

Vehicle Theft Prevention using Machine Learning

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Abstract— It is evident that the usage of vehicles has been increasing gradually. The vehicle thefts are also hiking everyday. Majority of the cases are reporting related to thefts at parking lots. The already existing vehicle number plate detection systems are proving to be inefficient. Thus there is a strong requirement for improved mechanism to prevent these thefts. In this paper, we develop an automatic facial and number plate recognition system. Here we combine the number plate recognition mechanism with driver face recognition, to keep track of the vehicle along with driver at both entry and exit points of parking premises. This works by detecting the vehicle number plate and driver's face in the initial step. In the second step, it recognizes the characters in the number plate through Optimal Character Recognition(OCR) and maps the corresponding driver's face to the number plate and stores this data in the database repository. Finally, at the exit point of the premises, the number plate and driver's face are once again detected and compared with the data in the database. If the driver's face matches with the number plate in the database, the vehicle will be allowed to leave the premises, otherwise the driver will be questioned further. This reduces the vehicle thefts by a large margin.

Index Terms: detection, database repository, Optimal Character Recognition (OCR), recognition.

I.INTRODUCTION

The improvement of technology in a networking environment has necessitated the need to maintain the security of information or physical property. Security is a significant concern that should be overseen determinedly when it comes into the matter of getting to certain restricted premises. Cameras are broadly used, which permits keeping a digital record of people and vehicles entering the concerned premises. Automatic Face and Number Plate Recognition

(AFNPR) framework is a significant mechanism, utilized in Intelligent Transportation System. AFNPR is a high level machine vision innovation used to recognize vehicles by their face and their number plates. It is a significant region of examination because of its numerous applications. The improvement of Intelligent Transportation System gives the information of vehicle numbers which can be utilized in follow up, to analyze and screen. Extraction of number plate is troublesome assignment, basically because of: Number plates by and large possess a little segment of entire picture; distinction in number plate arrangements, and impact of ecological components.

1.1 Number plate recognition: The NPR works in two major steps: vehicle plate detection and Character recognition. For number plate detection, it uses OpenCV's Haar cascade classifier which has to be trained with images of license plates to be detected. For character recognition, it uses Tesseract's OCR which has to be trained with characters on the license plates. together with these two trained files, a configuration file is required which contains the information regarding size of registration code and characters thereon as per government rules. If the car plate and characters on that are as per government standards then the registration code is recognized, otherwise no vehicle plate is detected. The OpenCV's cascade classifier is trained with Indian license plates for detection purpose.

1.2 Training Detector: The NPR utilizes OpenCV's course classifier for multi-scale discovery of number plate region in the picture. The OpenCV's classifier should be prepared with positive pictures, which are Indian number plate pictures for our situation and negative pictures, which are pictures not containing

number plate images. For building powerful classifier, we need huge set of positive pictures covering all the potential varieties.

1.3 Database creation for number plate: For recognition of number plates, in excess of 1000 pictures are needed for accomplishing the desired precision required which is for 98% or more. The data base has been made with varieties of catching distance, point and light .The number plates with various colors as per standards are collected to make detection background invariant. The pictures were caught in HD quality utilizing 12 MP camera at different public places, for example, school stopping, streets, local locations and to all ways. Every vehicle was caught with point variety of 20 degrees on both left and right side.At the point when the sun is bright, the pictures caught toward daylight were shiny and others were in shadow of some entity. At night, pictures acquired had number plate enlightened by just vehicle lights. While acquiring pictures it was ensured that the number plate is comprehensible by natural human eye in that condition.

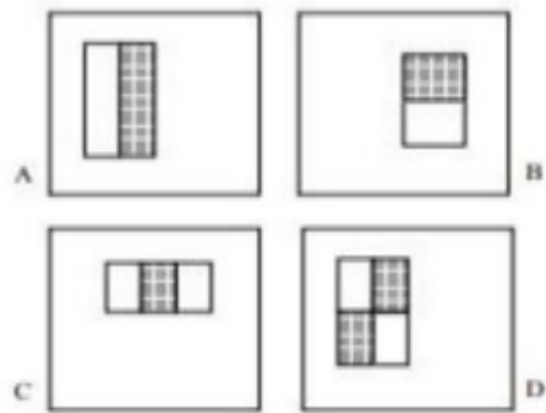
II. RELATED WORK

There are a few research works accessible in the Intelligent transportation systems (ITS) field including the ANPR and Automatic vehicle recognition procedures. They are summed up here under explicit subsections, alongside the researched identified with face identification.

2.1 Face recognition:

Face recognition involves three basic steps, first being training the system with labelled images, secondly, classifying them into labelled classes and thirdly, storing them in the database. When a test image of known or unknown person is presented to the system, it is compared with the existing database and classified. There are many classifiers uses for face recognition mainly Haar cascade have been considered, implemented and compared in terms of reliability, accuracy and speed. Haar is transcendently a text based detection algorithm. It recognizes the lighter and hazier locales of the face. The initial step of the algorithm is to gather haar-features. It considers adjacent rectangular region at a specific location of the detection window and sums

up the pixel values of the darker region and this value is subtracted from the pixel sum of the lighter region. For example, the eye district is hazier when contrasted with the Nose Bridge and upper cheek area in all countenances. It is one of the solid two-include classifiers. The estimation of a two-square shape highlight is the deduction of the amount of pixels of one rectangular locale from the other. In fig. 1 the locales are comparative in measurements and are evenly neighboring one another. It very well might be either flat or vertical as demonstrated. With regards to a three-rectangle shape highlight the calculation is finished by ascertaining the amount of pixels inside two external rectangle shapes deducted from the amount of pixels in the middle square shape. Furthermore, in a four-rectangle shape include the worth is processed by taking the distinction between slanting sets of rectangle.



(A)and (B) Two-rectangular features,(C)Three-rectangular feature, (D) Four-rectangular feature

Fig: 1 Face recognition features

III. METHODOLOGY

By capturing number plate which on the vehicle and the number plate image is convert into text, and it will check into database. if the number plate is present in the database ,will go for face detection, if the number doesn't found it will terminate and give respective output by capturing the face and check into the database if it presents it will let the user/driver inside. Capturing the frame from the video using the system's camera initializes the execution of the proposed system. The Number Plate Detection Algorithm then processes on the captured

image frames to give out the rectangular boxed face. This output from Face Detection Algorithm then gets processed using OpenCV Classifier to detect the Number Plate region in the face. If it's there, then this movement will give access to detect the person inside the vehicle and elaborates the basic modules of our system. In the first module, the system detects the face of a person through the webcam using detection algorithms (HaarCascade), (Ada Boost). Then the system detects the Number Plate (OpenCV). After that the system detects and captures the eye moments (Centre, Left and Right). Then the system detects the Face. In the last module, the system starts displaying a message if it accepted or not. Finally, pre Processing is done to improve the results. There are many Pre Processing techniques that can be used after background mode.

Foreground extraction is the final step in the process which extracts the moving object from the frame. The result of this step helps in the judgment of the efficiency of the background subtraction system.

3.1 Objective:

The main objective is to design an efficient automatic authorized vehicle identification system by using number plate and their face. The system aims to design different morphological operations in such a way number plate and face can identify accurately. This is based on various operations such as image enhancement, morphological transformation, edge detection, feature extraction of number plate and face from image.

IV. SYSTEM DESIGN

4.1 Use Case Design:

In Fig 2, it shows use case diagram; the system accomplishes to have the following steps. Open the webcam on the laptop and show the image of a person. Number Plate detection action is performed. If it accepts, then face detection is performed. After the above action, the system moves on to the next operation. In the next step, the system compares the given data with the stored data. When it matches with the stored data then display the respected output.



Fig. 2 Use case Diagram

4.2 Work Flow Diagram:

The design part includes the data flow diagram. The data flow diagram explains the workflow of system proposed. The workflow mainly highlights the data flow direction, that mean show the data is being modified. How it is being use? And how the results vary with it?

4.2.1 Steps in work flow diagram:

Capturing the frame from the video using the system's camera initializes the execution of the proposed system. The Detection Algorithm then processes on the captured video frames to give out the rectangular boxed face. This output from detection Algorithm then gets processed using Haar Cascade Classifier to detect the number plate. The image will convert and will be sent to check if there is in database. If it's there, face detection algorithm will capture the face and check if it is there in database then this movement will be checked into database and will give output.

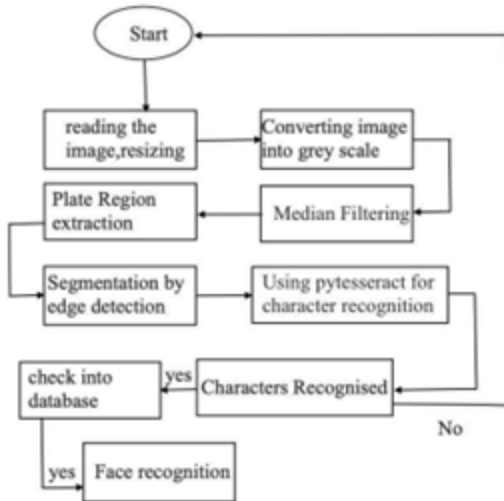


Fig.3: Work flow diagram for face recognition

In Fig.3 the system sequence diagram, elaborates the five basic modules of our system. In the first module, the system detects the face of a person through the webcam using detection algorithms (Haar Cascade). In second module it will detect the number plate (OpenCV). After that the system detects and captures the face and number plate moments (Centre, Left, Right). Then the system detects the user and will give permission to enter or not.

V. SYSTEM ARCHITECTURE

Systems design is the process of in fig.4 defining elements of a system in fig. like modules, architecture, components and their interfaces and data for a system based on the specified requirements.

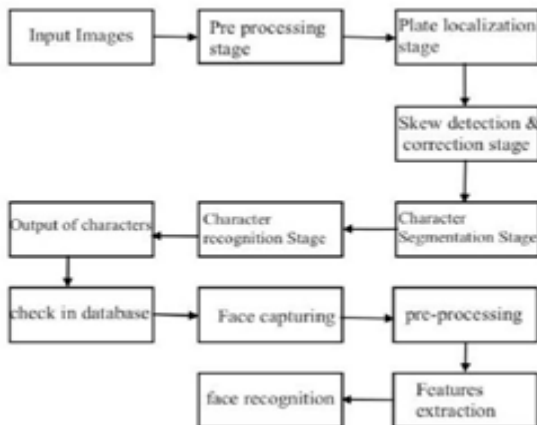


Fig.4: System Architecture

5.1 Digital Camera:

A digital camera shown in Fig. 5. Unlike an analog camera, which exposes the chemicals on film to light, a digital camera uses digital optical components to register the intensity and color of light, and converts it into pixel data.



Fig. 5: Camera

5.2 Computer System: A computer system is a set of integrated devices that input, output, process, and store data and information. Computer systems are currently built around at least one digital processing device. There are five main hardware components in a computer system: Input, Processing, Storage, Output and Communication devices.

VI. RESULT ANALYSIS

The system is implemented using python language in Open CV platform. Recognition accuracy is analyzed for both the face and number plate.

6.1 Number plate Recognition:

We worked on our proposed method in which vehicle pictures are taken with a 13mp and 12mp camera. In the experiments we tested our proposed method on different types car image to identify the location exactly.



Fig.6: Sample Number Plate(1)



Fig. 7: Sample Number Plate(2)

To perform this experiment, we have used two data sets which has one West Bengal set and Kerala set. It is divided into two types of sets which contains training set (70% of images) and testing set (30% of images). For a license plate to extract, there are two ways. They are trained and tested using two different data sets. There are others test methods for discovery of our item; the first rule of content of the license plate includes the number and alphabets as a result of the process of obtaining a license plate. Another law is a character released from a license the plate itself as a result of the process of issuing the license plate. After that, it will be compared to a true picture of the ground.

| Number plates | Letter Count | Accuracy (%) |
|---------------|--------------|--------------|
| WB 06 F 5977 | 09 | 98 |
| KL 47 F 7878 | 09 | 97.6 |

Table.1: Result of number plate matching

6.1 Face Recognition:

As we said before, Haar Cascades use machine learning techniques in which a function is trained from a lot of positive and negative images. This process in the algorithm is feature extraction.

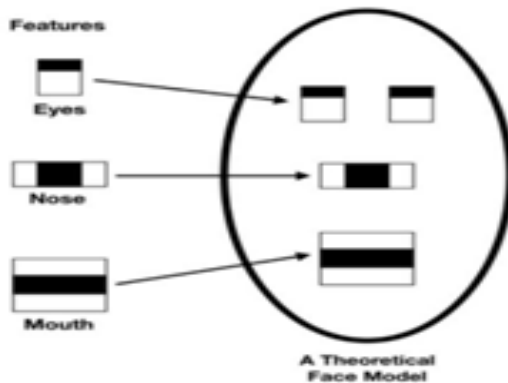


Fig.9: A Theoretical Face model for Face Recognition

It depends on the Haar Wavelet procedure to break down pixels in the picture into squares by work. This uses AI strategies to get a serious level of precision based on the thing is designated "preparing information".

This uses "fundamental picture" ideas to register the "highlights" recognized. Haar Cascades utilize the

Adaboost learning calculation which chooses few significant highlights from a huge set to give a proficient consequence of classifiers.

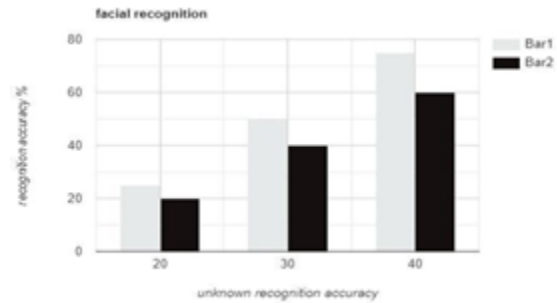


Fig. 10 Recognition accuracy Vs Unknown recognition accuracy

VII. CONCLUSION

The created framework has three separate stages: vehicle number plate detection, driver face discovery, and driver face identification. On effective identifying of driver's face, vehicle is permitted to enter into the respective place. The use of this framework will guarantee just true vehicles are permitted and parked in any public car parking area or any other places. Successful detection and correction recognition for overall LP characters was 96.26% and 19.74% respectively. The average sensitivity within the experiment was 98.2%. The faster authentication approach can reduce the traffic blocks that may arise as a result of good performance.

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