AUTOMATIC VEHICLE LOG SYSTEM

A CAPSTONE PROJECT REPORT

Submitted in partial fulfillment of the requirement for the award of the Degree of

BACHELOR OF TECHNOLOGY
IN
COMPUTER SCIENCE AND ENGINEERING

by

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CERTIFICATE

This is to certify that the Capstone Project work titled "**AUTOMATIC VEHICLE LOG SYSTEM**" that is being submitted by **K KAUSHIK (19BCD7137), M ABHIRAM KALYAN (19BCD7118), R DINESH ROHIT (19BCD7122)** is in partial fulfillment of the requirements for the award of Bachelor of Technology, is a record of bona fide work done under my guidance. The contents of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

Dr. S Gopikrishnan

Guide

The thesis is satisfactory / unsatisfactory

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SUBMITTED

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ABSTRACT

Traffic issues are inevitable given the increase in the number of vehicles on the road. This is because the built parking facilities and present transit infrastructure are inadequate to manage the increased number of automobiles on the road. It makes it difficult for anybody working at a gate to identify cars and keep records. Additionally, doing this took a lot of time. An automated system for controlling car access into buildings or public parking lots is really necessary. Keeping track of the entry and exit times of vehicles. creates a text log for cars entering and leaving the building, which solves administrative problems. This aids in tracking vehicle entry, exit, and the number of cars on the property, which is useful for fleet management. The system features a feature that allows records to be kept for a specific amount of time. Compared to conventional approaches, it offers a quick, effective, and reliable way to detect the presence of cars on a property. As a result, the project's goal is to put in place a system that checks the vehicle's entrance status automatically. The vehicle's number plate is recognized throughout the verification process utilizing image processing (Utilize ANPR to extract the number from these images) with a timestamp, we then add the new vehicle's data to the database.

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CHAPTER 1
INTRODUCTION

ANPR stands for automatic number plate recognition. It is a technology that uses optical character recognition (OCR) to automatically read and recognize the license plate numbers of vehicles. ANPR systems are commonly used in parking garages, toll booths, and traffic management systems to automatically identify and track vehicles as they enter and exit a facility.

An automated vehicle entry system using ANPR typically consists of a camera, a processor, and a database. The camera is mounted at the entrance of the facility and captures images of the license plates of incoming vehicles. The processor uses OCR software to recognize the characters on the license plate and convert them into text. The text is then compared to a database of authorized vehicles, and if the license plate number matches an entry in the database, the system grants access to the vehicle.

Figure 1 Automatic number plate detection

Automatic Number Plate Recognition (ANPR) is achieved through video cameras capturing images that are analyzed using Optical Character Recognition (OCR), which scans each group of pixels within the images and estimates whether or not it could be a letter and replaces the pixels with the ASCII* code for the letter. American Standard Code for Information Interchange.

OCR is the fundamental technology used in ANPR and provides the capability to store and sort data. ANPR cameras need to be of a special type and set up within certain designated parameters.

As a vehicle approaches the camera the software takes a series of 'snapshots' and stores them in a file. When the number plate is of sufficient size for the OCR software the frame is scanned and the registration number is converted to ASCII code and held in a list. This continues for a series of images according to the speed and position of the vehicle ensuring that the optimum view of the license plate is achieved.

ANPR capture is totally dependent on the correct set up of camera, lens, illumination, angle of view and configuration.

1.1Objectives

There are many potential applications for an automated vehicle entry system using ANPR, including improving security at gated communities, enhancing the efficiency of parking garages and toll booths, and automating the collection of tolls on highways. ANPR systems can also be used to enforce parking regulations, track the movements of vehicles, and identify vehicles that have been reported stolen or involved in criminal activity.

The following are the objectives of this project:

1. **To Increase efficiency**: ANPR systems can process license plate numbers automatically and quickly, reducing the need for manual entry and improving the speed and efficiency of vehicle entry and exit processes.
2. **For a better Enhanced security**: ANPR systems can be used to grant access to authorized vehicles only, improving security at gated communities and other facilities.

3. **Automated toll collection**: ANPR systems can be used to automatically collect tolls on highways, eliminating the need for drivers to stop and pay manually.
4. **For Vehicle tracking**: ANPR systems can be used to track the movements of vehicles, which can be useful for law enforcement agencies and other organizations that need to monitor vehicle activity.
5. **To Reduce fraud**: ANPR systems can be used to prevent fraud by ensuring that only authorized vehicles are granted access to a facility or are allowed to use a toll road.
6. **Traffic management**: Automated vehicle entry systems can be used to track the movements of vehicles and collect data on traffic patterns, which can be useful for traffic management and planning purposes.

   This system uses automated license plate detection and computer vision to make logs of vehicles in real time and store the information in a database.

1.2 Background and Literature Survey

A similar type of approach described in provided is a multi-step process for detecting and recognizing license plates in CCTV footage. The first step involves finding contours and connected components in the image, which can be done using techniques such as edge detection and connected component analysis as we described earlier. The second step involves selecting a rectangle region based on size and aspect ratio, which can help to filter out noise and focus on regions of the image that are likely to contain license plates. The third step involves initial learning for adaptive camera distance/height, which is a process of adjusting the detection algorithm to account for variations in the distance between the camera and the license plates as well as changes in the lighting conditions. The fourth step involves localization based on histogram, gradient processing, and nearest mean classifier. Histogram analysis can be used to identify patterns in the image data, such as the distribution of pixel values, which can help to differentiate between different types of objects. Gradient processing involves analyzing the changes in pixel intensity across the image, which can be useful for identifying edges and other features. The nearest mean classifier is a machine learning algorithm that can be used to classify the detected regions based on their characteristics, such as size and shape.

After these steps have been completed, the final detection result is forwarded for tracking, which involves following the detected license plate as it moves through the scene. This can be done using techniques such as object tracking and Kalman filtering to predict the movement of the license plate and maintain accurate tracking even when it is partially occluded or moving quickly.

We also referred to a paper titled “Automatic License-Plate Location and Recognition Based on Feature Salience”. This approach involves using the feature salient method to extract the vehicle number plate from an image by using shape, texture, and color as salient features. Salient features are characteristics of an object that make it stand out from the background and are useful for identifying and extracting the object from the image.

The authors used Hough transform (HT) to detect vertical and horizontal lines in the image, which can be useful for identifying the rectangular shape of the number plate. The image was then processed by converting it from the RGB color space to the hue-intensity-saturation color space, which can help to emphasize certain features and make them more visible. Finally, the number plate was segmented, or separated from the rest of the image, using the detected lines and other features.

For improving the accuracy and developing an application we also referred the paper titled “Real-time automatic license plate recognition for CCTV forensic applications” This approach described provided involves using texture characteristics to extract the characters from the license plate in Indian conditions. Texture characteristics refer to the patterns and structures in the image data that can be used to differentiate between different types of objects or surfaces. Wavelets are a type of mathematical function that can be used to analyze and represent data in a compact form, and they have applications in image processing and other fields.

The authors also used morphological operations, which are image processing techniques that involve analyzing the shape and structure of objects in an image. Morphological operations can be used to enhance or extract features in an image, such as edges, lines, and curves.

1.3 Organization of the Report

The remaining chapters of the project report are described as follows:

1. Chapter 2 contains the proposed system, methodology, hardware and software details.
2. Chapter 3 gives the cost involved in the implementation of the project.
3. Chapter 4 discusses the results obtained after the project was implemented.
4. Chapter 5 concludes the report.
5. Chapter 6 consists of codes.
6. Chapter 7 gives references.

CHAPTER 2

AUTOMATIC VEHICLE LOG SYSTEM

2.1 Proposed System

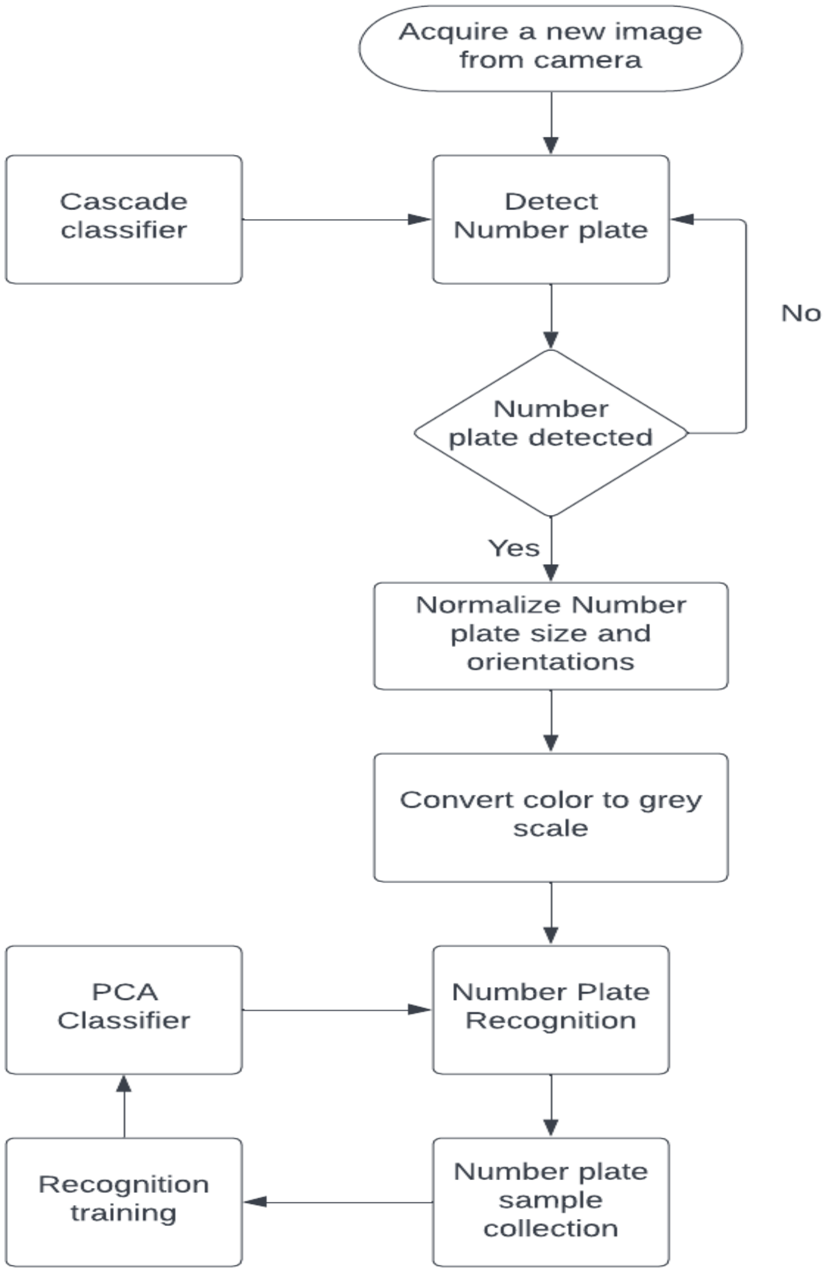

Figure 2.1.1 Automatic vehicle log system flowchart

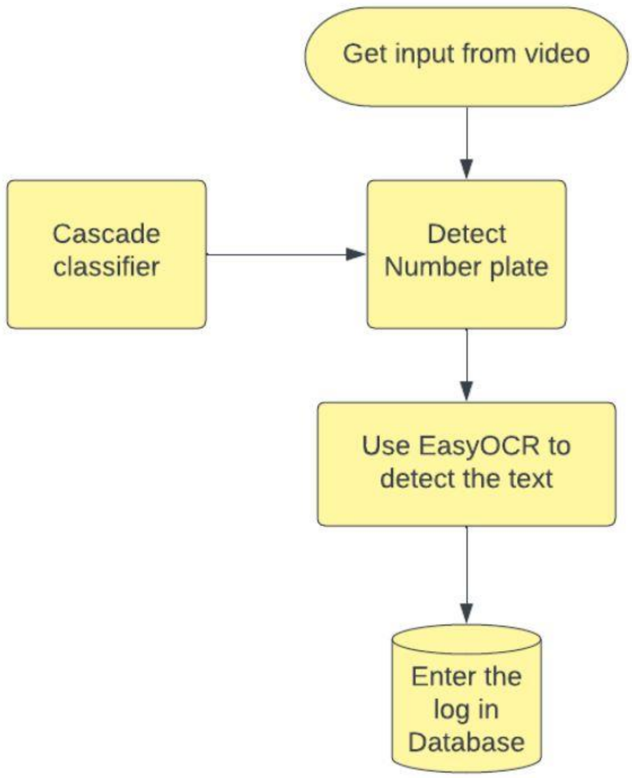

Figure 2.1.2 Model

2.2Working Methodology

We are undergoing to three stages in this project. In the first stage we are going to identify the number plate using "open cv" live.

OpenCV uses two types of classifiers, LBP (Local Binary Pattern) and Haar Cascades.

HAAR CASCADES

Haar Cascade classifier is based on the Haar Wavelet technique to analyse pixels in the image into squares by function. This uses "integral image" concepts to compute the "features" detected. Haar Cascades use the Ada-boost learning algorithm which selects a small number of important features from a large set to give an efficient result of classifiers then use cascading techniques to detect face in a image. Here are some Haar-Features

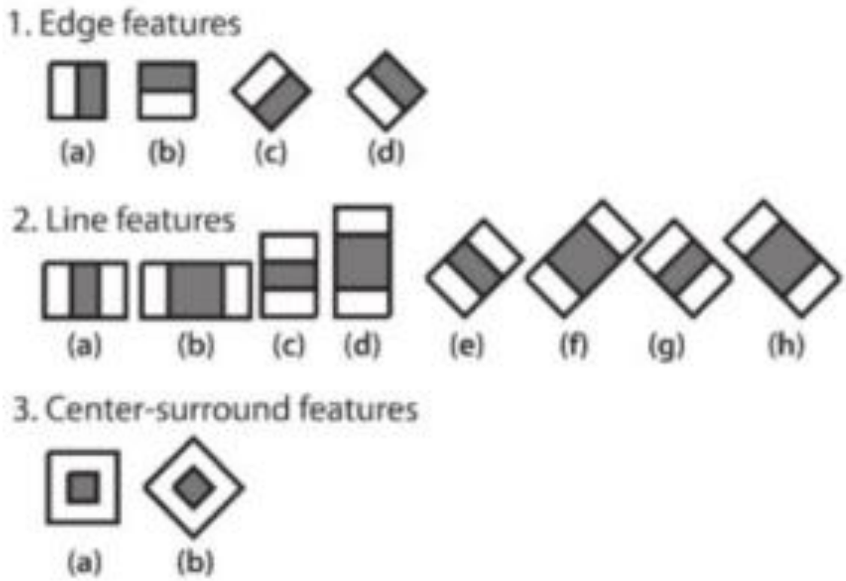

Figure 2.2.1 Few Haar Features

Haar feature-based cascade classifiers are a type of object detection method that uses machine learning to identify objects in images. It involves training a classifier using a large number of positive and negative images, extracting features using Haar features, and using Ad boost to select the best features. The final classifier is a weighted sum of these features and is used to detect objects in other images.

To make the process more efficient, the authors introduced the concept of a cascade of classifiers, where the features are grouped into different stages and applied one by one. If a window fails a stage, it is discarded, and the remaining features are not applied. This allows the algorithm to focus on regions where there is a higher likelihood of finding an object, rather than processing the entire image.

Overall, the Haar feature-based cascade classifier method is a powerful tool for object detection, and it has been widely used in a variety of applications

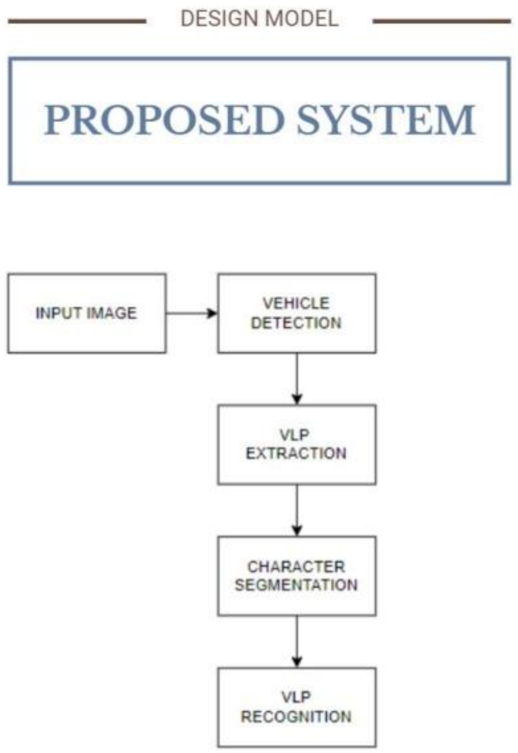

Figure 2.2.2 Haar Proposed System

CASCADING

A cascade classifier is a machine learning algorithm that is commonly used in automatic number plate recognition (ANPR) systems. ANPR systems use computer vision techniques to identify and extract vehicle license plate numbers from images or video streams.

These classifiers consist of multiple simple classifiers, or "stages," that are trained to detect certain features or patterns in the input data. Each stage processes the input data and passes it on to the next stage if it meets certain criteria. If the input data does not meet the criteria, it is discarded and the next stage is not executed.

In ANPR systems, a cascade classifier is often used to detect the presence and location of license plates in images. The classifier is trained on a large dataset of images with and without license plates, and each stage of the classifier is designed to identify specific features that are characteristic of license plates. The classifier can then be used to quickly and accurately detect license plates in new images.

Overall, the use of a cascade classifier in ANPR systems helps to improve the efficiency and accuracy of license plate detection, making it possible to automate the process of identifying and recording vehicle license plate numbers.

PRE-PROCESSING

In this pre processing we are going to four stages. In the second stage we are preprocess the number and use OCR to read the text. These stages we will discuss in results and discussions section.

In the last stage we maintain a log of the entry and exit of the vehicles.

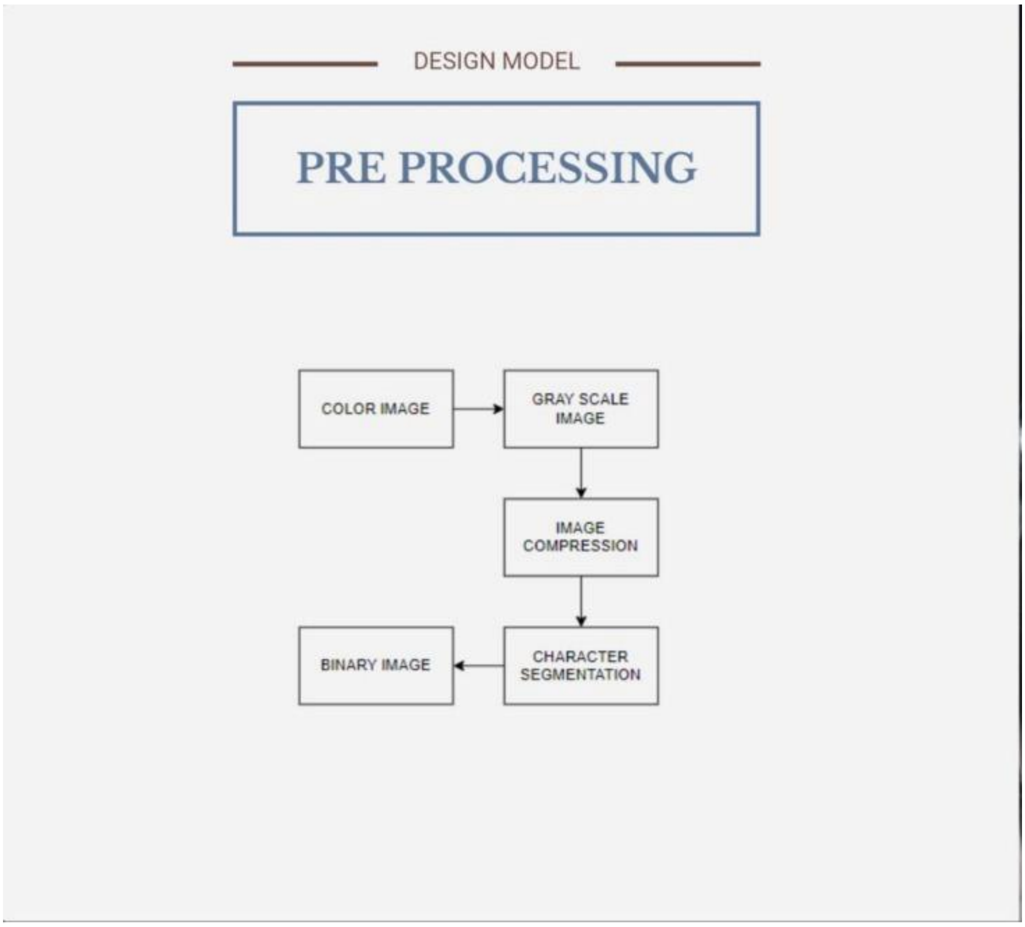

Figure 2.2.3 Pre-Processing Flow Chart

2.3 System Details

This section describes the hardware and software details of the project.

2.3.1 Software Details

CHAPTER 3

3.1. List of components and their cost

The costs of various components used in this project are given below in table 3.1

Table 3.1 List of components and their costs

COMPONENT	COST
Web Camera	**1699/-**
Total	**1699/-**

CHAPTER 4

RESULTS AND DISCUSSIONS

1. **Number Plate Detection**

Figure 4.1.1 Testing Car

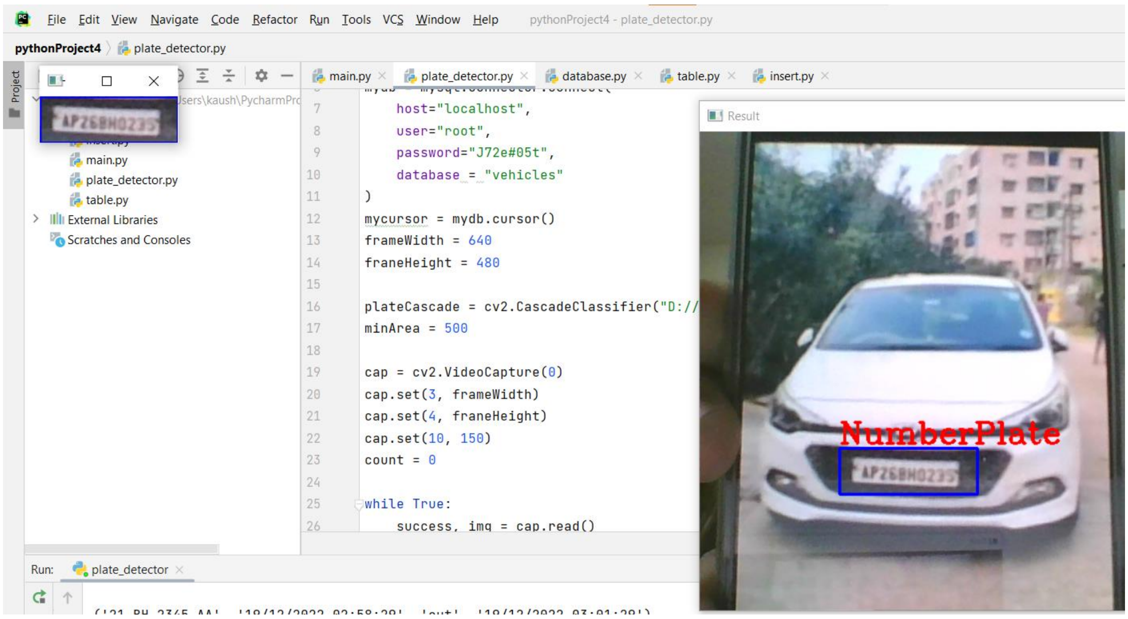

Figure 4.1.2 Live License plate detection

2. Pre-Processing

Read in Image, Grayscale and Blur

It is an image conversion technique in digital photography. It eliminates every form of color information and only leaves different shades of gray; the brightest being white and the darkest of it being black. It helps in simplifying algorithms and as well eliminates the complexities related to computational requirements.

It makes room for easier learning for those who are new to image processing. This is because grayscale compressors an image to its barest minimum pixel.

It enhances easy visualization. It differentiates between the shadow details and the highlights of an image because it is mainly in 2 spatial dimensions (2D) rather than 3D.

color complexity is also reduced. A typical 3D image requires camera calibration on brightness among others. The grayscale conversion option is very useful for captured images which do not need to match colored detail.

Figure 4.1.3 Gray Scale Image

Apply filter and find edges for localization

An edge (contour) in an image is the frontier that delimits two objects. Therefore, edge detection is useful for identifying or measuring objects, or segmenting the image. Edges are characterized by a rapid variation in the intensity of the pixels. One clearly see that the outline of the industrial piece shows a sudden decrease in the brightness of the pixels.

Figure 4.1.4 Apply Filters for Localizations

3. EasyOCR to read Text

EasyOCR like any other OCR (tesseract of Google or any other) detects the text from images but in my reference. EasyOCR supports 42+ languages for detection purposes. After detecting the number and applying the mask we use EasyOCR to read the text from the number plate. EasyOCR can be used to extract text from a variety of image formats, including JPEG, PNG, and TIFF. EasyOCR is available as a Python library and can be installed using pip. It is easy to use and requires minimal configuration, making it a convenient option for developers looking to add OCR functionality to their applications. It is implemented using Python and PyTorch, and that it can take advantage of GPU acceleration for faster performance. It's also useful to know that EasyOCR supports OCR for 58 languages and that the developers plan to add support for handwriting recognition in the future and it can be a convenient and accurate tool for extracting text from images and converting it into machine-readable form. It can be useful in a variety of applications, including document scanning, data entry, and text analysis. If you need to perform OCR on a large number of images, you may find EasyOCR to be a fast and efficient solution.

Figure 4.1.5 Render Result

4. Maintaining the Log

Render Result

Now we maintain a log of vehicles. We maintain the entry time and exit time of vehicles. We also maintain the status of the car whether it is in or out.

```
mysql> select * from final;
+---------------+---------------------+--------+---------------------+
| license_plate | entry_time          | status | exit_time           |
+---------------+---------------------+--------+---------------------+
| 21 BH 0001 AA | 19/12/2022 02:00:04 | out    | 19/12/2022 02:49:57 |
| 21 BH         | 19/12/2022 02:48:55 | out    | 19/12/2022 02:49:57 |
| 21 BH 0001 AA | 19/12/2022 02:51:32 | in     | -----               |
| 21 BH 2345 AAI| 19/12/2022 02:58:14 | in     | -----               |
| 21 BH 2345 AA | 19/12/2022 02:58:29 | out    | 19/12/2022 03:01:29 |
+---------------+---------------------+--------+---------------------+
5 rows in set (0.00 sec)
```

Figure 4.1.6 MySQL Databae

CHAPTER 5

CONCLUSION AND FUTURE WORK

This project explored how to use AdaBoost for a strong classifier to detect LPs, and demonstrated that Haar-like cascade classifier is an efficient method in LP location. The key is the selection of positive and negative samples. Here we use random generator to randomize dataset's distribution and select samples randomly in the dataset. In this way we can get a positive dataset representing possible situations and achieved least information redundancy.

Negative samples were selected randomly from the internet. The classifier trained by the positive and negative dataset described above is better than the classifier trained from samples without randomization. Our experience shows that the proposed method based on machine learning is better than the method based on image processing, and combing appropriate image post-processing with some priori knowledge can improve the classifier's accuracy. Our algorithm can be used in situations with complex background as well as degraded LP images. We noticed that when the plates have a big angle with camera, the classifier may fail. Sometimes though the classifiers have detected the LP region, the aspect ratio of the region (width/height) will reject to cause failure. To handle the big angle, the range of aspect ratio needs to be enlarged and image processing should be explored. We also noticed that when the lamps of the car were turned on at night, the contrast of the LP would be low, and the detection may fail. Our future work involves putting other features which may go beyond Haar-like features, using other image processing methods to further improve the accuracy, and exploring other methods to choose samples for training classifiers.

CHAPTER 6

APPENDIX

Creating Database

```
import mysql.connector

mydb = mysql.connector.connect(
  host="localhost",
  user="root",
  password="J72e#05t"
)

mycursor = mydb.cursor()

mycursor.execute("CREATE DATABASE vehicles")
```

Creating Table

```
import mysql.connector

mydb = mysql.connector.connect(
    host="localhost",
    user="root",
    password="J72e#05t",
    database = "vehicles"
)

mycursor = mydb.cursor()
mycursor.execute("CREATE TABLE final (license_plate
VARCHAR(255), entry_time VARCHAR(255), status
VARCHAR(255), exit_time VARCHAR(255))")
sql = "INSERT INTO final (license_plate, entry_time,
status, exit_time) VALUES (%s, %s, %s, %s)"
val = ('AP26L348', '12:30', 'in', 'ss')
mycursor.execute(sql, val)

mydb.commit()
```

Read Image, GrayScale and Blur

```
img = cv2.imread('/content/number_plates1.jpg')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(cv2.cvtColor(gray, cv2.COLOR_BGR2RGB))
```

Apply filter and find edges for localization

```
bfilter = cv2.bilateralFilter(gray, 11, 17, 17)
edged = cv2.Canny(bfilter, 30, 200)
plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))
```

Use Easy OCR To Read Text

```
reader = easyocr.Reader(['en'])
result = reader.readtext(img)
result
```

Source Code

```
import cv2
import easyocr
import mysql.connector
from datetime import datetime

mydb = mysql.connector.connect(
    host="localhost",
    user="root",
    password="J72e#05t",
    database = "vehicles"
)
mycursor = mydb.cursor()
frameWidth = 640
franeHeight = 480

plateCascade =
cv2.CascadeClassifier("D://haarcascade_russian_plate_
number.xml")
minArea = 500

cap = cv2.VideoCapture(0)
cap.set(3, frameWidth)
cap.set(4, franeHeight)
cap.set(10, 150)
count = 0

while True:
    success, img = cap.read()
    imgGray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

    numberPlates = plateCascade
```

```
.detectMultiScale(imgGray, 1.1, 4)

    for (x, y, w, h) in numberPlates:
        area = w*h
        if area > minArea:
            cv2.rectangle(img, (x, y), (x + w, y +
h), (255, 0, 0), 2)
            cv2.putText(img,"NumberPlate",(x,y-
5),cv2.FONT_HERSHEY_COMPLEX, 1, (0, 0, 255), 2)
            imgRoi = img[y:y+h,x:x+w]
            cv2.imshow("ROI",imgRoi)
    cv2.imshow("Result",img)
    if cv2.waitKey(1) & 0xFF == ord('s'):

cv2.imwrite("D://number_plates//number_plates"+str(co
unt)+".jpg", imgRoi)
        now = datetime.now()
        dt_string = now.strftime("%d/%m/%Y %H:%M:%S")
        plate =
"D://number_plates//number_plates"+str(count)+".jpg"

cv2.rectangle(img,(0,200),(640,300),(0,255,0),cv2.FIL
LED)
        cv2.putText(img,"Scan
Saved",(15,265),cv2.FONT_HERSHEY_COMPLEX,2,(0,0,255),
2)

        img = cv2.imread(plate)
        reader = easyocr.Reader(['en'])
        result = reader.readtext(img)
        print(result)
        text = result[0][-2]

        status_check = "select * from final where
license_plate = '%s' AND status = 'in' " % text
        mycursor.execute(status_check)
        row_count = mycursor.fetchone()
        print(row_count)

        if row_count != None:
            print("if entered")
            update = "update final set exit_time =
%s, status = 'out' where license_plate = %s"
            input_data = (dt_string, text)
```

```
            mycursor.execute(update, input_data)
            mydb.commit()
        else:
            print("entered")
            sql = "INSERT INTO final (license_plate, 
entry_time, status, exit_time) VALUES (%s, %s, %s, 
%s)"
            val = (text, dt_string, "in", "-----");
            mycursor.execute(sql, val)
            mydb.commit()

        mycursor.execute("SELECT * FROM final")
        result = mycursor.fetchall()
        for row in result:
            print(row)
            print("\n")
        cv2.imshow("Result", img)
        cv2.waitKey(500)
        count += 1
```

CHAPTER 7

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