IE6700 DATA MANAGEMENT FOR ANALYTICS

Project Title: "PARKeasy: Parking Management System"

PROJECT REPORT

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EXECUTIVE SUMMARY

Our study set out to develop a practical solution for common urban parking challenges through the creation of the "PARKeasy" parking management system. The identified issues included inefficient use of parking spaces, lack of real-time information for drivers, and the resultant traffic congestion. The primary objectives were to enhance space utilization, provide timely data to drivers, and simplify the overall parking experience. In crafting the system, a detailed plan was laid out in the form of an SQL script, delineating the structure for storing and organizing information about administrators, parking lots, bookings, and related components. This structured approach aimed to ensure seamless communication and coordination within the system.

In the practical implementation of PARKeasy, notable progress was achieved. The system effectively optimized parking space allocation, leading to increased efficiency and a reduction in traffic congestion. Real-time information provision for drivers significantly improved their overall experience. The incorporation of user-friendly interfaces for administrators and members facilitated smooth interactions with the system. Nevertheless, practical challenges surfaced, including the integration of external sensors and the need to encourage widespread adoption among users. To address these challenges, recommendations include comprehensive testing, user education initiatives, continual improvement processes, strategic collaborations, and an emphasis on sustainable practices.

In summary, PARKeasy represents a significant advancement in addressing urban parking challenges. The study underscores the importance of meticulous planning during implementation, user engagement, and a commitment to continuous improvement to ensure the sustained success of PARKeasy in enhancing urban parking management.

I. INTRODUCTION

In the intricate urban landscape, parking management presents a nexus of challenges, including inefficient space utilization, a lack of real-time information, and the consequential menace of traffic congestion. Enter the "PARKeasy: Parking Management System," a strategic initiative poised to comprehensively address these urban intricacies. At its core, PARKeasy seeks to revolutionize parking dynamics by optimizing the allocation of parking spaces, aiming for a judicious use of resources within parking facilities. This shift holds the promise of alleviating congestion and enhancing overall efficiency in urban parking—an imperative need in bustling city environments.

Crucial to PARKeasy's strategy is the provision of real-time information to drivers, addressing the frustration stemming from navigating parking lots without timely data. The system aims to implement a solution that provides accurate, up-to-the-minute information on available parking spaces, not only improving user experience but also significantly reducing the time and fuel spent in the search for suitable parking. This emphasis on real-time accessibility reflects PARKeasy's commitment to making urban parking smarter and more user-friendly.

Driving the operational backbone of PARKeasy is a sophisticated database schema, meticulously outlined in the SQL script. This script intricately weaves together tables for administrators, parking lots, bookings, and their interconnections. These tables form a cohesive structure, ensuring seamless communication between different facets of the system and facilitating efficient parking management. Moreover, PARKeasy recognizes the significance of user interfaces tailored to administrators and members, serving as intuitive portals for real-time data access. Administrators gain a comprehensive overview of parking facilities, while members find an easily navigable platform for making bookings and accessing pertinent information. In conclusion, PARKeasy is not merely a parking management system; it is a transformative force poised to redefine the urban parking experience by systematically addressing inefficiencies, providing real-time information, and fostering sustainable practices—all encapsulated in a sophisticated, three-fold strategy.

II. CONCEPTUAL DATA MODELLING

1. EER Diagram
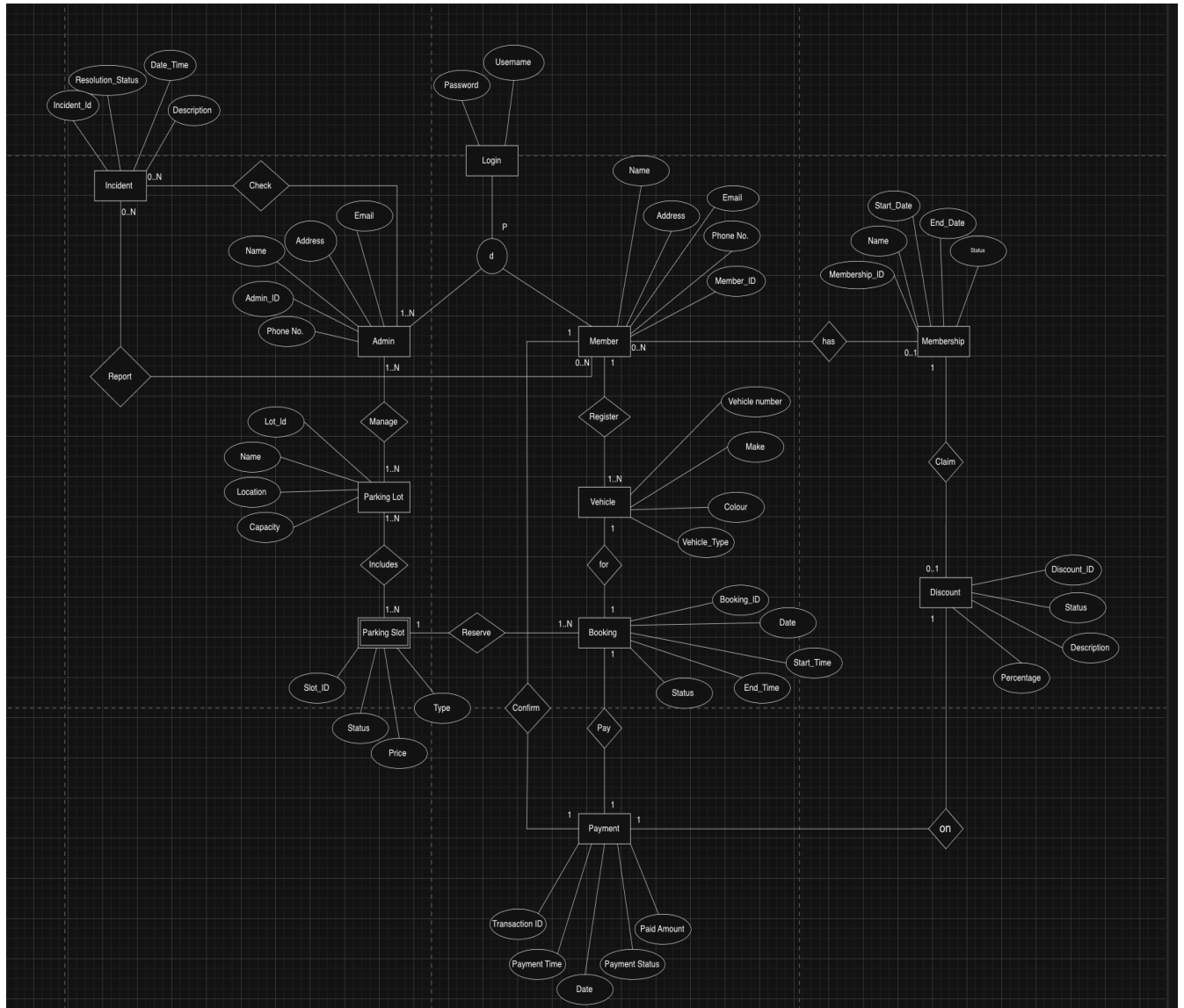
2.UML Diagram
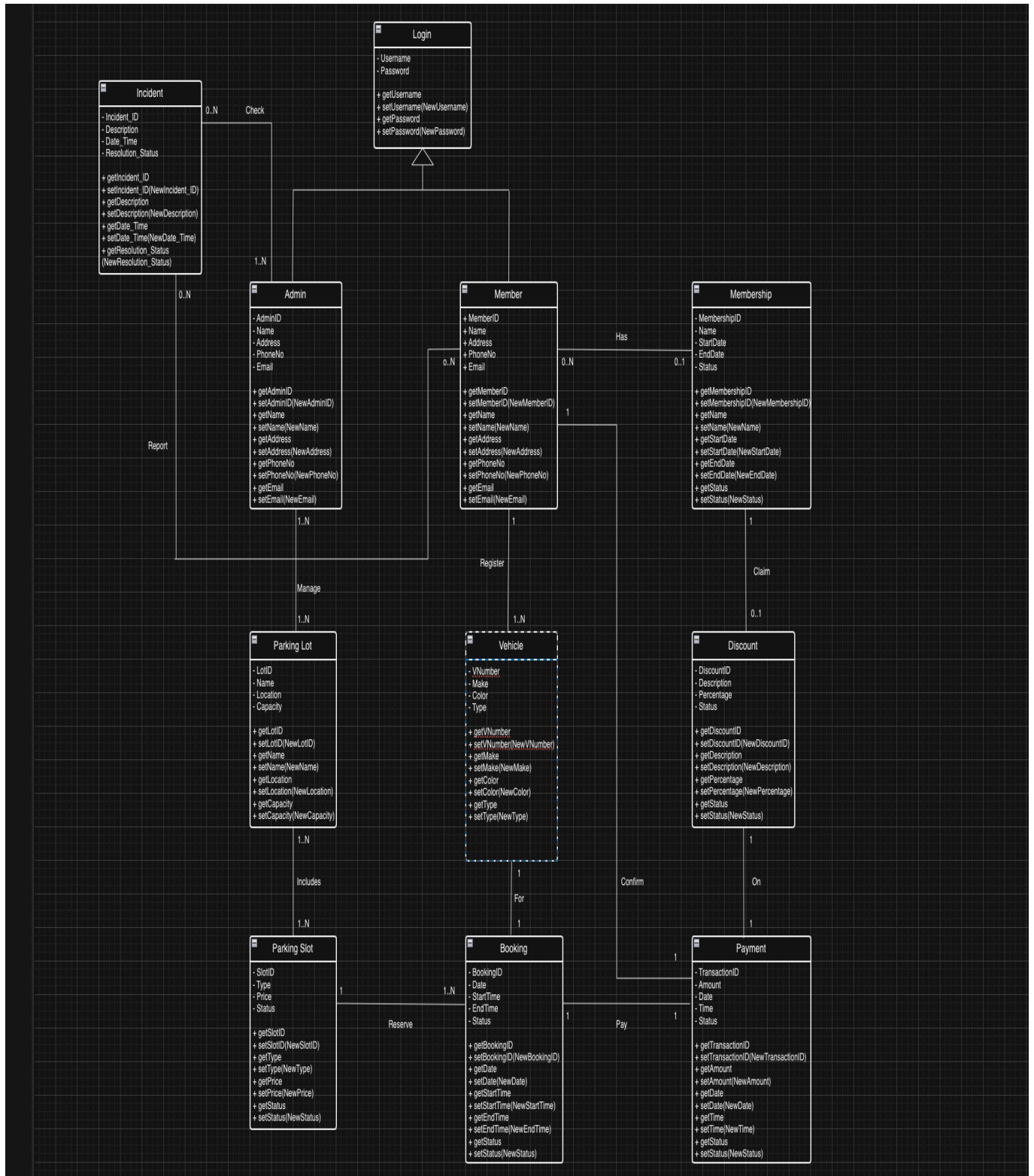
III. RELATIONAL MODEL

Primary Key- PK
Foreign Key- FK

-**Admin** (<u>AdminID</u>, Name, Address, Email, PhoneNo, <u>Username</u>)
PK: AdminID
FK: Username refers to Login – Not NULL

-**ParkingLot** (<u>LotID</u>, Name, Location, Capacity)
PK: LotID

-**Manage** (<u>AdminID</u>, <u>LotID</u>)
FK: AdminID refers to Admin – Not NULL
    LotID refers to ParkingLot – Not NULL

-**Includes** (<u>SlotID</u>, <u>LotID</u>)
FK: SlotID refers to ParkingSlot – Not NULL
    LotID refers to ParkingLot – Not NULL

-**ParkingSlot** (<u>SlotID</u>, Status, Price, Type)
PK: SlotID

-**Booking** (<u>BookingID</u>, Date, StartTime, EndTime, Status, <u>TransactionID</u>, <u>SlotID</u>)
PK: BookingID
FK: TransactionID refers to Payment – Not NULL
    SlotID refers to ParkingSlot – Not NULL

-**Login** (<u>Username</u>, Password)
PK: Username

-**Vehicle** (<u>VehicleNumber</u>, Make, Color, VehicleType, <u>MemberID</u>, <u>BookingID</u>)
PK: VehicleNumber
FK: MemberID refers to Member – Not NULL
    BookingID refers to Booking – Not NULL

-**Member** (<u>MemberID</u>, PhoneNo, Email, Address, Name, <u>MembershipID, Username</u>)
PK: MemberID
FK: MembershipID refers to Membership – NULL Allowed
    Username refers to Login- Not NULL

-Membership (<u>MembershipID</u>, Name, StartDate, EndDate, Status, <u>DiscountID</u>)
PK: MembershipID
FK: DiscountID refers to Discount – NULL Allowed

-Discount (<u>DiscountID</u>, Status, Description, Percentage)
PK: DiscountID

-Payment (<u>TransactionID</u>, Date, Time, PaymentStatus, Amount, <u>MemberID</u>)
PK: TransactionID
FK: MemberID refers to Member – Not NULL

-Incident (<u>IncidentID</u>, ResolutionStatus, Date_Time, Description, <u>MemberID</u>)
PK: IncidentID
FK: MemberID refers to Member – NULL Allowed

-Inspect (<u>IncidentID</u>, <u>AdminID</u>)
FK: IncidentID refers to Incident – Not NULL
     AdminID refers to Admin – Not NULL

-Report (<u>IncidentID</u>, <u>MemberID</u>)
FK: IncidentID refers to Incident – Not NULL
     MemberID refers to Member – Not NULL

IV. IMPLEMENTATION USING MySQL AND NoSQL

MySQL Implementation:

The database was created in MySQL and the following queries were performed:

-- Question 1 : Total Count of Parking Slots by Status:

SELECT Status, COUNT(*) as TotalSlots
FROM ParkingSlot
GROUP BY Status;

Status	TotalSlots
Available	30
Occupied	30

-- Question 2 : Inner Join (List of Members with their Membership Details):

SELECT m.MemberID, m.Name, mb.Name as MembershipName, mb.StartDate, mb.EndDate
FROM Member m
INNER JOIN Membership mb
ON m.MembershipID = mb.MembershipID;

MemberID	Name	MembershipName	StartDate	EndDate
1001	John Doe	Silver Membership	2023-01-01	2023-12-31
1002	Jane Smith	Gold Membership	2023-01-01	2023-12-31
1003	Bob Jones	Bronze Membership	2023-01-01	2023-12-31
1004	Susan White	Silver Membership	2023-01-01	2023-12-31
1005	Mike Brown	Gold Membership	2023-01-01	2023-12-31
1006	Emily Green	Bronze Membership	2023-01-01	2023-12-31
1007	David Gray	Platinum Membership	2023-01-01	2023-12-31
1008	Laura Black	Silver Membership	2023-01-01	2023-12-31
1009	Chris Baker	Gold Membership	2023-01-01	2023-12-31
1010	Amy Taylor	Bronze Membership	2023-01-01	2023-12-31
1011	Robert Joh…	Platinum Membership	2023-01-01	2023-12-31
1012	Olivia Martin	Silver Membership	2023-01-01	2023-12-31
1013	William Mo…	Gold Membership	2023-01-01	2023-12-31
1014	Grace Wilson	Bronze Membership	2023-01-01	2023-12-31
1015	Jackson Mi…	Platinum Membership	2023-01-01	2023-12-31
1016	Ava Hill	Silver Membership	2023-01-01	2023-12-31
1017	Nathan Ad…	Gold Membership	2023-01-01	2023-12-31
1018	Emma Hayes	Bronze Membership	2023-01-01	2023-12-31
1019	Samuel Co…	Platinum Membership	2023-01-01	2023-12-31
1020	Mia Wood	Silver Membership	2023-01-01	2023-12-31
1021	Daniel Ross	Gold Membership	2023-01-01	2023-12-31
1022	Hannah Perry	Bronze Membership	2023-01-01	2023-12-31
1023	Jack Harrison	Platinum Membership	2023-01-01	2023-12-31
1024	Lily Butler	Silver Membership	2023-01-01	2023-12-31
1025	Ryan Long	Gold Membership	2023-01-01	2023-12-31
1026	Zoey Fisher	Bronze Membership	2023-01-01	2023-12-31
1027	Ethan Price	Platinum Membership	2023-01-01	2023-12-31
1028	Oliver Ram…	Silver Membership	2023-01-01	2023-12-31
1029	Amelia Ward	Gold Membership	2023-01-01	2023-12-31
1030	Luke Bell	Bronze Membership	2023-01-01	2023-12-31
1031	Leah Miller	Platinum Membership	2023-01-01	2023-12-31
1033	Sophia Ste…	Silver Membership	2023-01-01	2023-12-31
1034	Gabriel Kelly	Gold Membership	2023-01-01	2023-12-31
1035	Madison Ri…	Bronze Membership	2023-01-01	2023-12-31
1036	Logan Brooks	Platinum Membership	2023-01-01	2023-12-31
1037	Zoey Hill	Silver Membership	2023-01-01	2023-12-31
1038	Connor Wh…	Gold Membership	2023-01-01	2023-12-31
1039	Chloe Martin	Bronze Membership	2023-01-01	2023-12-31
1040	Ethan Cooper	Platinum Membership	2023-01-01	2023-12-31
1041	Olivia Price	Silver Membership	2023-01-01	2023-12-31
1042	Jacob Ram…	Gold Membership	2023-01-01	2023-12-31
1043	Emma Ward	Bronze Membership	2023-01-01	2023-12-31
1044	Aiden Bell	Platinum Membership	2023-01-01	2023-12-31
1045	Mia Brooks	Silver Membership	2023-01-01	2023-12-31
1046	Lucas Hill	Gold Membership	2023-01-01	2023-12-31
1047	Aubrey Co…	Bronze Membership	2023-01-01	2023-12-31
1048	Zoey Richa…	Platinum Membership	2023-01-01	2023-12-31

-- Question 3 : Members Who Have Made Bookings for 'Premium' Parking Slots:

SELECT * FROM Member
WHERE MemberID IN (SELECT MemberID FROM Booking WHERE SlotID IN
        (SELECT SlotID FROM ParkingSlot WHERE Type = 'Premium'));

MemberID	PhoneNo	Email	Address	Name	MembershipID	Username
1001	123-456-7890	john.doe@email.com	123 Main St, Cityville	John Doe	10000001	john_doe_01
1002	234-567-8901	jane.smith@email.com	456 Oak St, Townsville	Jane Smith	10000002	jane_smith_02
1003	345-678-9012	bob.jones@email.com	789 Pine St, Villageton	Bob Jones	10000003	bob_jones_03
1004	456-789-0123	susan.white@email.com	987 Elm St, Hamletville	Susan White	10000004	susan_white_04
1005	567-890-1234	mike.brown@email.com	654 Birch St, Countryside	Mike Brown	10000005	mike_brown_05
1006	678-901-2345	emily.green@email.com	321 Cedar St, Hilltop	Emily Green	10000006	emily_green_06
1007	789-012-3456	david.gray@email.com	876 Maple St, Lakeside	David Gray	10000007	david_gray_07
1008	890-123-4567	laura.black@email.com	543 Redwood St, Riverside	Laura Black	10000008	laura_black_08
1009	901-234-5678	chris.baker@email.com	210 Fir St, Mountainside	Chris Baker	10000009	chris_baker_09
1010	012-345-6789	amy.taylor@email.com	135 Pinecone St, Meadowville	Amy Taylor	10000010	amy_taylor_10
1011	123-234-5678	robert.johnson@email...	456 Birchwood St, Hillside	Robert Joh...	10000011	robert_johnson...
1012	234-345-6789	olivia.martin@email.com	789 Maplewood St, Lakeshore	Olivia Martin	10000012	olivia_martin_12
1013	345-456-7890	william.moore@email.c...	987 Oakwood St, Countrysid...	William Mo...	10000013	william_moore...
1014	456-567-8901	grace.wilson@email.com	654 Redwoodwood St, River...	Grace Wilson	10000014	grace_wilson_14
1015	567-678-9012	jackson.mitchell@emai...	321 Cedarwood St, Hilltopville	Jackson Mi...	10000015	jackson_mitch...
1016	678-789-0123	ava.hill@email.com	876 Mapleside St, Lakesidehill	Ava Hill	10000016	ava_hill_16
1017	789-890-1234	nathan.adams@email...	543 Pinehill St, Mountainside...	Nathan Ad...	10000017	nathan_adams...
1018	890-901-2345	emma.hayes@email.com	210 Firside St, Meadowtown	Emma Hayes	10000018	emma_hayes_18
1019	901-012-3456	samuel.cooper@email...	135 Oakmeadow St, Riverto...	Samuel Co...	10000019	samuel_coope...
1020	012-123-4567	mia.wood@email.com	456 Redside St, Countryside...	Mia Wood	10000020	mia_wood_20
1021	123-234-5678	daniel.ross@email.com	789 Maplehill St, Hillsidevale	Daniel Ross	10000021	daniel_ross_21
1022	234-345-6789	hannah.perry@email.c...	987 Pinetown St, Meadowhill	Hannah Perry	10000022	hannah_perry...
1023	345-456-7890	jack.harrison@email.com	654 Oakvale St, Riversidehill	Jack Harrison	10000023	jack_harrison_23
1024	456-567-8901	lily.butler@email.com	321 Pinevale St, Hilltown	Lily Butler	10000024	lily_butler_24
1025	567-678-9012	ryan.long@email.com	876 Oakmeadow St, Lakesid...	Ryan Long	10000025	ryan_long_25
1026	678-789-0123	zoey.fisher@email.com	543 Pinewood St, Countrysid...	Zoey Fisher	10000026	zoey_fisher_26
1027	789-890-1234	ethan.price@email.com	210 Cedarhill St, Meadowville	Ethan Price	10000027	ethan_price_27
1028	890-901-2345	oliver.ramirez@email.c...	135 Birchvale St, Hilltopvale	Oliver Ram...	10000028	oliver_ramirez...
1029	901-012-3456	amelia.ward@email.com	456 Pinetown St, Riversidevale	Amelia Ward	10000029	amelia_ward_29
1030	012-123-4567	luke.bell@email.com	789 Mapletown St, Lakeside...	Luke Bell	10000030	luke_bell_30
1031	123-234-5678	leah.miller@email.com	987 Redvale St, Hilltownville	Leah Miller	10000031	leah_miller_31
1033	345-456-7890	sophia.stewart@email....	321 Cedarwood St, Hillsideville	Sophia Ste...	10000032	sophia_stewart...
1034	456-567-8901	gabriel.kelly@email.com	876 Mapleside St, Lakesidehill	Gabriel Kelly	10000033	gabriel_kelly_33
1035	567-678-9012	madison.richards@em...	543 Pinemeadow St, Mounta...	Madison Ri...	10000034	madison_richa...
1036	678-789-0123	logan.brooks@email.com	210 Oakhill St, Meadowtown	Logan Brooks	10000035	logan_brooks_35
1037	789-890-1234	zoey.hill@email.com	135 Birchside St, Rivertowns...	Zoey Hill	10000036	zoey_hill_36
1038	890-901-2345	connor.wheeler@email...	456 Pinetown St, Countrysid...	Connor Wh...	10000037	connor_wheel...
1039	901-012-3456	chloe.martin@email.com	789 Maplemeadow St, Hillsid...	Chloe Martin	10000038	chloe_martin_38
1040	012-123-4567	ethan.cooper@email.com	987 Oakvale St, Lakesidevale	Ethan Cooper	10000039	ethan_cooper_...
1041	123-234-5678	olivia.price@email.com	654 Pinewood St, Riversidehill	Olivia Price	10000040	olivia_price_40
1042	234-345-6789	jacob.ramirez@email.c...	321 Mapletown St, Hilltopvale	Jacob Ram...	10000041	jacob_ramirez...
1043	345-456-7890	emma.ward@email.com	876 Birchvale St, Lakesideville	Emma Ward	10000042	emma_ward_42
1044	456-567-8901	aiden.bell@email.com	543 Pinetown St, Countrysid...	Aiden Bell	10000043	aiden_bell_43
1045	567-678-9012	mia.brooks@email.com	210 Mapleside St, Meadowville	Mia Brooks	10000044	mia_brooks_44
1046	678-789-0123	lucas.hill@email.com	135 Cedarhill St, Hilltopville	Lucas Hill	10000045	lucas_hill_45
1047	789-890-1234	aubrey.cooper@email....	456 Oakside St, Riversideville	Aubrey Co...	10000046	aubrey_cooper...
1048	890-901-2345	zoey.richards@email.c...	789 Redvale St, Hilltownville	Zoey Richa...	10000047	zoey_richards...

-- Question 4 : Find all members who have booked a slot with a discount.

SELECT DISTINCT M.Name
FROM Member M
JOIN Vehicle V ON M.MemberID = V.MemberID
JOIN Booking B ON V.BookingID = B.BookingID
JOIN Payment P ON B.TransactionID = P.TransactionID
JOIN Membership MS ON M.MembershipID = MS.MembershipID
WHERE EXISTS (
   SELECT 1
   FROM Discount D
   JOIN Membership MS2 ON D.DiscountID = MS2.DiscountID
   WHERE MS2.MembershipID = MS.MembershipID
);

Name
John Doe
Susan White
Laura Black
Olivia Martin
Ava Hill
Lily Butler
Sophia Stewart
Zoey Hill
Olivia Price
Jane Smith
Mike Brown
Nathan Adams
Daniel Ross
Ryan Long
Amelia Ward
Gabriel Kelly
Connor Whee…
Lucas Hill
Amy Taylor
Emma Hayes
Hannah Perry
Zoey Fisher
Madison Rich…
Chloe Martin
Emma Ward
Aubrey Cooper
David Gray
Jackson Mitc…
Samuel Cooper
Ethan Price
Leah Miller
Logan Brooks
Ethan Cooper
Aiden Bell
Zoey Richards

-- Question 5 : Find Parking Lots with Capacity Greater Than Any 'Tech Hub' Lot:

SELECT * FROM ParkingLot WHERE Capacity > ANY (SELECT Capacity FROM ParkingLot WHERE Name LIKE '%Tech Hub%');

LotID	Name	Location	Capacity	
1111	Downtown Parking	Main Street	150	
1112	Central Plaza Parking	Center Avenue	200	
1114	Metro Mall Parking	Shopping Mall	250	
1116	Riverside Parking	Riverfront Drive	180	
NULL	NULL	NULL	NULL	

-- Question 6 : Find all incidents reported by members who have an active membership ?

SELECT DISTINCT I.IncidentID, I.Description FROM Incident I
WHERE EXISTS (
    SELECT 1 FROM Member M WHERE M.MemberID = I.MemberID
    AND EXISTS (
        SELECT 1
        FROM Membership MS WHERE MS.MembershipID = M.MembershipID
        AND MS.Status = 'Active'
    ));

IncidentID	Description	
2001	Network connectivity issue	
2003	Printer malfunction	
2004	Password reset request	
NULL	NULL	

-- Question 7 : UNION query combining information about members and admins ?

SELECT 'Member' AS UserType, MemberID AS ID, Name, Email, PhoneNo, Address, Username
FROM Member
UNION
SELECT 'Admin' AS UserType, AdminID AS ID, Name, Email, PhoneNo, Address, Username
FROM Admin;

UserType	ID	Name	Email	PhoneNo	Address	Username
Member	1001	John Doe	john.doe@email.com	123-456-7890	123 Main St, Cityville	john_doe_01
Member	1002	Jane Smith	jane.smith@email.com	234-567-8901	456 Oak St, Townsville	jane_smith_02
Member	1003	Bob Jones	bob.jones@email.com	345-678-9012	789 Pine St, Villageton	bob_jones_03
Member	1004	Susan White	susan.white@email.com	456-789-0123	987 Elm St, Hamletville	susan_white_04
Member	1005	Mike Brown	mike.brown@email.com	567-890-1234	654 Birch St, Countryside	mike_brown_05
Member	1006	Emily Green	emily.green@email.com	678-901-2345	321 Cedar St, Hilltop	emily_green_06
Member	1007	David Gray	david.gray@email.com	789-012-3456	876 Maple St, Lakeside	david_gray_07
Member	1008	Laura Black	laura.black@email.com	890-123-4567	543 Redwood St, Riverside	laura_black_08
Member	1009	Chris Baker	chris.baker@email.com	901-234-5678	210 Fir St, Mountainside	chris_baker_09
Member	1010	Amy Taylor	amy.taylor@email.com	012-345-6789	135 Pinecone St, Meadowville	amy_taylor_10
Member	1011	Robert Joh…	robert.johnson@email…	123-234-5678	456 Birchwood St, Hillside	robert_johnson…
Member	1012	Olivia Martin	olivia.martin@email.com	234-345-6789	789 Maplewood St, Lakeshore	olivia_martin_12
Member	1013	William Mo…	william.moore@email.c…	345-456-7890	987 Oakwood St, Countrysidelake	liam_moore…
Member	1014	Grace Wilson	grace.wilson@email.com	456-567-8901	654 Redwoodwood St, River…	grace_wilson_14
Member	1015	Jackson Mi…	jackson.mitchell@emai…	567-678-9012	321 Cedarwood St, Hilltopville	jackson_mitch…
Member	1016	Ava Hill	ava.hill@email.com	678-789-0123	876 Mapleside St, Lakesidehill	ava_hill_16
Member	1017	Nathan Ad…	nathan.adams@email.…	789-890-1234	543 Pinehill St, Mountainside…	nathan_adams…
Member	1018	Emma Hayes	emma.hayes@email.com	890-901-2345	210 Firside St, Meadowtown	emma_hayes_18
Member	1019	Samuel Co…	samuel.cooper@email.…	901-012-3456	135 Oakmeadow St, Riverto…	samuel_coope…
Member	1020	Mia Wood	mia.wood@email.com	012-123-4567	456 Redside St, Countryside…	mia_wood_20
Member	1021	Daniel Ross	daniel.ross@email.com	123-234-5678	789 Maplehill St, Hillsidevale	daniel_ross_21
Member	1022	Hannah Perry	hannah.perry@email.c…	234-345-6789	987 Pinetown St, Meadowhill	hannah_perry…
Member	1023	Jack Harrison	jack.harrison@email.com	345-456-7890	654 Oakvale St, Riversidehill	jack_harrison_23
Member	1024	Lily Butler	lily.butler@email.com	456-567-8901	321 Pinevale St, Hilltown	lily_butler_24
Member	1025	Ryan Long	ryan.long@email.com	567-678-9012	876 Oakmeadow St, Lakesid…	ryan_long_25
Member	1026	Zoey Fisher	zoey.fisher@email.com	678-789-0123	543 Pinewood St, Countrysid…	zoey_fisher_26
Member	1027	Ethan Price	ethan.price@email.com	789-890-1234	210 Cedarhill St, Meadowville	ethan_price_27
Member	1028	Oliver Ram…	oliver.ramirez@email.c…	890-901-2345	135 Birchvale St, Hilltopvale	oliver_ramirez…
Member	1029	Amelia Ward	amelia.ward@email.com	901-012-3456	456 Pinetown St, Riversidevale	amelia_ward_29
Member	1030	Luke Bell	luke.bell@email.com	012-123-4567	789 Mapletown St, Lakeside…	luke_bell_30
Member	1031	Leah Miller	leah.miller@email.com	123-234-5678	987 Redvale St, Hilltownville	leah_miller_31
Member	1033	Sophia Ste…	sophia.stewart@email.…	345-456-7890	321 Cedarwood St, Hillsideville	sophia_stewart…
Member	1034	Gabriel Kelly	gabriel.kelly@email.com	456-567-8901	876 Mapleside St, Lakesidehill	gabriel_kelly_33
Member	1035	Madison Ri…	madison.richards@em…	567-678-9012	543 Pinemeadow St, Mounta…	madison_richa…
Member	1036	Logan Brooks	logan.brooks@email.com	678-789-0123	210 Oakhill St, Meadowtown	logan_brooks_35
Member	1037	Zoey Hill	zoey.hill@email.com	789-890-1234	135 Birchside St, Rivertowns…	zoey_hill_36
Member	1038	Connor Wh…	connor.wheeler@email…	890-901-2345	456 Pinetown St, Countrysid…	connor_wheel…
Member	1039	Chloe Martin	chloe.martin@email.com	901-012-3456	789 Maplemeadow St, Hillsid…	chloe_martin_38
Member	1040	Ethan Cooper	ethan.cooper@email.c…	012-123-4567	987 Oakvale St, Lakesidevale	ethan_cooper_…
Member	1041	Olivia Price	olivia.price@email.com	123-234-5678	654 Pinewood St, Riversidehill	olivia_price_40
Member	1042	Jacob Ram…	jacob.ramirez@email.c…	234-345-6789	321 Mapletown St, Hilltopvale	jacob_ramirez…
Member	1043	Emma Ward	emma.ward@email.com	345-456-7890	876 Birchvale St, Lakesideville	emma_ward_42
Member	1044	Aiden Bell	aiden.bell@email.com	456-567-8901	543 Pinetown St, Countrysid…	aiden_bell_43
Member	1045	Mia Brooks	mia.brooks@email.com	567-678-9012	210 Mapleside St, Meadowville	mia_brooks_44
Member	1046	Lucas Hill	lucas.hill@email.com	678-789-0123	135 Cedarhill St, Hilltopville	lucas_hill_45
Member	1047	Aubrey Co…	aubrey.cooper@email.…	789-890-1234	456 Oakside St, Riversideville	aubrey_cooper…
Member	1048	Zoey Richa…	zoey.richards@email.c…	890-901-2345	789 Redvale St, Hilltownville	zoey_richards…

-- Question 8 : Retrieve parking lot information with the average slot price using subqueries ?

```
SELECT
    PL.Name AS ParkingLotName,
    PL.Location,
    PL.Capacity,
    (
        SELECT AVG(PS.Price)
        FROM Includes I
        JOIN ParkingSlot PS ON I.SlotID = PS.SlotID
        WHERE I.LotID = PL.LotID
    ) AS AverageSlotPrice
FROM
    ParkingLot PL;
```

ParkingLotName	Location	Capacity	AverageSlotPrice	
Downtown Parking	Main Street	150	10.937500	
Central Plaza Parking	Center Avenue	200	11.666667	
Greenfield Park Parking	Park Street	100	10.909091	
Metro Mall Parking	Shopping Mall	250	11.666667	
Tech Hub Parking	Innovation Avenue	120	11.363636	
Riverside Parking	Riverfront Drive	180	11.041667	

NoSQL Implementation:

Question 1 : Identify the admins who have resolved the most number of inspections.

db.Incident.aggregate([{ $match: { ResolutionStatus: "Resolved" } },
    { $lookup: {from: "Inspect", localField: "IncidentID", foreignField: "IncidentID",
    as: "inspection_info"}},
    { $unwind: "$inspection_info" }, { $group: {_id: "$inspection_info.AdminID",
        resolvedCount: { $sum: 1 }}}, { $sort: { resolvedCount: -1 } }])

```
< {
    _id: 7,
    resolvedCount: 1
}
{
    _id: 3,
    resolvedCount: 1
}
{
    _id: 45,
    resolvedCount: 1
}
```

Question 2 : Retrieve all incidents, including the handling admin's details and the associated member's booking information.

```
db.Incident.aggregate([ { $lookup: {from: "Inspect",
    localField: "IncidentID",
    foreignField: "IncidentID",as: "inspect_info"   } }, { $unwind: "$inspect_info" },
  { $lookup: {from: "Admin",
    localField: "inspect_info.AdminID", foreignField: "AdminID",
    as: "admin_info"   } },
  { $lookup: {from: "Booking",
    localField: "MemberID",
    foreignField: "MemberID",
    as: "booking_info"}}])
```

```
< {
    _id: 10000042,
    totalPayments: 25,
    membership_info: [
      {
        _id: ObjectId("656b8a96b4dc7880fc5bb207"),
        MembershipID: 10000042,
        Name: 'Bronze Membership',
        StartDate: 2023-01-01T00:00:00.000Z,
        EndDate: 2023-12-31T00:00:00.000Z,
        Status: 'Active',
        DiscountID: 993
      }
    ],
    discount_info: [
      {
        _id: ObjectId("656b89ddb4dc7880fc5bb11b"),
        DiscountID: 993,
        Status: 'Active',
        Description: '20% off',
        Percentage: 20
      }
    ]
  }
  {
    _id: 10000001,
    totalPayments: 30,
    membership_info: [
      {
        _id: ObjectId("656b8a96b4dc7880fc5bb1de"),
        MembershipID: 10000001,
        Name: 'Silver Membership',
        StartDate: 2023-01-01T00:00:00.000Z,
        EndDate: 2023-12-31T00:00:00.000Z,
        Status: 'Active',
        DiscountID: 991
      }
    ],
    discount_info: [
      {
        _id: ObjectId("656b89ddb4dc7880fc5bb119"),
        DiscountID: 991,
        Status: 'Active',
        Description: '10% off',
        Percentage: 10
      }
    ]
  }
```

Question 3 : Compute the average price of parking slots for each parking lot.

```
db.Includes.aggregate([
  { $lookup: {
      from: "ParkingSlot",
      localField: "SlotID",
      foreignField: "SlotID",
      as: "slot_info"   } }, { $unwind: "$slot_info" },
  { $group: {
_id: "$LotID",
averagePrice: { $avg: "$slot_info.Price" }
}
}
])
```

```
< {
    _id: 1113,
    averagePrice: 10.909090909090908
  }
  {
    _id: 1111,
    averagePrice: 10.9375
  }
  {
    _id: 1112,
    averagePrice: 11.66666666666666
  }
  {
    _id: 1114,
    averagePrice: 11.66666666666666
  }
  {
    _id: 1115,
    averagePrice: 11.36363636363636
  }
  {
    _id: 1116,
    averagePrice: 11.04166666666666
  }
```

Question 4 : Fetch Parking Slots with Specific Status.

db.ParkingSlot.find({ Status: "Available" }) // Or "Occupied"

```
< {
    _id: ObjectId("656b8ad2b4dc7880fc5bb218"),
    SlotID: 10001,
    Status: 'Available',
    Price: 10,
    Type: 'Standard'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb219"),
    SlotID: 10002,
    Status: 'Available',
    Price: 12.5,
    Type: 'Premium'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb21c"),
    SlotID: 10005,
    Status: 'Available',
    Price: 10,
    Type: 'Standard'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb21d"),
    SlotID: 10006,
    Status: 'Available',
    Price: 12.5,
    Type: 'Premium'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb21f"),
    SlotID: 10008,
    Status: 'Available',
    Price: 12.5,
    Type: 'Premium'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb222"),
    SlotID: 10201,
    Status: 'Available',
    Price: 10,
    Type: 'Standard'
  }
  {
    _id: ObjectId("656b8ad2b4dc7880fc5bb224"),
    SlotID: 10203,
    Status: 'Available',
    Price: 10,
    Type: 'Standard'
```
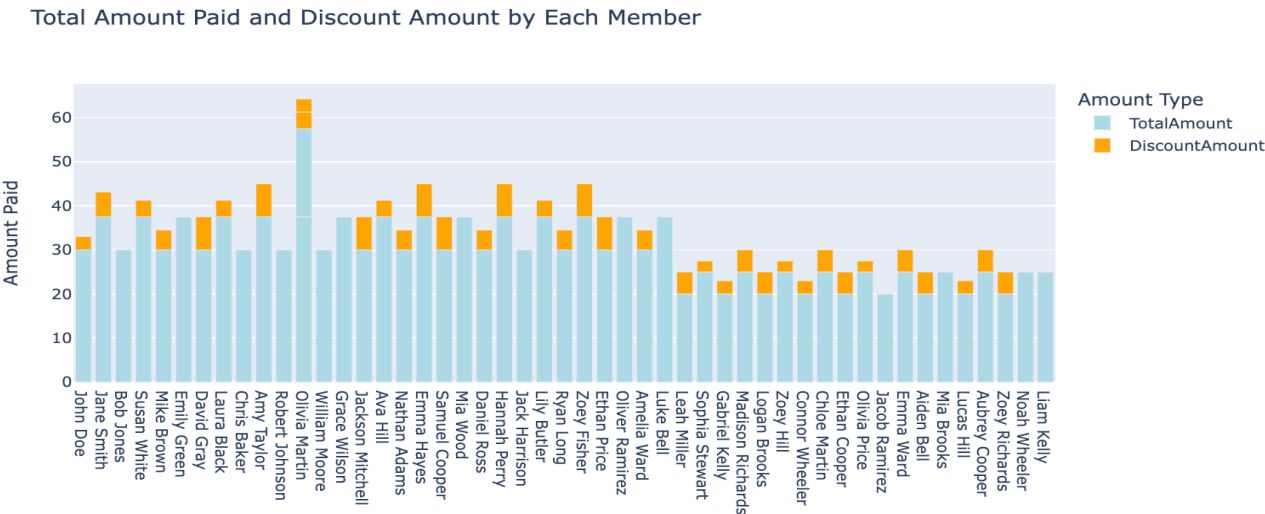
V. Database Visualization via Python

1. Visualization to find the number of standard and premium parking slots in each parking lots.
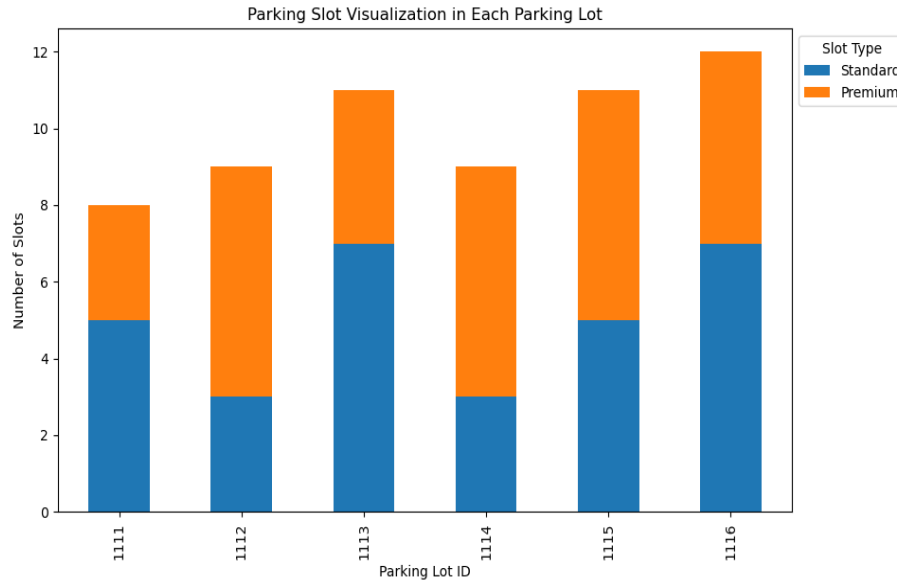
2.To check the availability of the parking slots.
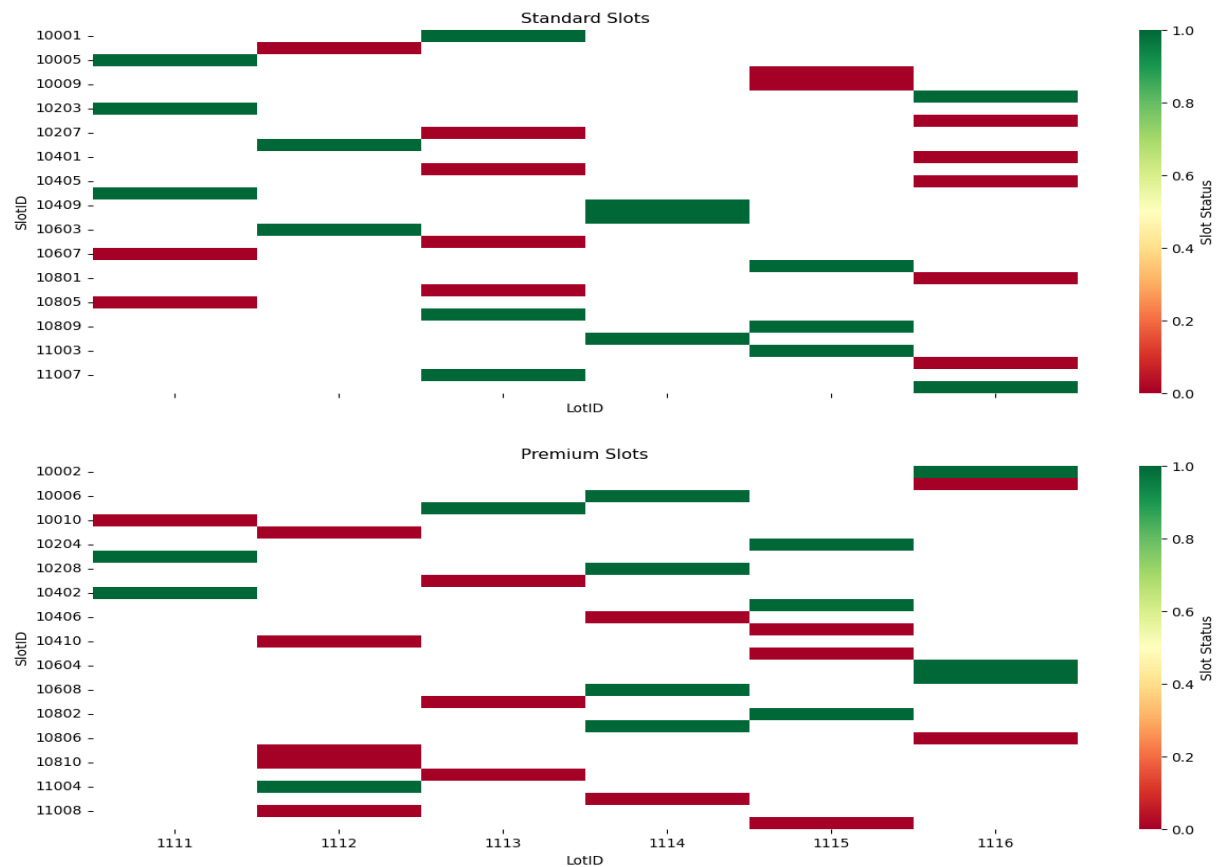
3.Visualization of total amount paid and discounted amount for each member


Total Amount Paid and Discount Amount by Each Member

4.Visualizing the distribution of incident resolution status performed by each admin.

Distribution of Incident Resolution Status by Admin
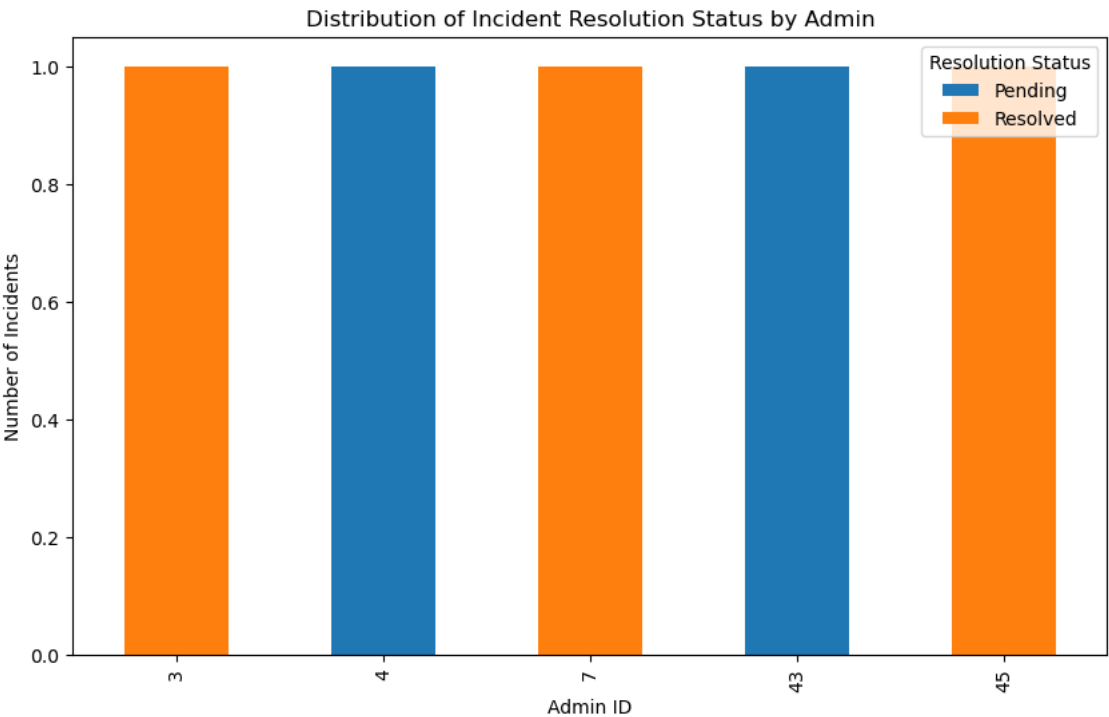
5. Chart to represent the distribution of vehicle types among the bookings.

Distribution of Vehicle Types Among Bookings
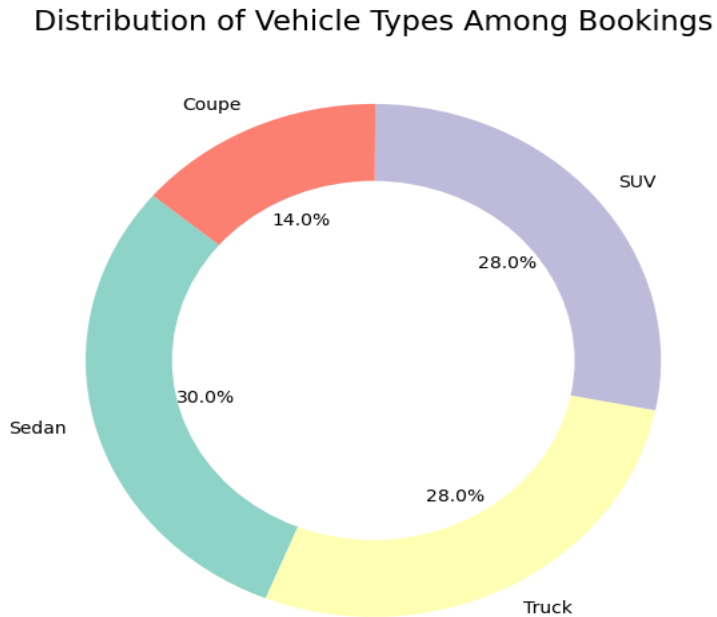
6. Pie Chart to show Total Revenue Generated by Each Parking Lot.

Total Revenue by Parking Lot
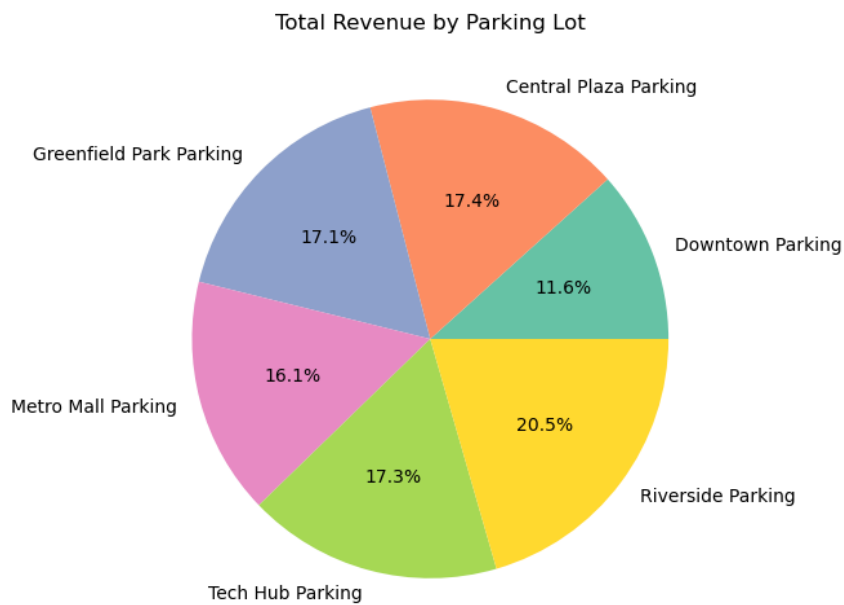
VI. Summary

The "PARKeasy: Parking Management System" endeavors to tackle urban parking issues by optimizing space utilization, offering real-time information, and reducing traffic congestion. It introduces a comprehensive database structure with tables for administrators, parking lots, and bookings, supported by user-friendly interfaces.

Advantages of PARKeasy include improved space utilization, timely information access for drivers, reduced traffic congestion, cost-effective maintenance, and a positive impact on the environment by diminishing fuel consumption and emissions during parking searches.

However, potential challenges include technical issues during integration with external sensors and the necessity of ensuring broad user adoption. Recommendations for successful implementation involve rigorous testing, user training programs, continuous improvement mechanisms, strategic partnerships, and the incorporation of sustainability measures.

In conclusion, while PARKeasy holds promising solutions for urban parking, careful attention to integration, user engagement, and ongoing enhancements is vital for its effective implementation and long-term success.