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Enhanced Cloud Car Parking System using ML and Advance Neural Network[1]

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ABSTRACT

It is a challenging challenge for the users to find a parking spot to park their vehicles because of the rapid increase in vehicle density, particularly during the busiest times of the day. Moreover, a smartphone application is available that enables users to check parking space availability and reserve a spot accordingly. By lowering fuel use and pollution in cities, smart parking can boost the economy. Using parking resources more effectively is referred to as parking management. Finding the root of the issue is the first step in effective parking management. In light of the rising number of vehicles on the road, finding adequate parking is one of the sectors with the quickest growth rates. Traffic has typically been a nightmare. intelligent parking solutions from major hardware vendors to address these problems. On the other side, these are unsuited for their intended use and have led to significant parking problems at numerous businesses. The strategy makes an effort to provide a workable solution to the smart parking issue.

Keywords- *open cv; SVM; Parking Management; Architecture; CNN model*

INTRODUCTION

The number of automobiles on the road has increased dramatically along with the population and economic reasons. The amount of appropriate parking spaces that can be made available to individuals is severely limited as a result.

The requirement for parking space planning is significantly more critical in populous nations like India. Individuals spend a lot of time looking for parking spots and frequently have to wait for cars to move before they can park. Most frequently, the crowded roads make it more difficult for them to locate locations that are appropriate for the vehicles they own.[1][2] The State Government is revisiting the towing vehicle policy in response to mounting complaints. Yet experts claim that a long-term fix is required, , one that will improve the current mass transit networks and reduce dependency on personal vehicles. The number of vehicles in Bengaluru has dramatically expanded during the previous ten years. A total of 41.56 lakh automobiles were registered in 2011–2012. Ten years later, the number of automobiles in Bengaluru has surpassed one crore, at 1,00,44,491, according to figures from November 2021.[3]

The number of two-wheelers in private automobiles increased from 28.67 lakh to 66.97 lakh, The number of cars registered increased from 8 lakh to 20.94 lakh over the same 10-year period. According to IBM's initial parking study, obtaining a parking space is a daily issue for drivers in 20 international locations.

The most heated arguments between drivers over a parking spot occurred in Milan (37%), Bangalore (44%), Nairobi (43%), and New Delhi (58%) respectively. According to the report, Chicago (89%), Los Angeles and Stockholm (87%) and Montreal (85%) have the kindest drivers who avoid confrontations over parking. Singapore and Singapore

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also have the kindest drivers (83 per cent).[4]

According to the poll, "almost 30% of traffic in a city is caused by cars hunting for a parking spot," in addition to the usual traffic jams brought on by everyday commutes, construction, and accidents. Nairobi commuters spent an average of 31.7 minutes looking for parking, while commuters in Bangalore, Beijing, Buenos Aires, Madrid, Mexico City, Paris, and Shenzhen all reported mean times that were much longer than the global average. 17% of drivers in Milan, 16% in Beijing, 16% in Madrid, and 16% in Shenzhen spent 31 to 40 minutes seeking for parking.

The average amount of time spent searching for parking around the world is 20 minutes, and its merely wastage of precious time

This focuses on parking lots in open spaces, shopping malls, and commercial streets with dedicated parking places. Automating the process of discovering parking spaces will be far more effective when done with technology-based video surveillance rather than with sensor-based labour. The sensor-based approach requires more complex hardware work, higher costs for the placement and operation of the sensors, and a higher risk of technical failure than the suggested method of using video-based monitoring. The video-based monitoring system was built using a variety of technologies, including Convolutional Neural Networks and OpenCV (CNN). Convolutional neural networks are proven to be helpful in classifier building since they automatically gather and apply the extracted properties of the input for improved outcomes...

The suggested solution focuses not just on the video monitoring component but also on offering consumers a practical way to receive real-time parking spot identification through an app. Also, the app will be very helpful to the user by offering options for paperless payment.

The parking situation right now: The demand for parking applications is being driven by the desire for better customer service. Today, parking fines can be paid via a (online) application. To make the idea of finding ample parking a reality, there have been other ways to integrate mobile apps into the parking procedure. inclination towards cashless transactions: Today's consumers require a wide range of payment alternatives, including parking.

Electronic payments are gradually replacing cash payments in the parking sector. Businesses that provide parking services are increasingly accepting credit cards and mobile internet payments. Demand for energy, environmentally beneficial, and workable solutions: Sustainability is a must, especially in light of the devastation caused by climate change.. People are becoming more and more concerned with long-term solutions and energy efficiency. In the long term, it not only saves money but is also better for the environment.[5]

PROBLEM STATEMENT

As the number of cars has increased, parking space in Indian cities has remained constant or even decreased due to rising population. The majority of towns advise adding parking spaces to help with the problem. Despite the limited land area and available resources, multi-level buildings are being created and parks and vacant lots are being exploited as potential parking spots.

Due to an uncontrolled pricing system, parking spots are limited. A cheap parking charge encourages more cars to be on the road, adding to pollution issues. Automobile dependency costs society a lot of money. User expenses include fewer transport options and more automobileresidential parking spaces, which increases the danger of an accident. Excessive automobile use is caused by external expenditures such as road and parking facilities, congestion, and uncompensated accident damages. Commercial vehicles will be unable to load or unload due to a lack of parking, which will lead them to block traffic lanes.

Oversupply of parking spaces and inefficient andinconsistent parking laws can be caused by local zoningordinances, construction codes, and other development activities. Regulations and taxes may be in effect at particular times, and parking subsidies may be available to some but not all users.

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On-street parking troubles are a common cause of delays,especially on congested highways. For both sorts of placesto be used to their full potential, a tariff balance is required. Overcrowding of parking places is one of today's mostcommon issues. The number of vehicles on the roadcontinues to outnumber available parking spots, clutteringthe roads.[6]

Violence resulting from overcrowding, deformed cars as a result of a space crisis, and overcharging for parking are justa few of the issues that arise.

Cruising, or cars seeking a parking spot, results in longlines, traffic congestion, and pollution.

Parking lots collect many pollutants that don't get absorbed and end up in water bodies after rainstorms. They also resultin the production of Sulphur dioxide as well as particulate matter, although both are detrimental to human health. Parking on important events causes endless traffic because asignificant number of vehicles flood the streets, putting enormous strain on available parking spaces. As a result, there will be more cruising, turmoil, quarrels, and long lines than usual.[7]

CREATING AN ONLINE MAP OF INDIA'S PARKING LOTS

Get My Parking, which promises to make parking lots more visible, effective, and accessible to the typical urban commuter, intends to address the parking situation in India. Within a few minutes, a commuter can access the Get My Parking smartphone app, find a parking lot, and check the space availability.

It is difficult to create a digital map of every parking lot in India because neither an online nor offline list of all parking lots is available. Also, Get My Parking required information on each parking lot's dimensions and infrastructure as well as current availability of places. This data had to be gathered entirely from scratch.

a)Data Augmentation

India, one of the fastest-growing third-world nations worldwide, is experiencing a dramatic increase in the number of cars on the road. The population is increasing dramatically, as are the number of cars (particularly cars), while parking spaces have stayed constant or have even decreased. This is a major source of annoyance, pollution, and one of the reasons why accidents happen on the roads.[14]

data/input2.txt

```
..   @@ -0,0 +1,27 @@
1   + create_parking_lot 8
2   + park PB-01-KL-1234 Red
3   + park PB-01-KL-2999 White
4   + park PB-01-BB-0001 Black
5   + status
6   + leave 3
7   + park DL-01-KL-7777 Red
8   + park DL-01-KL-2701 Blue
9   + park DL-01-KL-3141 Black
10  + leave_car_by_registration_number JH-01-BB-0001
11  + leave_car_by_registration_number PB-01-KL-1234
12  + park KA-01-BB-0001 Black
13  + park KA-01-HH-7777 Red
14  + leave 3
15  + park KA-01-HH-2701 Blue
16  + status
17  + leave 2
18  + leave 7
19  + available_slot_numbers
20  + allocated_slot_numbers
21  + leave 3
22  + registration_numbers_for_cars_with_colour White
23  + slot_numbers_for_cars_with_colour White
24  + slot_number_for_registration_number JH-01-HH-1234
25  + park HR-03-CJ-6453 blue
26  + park KP-02-DP-1234 white
27  + status
```

Fig4 applying data set

Fig 1 world data

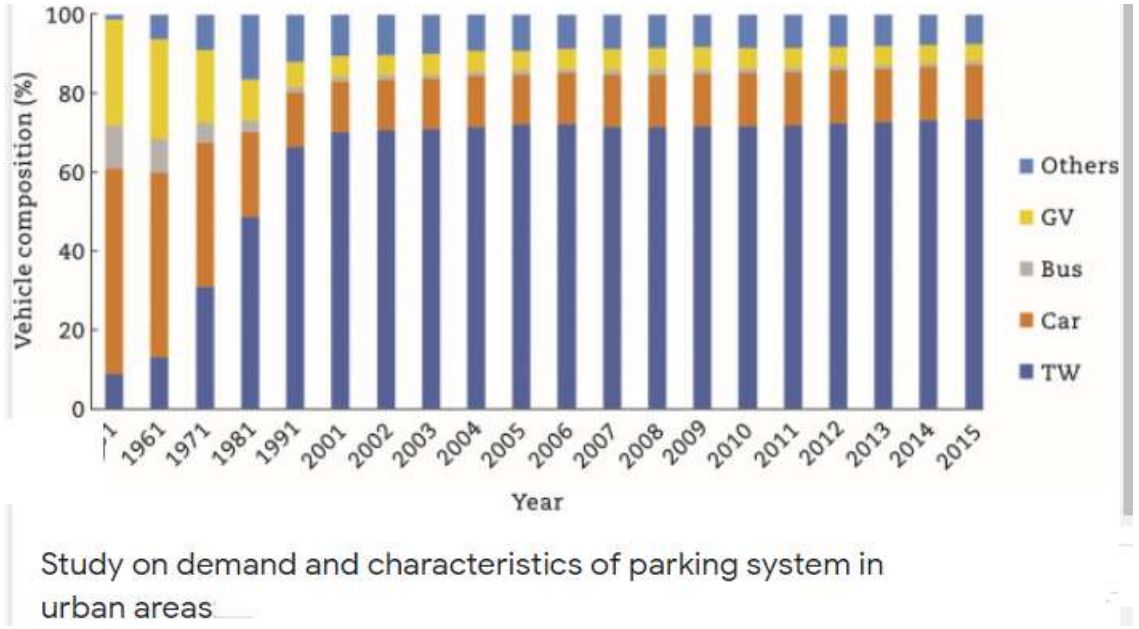

Fig2 urban area Data

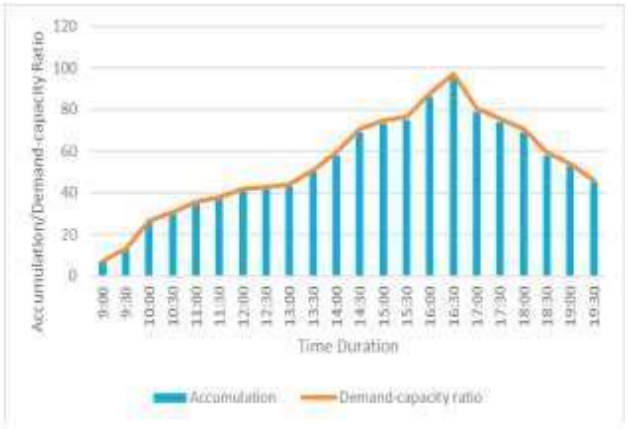

Fig3. Parking accumulation and D/C ratio curve for P1 from the experiments conducted in [14] showing the time and accumulationof vehicles.

b) Solution Architecture

The construction of this parking detecting model involves two key steps:

- Locating every parking place that is available
- Analyzing availability a parking space

We can use OpenCV to perform a one-time mapping of each parking space because the camera view is mounted in this location. Since you are aware of where each parking space is, you can apply deep learning to forecast whether or not it is empty.[13]

Fig 4 open CV Approach

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```
public void parkingLotFull() {


        outputPrinter.statusHeader();
        for (Slot slot : occupiedSlots) {
        final Car parkedCar = slot.getParkedCar();
        outputPrinter.printWithNewLine(slot.getSlotNumber()
        + "\t\t" + parkedCar.getRegistrationNumber()
        + "\t\t" + parkedCar.getColor());
        final String slotNumber = slot.getSlotNumber().toString();

        outputPrinter.printWithNewLine(padString(slotNumber, 12)
        + padString(parkedCar.getRegistrationNumber(), 19) + parkedCar.getColor());
        }
        }

        private static String padString(final String word, final int length) {
        String newWord = word;
        for(int count = word.length(); count < length; count++) {
        newWord = newWord + " ";
        }
        return newWord;
        }
        }
```

6 src/modules/parkingLot.js

```
@@ -80,7 +80,7 @@ class ParkingLot {
                                throw new Error(`Slot number ${index + 1} is not found`);
                        }
                        else if (this.parkingSlots[index] === null) {
-                               throw new Error(`Slot number ${index+1} is already free`);
+                               throw new Error(`Slot number ${index + 1} is already free`);
                        }
                else if (index > -1 && index <= this.parkingSlots.length) {
                        this.parkingSlots[index] = null;
@@ -94,7 +94,7 @@ class ParkingLot {
        }

        /**
-        *
+        *
         * @param {String} input user's input via terminal
         * @description it makes the slot free for the car of given registration number.
         * It throws an error if car is not found.
@@ -135,9 +135,9 @@ class ParkingLot {
                        throw new Error('Sorry, parking lot is empty');
                }
        }
-
```

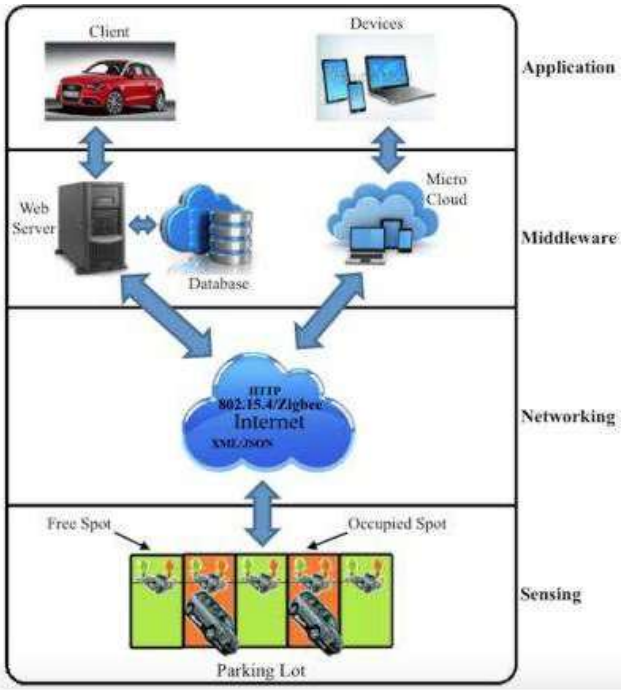


Fig 5. Shows a proposed Smart Parking system that was proposed in [11] which is divided into four basic layers depending on the kind of technology used. Our proposed solution makes use of these basic layers to form the components of the solution. Parking spaces can be identified and displayed to app users using the footage from parking lots' CCTV cameras. Users will be able to plan ahead by looking for parking spots in specific locations, saving themselves a lot of time in the process. The app will also enable users to monitor their vehicle using camera feeds from a distance. With the software, sensors, and camera working together, the entire system will thus offer a straightforward yet practical solution for smart parking.

Figure 7 securitycameras using vehicle identification(Support Vector Machine & open cv)

LITERATURE REVIEW

These studies all examine the many approaches suggested for smart parking. We have investigated a number of methodologies and tools, including sensors and computer vision.

A qualitative and quantitative economic analysis of these technologies is also advised by the study.

Risks can be decreased and investment efficiency can be increased by using economic analysis. The goal of economic

analysis is to lower risks and boost the effectiveness of investments.

The reviews suggest several implementation strategies for smart parking solutions. Some of them place emphasis on the different kinds of sensors that may be deployed in such a solution Some, meanwhile, don't utilise specialised sensors and instead link sensing modules to Arduino or other comparable gadgets. The energy autonomy characteristics of these microcontrollers differ from those of special purpose sensors. These microcontrollers are also not IP68 certified, making them unsuitable for inclement weather. No of the weather, sensors must be able to detect the presence of a vehicle. As a result, sensors in a smart parking solution must be able to function in adverse weather (i.e., rains, dust).

The components of a parking management system include In a work [3], an Arduino hardware and mobile apps are proposed. Users can also check the availability of public parking and reserve a spot using a smartphone application. Our mobile app allows users to reserve a parking space for themselves.

A proper platform has been provided for all users by outlining the potential problems that could arise when utilising a smart parking system and their solutions. Those who struggle with daily tasks will live better lives as a result of the advent of smart parking systems. The paper wants to go beyond just permitting smart parking by improving real-time monitoring and administration of available parking spaces, which will generate a lot of money.[15]

This article [4] reviews numerous works related to the deployment of smart parking systems and analyses the types of each component that are most frequently utilised, focusing on use patterns throughout the analysis period. Each section analyses and examines current usage patterns for software, protocols, and sensors. In addition to usage patterns, this article compiles a list of complementary qualities from the types of components that should be taken into account while creating a smart parking system..

PROPOSED ALGORITHM

Step1 Get from the owners the parking lot's dimensions
Step 2. Get the parking lot's live CCTV footage.
Step 3. In the backend, extract the video using OpenCV.
Step 4. Locate the video frame and convert it to grayscale.
Step 5. Remove extra layers, too much exposure, and any interruptions.
Step 6. Reduce the video to its ROI form for more effective detection.
Step 7. Execute the video's prediction using the trained model.
Step 8 Plot the outlines of parking spaces and use OpenCV to get the dimensions.
Step 9. Delineate the free areas with green outlines and the places with parked cars with red contours.
Step 10. Calculate this count along with the trained model's count.
Step 11. Using OpenCV, provide the parking count status and contours in real-time to the Flask API.
Step 12. Integrate the model with a Flask API to show the values in real time on a localhost.

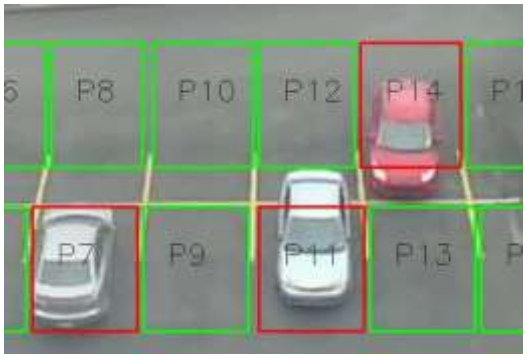


Fig. 8. Detection & prediction for parking slot

b) Mobile app Deployment

a)If the user already has an account, he logs in to the app; otherwise, he must create one.
b)The user is taken to the Services screen after logging in, where he can reserve parking spaces or utilise the navigation tool.[17]
c)The user is then directed to a screen where he can select to reserve an accessible parking place. Also, he cannot reserve a time period that is already taken by another user.
d)User is then led to the Navigation screen, which assists the user in creating a digital route and enables him to locate his parking space.
e) User gets brought to the Payment screen after finding the slot and parking. The app sends him a confirmation after the transaction is successful.

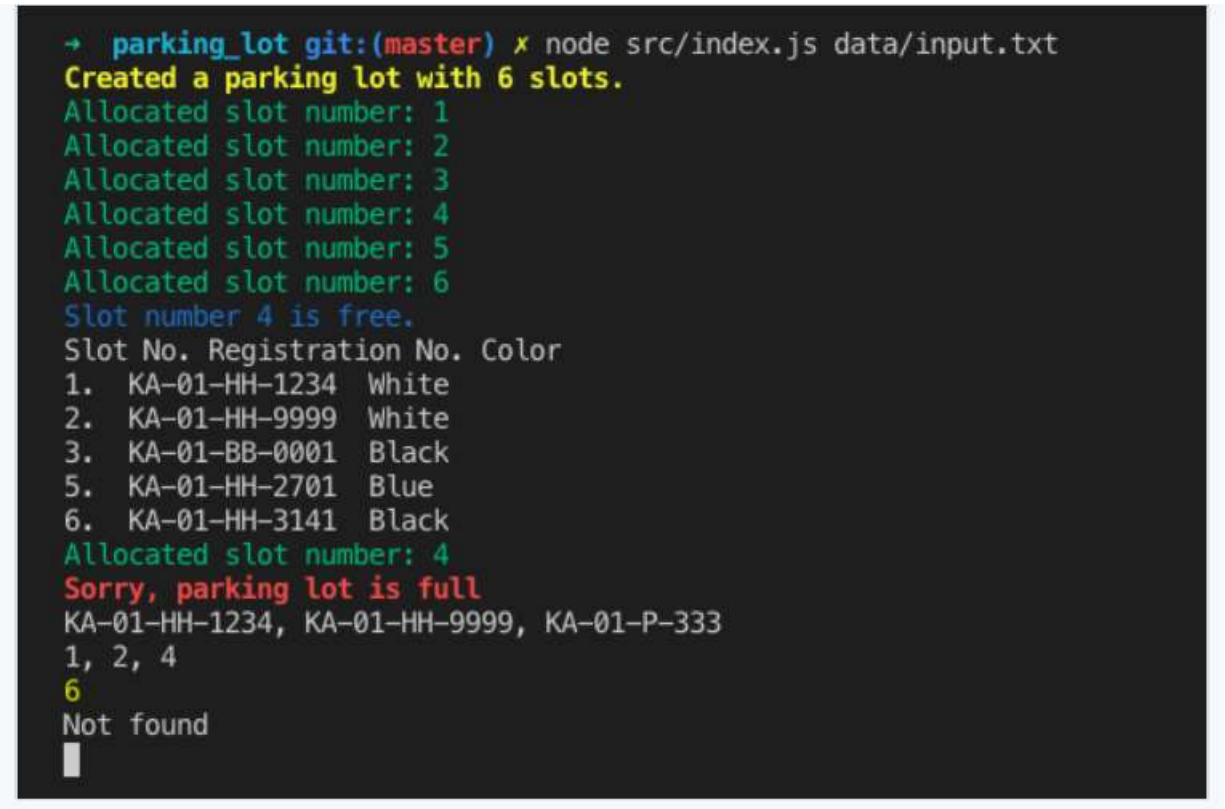
SIMULATION RESULT

Tests are written using Mocha and can be run using npm test[12][10]

```
  17 passing (29ms)

All the tests has passed successfully
```

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Line #s
All files	91.48	69.57	89.53	91.25	
parking_lot	100	100	100	100	
.eslintrc.js	100	100	100	100	
parking_lot/scripts	86.29	60	90	86.29	
test-lint.js	100	100	100	100	
test-system.js	88.24	25	87.5	88.24	... 10,112,113,116
test.js	72	50	100	72	... 21,22,31,32,39
parking_lot/scripts/utils	100	100	100	100	
data.js	100	100	100	100	
infra.js	100	100	100	100	
parking_lot/src/modules	89.47	75	71.43	88.41	
car.js	75	0	50	75	19
parkingLot.js	90.28	78.95	75	89.23	... 06,127,148,170
parking_lot/tests	98.85	50	100	98.85	
specs.js	98.85	50	100	98.85	13



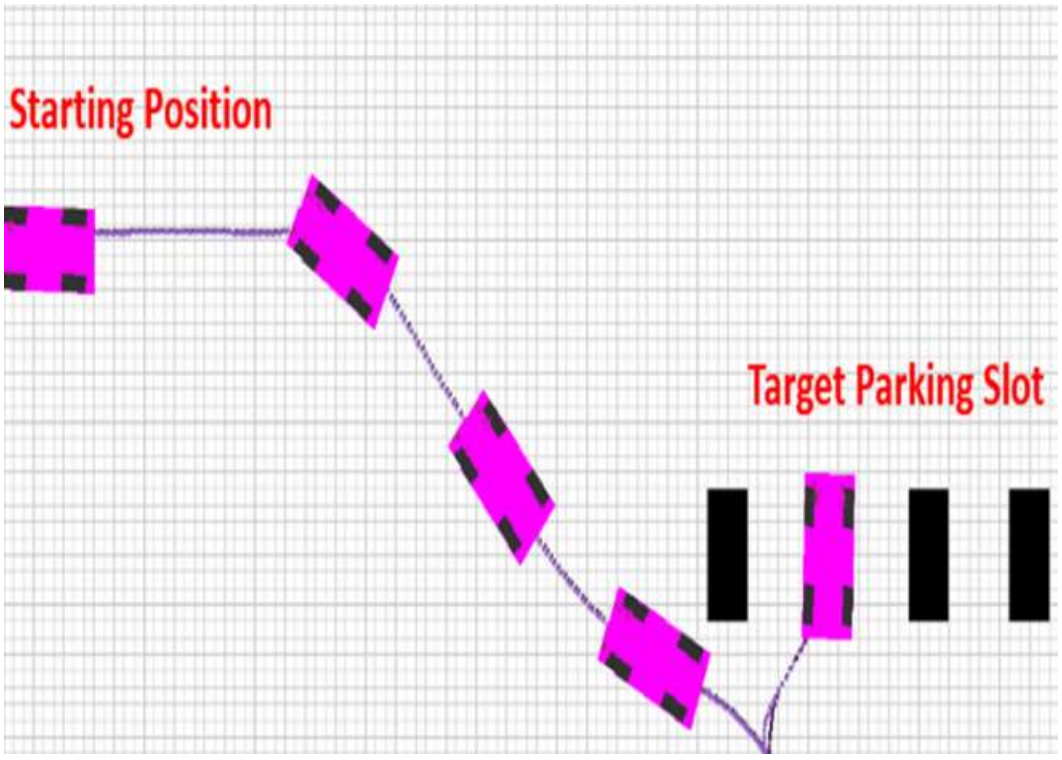


Fig. 10. Model developedthrough experimentation

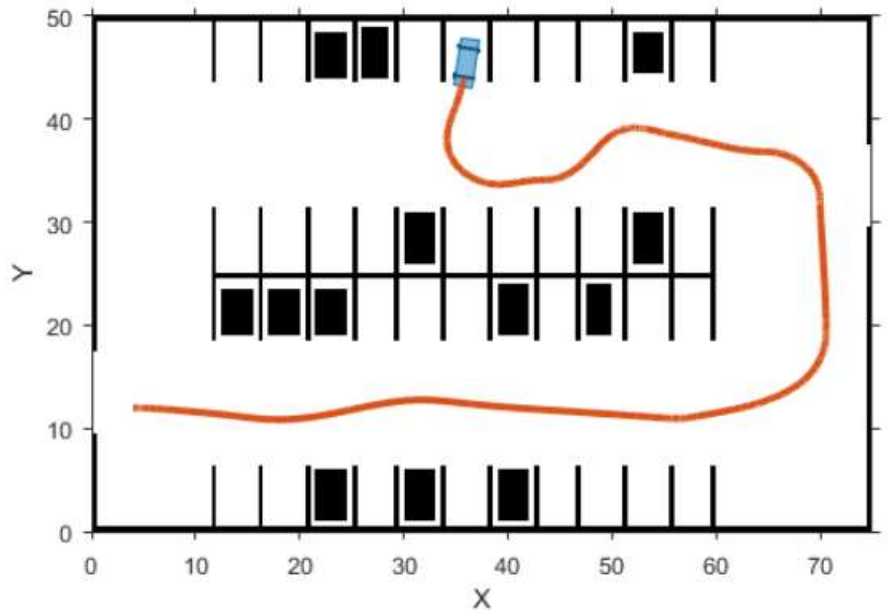


Fig 11 simulation using MATLAB

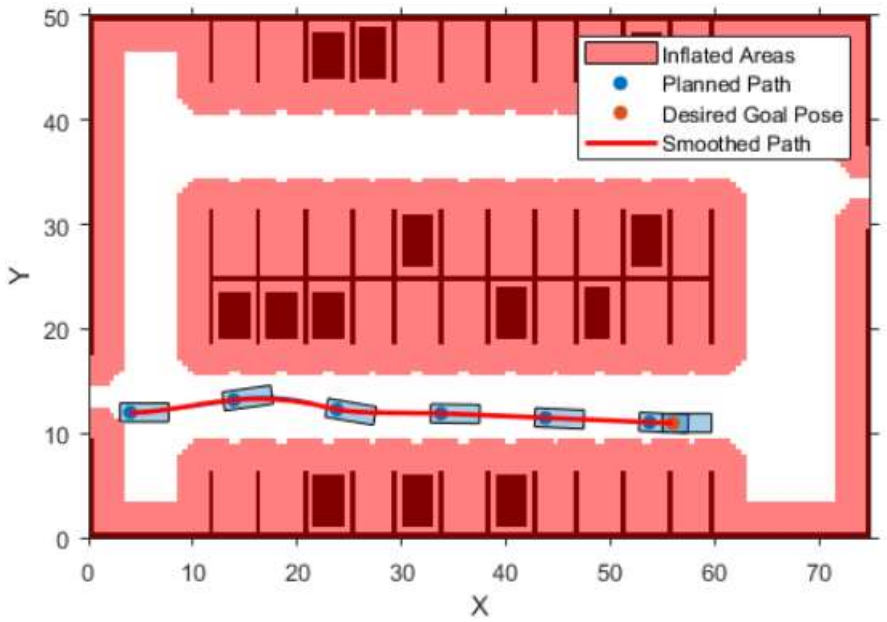


Fig12 Automated car Systematic open CV Simulation result

CONCLUSION

One of the major problems is learning and comprehending how app development functions in order to produce a user-friendly interface for the programme. Also, by comprehending and studying the hardware elements needed for a flawless integration of hardware and software. solution focuses on connecting APIs directly for this purpose, which improves real-time data transfer more than conventional hardware and software connections. More development is possible[16]. by including more learning models in the app to collect data and forecast parking and traffic congestion rates.

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Conflict of Interest: None

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