Smart Parking Lot

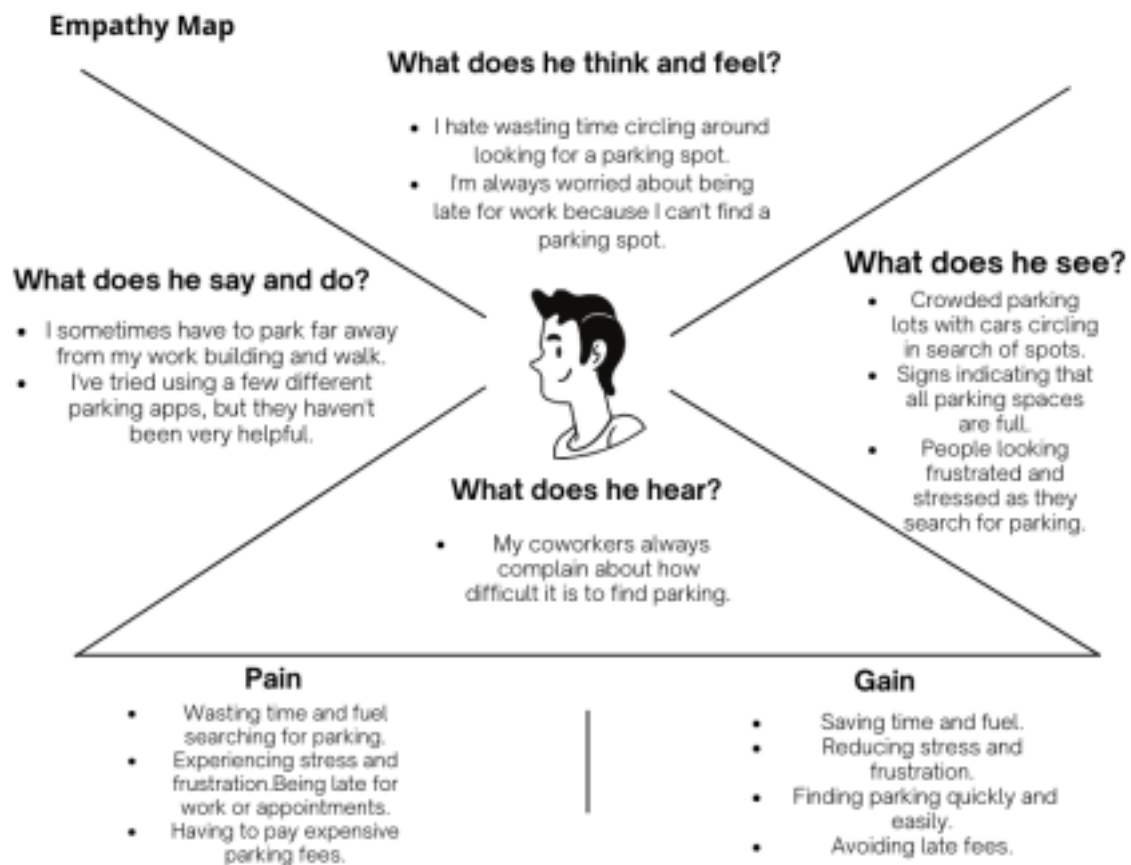# Phase -1 (Problem Statement and design Thinking)

ABSTRACT:

A Smart Parking Lot is an advanced and technologically enhanced parking facility designed to optimize parking space management, improve the overall parking experience for users, and maximize operational efficiency. It employs a combination of sensors and real time communication systems to provide users with up-to-the-minute information on parking space availability, streamline entry and exit processes and contribute to reduced traffic congestion and environmental impact. Smart Parking Lots are characterized by their ability to enhance user convenience, increase revenue for facility owners, and promote sustainable urban mobility solutions

PROBLEM STATEMENT:

Problem Statement	I am	I'm Trying to	But	Because	Which makes me feel
Parking	A driver	Find available parking spaces	I often struggle to find a parking spot, especially during peak hours.	The parking lot lacks a system to provide real time availability information and streamline entry/exit processes.	Frustrated and stressed.
Inefficient Space Utilization and Revenue Loss	The management of a parking facility	Maximize revenue and efficiently manage parking spaces	Currently experiencing revenue loss due to inefficient space allocation.	The existing parking system lacks the capability to allocate parking spaces optimally, resulting in underutilization and financial losses.	Frustrated and concerned about profitability.

EMPATHY MAP:

Empathy Map

What does he think and feel?
- I hate wasting time circling around looking for a parking spot.
- I'm always worried about being late for work because I can't find a parking spot.

What does he say and do?
- I sometimes have to park far away from my work building and walk.
- I've tried using a few different parking apps, but they haven't been very helpful.

What does he see?
- Crowded parking lots with cars circling in search of spots.
- Signs indicating that all parking spaces are full.
- People looking frustrated and stressed as they search for parking.

What does he hear?
- My coworkers always complain about how difficult it is to find parking.

Pain
- Wasting time and fuel searching for parking.
- Experiencing stress and frustration.Being late for work or appointments.
- Having to pay expensive parking fees.

Gain
- Saving time and fuel.
- Reducing stress and frustration.
- Finding parking quickly and easily.
- Avoiding late fees.

LITERATURE SURVEY:

IEEE Paper	Type	Year	Author	Findings
Park King: An IoT-based Smart Parking System	Conference	2019	C. Ajchariyavanich1, T. Limpisthira1, N. Chanjarasvichai1, T. Jareonwatanan1, W. Phongphanpanya1, S. Wareechuensuk1, S. Srichareonkul1 , S. Tachatanitanont1, C. Ratanamahatana 2, N. Prompoon2 and M. Pipattanasomporn3,4	Possible future work includes adding data analytic features to analyze the parking datasets, for example, analyzing prime time for parking, comparing utilization of each parking building on campus, and identifying possible revenue stream based on time-varying parking fees.

An IoT-based Eco Parking System for Smart Cities	Conference	2020	Soufiene Djahel	Eco-Parking with traffic prediction solutions run by traffic authorities to achieve better control of traffic congestion and avoidance of potential bottlenecks in key cities.
Navigation based - Intelligent Parking Management System using Queuing theory and IOT	Conference	2018	Seema Hanchate	• Computer vision based IOT implementation can be done as well as same visuals can be accessed by users to check aginst theft attempts • IOT enabled locks can be provided to the parking spaces which unlock only after user authentication allowing user to take away his vehicle.
IoT Platform Based Smart Parking Navigation System with Shortest Route and Anti Collision	Conference	2018	Dae-hyun Kim, Sung-hyun Park, Seungwoon Lee, Byeong-hee Roh	The IoT Platform Based Smart Parking proposed by this paper is expected to reduce the problem of lack of parking spaces. And, it is also possible to reduce the intersection accident in the parking lot frequently occurred in the parking lot. Out future work is to use many Beacons to calculate more accurate positions.
ITS for Smart Parking Systems, towards the creation of smart city services using IoT and cloud approaches	Conference	2019	Luis Felipe Herrera Quintero∗ , Julian Vega-Alfonso ´ † Diego Bermudez ´ ‡ , Luis Andres Marentes§ , Klaus Banse¶	taking advantage of the data pipeline presented, a parking system is developed, which generates ITS services, adds value for traffic and transport authorities and road actors, it can reduce the search time of free parking, and potentially traffic jams in urban areas

|				of the city of Bogota.
An IOT based smart outdoor parking	Conference	2021	GokulKrishna. S, Harsheetha. J, Akshaya. S, Jeyabharathi. D	The user-friendly application will stockpile the necessary details of the users which will assist the drivers to provide real-time visualization of parking areas and assist the drivers to easily visualize a live parking spots vacancy and location information from anywhere at any time in a very simple way
IoTRec: The IoT Recommender for Smart Parking System	Journal	2020	Yasir Saleem, Pablo Sotres, Samuel Fricker, Carmen Lopez de la Torre, Noel Crespi, Gyu Myoung Lee, Roberto ´ Minerva and Luis Sanchez	we plan to extend the parking area occupancy statistics to more than one year. We also intend to apply machine learning techniques to predict the state of parking spots in the near future and to consider that in the recommendation of parking spots
A Smart, Efficient, and Reliable Parking Surveillance System With Edge Artificial Intelligence on IoT Devices	Journal	2021	Ruimin ke , Yifan Zhuang, Ziyuan Pu , and Yinhai Wang	. The design has multiple advantages over the state-of the-art parking surveillance systems and has a bright prospect in the applications of smart city and intelligent transportation systems

FLOW DIAGRAM:
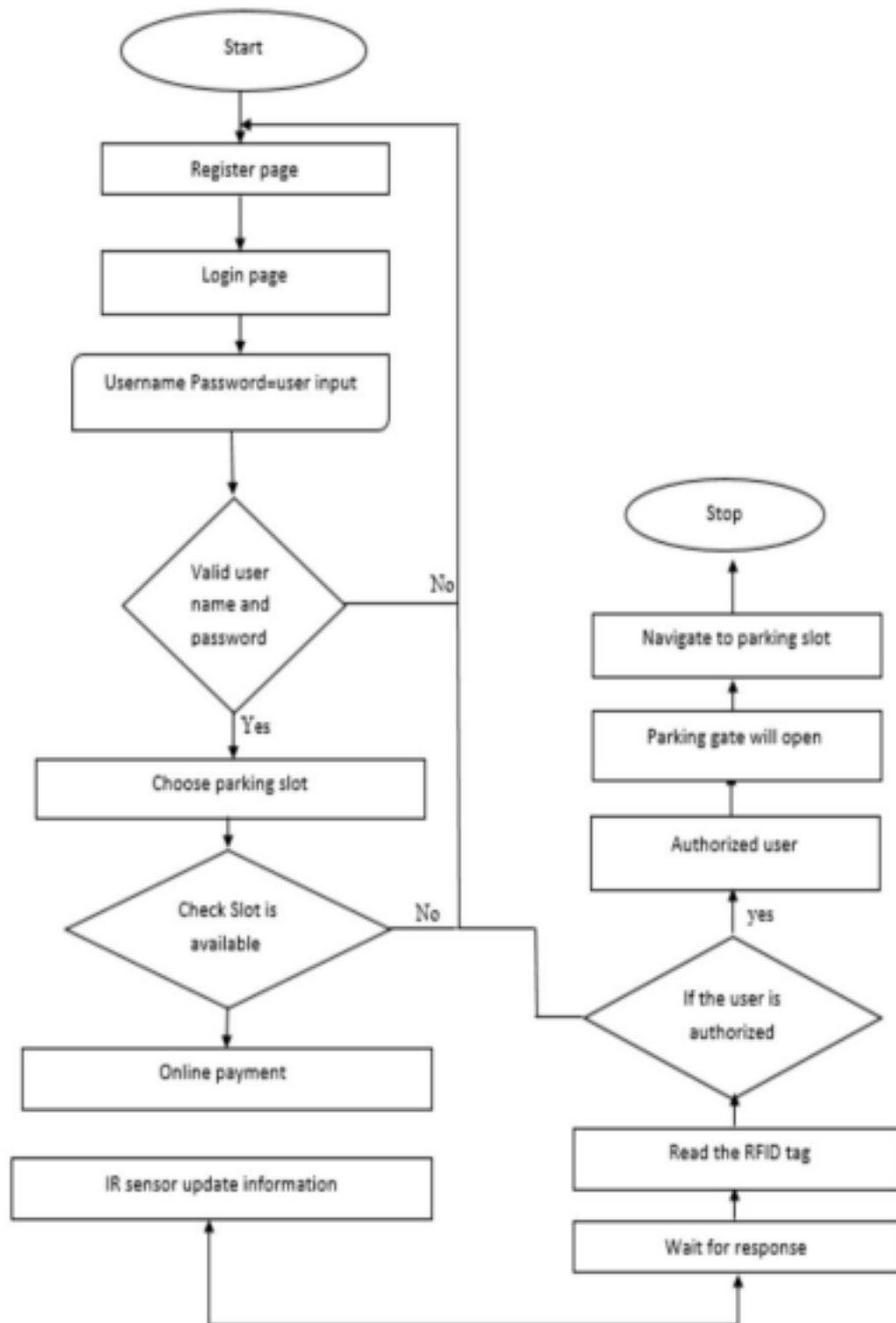
Figure 10. Flow Diagram for Overall System

PROPOSED SOLUTION:

S.No	Parameter	Description
1	Problem Statement	Finding a parking spot can be a time-consuming and frustrating experience, especially in urban areas. This can lead to traffic congestion, air pollution, and increased stress levels for drivers.

2	Idea/Solution Description	We propose a smart parking lot solution that uses sensors and machine learning to detect and monitor parking space availability in real time. Drivers can use a mobile app to view the availability of parking spaces in nearby lots and reserve a spot in advance. This will help drivers to find a parking spot quickly and easily, and reduce traffic congestion and air pollution.
3	Novelty/Uniqueness	Our smart parking lot solution is unique in several ways. First, it uses a combination of sensors and machine learning to detect and monitor parking space availability in real time. This provides a more accurate and up-to-date picture of parking availability than traditional solutions. Second, our solution allows drivers to reserve a parking spot in advance. This helps drivers to find a parking spot quickly and easily, and reduce the amount of time they spend searching for a spot.
4	Social Impact/Custom er Satisfaction	Our smart parking lot solution will have a positive social impact by reducing traffic congestion and air pollution. It will also improve customer satisfaction by making it easier for drivers to find a parking spot.
5	Business Model	We will generate revenue from our smart parking lot solution by charging drivers a fee to reserve a parking spot. We will also partner with parking lot owners and operators to share the revenue generated by the solution.
6	Scalability of the Solution	Our smart parking lot solution is scalable to any size parking lot. We can easily add more sensors and computing resources to accommodate larger and more complex parking lots.

DESIGN THINKING:

1. Project Objectives:

The specific objectives of this project are to:

- Develop a real-time parking space monitoring system that can accurately detect the occupancy and availability of parking spaces.
- Integrate the system with a mobile app to provide users with real-time information about parking availability.
- Implement an efficient parking guidance system that helps users find available parking spaces quickly and easily.

2. IoT Sensor Design:

The IoT sensors used in this system will be deployed in parking spaces to detect whether or not a vehicle is present. The most common types of sensors used for parking space monitoring are:

- Ultrasonic sensors: These sensors emit ultrasonic waves and measure the time it takes for the waves to return to the sensor. The distance to the object is then calculated based on the time of flight.

- Inductive loop sensors: These sensors create a magnetic field around a loop of wire embedded in the pavement. When a vehicle passes over the loop, the magnetic field is disrupted, which triggers the sensor.

- Camera sensors: These sensors use image processing to detect vehicles in parking spaces.

The specific type of sensor used will depend on the specific needs of the parking lot and the budget available.

3. Real-Time Transit Information Platform:

The mobile app interface will display real-time parking availability information to users. The app should include the following features:

- A map of the parking lot with the occupancy status of each parking space indicated.

- A list of available parking spaces, sorted by distance to the user's current location.

- Turn-by-turn navigation to available parking spaces.

- The ability to reserve parking spaces in advance (if supported by the parking lot).

4. Integration Approach:

The Raspberry Pi will be used to collect data from the IoT sensors and update the mobile app. The Raspberry Pi will be connected to the IoT sensors via a wireless network, such as ZigBee or LoRaWAN. The Raspberry Pi will also be connected to the internet so that it can update the mobile app with real-time parking availability information.
Here is a high-level overview of the integration approach:

1. The IoT sensors will detect the occupancy of parking spaces and send this information to the Raspberry Pi.

2. The Raspberry Pi will process the data from the IoT sensors and determine which parking spaces are available.

3. The Raspberry Pi will update the mobile app with the real-time parking availability information.

4. The mobile app will display the real-time parking availability information to users.

Architecture: