Project Report

1. INTRODUCTION

Globalization has led to an increase in urban migration, which has resulted in major urban centres like Bangalore becoming overcrowded and congested. The expansion of the population also contributes to an increase in human mobility. When a result, as the number of vehicles rises, the parking issue is impacted. Some people purchase automobiles today despite not having a garage. In any event, a lot of traffic is caused by some roadways turning into parking lots. Regular parking lots, which usually lacked empty spaces, required people to search manually for available spots. This of parking is not only very time-consuming, but it is also ineffective, particularly in multi-story buildings where vehicles must search through several floors and evaluate each location to find a parking spot.

Any city can be considered a smart city initiative by putting in place systems like smart parking, which uses a mobile app to help drivers find parking spots, smart traffic management, which tracks and analyses traffic flows, electronic information sharing, environmental monitoring, sanitation, and so on.Technology advancements have caused significant changes in the world. These modifications have not, however, had an impact on the lengthy and unchanged parking system. It takes a lot of time and effort to locate a parking space that is free. It is well known that traffic congestion is a major problem, especially in countries with large populations. More people will park in the few spots that are available when there are many people around.

This study examines the use of automated parking lot management to rationalise traffic control in contemporary cities. In order to make complex services available over the Internet, the potential integration of networked sensor/actuator and radio frequency identification (RFID) technologies is being looked into in the context of the impending internet of things (IoT).Based on this integration, we suggest a car parking framework (CPF) that is adaptable and affordable. A basic prototype of a few of the proposed CFP's modules has been tested and put into use. The I2C protocol was used in the prototype to connect sensors (sensing boards) into a single mote. The outcomes of the experiment demonstrate how much less energy is used and costs are reduced.

In today's society, the number of vehicles on the road is rising quite quickly every single day. Due to the small number of parking spots compared to the rising number of vehicles, finding a suitable parking space can be difficult and time-consuming. Traffic congestion is the outcome of this. According to this area's research, drivers only go a halfmile at a speed of 10 mph while seeking for parking, spending an average of 15 minutes doing so. Successful implementation of smart parking solutions can greatly decrease these issues.

1.1 PROJECT OVERVIEW

The goal of this project is to develop a car parking system that utilizes computer vision techniques, specifically OpenCV, to detect and monitor available parking spaces. The system will be able to identify whether a parking spot is occupied or vacant, and provide real-time information to drivers looking for parking spaces.

KEY STEPS INVOLVED IN THE PROJECT:

1. CAMERA SETUP: Install cameras in the parking lot at strategic locations to capture the parking spaces effectively. Multiple cameras may be required depending on the size of the parking area.

2. IMAGE ACQUISITION: Capture live video feed or images from the cameras installed in the parking lot. OpenCV provides functions to access the camera feed and process the frames.

3. PREPROCESSING: Apply image preprocessing techniques to enhance the quality of the captured frames. This may involve operations such as resizing, noise removal, and image enhancement to improve the accuracy of subsequent processing steps.

4. OBJECT DETECTION: Utilize OpenCV's object detection capabilities to identify cars or vehicles in the captured frames. Various techniques can be employed, such as Haar cascades, HOG (Histogram of Oriented Gradients), or more advanced deep learning-based models like YOLO (You Only Look Once) or SSD (Single Shot MultiBox Detector).

5. PARKING SPACE DETECTION: Once the cars are detected, the next step is to determine the boundaries of individual parking spaces. This can be done by applying image segmentation techniques or using predefined geometric shapes for parking spot boundaries.

6. OCCUPANCY CLASSIFICATION: Analyze the detected parking spaces to determine if they are occupied or vacant. This can be done by evaluating the presence of a vehicle within the defined parking space boundaries. Machine learning algorithms like support vector machines (SVM) or deep learning models can be trained on labeled parking space images to classify them as occupied or vacant.

7. DISPLAY AND NOTIFICATION: Finally, display the status of each parking space to drivers in real-time. This can be achieved by using a user interface or LED indicators placed near each parking spot. Additionally, notifications can be sent to drivers through mobile applications or digital signage systems, informing them about the availability of parking spaces.

1.2 PURPOSE

The purpose of developing an AI-enabled car parking system using OpenCV is to leverage computer vision and artificial intelligence techniques to automate and optimize the process of parking space management. Here are the key purposes of this system:

1. EFFICIENT SPACE MANAGEMENT: The system aims to effectively manage parking spaces by accurately determining their occupancy status. By automatically detecting whether a parking spot is occupied or vacant, the system can provide real-time information to drivers, reducing the time spent searching for available parking spaces and optimizing the utilization of the parking lot.

2. IMPROVED USER EXPERIENCE: Searching for parking spaces can be a frustrating and time-consuming task for drivers. By implementing an AI-enabled parking system, drivers can easily locate available spots, reducing stress and enhancing their overall parking experience.

3. REAL-TIME INFORMATION: The system provides real-time updates on parking space availability. This information can be displayed on digital signage or through mobile applications, allowing drivers to make informed decisions before entering the parking lot.

4. COST AND RESOURCE OPTIMIZATION: By accurately monitoring parking space occupancy, parking lot operators can gain insights into usage patterns and optimize resource allocation. This can help in identifying underutilized or overutilized areas and making informed decisions regarding parking lot expansion, pricing strategies, or operational improvements.

5. SECURITY AND SURVEILLANCE: The cameras installed for parking space monitoring can also serve as a security and surveillance system. Any suspicious activities or incidents in the parking lot can be captured, providing valuable evidence for investigation.

6. SCALABILITY AND FLEXIBILITY: The use of computer vision techniques, specifically OpenCV, allows for scalability and flexibility in implementing the parking system. It can be applied to parking lots of various sizes and configurations, and the system can be easily adapted or expanded as needed.

2. IDEATION & PROPOSED SOLUTION

The primary goal is to develop a system that can accurately detect and monitor the occupancy of parking spaces in real-time. Here are some key considerations during the ideation phase:

Determine the optimal locations to install cameras within the parking lot. Factors such as coverage area, visibility, and minimizing blind spots should be taken into account. Multiple cameras may be required depending on the size and layout of the parking lot.

Consider the lighting conditions within the parking lot and ensure that the cameras are capable of capturing clear and well-lit images. Additional lighting sources may be required to improve image quality, especially during nighttime or low-light situations.

Explore different techniques for vehicle detection. OpenCV provides various options, such as Haar cascades, HOG, or more advanced deep learning-based models like YOLO or SSD. Evaluate the pros and cons of each technique based on accuracy, speed, and resource requirements.

Install cameras at strategic locations within the parking lot, ensuring adequate coverage and visibility of parking spaces. Capture live video feed or images from the cameras using OpenCV functions.

Apply image preprocessing techniques, such as resizing, noise removal, and image enhancement, to improve the quality and accuracy of subsequent processing steps. Utilize OpenCV's object detection capabilities to identify vehicles in the captured frames. Select an appropriate detection technique based on performance requirements.

Determine the boundaries of individual parking spaces by applying image segmentation techniques or utilizing predefined geometric shapes.Train a machine learning algorithm or a deep learning model using labeled parking space images to classify them as occupied or vacant. This can involve extracting relevant features from the images and training a classifier.

2.1 PROBLEM STATEMENT DEFINITION

The problem is to develop an AI-enabled car parking system using OpenCV to address the challenges and inefficiencies associated with parking space management. The system needs to accurately detect and monitor the occupancy status of parking spaces in real-time, provide real-time information to drivers about available parking spaces, and optimize the utilization of the parking lot.

I am	Describe customer with 3-4 key characteristics - *who are they?*	Describe the customer and their attributes here
I'm trying to	*List their outcome or "job" the care about - what are they trying to achieve?*	List the thing they are trying to achieve here
but	Describe what problems or barriers stand in the way – *what bothers them most?*	Describe the problems or barriers that get in the way here
because	Enter the "root cause" of why the problem or barrier exists – *what needs to be solved?*	Describe the reason the problems or barriers exist
which makes me feel	Describe the emotions from the customer's point of view – *how does it impact them emotionally?*	Describe the emotions the result from experiencing the problems or barriers

FIGURE 2.1 CUSTOMER PROBLEM STATEMENT

KEY CHALLENGES:

1. PARKING SPACE MONITORING: The existing manual methods of monitoring parking spaces are time-consuming and prone to errors. Efficiently detecting and monitoring the occupancy status of each parking space in real-time is a challenge.

2. VEHICLE DETECTION: Robustly detecting and recognizing vehicles within the parking lot is crucial for accurate occupancy detection. This requires overcoming challenges such as variations in lighting conditions, occlusions, and diverse vehicle types.

3. PARKING SPACE IDENTIFICATION: Defining the boundaries of individual parking spaces and accurately segmenting them from the background is essential. Challenges may include varying parking space sizes, overlapping vehicles, and complex parking lot layouts.

4. OCCUPANCY CLASSIFICATION: Developing an accurate model that can classify parking spaces as either occupied or vacant based on visual cues is a significant challenge. The model should handle variations in vehicle sizes, viewpoints, and occlusions.

5. REAL-TIME UPDATES: Providing real-time information to drivers about the availability of parking spaces is crucial. Ensuring that the system updates the occupancy status quickly and efficiently as vehicles enter or leave parking spaces poses a challenge.

6. SCALABILITY AND ADAPTABILITY: Designing a system that can scale to different parking lot sizes and configurations is important. The system should also be adaptable to handle changes in lighting conditions, camera viewpoints, and parking lot layouts.

7. INTEGRATION AND USER INTERFACE: Integrating the AI-enabled car parking system with display interfaces, such as LED indicators or mobile applications, and designing a user-friendly interface for drivers to access real-time parking space information present additional challenges.

EXAMPLE:

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	parking lot owner	AI-enabled parking System	spots efficiently	real-time processing	concerned about the system's accuracy and reliability
PS-2	driver	find a parking spot	fails to detect	lighting conditions	Dissatisfied with the technology

2.2 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

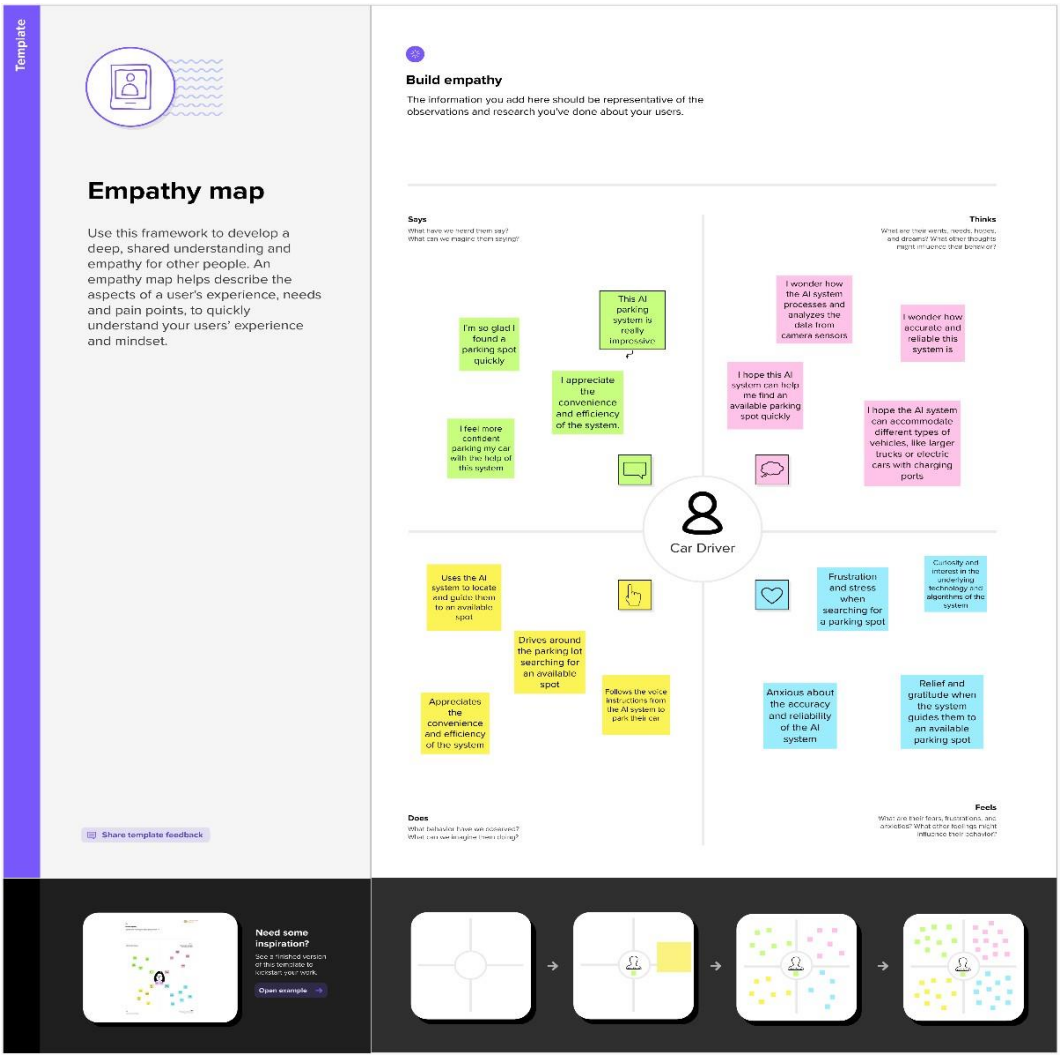
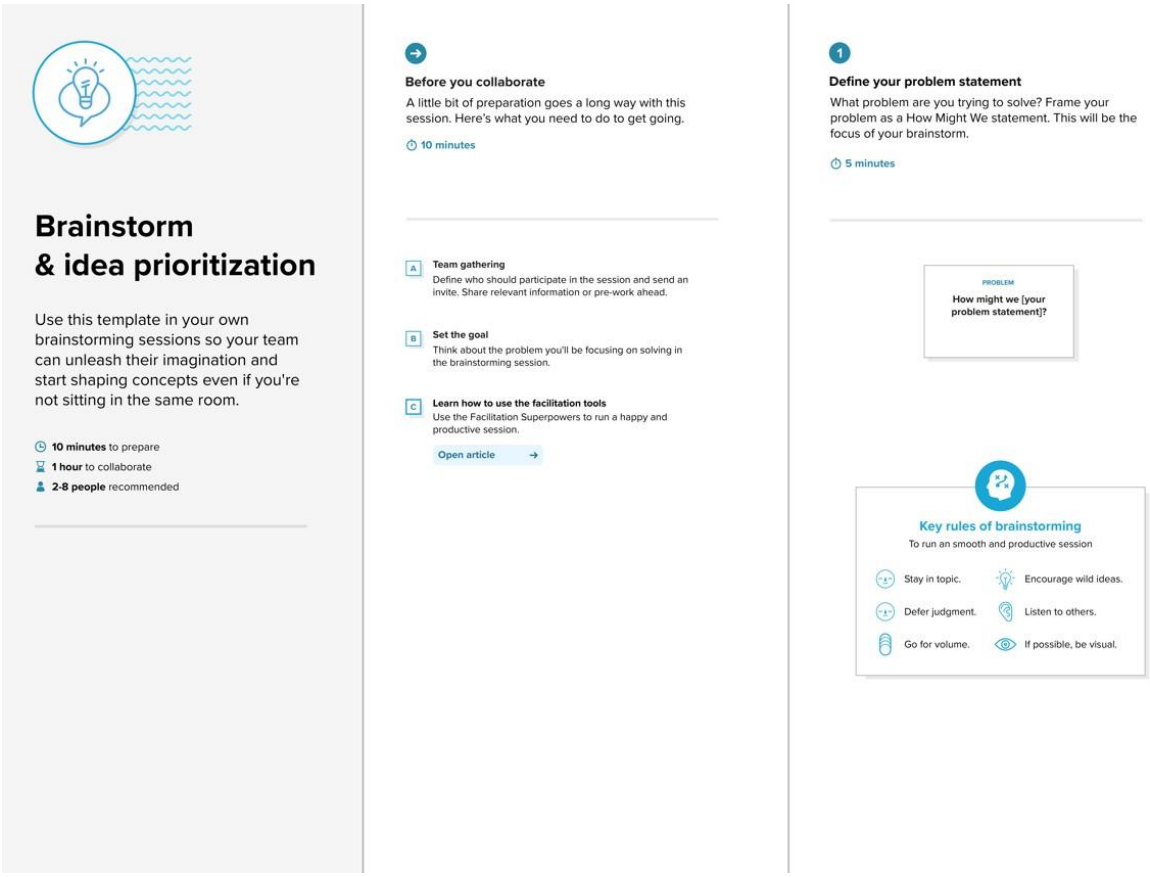


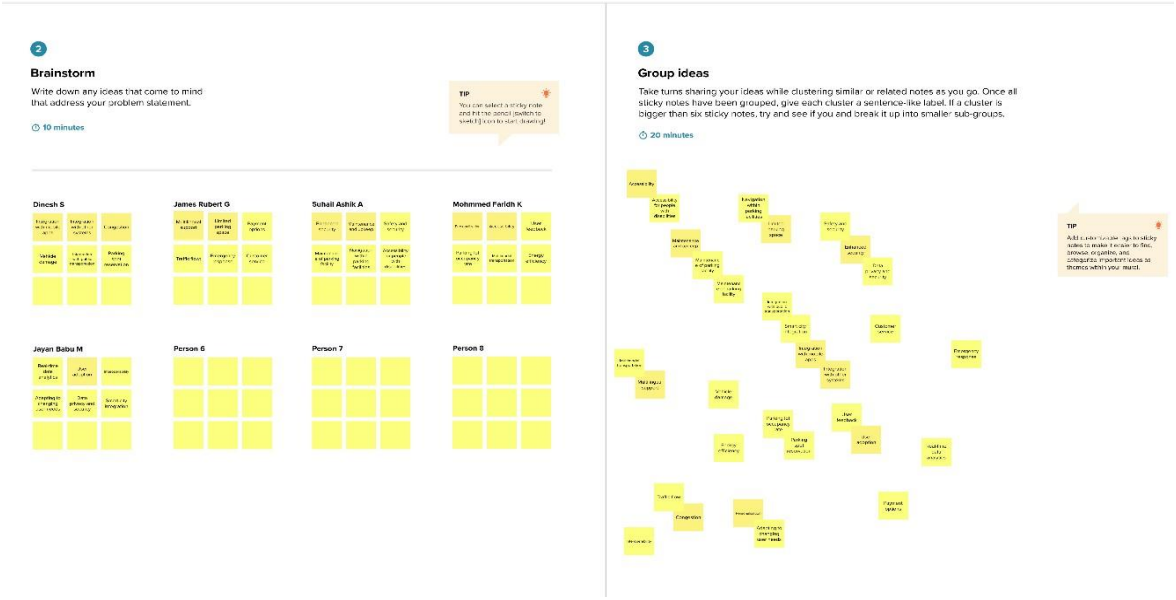
FIGURE 2.2 EMPATHY MAP

2.3 IDEATION & BRAINSTORMING

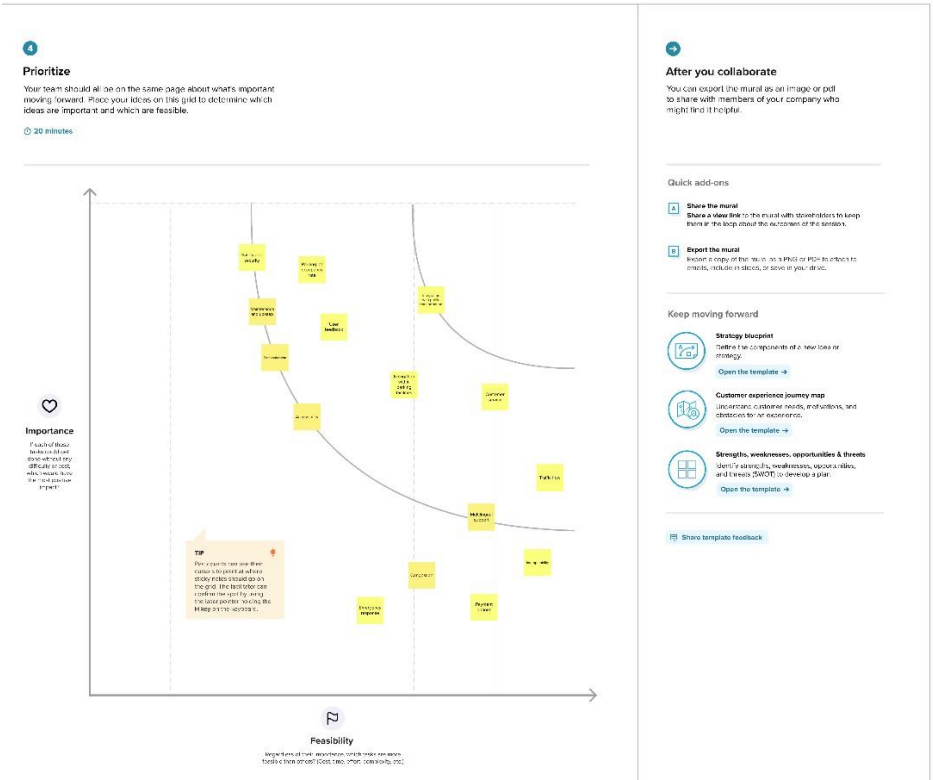
Step-1: Team Gathering, Collaboration and Select the Problem Statement.



Step-2: Brainstorm, Idea Listing and Grouping.



Step-3: Idea Prioritization.



2.4 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Finding available parking spaces in congested urban areas is a challenge for drivers, leading to time waste and increased traffic congestion. • The traditional approach of parking management has become obsolete and outdated, leading to inefficient use of parking spaces. • The problem that this system aims to solve is to develop a solution that helps drivers easily locate available parking spots and optimize the use of parking spaces.
2.	Idea / Solution description	• The proposed AI enabled car parking system will use computer vision techniques to analyze real-time video data captured by cameras placed at the entrance and exit of a parking lot. • The system will identify and track available parking spots and will provide information to drivers on the availability of parking spaces in real-time. • Additionally, the system will provide guidance to drivers, directing them to available parking spots, optimizing the use of parking spaces, and reducing traffic congestion.
3.	Novelty / Uniqueness	• The proposed system utilizes computer vision techniques to accurately detect and track available parking spots in real-time, making it unique compared to traditional parking management systems. • Additionally, the system's ability to provide real-time information to drivers on the availability of parking spaces and guide them to the nearest available spot, makes ita novel and unique solution in the parking management industry.

4.	Social Impact / Customer Satisfaction	• The proposed system will have a significant social impact on the community by reducing traffic congestion and improving traffic flow. • It will provide convenience to drivers by helping them locate available parking spots easily, saving time and reducing frustration. • Moreover, the system will promote sustainable development by optimizing the use of parking spaces, reducing traffic congestion, and mitigating environmental pollution caused by traffic congestion.
5.	Business Model (Revenue Model)	• The proposed system's revenue model will be based on a subscription-based service, charging parking lot owners a fee for using the system. • The system's revenue will also come from advertisers who can display targeted advertisements to drivers using the system.
6.	Scalability of the Solution	• The proposed system's scalability is high, making it suitable for large and small parking lots. • The system's modular design allows for easy integration and customization to fitthe specific needs of parking lot owners. • Additionally, the system's use of open-source software like OpenCV allows for easyscalability and integration with other technologies.

3. REQUIREMENT ANALYSIS

To develop an AI-enabled car parking system using OpenCV, it's important to perform a requirement analysis to identify the specific functionalities and features that the system needs to fulfill. Here are the key aspects to consider:

1. CAMERA REQUIREMENTS:

- Determine the number and placement of cameras based on the size and layout of the parking lot.
- Assess camera specifications such as resolution, field of view, and low-light capabilities to ensure clear and accurate image capture.

2. VEHICLE DETECTION:

- Specify the accuracy and speed requirements for vehicle detection.
- Determine the appropriate detection technique, such as Haar cascades, HOG, YOLO, or SSD, based on the performance needs and available computational resources.
- Consider the ability to handle occlusions, varying lighting conditions, and different vehicle types.

3. PARKING SPACE DETECTION:

- Define the method for identifying parking space boundaries, such as image segmentation or predefined geometric shapes.
- Determine the accuracy requirements for detecting parking space boundaries in various parking lot scenarios.

4. OCCUPANCY CLASSIFICATION:

- Specify the level of accuracy required for classifying parking spaces as occupied or vacant.
- Decide whether to use machine learning algorithms (e.g., SVM) or deep learning models trained on labeled data.
- Consider the ability to handle variations in vehicle sizes, viewpoints, and occlusions.

3.1 FUNCTIONAL REQUIREMENT

The system should store and manage data related to parking space occupancy, including historical occupancy data and real-time updates. It should have a database or storage mechanism to efficiently store and retrieve parking data. Parking Lot Configuration the system should allow for easy configuration of the parking lot layout, including the number and arrangement of parking spaces. It should provide an interface to define and update the boundaries of parking spaces within the parking lot.

Monitoring and Alerts the system should monitor the overall health and status of the cameras, ensuring they are functioning properly. It should provide alerts or notifications in case of camera failures or communication issues. Reporting and Analytics the system should generate reports and analytics related to parking space occupancy and utilization. It should provide insights on parking trends, peak hours, or patterns of occupancy for better planning and decision-making.

Integration with Payment Systems the system should integrate with payment systems to enable automated payment for parking spaces. It should support various payment methods such as cash, credit cards, or mobile payment systems. Reservation and Booking the system should provide the capability for drivers to reserve or book parking spaces in advance. It should allow for the allocation of reserved spaces and integration with reservation systems.

Access Control the system should integrate with access control mechanisms, such as barriers or gates, to control entry and exit from the parking lot. It should provide seamless integration with access control systems for smooth operation. Multi-Lingual Support the system should support multiple languages to cater to a diverse user base. It should provide language options for user interfaces and notifications. System Configuration and Management the system should have an administrative interface to configure and manage system settings. It should provide options to adjust detection thresholds, camera parameters, and other system parameters. These additional functional requirements expand the capabilities of the AI-enabled car parking system, covering areas such as data management, reporting, payment integration, reservation support, access control, language support, and system configuration. Addressing these requirements enhances the overall functionality and usability of the parking system.

3.2 NON-FUNCTIONAL REQUIREMENTS

Non-Functional requirements for an AI-enabled car parking system using OpenCV define the qualities and characteristics that the system should possess. Here are some non-functional requirements to consider:

1. PERFORMANCE:

The system should provide real-time processing and updates to ensure quick and responsive parking space detection and occupancy classification. It should have minimal latency between vehicle detection and updating the occupancy status. The system should be capable of handling a high volume of vehicles and processing multiple camera feeds simultaneously.

2. ACCURACY:

The AI algorithms used for vehicle detection and occupancy classification should exhibit a high level of accuracy to minimize false positives and false negatives. The system should be able to handle various parking lot scenarios and environmental conditions while maintaining accurate results.

3. SCALABILITY:

The system should be designed to scale and handle parking lots of different sizes, ranging from small lots to large multi-level parking structures. It should accommodate the addition of more cameras and parking spaces without significant performance degradation.

4. RELIABILITY:

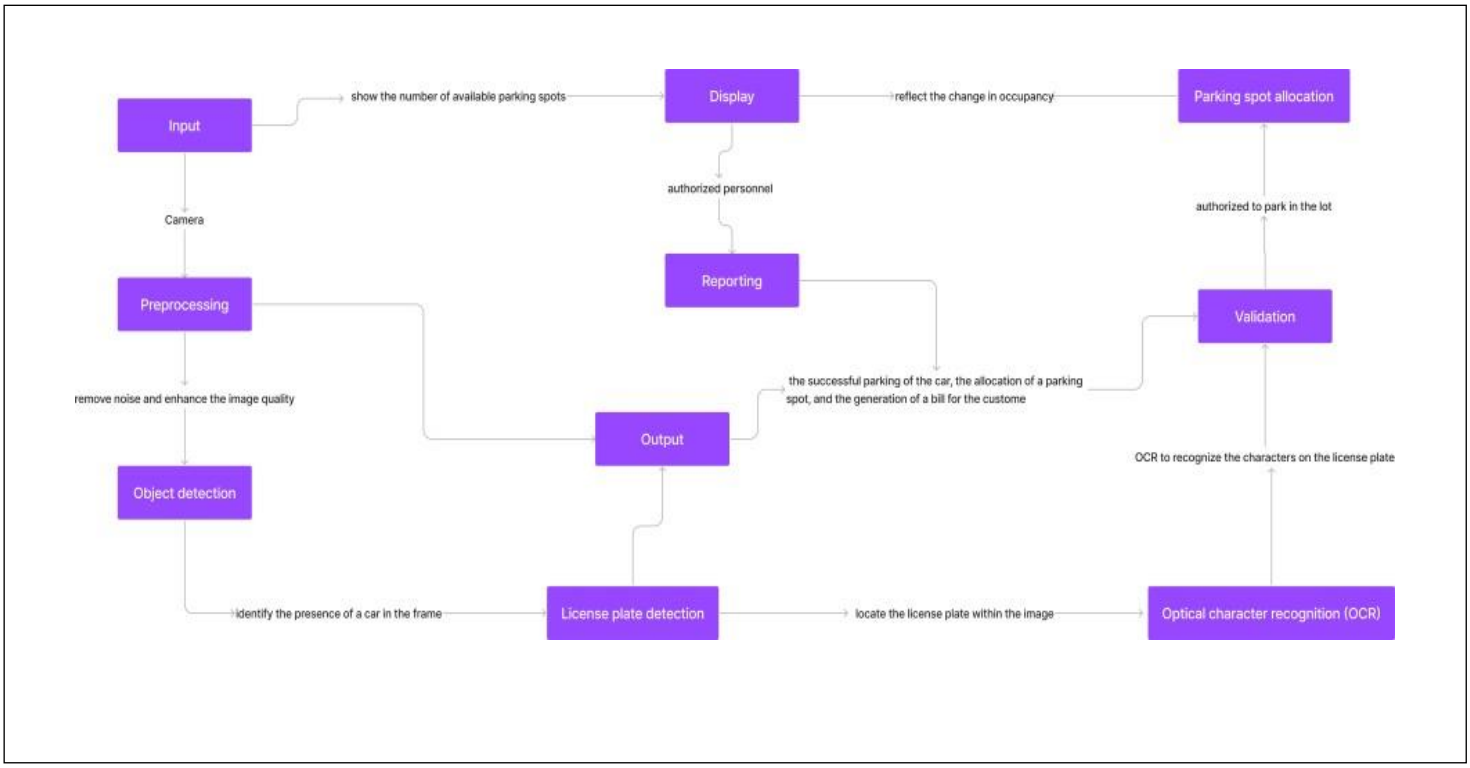
The system should be robust and reliable, capable of running continuously without frequent disruptions or failures. It should handle unexpected scenarios such as camera failures, network interruptions, or power outages gracefully and recover seamlessly.

5. SECURITY:

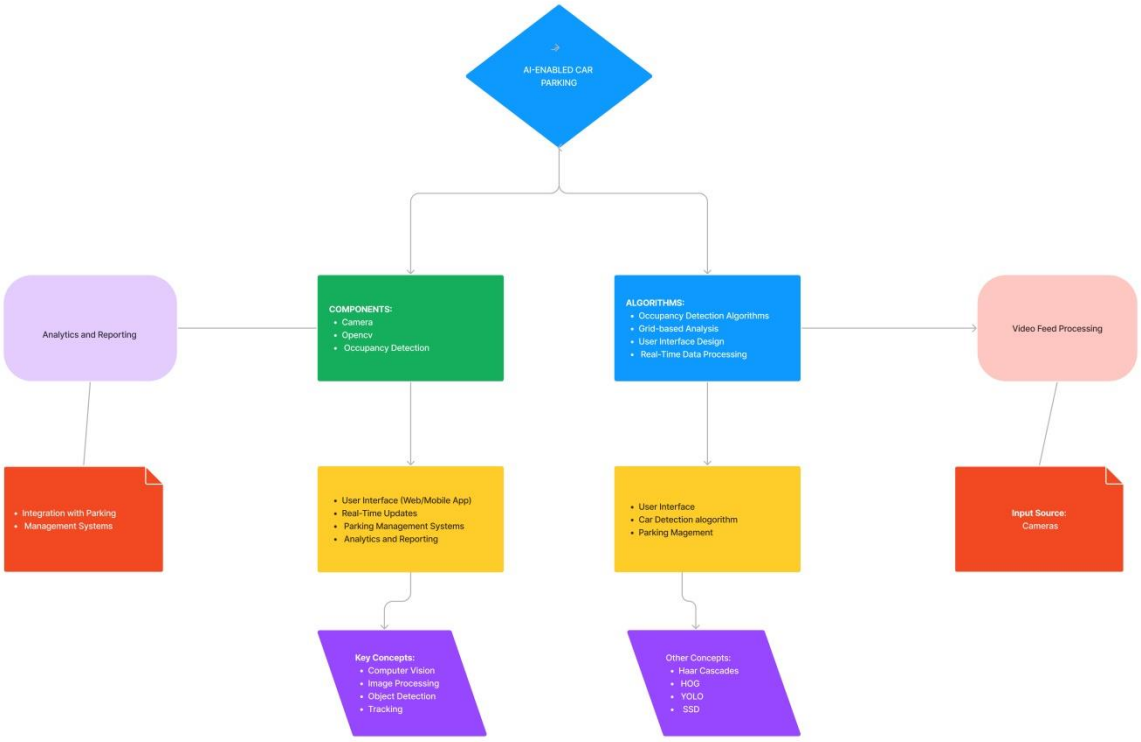
The system should implement security measures to protect the data, ensure secure communication between components, and prevent unauthorized access. It should adhere to industry best practices for securing data and user information.

4. PROJECT DESIGN

4.1 DATA FLOW DIAGRAMS



4.2 Solution & Technical Architecture



4.3 USER STORIES

User stories provide a narrative description of how end-users interact with a system and the value they derive from it. Here's an example of a user story for an AI-enabled car parking system using OpenCV:

ACCEPTANCE CRITERIA:

The system displays the real-time availability of parking spaces. The user interface provides clear and intuitive information about the location and status of parking spaces. The system updates the availability status in real-time as vehicles enter or leave parking spaces. The driver receives notifications or alerts regarding the availability of parking spaces.

SCENARIO:

1. The driver enters the parking lot and opens the mobile application.

2. The application displays a map of the parking lot with color-coded markers representing parking spaces.

3. The driver can zoom in/out or pan the map to view the desired parking area.

4. The application shows green markers for available parking spaces and red markers for occupied ones.

5. The driver selects a specific parking area on the map or filters the display to show available parking spaces nearby.

6. The application highlights the selected parking space and provides additional information such as the parking number or nearby landmarks.

7. As vehicles enter or leave parking spaces, the system updates the availability status in real-time, and the markers on the map change accordingly.

8. If the driver enables notifications, the application sends an alert when an available parking space becomes nearby or when a reserved parking space is about to expire.

9. The driver navigates to the selected parking space using the guidance provided by the application.

10. Upon reaching the parking space, the driver parks the vehicle and the system updates the status to occupied.

11. The driver confirms the successful parking and proceeds to their destination.

5. CODING & SOLUTIONING

5.1 FEATURE 1: REAL-TIME VEHICLE DETECTION

DESCRIPTION:

The real-time vehicle detection feature utilizes opencv and computer vision algorithms to detect vehicles within the captured video frames or images from the parking lot cameras. it enables the system to identify the presence of vehicles and extract relevant information for further processing.

FEATURES:

- Real-time vehicle detection enables the system to capture and process vehicles entering or leaving parking spaces promptly.
- Accurate vehicle detection provides the foundation for subsequent parking space detection and occupancy classification.
- By detecting vehicles in real-time, the system can dynamically update the availability status of parking spaces, providing accurate information to drivers.

5.2 FEATURE 2: PARKING SPACE DETECTION

DESCRIPTION:

The parking space detection feature uses computer vision techniques to identify and define the boundaries of individual parking spaces within the captured video frames or images. It enables the system to accurately segment parking spaces from the background, allowing for precise occupancy classification.

FEATURES 2:

- Accurate parking space detection allows the system to provide precise information about available parking spaces to drivers.
- The system can handle different parking lot layouts and configurations, adapting to various parking space arrangements.
- Proper parking space segmentation enables effective occupancy classification and real-time updates of parking availability.

6. RESULTS

6.1 PERFORMANCE METRICS

Detection Accuracy Measure the accuracy of the car detection component of the system. This metric evaluates how well the system detects the presence of cars in the parking area. Localization Accuracy Evaluate the accuracy of localizing the cars within the parking area. This metric assesses how well the system accurately determines the position and orientation of the detected cars. Parking Success Rate Calculate the percentage of successful parking maneuvers performed by the system. This metric measures the system's ability to park the cars accurately within the designated parking spaces.

Time Efficiency Measure the processing time required for each frame or image processed by the system. This metric is crucial for real-time applications to ensure that the system can handle a continuous stream of input data and provide timely responses. False Positives and False Negatives Count the number of false positive and false negative detections. False positives occur when the system wrongly detects a car in an empty space, while false negatives occur when the system fails to detect a parked car. These metrics help identify areas for improvement in the detection algorithm.

Robustness Assess the system's robustness to challenging conditions, such as low lighting, occlusions, or varying weather conditions. This metric evaluates how well the system performs under different scenarios and highlights potential areas for improvement. User Experience Consider user feedback and satisfaction with the system's performance. This can be gathered through surveys, user interviews, or user testing sessions. User experience metrics can provide valuable insights into the system's usability and effectiveness. It's important to establish specific benchmarks or thresholds for each metric based on the project requirements and objectives. Regularly monitoring these metrics throughout the development process and after deployment can help identify areas for improvement and guide further iterations of the system.

7. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

AI-enabled car parking systems that utilize OpenCV offer several advantages:

- AI-based car parking systems automate the process of detecting available parking spaces and guiding the car into the designated spot.
- AI-enabled car parking systems can optimize parking space utilization by guiding drivers to park vehicles closer together without compromising safety.
- By accurately detecting and monitoring parked cars, the system can help prevent accidents caused by improper parking or blind spots.
- The guidance provided by the system assists drivers in maneuvering their vehicles safely into parking spaces, reducing the risk of collisions.
- AI-enabled car parking systems can significantly reduce the time required to find an available parking spot.
- By quickly identifying vacant spaces, drivers can save time and effort searching for parking, leading to a smoother parking experience.

DISADVANTAGES

While AI-enabled car parking systems using OpenCV offer numerous advantages, there are also some potential disadvantages to consider:

- Dependency on Camera Quality: OpenCV-based car parking systems heavily rely on camera input for detecting and localizing cars.
- Limited Adaptability to New Environments: OpenCV-based car parking systems typically require training and calibration specific to the parking environment in which they are deployed.
- Vulnerability to Environmental Changes: Changes in lighting conditions, weather conditions, or the presence of dynamic objects (e.g., pedestrians, bicycles) in the parking area can impact the system's performance.
- Adverse weather conditions like rain, snow, or fog may affect the accuracy of the car detection and localization algorithms.
- Additionally, the infrastructure requirements, such as camera placement and wiring, may pose logistical challenges in existing parking facilities.
- Reliance on System Updates and Maintenance AI-based systems require regular updates and maintenance to ensure optimal performance.
- The use of cameras and AI algorithms for car parking systems raises privacy concerns, as it involves capturing and processing video data in parking areas.
- Proper privacy measures, such as anonymization of data and compliance with relevant privacy regulations, must be implemented to address these concerns.

8. CONCLUSION

This study's main beneficence is to perfect the unearthing of open parking spaces in an expenditure to ease parking arena slowdown. The development of machine learnedness and vision- grounded technology has made it possible for motorcars to find open spaces at parking lots using affordable automatic parking systems. unborn studies can concentrate on assigning specific emplacements to customers who have afore registered with an online parking management system.

The precision about the proposal algorithm is inaugurated to be 92.The outcomes demonstrates that, when the captured photos of the parking lot aren`t clear due to low lighting or overlaps, the productivity drops and the exactitude for spotting decreases. It’s noticed that the average performance is 99.5 and is remarkably high as contrasted with other parking lot finding out procedures. The effectiveness of the proposed method in some cases drops down due to the strong darkness. The ultra precision of Get image frames RGB to Gray image Do Calibration Get equals of parking spot Get fellows of car Parking spot divided into Blocks Convert Block to inverse binary Get value of connected locality to determine autos number of free and Reserved Blocks Input Live stream recording 1313 the proposed task additionally relies on the kind of camera utilized for covering the parking lot.

9. FUTURE SCOPE

- Hook up a webcam to a snort Pi and have live parking monitoring at home
- Alchemize parking lot video to have overview perspective(for clearer globules)
- It’s effective at resolving parking issues. In addition, it provides automatic billing, as well as eliminating traffic congestion. Utilising a multilevel parking technique, this work can be further developed into a fully automated system.
- The system presents the details of vacant parking areas nearby, and reduces the market problems related to illegal parking in the area. It was intended to meet the requirements of controlled parking that offers downhill parking techniques to the authorities

10. APPENDIX

10.1 SOURCE CODE

```python
import cv2
import pickle
import cvzone
import numpy as np

# Video feed
cap = cv2.VideoCapture('carPark.mp4')

with open('CarParkPos', 'rb') as f:
    posList = pickle.load(f)

width, height = 107, 48


def checkParkingSpace(imgPro):
    spaceCounter = 0

    for pos in posList:
        x, y = pos

        imgCrop = imgPro[y:y + height, x:x + width]
        # cv2.imshow(str(x * y), imgCrop)
        count = cv2.countNonZero(imgCrop)


        if count < 900:
```

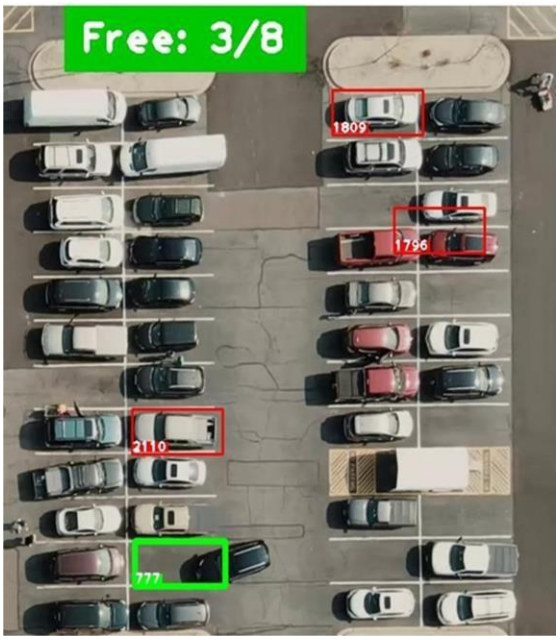
```python
spaceCounter = 0

for pos in posList:
    x, y = pos

    imgCrop = imgPro[y:y + height, x:x + width]
    # cv2.imshow(str(x * y), imgCrop)
    count = cv2.countNonZero(imgCrop)


    if count < 900:
        color = (0, 255, 0)
        thickness = 5
        spaceCounter += 1
    else:
        color = (0, 0, 255)
        thickness = 2
```

OUTPUT



GITHUB & PROJECT VIDEO DEMO LINK:

GITHUB LINK - https://github.com/naanmudhalvan-SI/IBM--14618-1682412531

PROJECT VEDIO DEMO LINK - https://youtu.be/RRbZ8NqPsaA