense


APC-SoCIT / APC-2024-2025-T1-06-ParkSense
Type / to search
Code
Issues 6
Pull requests
Actions
Projects
Security
Insights
Filters
is:issue is:open
Labels 9
Milestones 0
New issue
6 Open
10 Closed
Author
Label
Projects
Milestones
Assignee
Sort
Django Framework Installed
#17 opened yesterday by jtlandicho
CSS Page on the works
#16 opened yesterday by jtlandicho
Log-in Page HTML on the works
#13 opened yesterday by jtlandicho
Final and Approved Paper
#12 opened 2 days ago by tvsayson
SSYADD Documentation
#9 opened 2 days ago by amtauyan
Initial Development of Prototype
#2 opened 3 weeks ago by tvsayson
ProTip! Find all open issues with in progress development work with linked:pr.


APC-SoCIT / APC-2024-2025-T1-06-ParkSense
Type / to search
Code
Issues 6
Pull requests
Actions
Projects
Security
Insights
Branches
New branch
Overview
Yours
Active
Stale
All
Search branches...
Branch
Updated
Check status
Behind | Ahead
Pull request
main
14 hours ago
Default
feature/17_JJTL_Django
10 hours ago
0 | 9
feature/3_TJVS_Staging_Branch
10 hours ago
0 | 10
feature/9_AMMT_Documentation
14 hours ago
1 | 0
#27
content/14_AMMT_Diagrams
14 hours ago
7 | 0
#26
feature/6_RL_Register
yesterday
18 | 3
#18
feature/5_JJTL_Log-in-Page
yesterday
16 | 4

2.10 Prototype

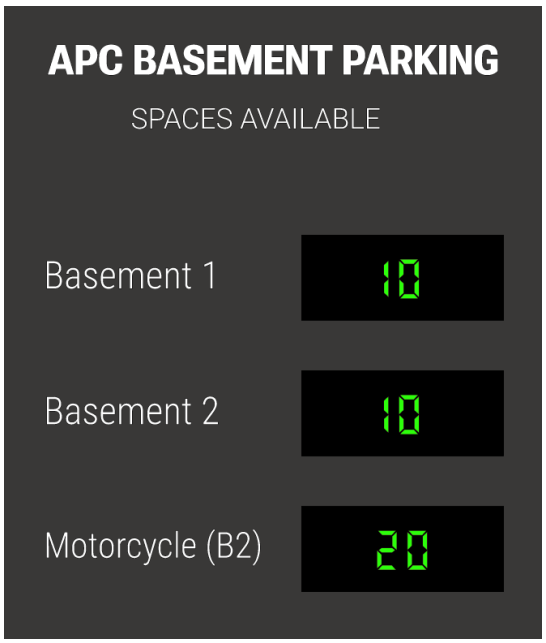


Figure 1 Prototype: Tracker Display

Figure 2 Prototype: Dashboard

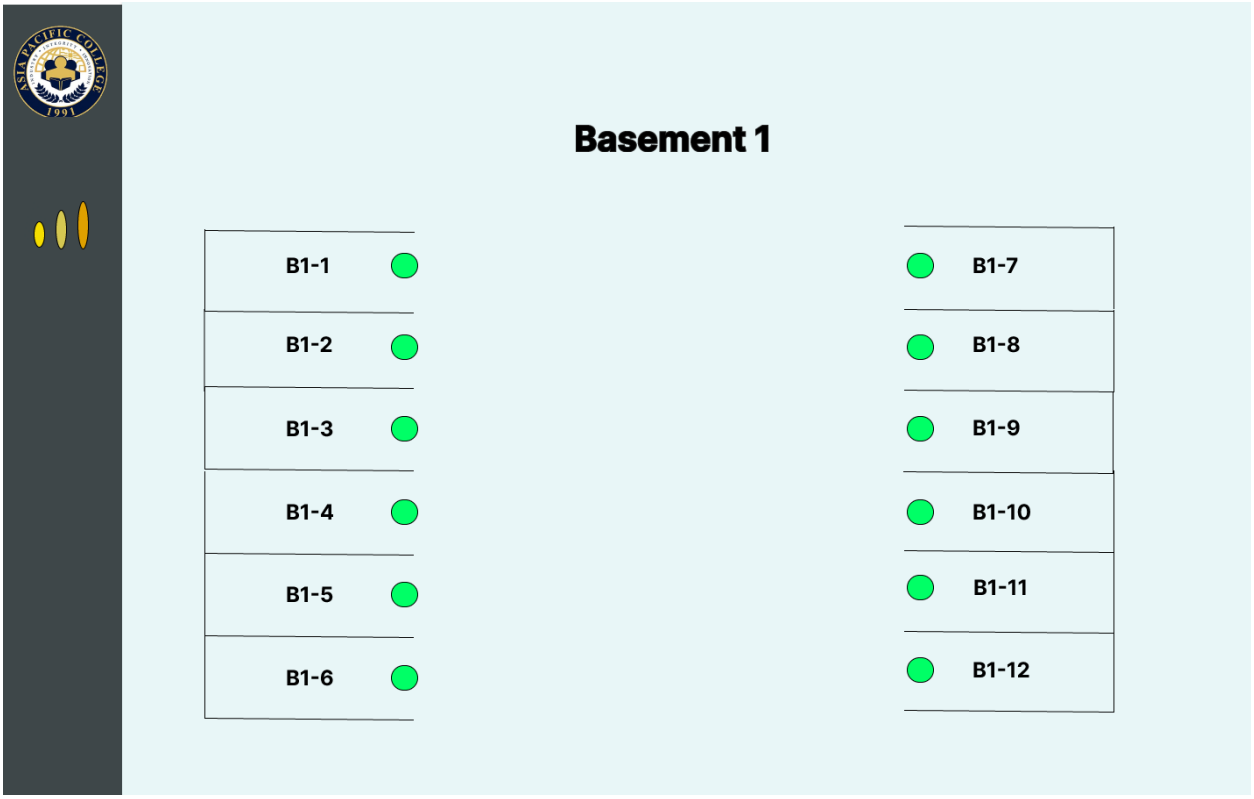


Figure 3 Prototype: Basement 1 Display

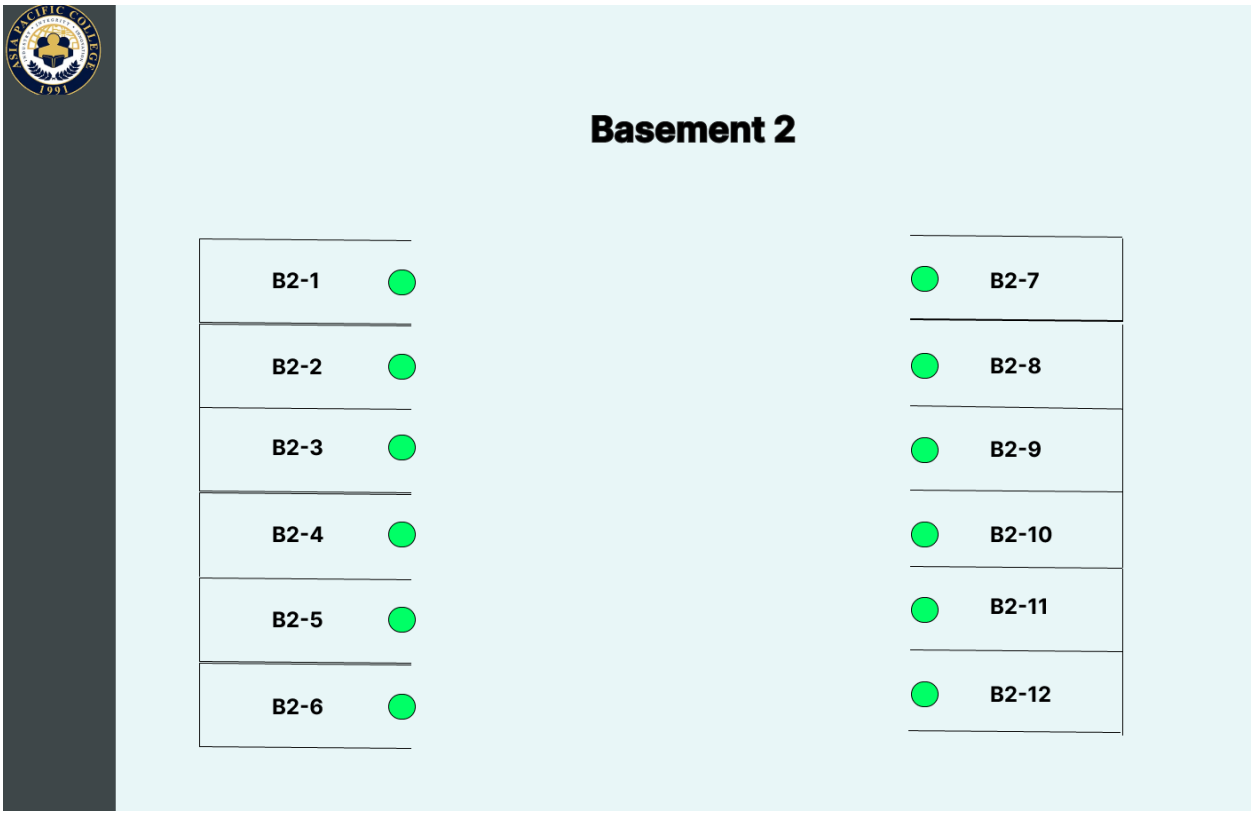


Figure 4 Prototype: Basement 2 Display

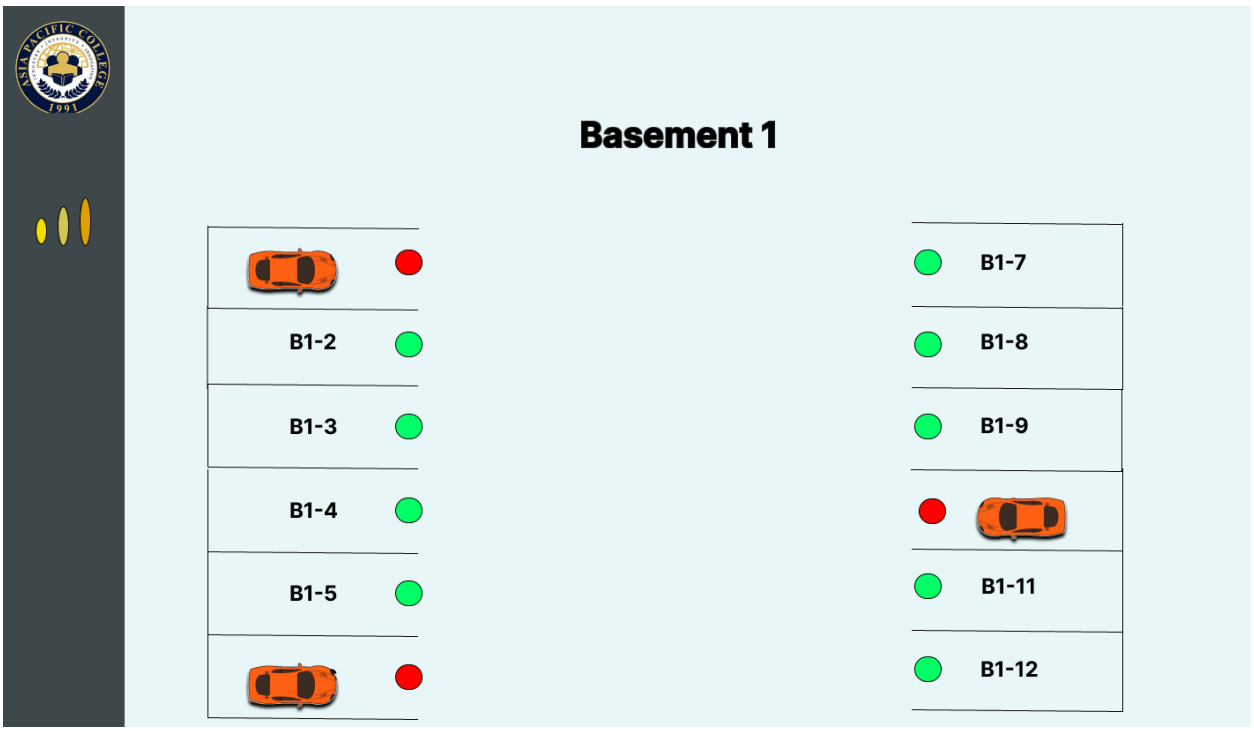


Figure 5 Prototype: Basement 1 Slots Taken

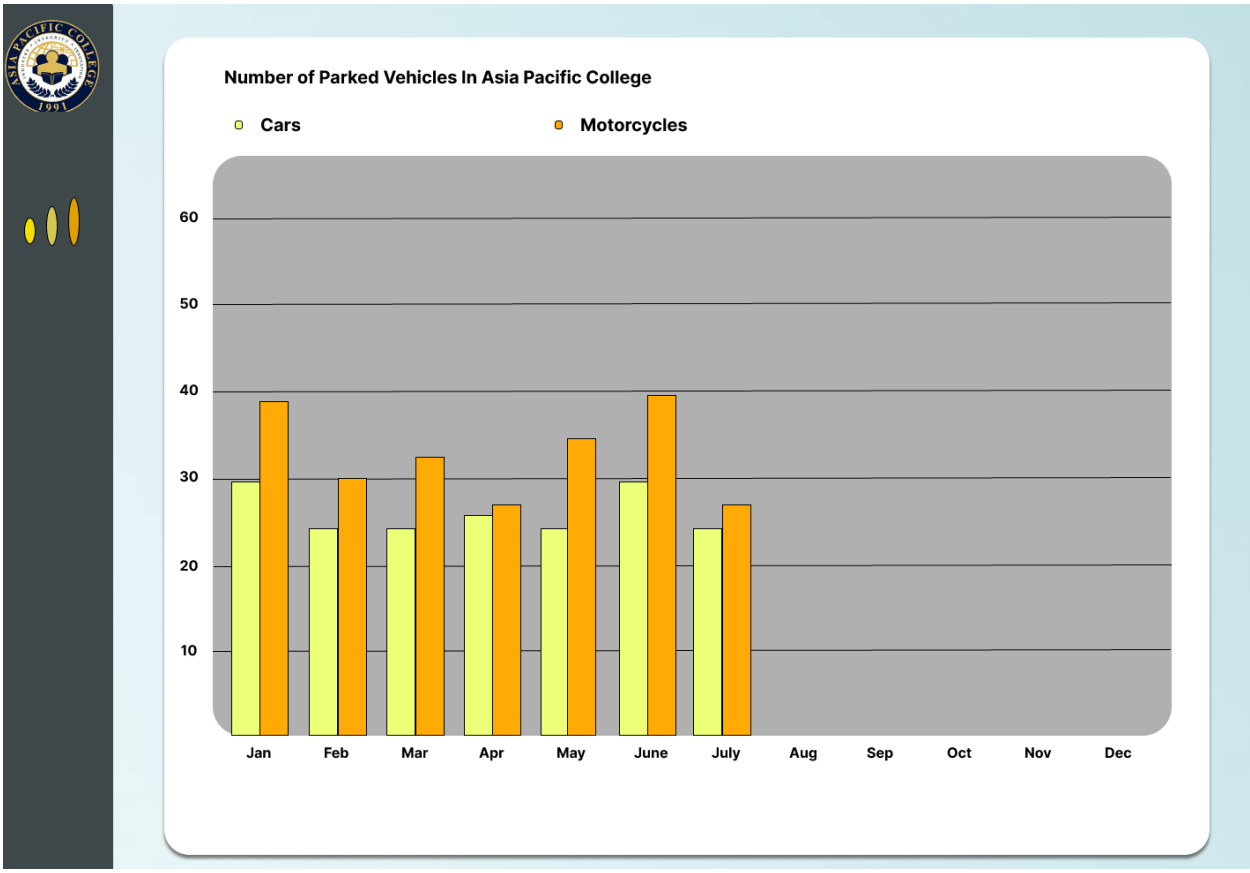


Figure 6 Prototype: Analytics

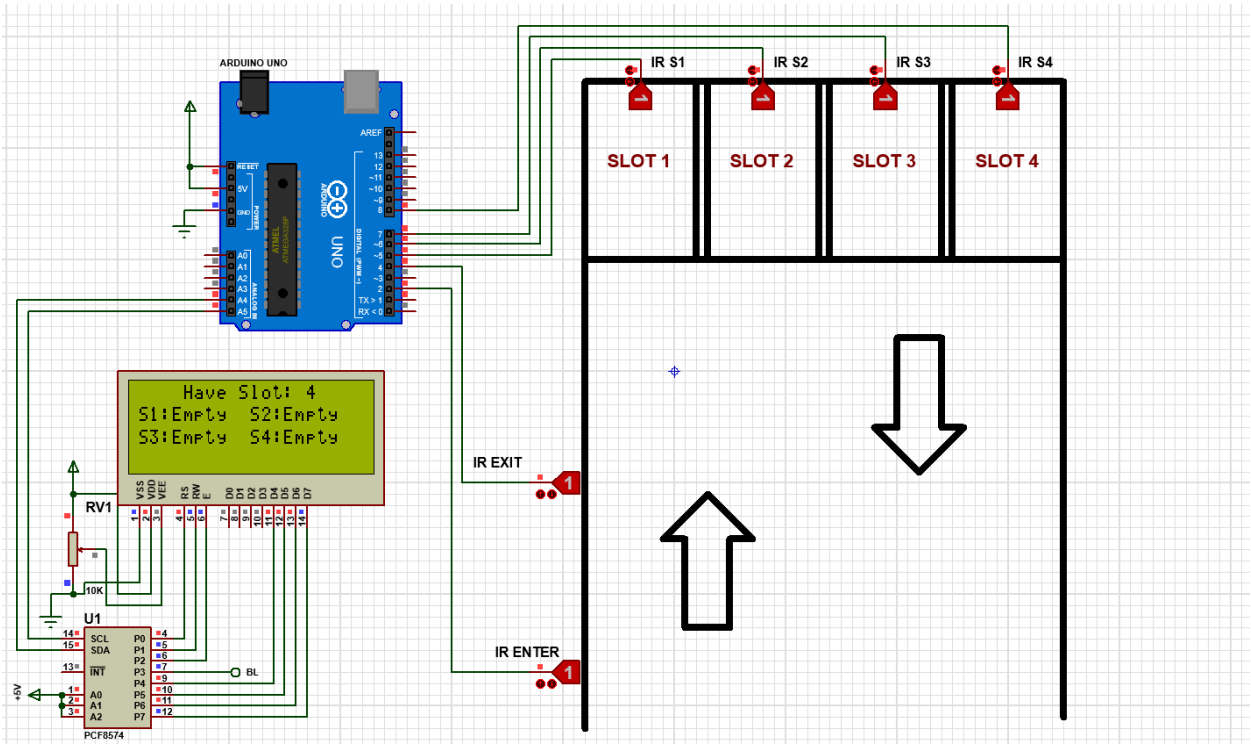


Figure 7 Prototype: Schematic Diagram

2.10.1 Technology Stack

1. Frontend:

- **HTML, CSS, JavaScript:** Standard web technologies for structure, styling, and interactivity.

2. Backend:

- **Django Framework (Python):** Used for building the entire web application with its backend feature and server-side logic.

3. Database:

- **SQLite:** A built-in database in Django

4. Authentication:

- **Django Authentication:** A built-in authentication system to handle user authentication authorization

5. Version Control:

- **Git:** For tracking changes in code.
- **Github:** Used for tracking, branching, merging codes, and collaborating with other developers.

2.10.2 GitHub Project Repository
The link below is the team’s collaborative space for their project.

ImPossible GitHub repository link: https://github.com/APC-SoCIT/APC-2024-2025-T1-06-ParkSense

2.11 Conclusion

The development of parking sensors and other advanced parking technologies is crucial for addressing the persistent challenges associated with finding parking in urban areas. These innovations offer significant benefits, including reducing search time, alleviating traffic congestion, and minimizing environmental impacts. By understanding and managing the effects on various stakeholders, such as students, faculty, and the local community, schools and other institutions can effectively navigate the complexities of these technological improvements. As the reliance on personal vehicles continues to grow, the adoption of smart parking solutions becomes increasingly essential for enhancing urban transportation efficiency and sustainability.

The successful implementation of this project can serve as a stepping stone for the improvement of our school's basement parking, allowing future PBL students to further improve and add additional features to the basement parking once the BMO receives all of the data and analytics on its usage.

Appendices

Appendix A: Project Vision

Our vision is to utilize innovative methods to make parking at Asia Pacific College more convenient, efficient, and user-friendly. Our goal is to create a completely automated parking management system that combines modern technology with the subjects we studied at Asia Pacific College. This contains sensors for each parking slot, display trackers to keep track of available slots on each basement level, and a real-time monitoring system that provides analytics and indicates whether or not the basement level is filled. By deploying this system, we want to improve the security and overall experience of all target users. The initiative aims to enhance campus parking by promoting a more orderly and sustainable environment.

Appendix B: Schedule

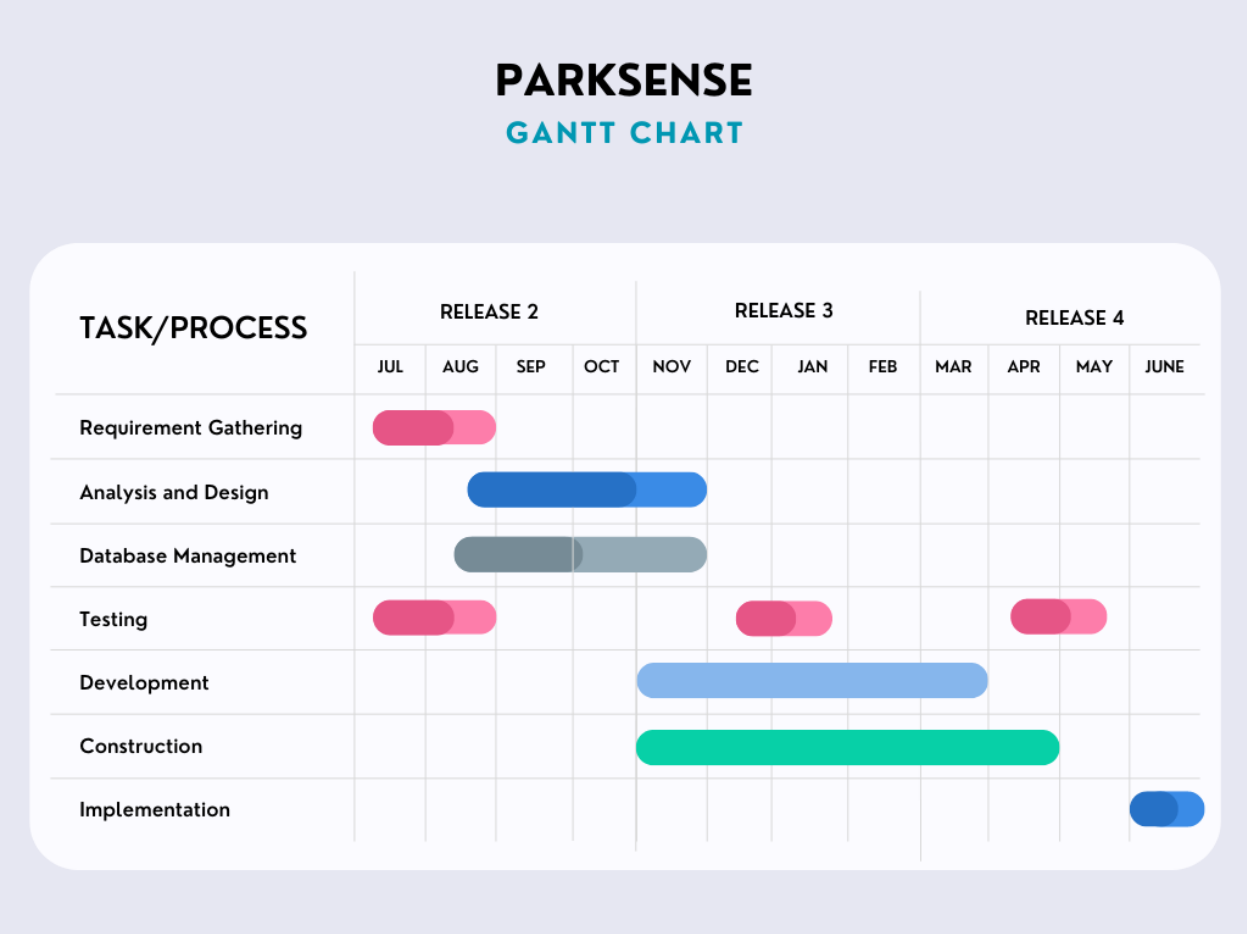


Figure 8 Release Plan

Appendix C: Release Plan

The release plan for our proposed system will be divided into four terms of the Project Based Learning courses based on the academic calendar for the Bachelor of Science in Information Technology with Specialization in Mobile and Internet Technologies 2022. This plan will include the milestones, deliverables, and timelines for each phase of the whole Project Based Learning course. Refer to Appendix B for the project's Gantt Chart and Appendix C for the product roadmap.

Target Group: Building Maintenance Office (BMO)

Goal: To create a completely automated parking management system that combines modern technology with the subjects we studied at Asia Pacific College. This contains sensors for each parking slot, display trackers to keep track of available slots on each basement level, and a real-time monitoring system that provides analytics and indicates whether or not the basement level is filled.

Needs:

- Real-time monitoring and analytics of parking usage
- Reduction of manual checking for available slot for BMO
- Precise and dependable data from trackers and sensors.
- Efficient management of parking spaces.

Values: ParkSense will allow the Building Maintenance Office (BMO) to simply examine the state of the basement parking spots without having to walk down and roam around. The technology will also allow them to measure how many students, staff, stakeholders, and visitors utilize our basement parking on a daily, monthly, and annual basis.

Key Features: Sensor integration, Display tracker, Real-time monitoring system, User interface with analytics and reporting

Release Plan

Release 1

- Research Paper
- Prototype

Release 2

- Designing the website interface
- Hardware acquisition and setup
- Integration of the system components
- Implementation of database system

Release 3

- Development of website interface
- Testing and troubleshooting
- Preparation of local/cloud server

Release 4

- Final testing
- Deployment and installation
- Project video teaser
- Training for BMO staff

Appendix D: Product Roadmap

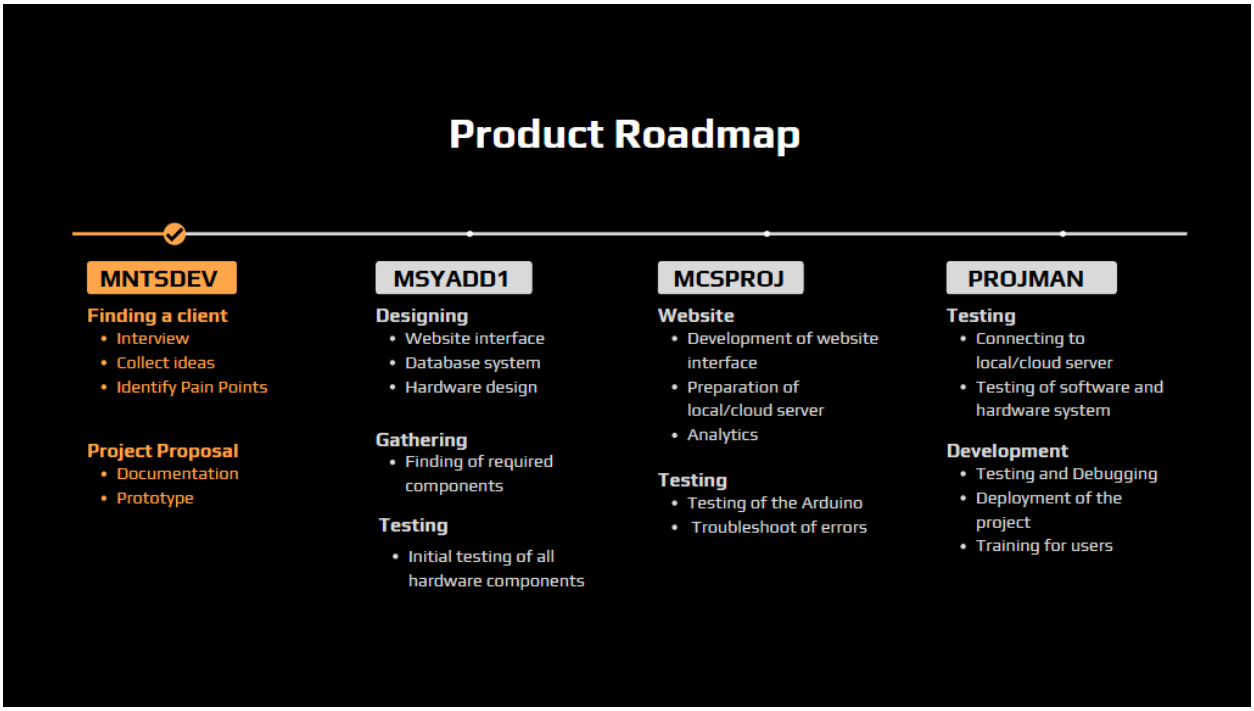


Figure 9 Roadmap

Appendix E: Minutes of the Meetings

Date	Minutes of the Meeting
August 12, 2024	• Identifying of Tasks • Assigning of Tasks • Creation of Timeline • TJ to ask for Sir Alvin's available time for this week or next week • Angela/JJ to ask for the client's and ITRO available time from this week till next week • Whole group will find and gather materials from 4th week of August to 1st week of September • TJ will try to use the arduino wifi for the first code on the 4th week of August or 1st week of September
August 19, 2024	• Revising of Initial DFD • Start of Creating Fully Dressed Use Case • The group is waiting for the reviewed DFD before revising it and will follow up the adviser tomorrow • The group will rewatch the dressed use case video and will start doing it by Thursday or Friday
August 29, 2024	• Assigning of tasks • All groupmates have 1 fully dressed use case to create test case. It should be done before Monday. • Rewatch or re-read the given links provided today
September 23, 2024	• Planning of meeting with the adviser • Discussion of what additional features should be our backup plan • Find another back up client • Erd planning • Overthinking the project whether to proceed • Face to face meeting with adviser on Friday (September 27,2024) • Revise what needs to be revised
October 06, 2024	• Revision • Framework • Final presentation reminders • All diagrams should be finalized by next week, assigned to all
October 13, 2024	• Consultation • Framework • Frappe could be the possible framework for the website • Other half of the diagrams should be done till the end of this week by the members
October 20, 2024	• Revision of diagrams • Framework • Revision of diagrams Sayson, Tauyan, and Libudan should be done on or before Thursday this week

	• Watch all the videos about Django before Wednesday for all members • Should started programming Django before this week ends all members