CREATIVE AND INNOVATIVE PROJECT (IT7611)

AUTOMATED PARKING SYSTEM

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OUTLINE

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PROBLEM STATEMENT

- With an increase in the population, the number of vehicles increases and due to unmanaged parking it leads to many problems.
- Parking Services companies performing contracting work for universities currently lack an online system interface for efficient and automatic processing of car registration, decal payments, fine payments and appeals Green Group.
- In center cities, people face difficulties as an increasing number of vehicles creates congestion, wastage of space, wastage of time, traffic problems, car napping, car vandalism and many other difficulties.

ABSTRACT

- The system is designed as the authorized automatic vehicle identifier with respect to vehicle owner identification, for the security of the highly restricted areas like housing areas, defence military areas, parliament areas etc.
- All of the number plate recognition, the vehicle owner recognition and vehicle type recognition use the object detection and recognition identification technology.
- The image of the vehicle, vehicle plate number and the vehicle owner are captured by using a camera and processed with PYTHON

- The system contains an embedded section which controls the CCTV cameras and the communication purpose.
- The user interface provided by mobile application gives visual assistance to the driver, the slot number allocated, bill payments, access control, logs etc., the entry of the unauthorized vehicle is restricted.
- The technology adopted in this research can be utilized not only for the security but also in other fields such as parking fee collection, automatic speed control, tracking stolen cars, automatic toll management and access control to limited areas, etc.

Objective

- The main objective of a planned system is to automate the parking system with the combined results from 3 strategies.
- The main aim of this project is to reduce the risk of finding the parking slots in any parking area.
- It eliminates the unnecessary travelling of vehicles across the filled parking slots in a city.
- To provide a simple user interface to manage allotted parking slots for end users.
- The proposed smart car parking system will overcome all the challenges and difficulties that are there in the conventional car- parking system.
- Smart car parking system will be a revolutionary change in the city life, which is so filled with automobiles.

Proposed system

SYSTEM DESIGN

Our project work involves 3 major components

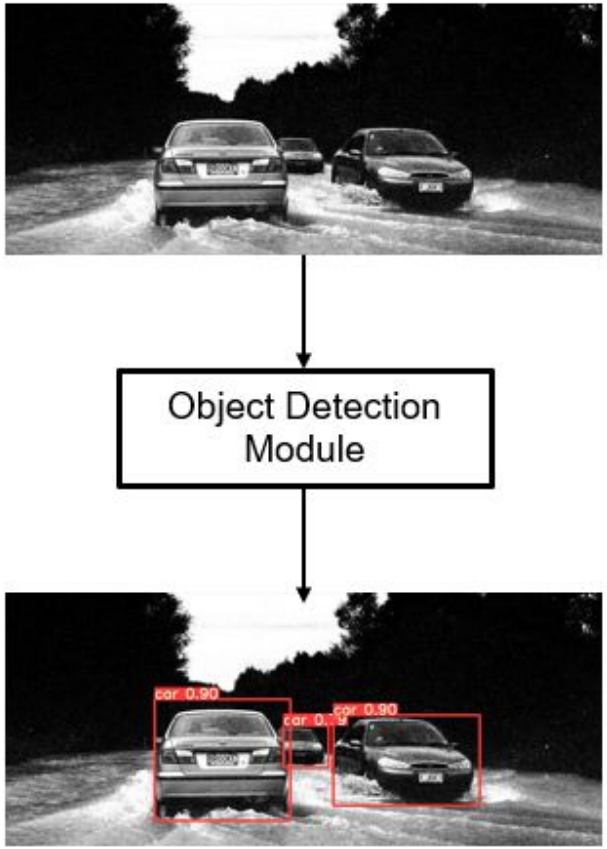
1. Face Recognition
2. Number Plate Recognition
3. Object Detection

Face Recognition

- A facial recognition system is a technology capable of matching a human face from a digital image or a video frame against a database of faces, typically employed to authenticate users through ID verification services, works by pinpointing and measuring facial features from a given image.
- Face recognition systems use computer algorithms to pick out specific, distinctive details about a person’s face.
- These details, such as distance between the eyes or shape of the chin, are then converted into a mathematical representation and compared to data on other faces collected in a face recognition database.

OBJECT DETECTION

- Object detection is a computer vision technique that works to identify and locate objects within an image or video.
- Object detection draws bounding boxes around these detected objects, which allow us to locate where said objects are in a given scene.
- Application od object detection are
  - Crowd counting
  - Self-driving cars
  - Video surveillance

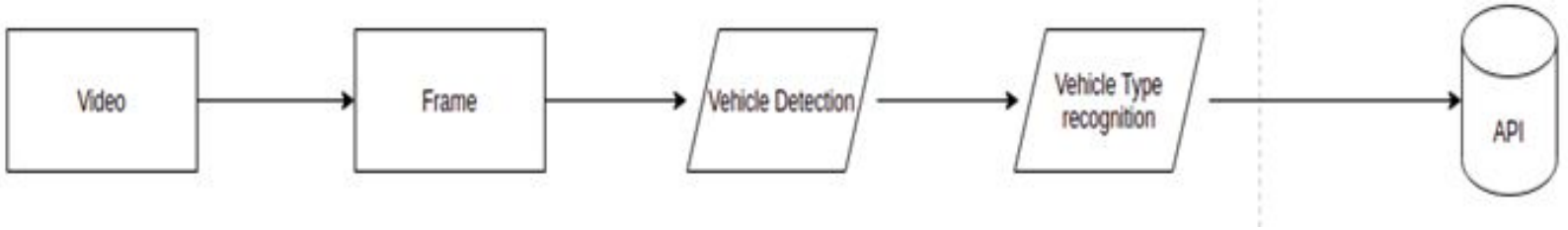


YOLO OBJECT DETECTION

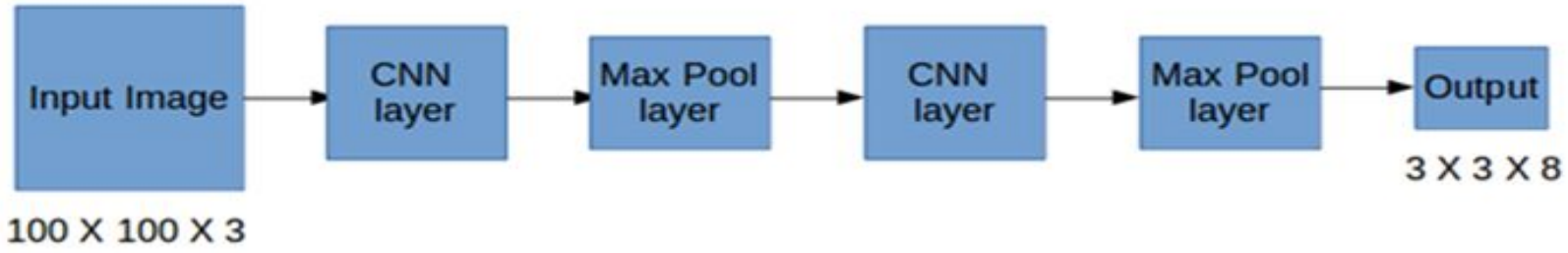
- For Object Detection in this project, a custom YOLO v4 model has been developed to classify whether a vehicle is a two-wheeler or car to divert them to their respective parking lots.

- Advantages of YOLO
  - ★ Speed (45 frames per second — better than realtime)
  - ★ Network understands generalized object representation .
  - ★ faster version (with smaller architecture) — 155 frames per sec but is less accurate.
  - ★ open source

YOLO SIGNIFICANCE IN OUR PROJECT



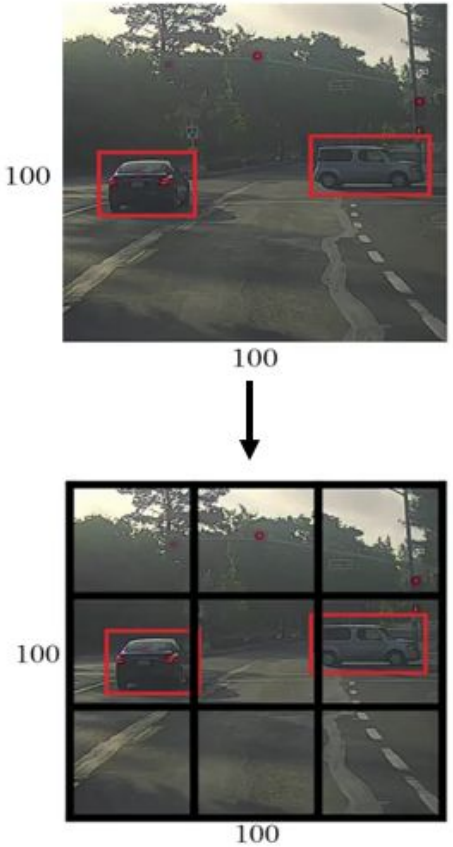
YOLO OVERALL MODEL



WORKING OF YOLO

- YOLO sees the entire image during training and test time so it implicitly encodes contextual information about classes as well as their appearance.

- The algorithm applies a single neural network to the full image, and then divides the image into regions.(Usually into 100*100 grid but in our example, assume it is 3*3 division)



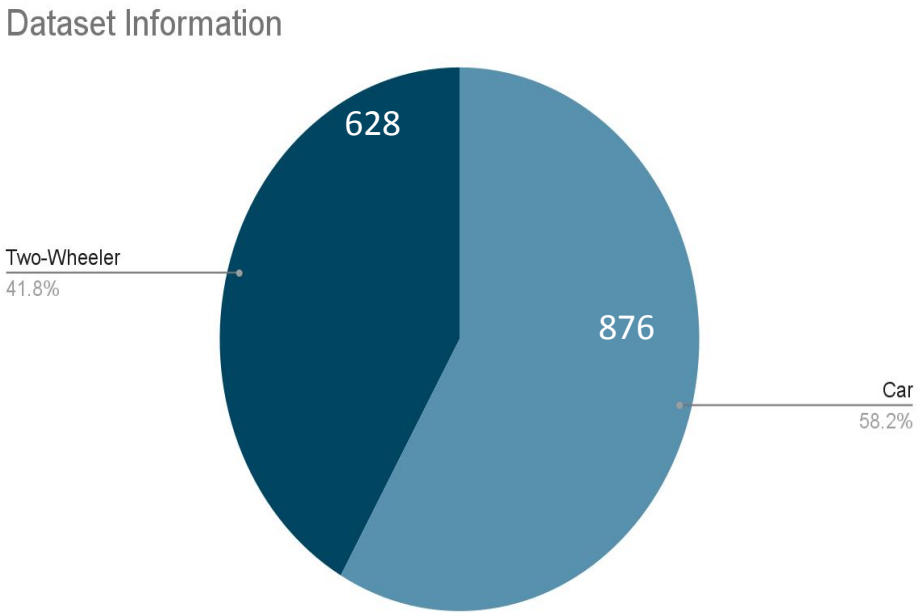
WORKING OF YOLO

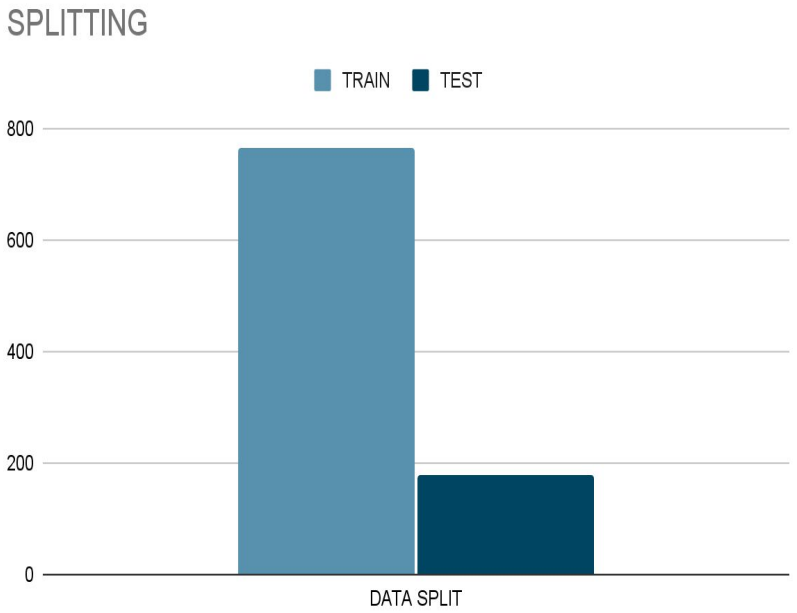
- Each grid is then checked for the information that was encoded in step 1.
- If the information is found within a grid, the model returns an 8 dimensional vector of the detected object.
- We use this vector to draw bounding boxes and find more information about the state of the detected entity.

y =	pc
	bx
	by
	bh
	bw
	c1
	c2
	c3

- Pc – If object is present in the grid or not
- bx, by, bh, bw specify the bounding box of the object
- c1, c2, c3 represent the classes. So, if the object is a car, c2 will be 1 and c1 & c3 will be 0, and so on

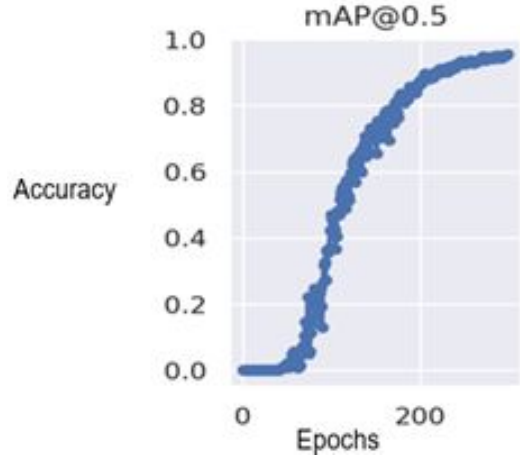
DATASET INFORMATION

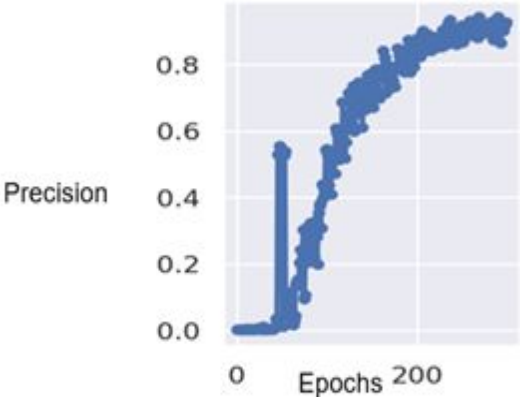




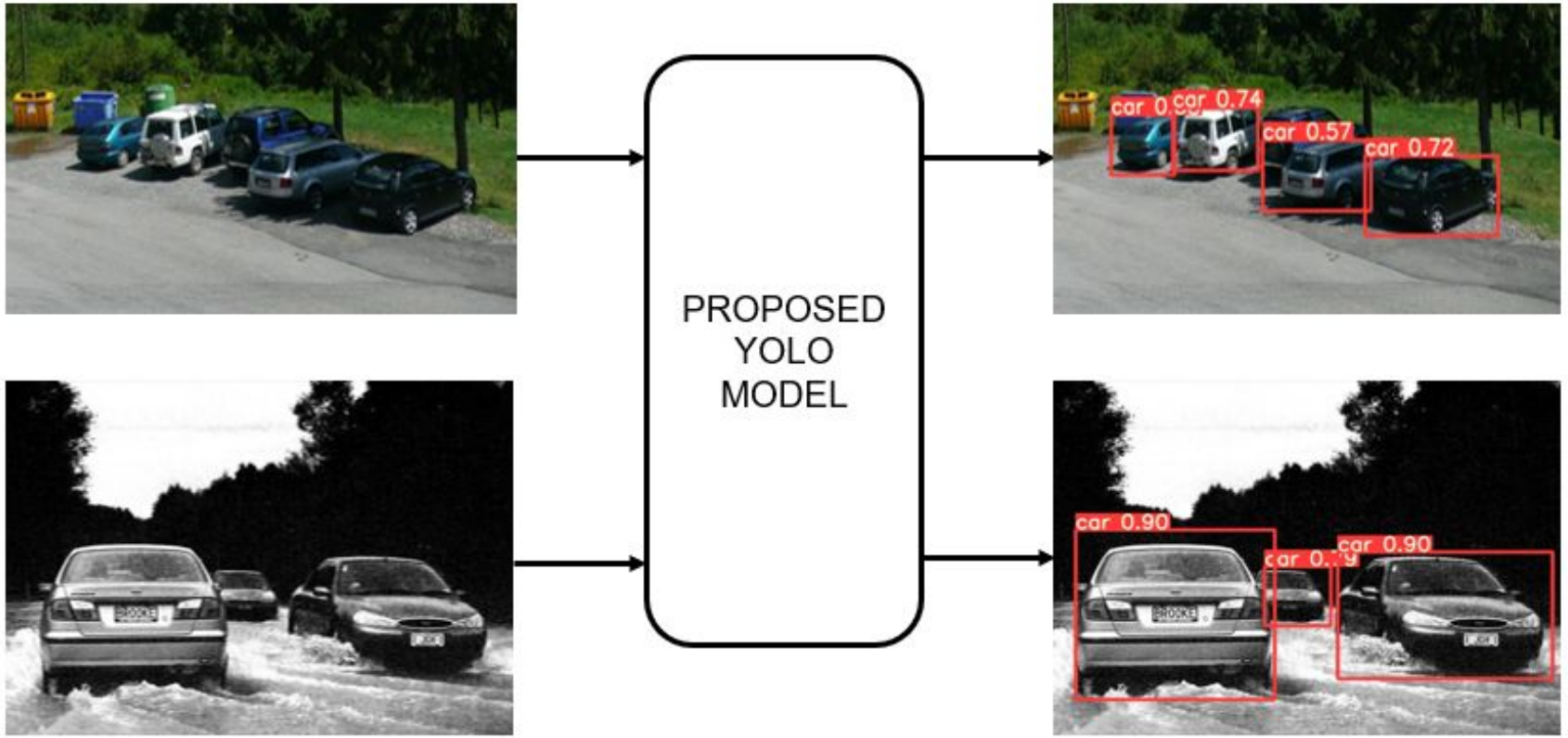
RESULTS

Method	Accuracy	Precision	Recall	F1 score
Proposed method(YOLO)	0.916	0.929	0.887	0.90
Existing method(SSD)	0.97	0.98	0.81	0.88





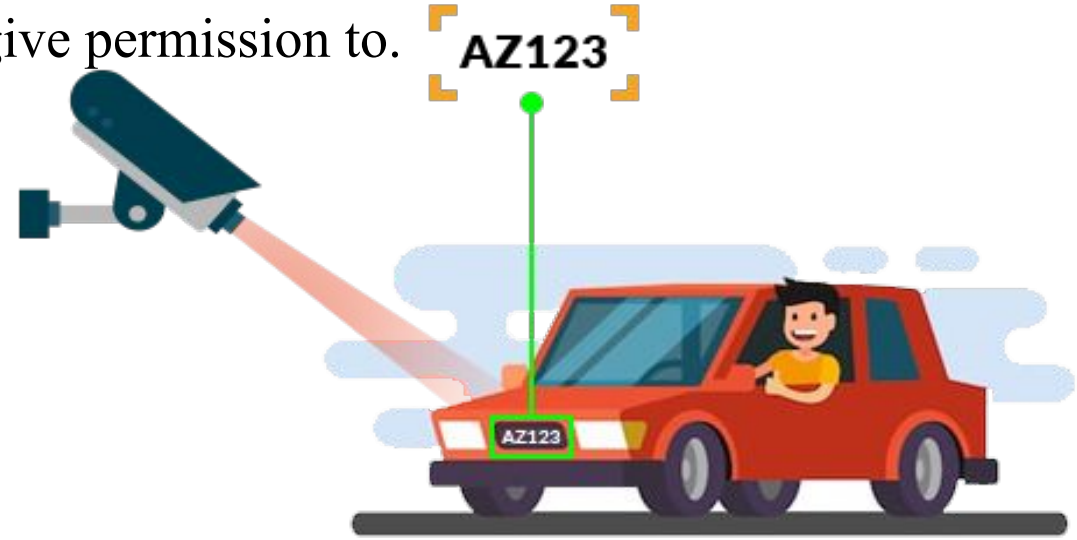
OUTPUT



Automatic Number Plate Recognition

- A conventional ANPR model consists of 4 stages: Vehicle image capture, Number plate detection, Character segmentation and Character recognition.
- This is where the license plate number is detected and recognised.

- In the database backend, it will be **linked** with the other obtained informations: **driver/owner** of the vehicle and the **type of vehicle**.
- Upon their every entry into the parking perimeters, the license plate is also recognised and verified with the existing database.
- This will aid in ensuring that only the user has access to their vehicle/s, and by extension, those they give permission to.



ALGORITHM

1. Number Plate Segmentation

1.1 **Gaussian Blur**

1.2 Convert from RGB to Grayscale

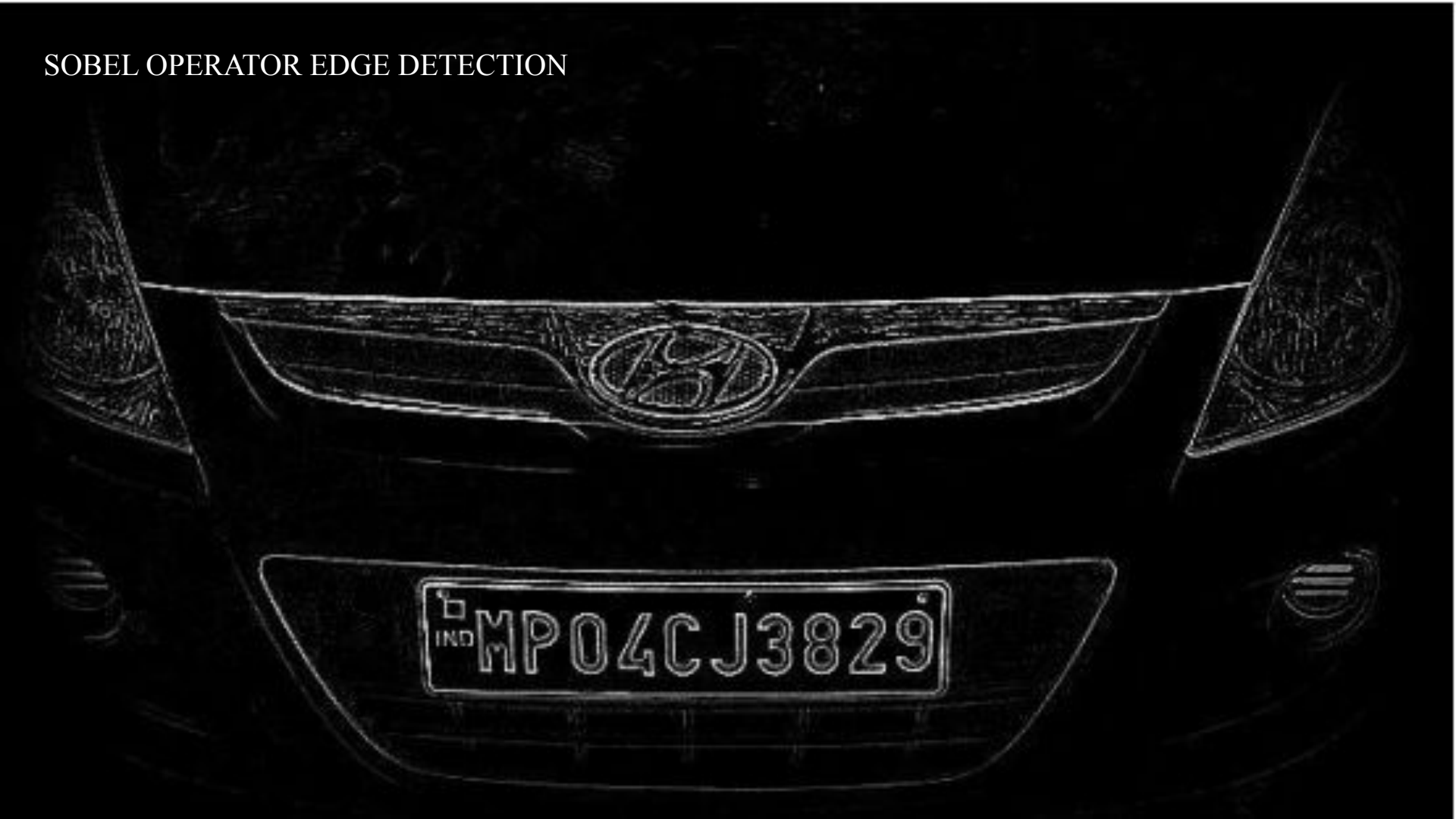
1.3 Edge detection using **Sobel Operator**

1.4 Apply **Otsu's Thresholding. Closing Morphological Transformation** is applied on thresholded image.

1.5 Binarise image again, and morph it for contour extraction. Find a minimum bounding rectangle enclosed by each contour.

1.6 Validate side ratios and area. From this, verify the side ratios and area of the bounding rectangle of the largest contour in that region.

SOBEL OPERATOR EDGE DETECTION



Edge detection in car

input image

canny image

sobel image

prewitt image

2. Character Segmentation

2.1 Apply image segmentation on input blurred image.

2.2 Extract value channel from HSV format of the image.

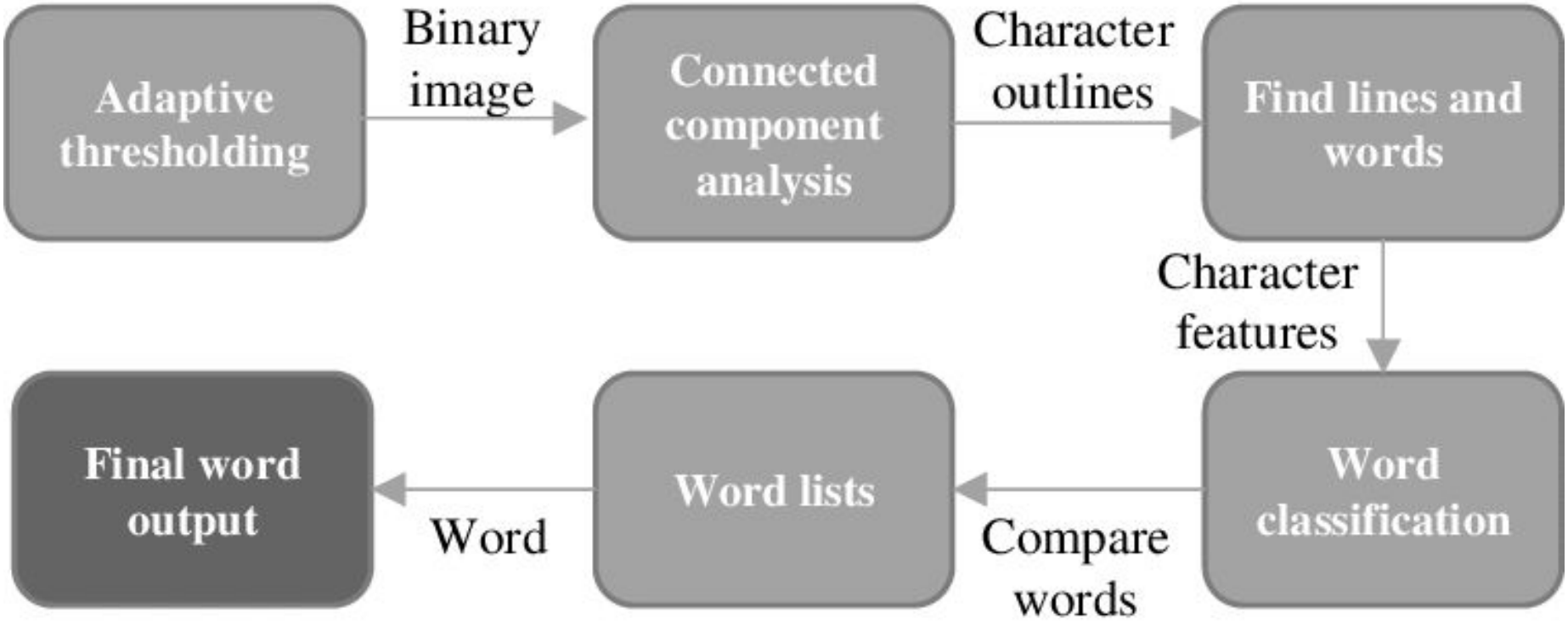
2.3 Apply **Adaptive thresholding**

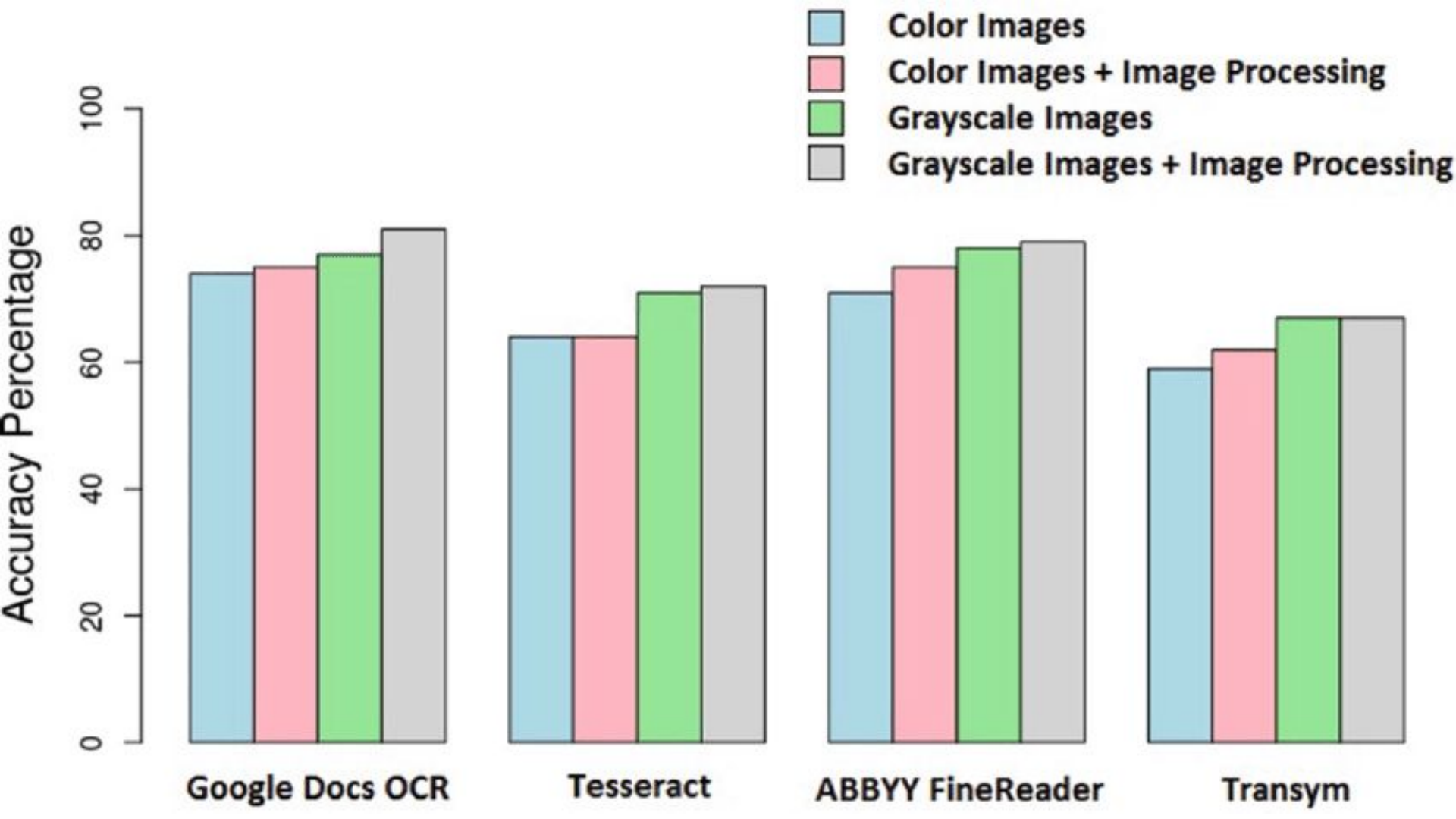
2.4 Perform Connected Component Analysis using Bitwise Not operation.

2.5 Find contours on image again, find bounding rectangle of the largest contour.

2.6 Extract contours again on thresholded image after the convex hull of the contour is found on the character candidate mask.

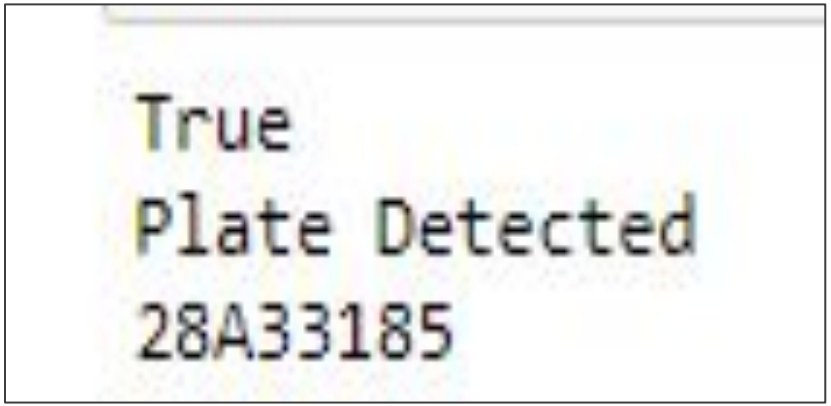
3. Character Recognition




Color Images
Color Images + Image Processing
Grayscale Images
Grayscale Images + Image Processing
Accuracy Percentage
0
20
40
60
80
100
Google Docs OCR
Tesseract
ABBYY FineReader
Transym

	Extracted characters				
Image category	Existing characters	Google Docs OCR	Tesseract	ABBY FineReader	Transym
Digital images	1834	1613 (87.95%)	1539 (83.91%)	1528 (83.31%)	1463 (79.77%)
Machine-written characters	703	569 (80.94%)	549 (78.09%)	574 (81.65%)	554 (78.81%)
Machine-written digits	211	191 (90.52%)	193 (91.47%)	193 (91.47%)	194 (91.94%)
Hand-written characters	2036	1254 (61.59%)	984 (48.33%)	1204 (59.14%)	960 (47.15%)
Hand-written digits	43	29 (67.44%)	11 (25.58%)	25 (58.14%)	10 (23.26%)
Barcodes	867	841 (97%)	844 (97.35%)	832 (95.96%)	845 (97.47%)
Black and white images	71	69 (97.19%)	69 (97.19%)	65 (91.55%)	61 (85.92%)
Multi-oriented text strings	106	68 (64.15%)	30 (28.3%)	75 (70.75%)	23 (21.7%)
Skewed images	96	38 (39.58%)	31 (32.3%)	36 (37.5%)	27 (28.13%)
License plate numbers	1953	1871 (95.8%)	1812 (92.78%)	1894 (96.98%)	1732 (88.68%)
PDF Files	15693	15409 (98.19%)	14121 (89.98%)	15376 (97.98%)	14133 (90%)
Digital receipts	3672	3256 (88.67%)	3341 (90.99%)	3302 (89.92%)	3077 (83.8%)
Noisy images	337	179 (53.12%)	161 (47.77%)	184 (54.6%)	169 (50.15%)
Blurred images	461	259 (56.18%)	263(57.05%)	282 (61.17%)	277 (60.09%)
Multilingual text images	3597	2831 (78.7%)	2474 (68.78%)	2799 (77.81%)	1740 (48.37%)
Standard Deviation		$\sigma = 18.19$	$\sigma = 25.56$	$\sigma = 18.02$	$\sigma = 25.79$

Results



These obtained values are retrieved to be stored in the backend **MySQL database**, syncing it with the user's other details.

Comprehensive security system with required information.

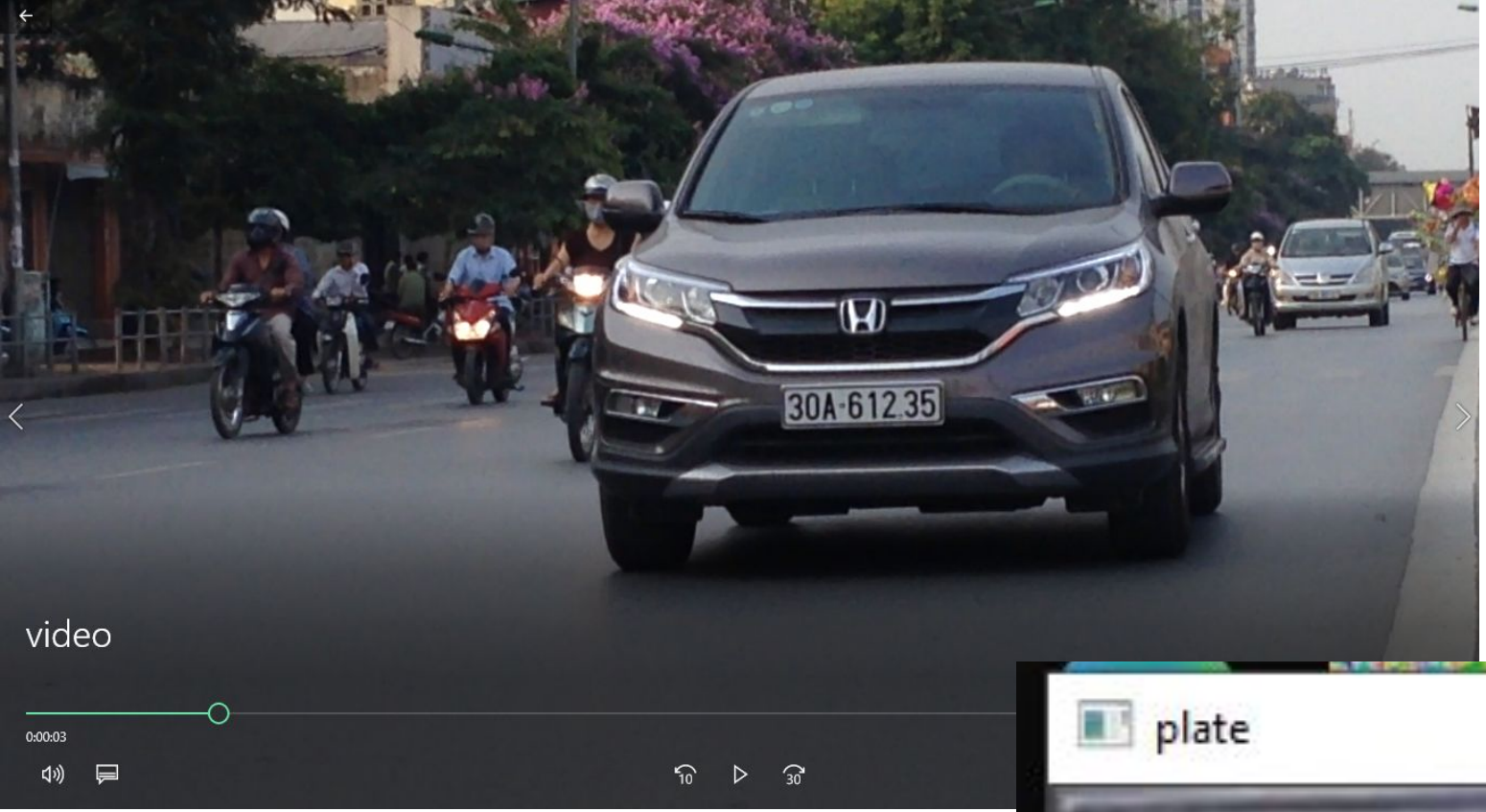
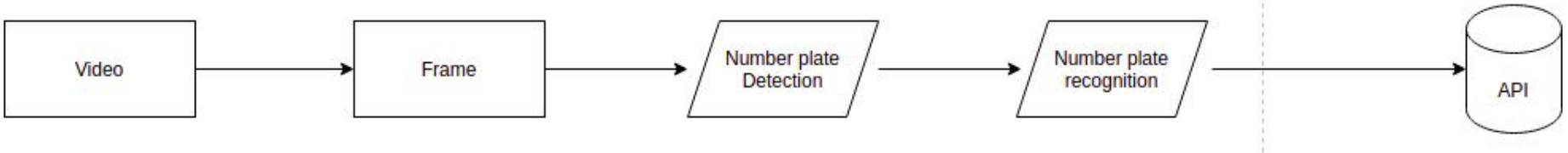
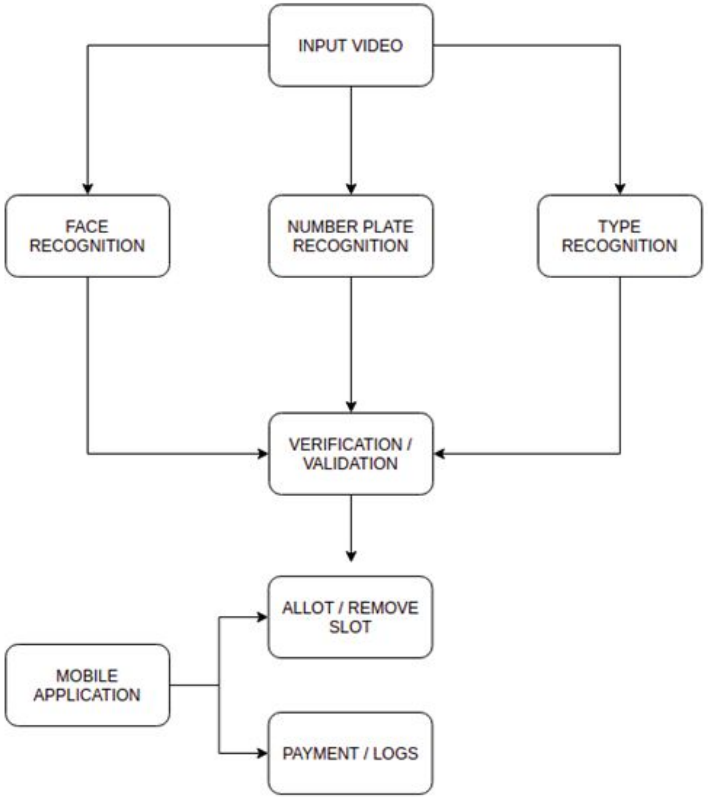

30A-612.35
video
0:00:03
10
30


plate
30A-612.35

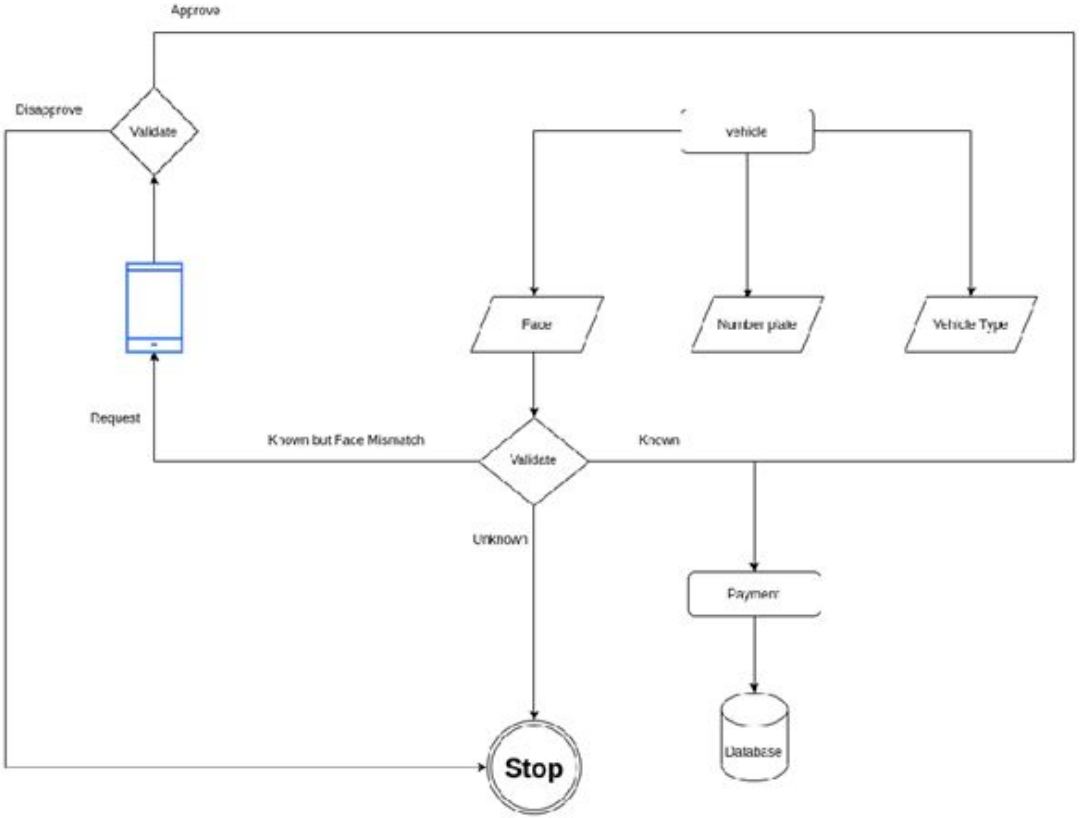
Flow of ANPR In Our Project



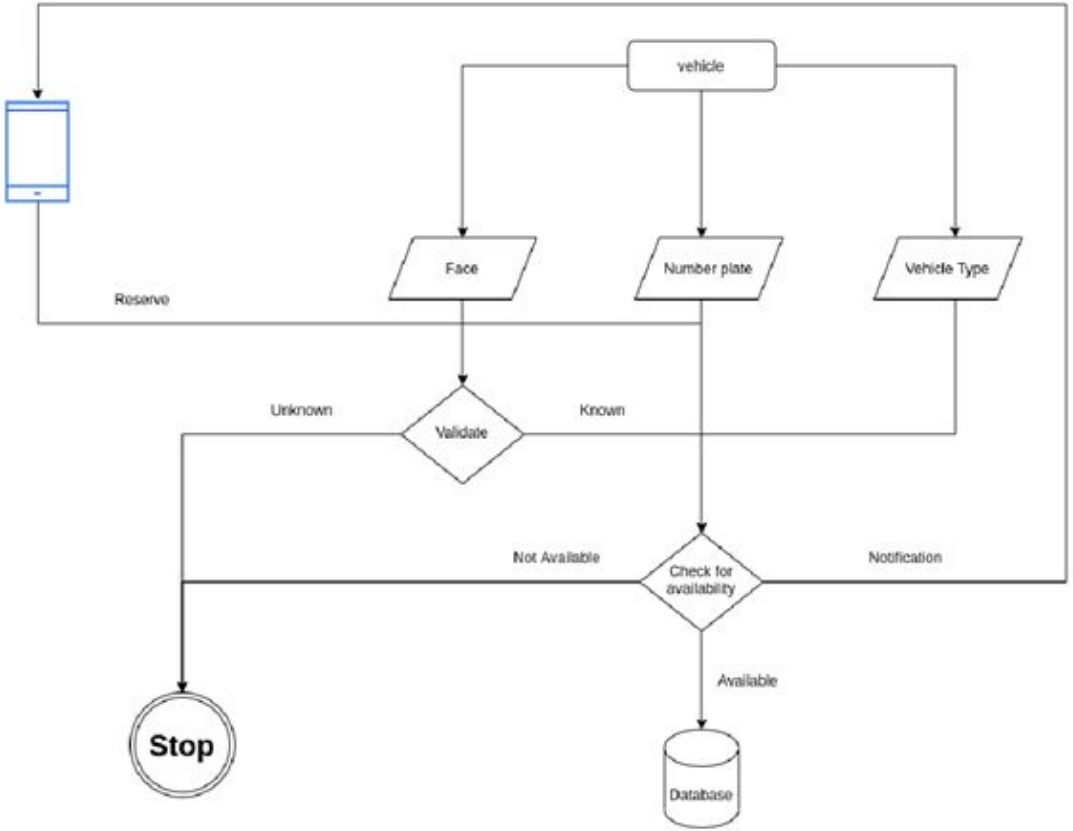
ARCHITECTURE :



Flow Diagram : **At Parking**



Flow Diagram : At Leaving

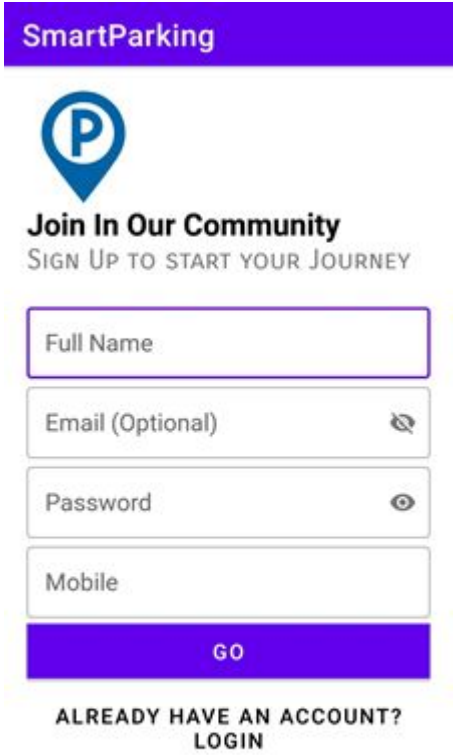


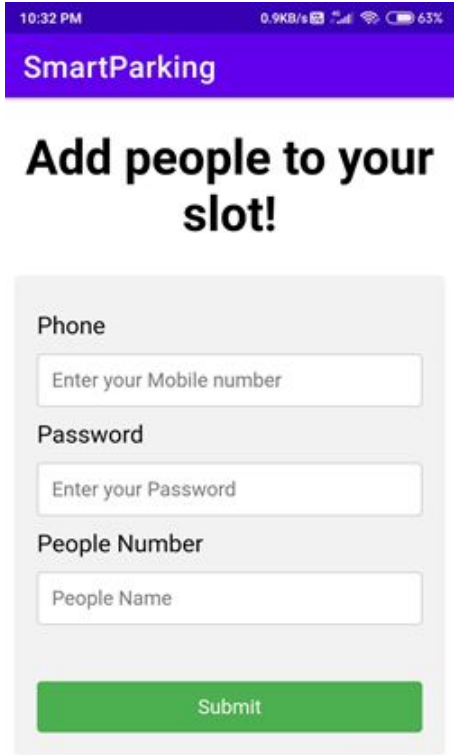
SIMILAR APPS

❖ Best Parking	❖ Parker	❖ SpotHero
❖ ParkWhiz	❖ Parkopedia	❖ ParkMe

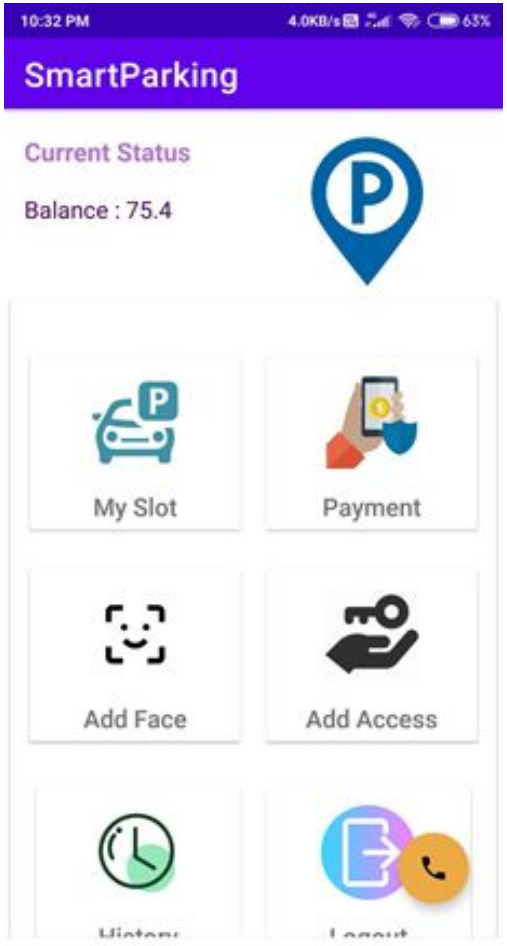


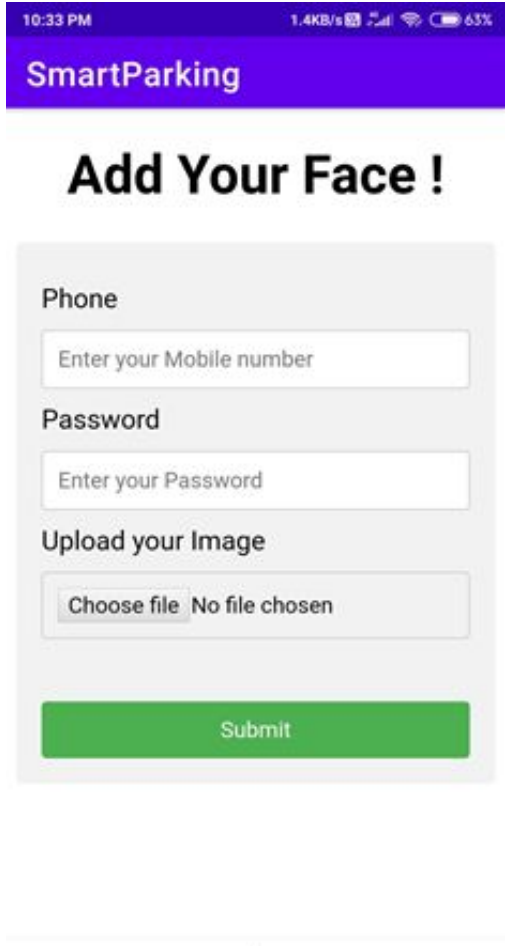

SCREENSHOTS

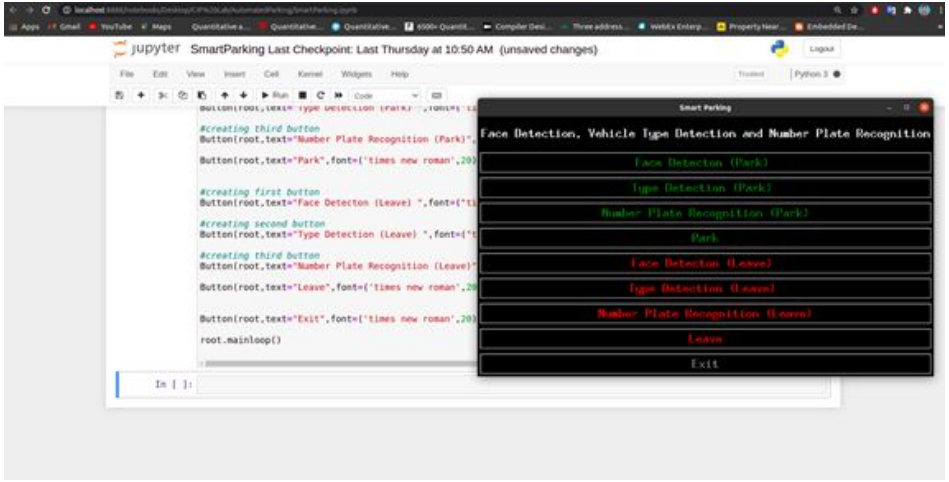


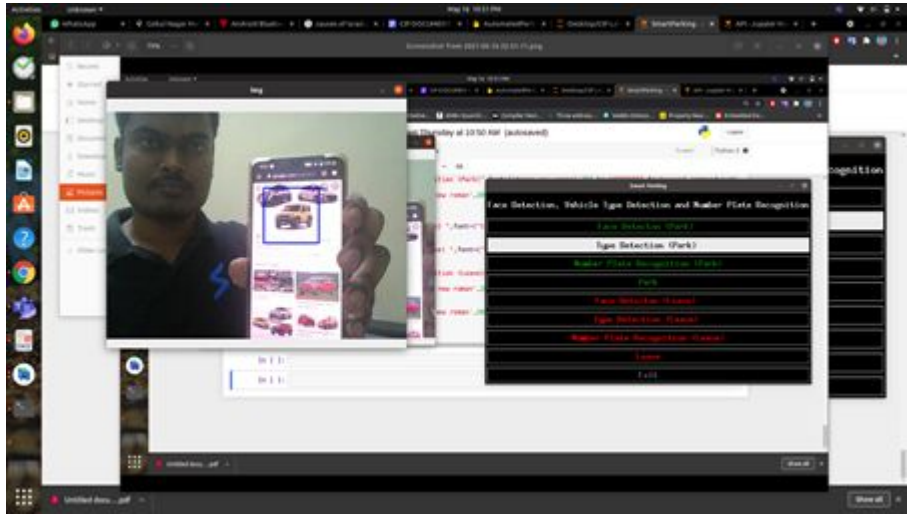


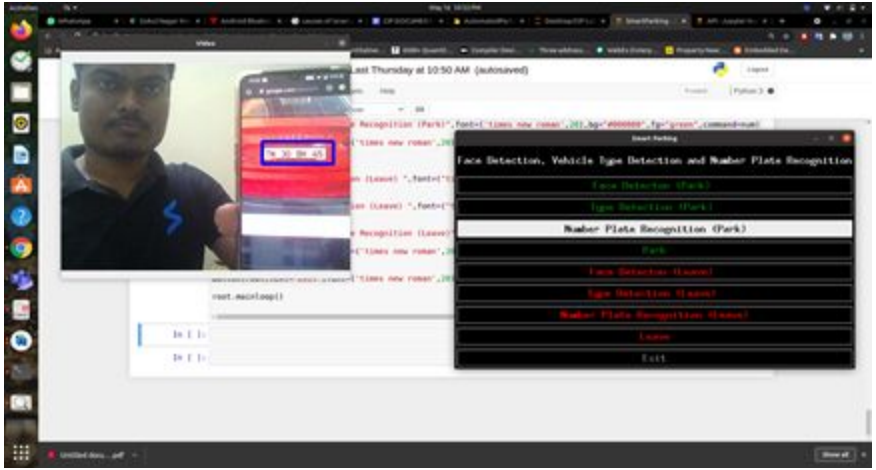

10:32 PM
8.9KB/s
63%
SmartParking
Parking Reserved !
And Your slot number is 1

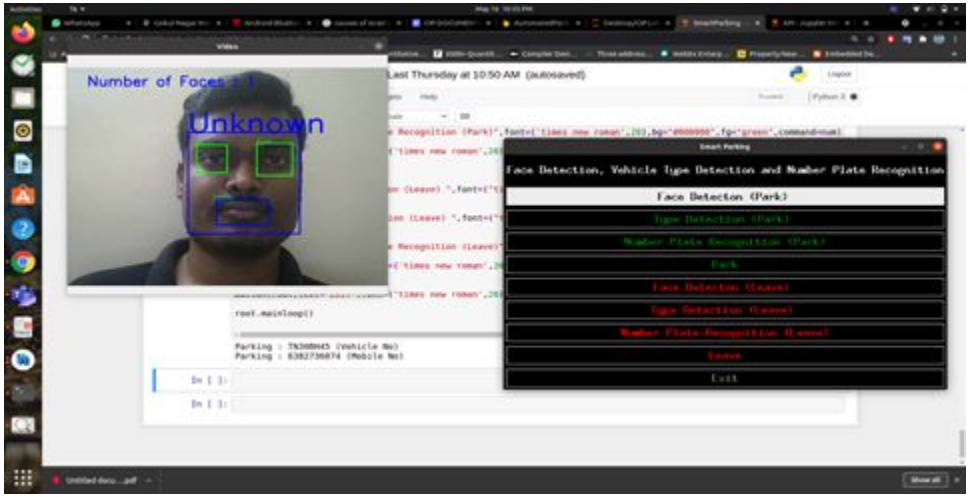

10:32 PM
4.0KB/s
63%
SmartParking
Current Status
Balance : 75.4
My Slot
Payment
Add Face
Add Access


10:33 PM
1.4KB/s
63%
SmartParking
Add Your Face !
Phone
Enter your Mobile number
Password
Enter your Password
Upload your Image
Choose file
No file chosen
Submit


jupyter SmartParking Last Checkpoint: Last Thursday at 10:50 AM (unsaved changes)
Logout
File Edit View Insert Cell Kernel Widgets Help
Python 3
#creating third button
Button(root,text="Number Plate Recognition (Park)",
Button(root,text="Park",font=('times new roman',20)
#creating first button
Button(root,text="Face Detecton (Leave) ",font=("t
#creating second button
Button(root,text="Type Detection (Leave) ",font=("t
#creating third button
Button(root,text="Number Plate Recognition (Leave)"
Button(root,text="Leave",font=('times new roman',20
Button(root,text="Exit",font=('times new roman',20)
root.mainloop()
In [ ]:
Smart Parking
Face Detection, Vehicle Type Detection and Number Plate Recognition
Face Detecton (Park)
Type Detection (Park)
Number Plate Recognition (Park)
Park
Face Detecton (Leave)
Type Detection (Leave)
Number Plate Recognition (Leave)
Leave
Exit


Face Detection, Vehicle Type Detection and Number Plate Recognition
Type Detection (Park)


Face Detection, Vehicle Type Detection and Number Plate Recognition
Face Detection (Park)
Type Detection (Park)
Number Plate Recognition (Park)
Park
Face Detection (Leave)
Type Detection (Leave)
Number Plate Recognition (Leave)
Leave
Exit


Number of Faces : 1
Unknown
Face Detection, Vehicle Type Detection and Number Plate Recognition
Face Detecton (Park)
Type Detection (Park)
Number Plate Recognition (Park)
Park
Face Detection (Leave)
Type Detection (Leave)
Number Plate Recognition (Leave)
Leave
Exit

SUMMARY

- A successful implementation of this project would result in less traffic and chaos in crowded parking spaces like malls and business buildings where many people share a parking area.
- Also, as it would reduce the waiting time, long queues, tension, stress and increase the efficiency of the parking system.
- As the Smart Car Parking System Requires minimal manpower, there are minimum chances for human errors, increased security in addition to a swift and friendly car parking experience for drivers.
- The main novelty of the proposed approach lies in the context of scalability, and in particular the reduced costs for obtaining it and the ease of introducing a new element to the existing infrastructure.

FUTURE WORK

- The proposed method can be further improved by increasing the accuracy of various algorithms used.
- The security of the transaction can be increased by applying cryptography.
- Face recognition and Optical Character recognition system used till date works pretty well under limited conditions, although most of the systems work much better with frontal pictures and constant bright lighting.
- Considering all the requirements, recognition systems that use face recognition and optical character recognition seem to be most potential for wide-spread application.

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