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An Experimental Evaluation on Smart No-Parking Detector Using IoT

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ABSTRACT: India has a very large population, so there are also a lot of cars there. This is one reason why traffic jams happen so often. Congestion in the Indian traffic system has become one of its biggest problems. People often break the rules of the road in our country. One of them is parking a car in an area that says "No Parking." Most traffic jams happen because cars are parked in places where they shouldn't be. With more cars on the road, India now has to have a strict traffic system. When people park in places where they aren't supposed to, the road gets smaller. This makes traffic jams more likely to happen. The traffic system we have now is not good enough to keep track of all the cars on the road. So that these kinds of problems don't happen in India, we've made a project that can find cars parked in no-parking zones and let the traffic police know.

KEYWORDS: Traffic congestion, Parking Zone.

I.INTRODUCTION

In the modern world, the number of privately owned cars has grown a lot, which makes traffic management a huge challenge. This has also led to traffic jams happening all the time. One of the main reasons for traffic jams is that people park their cars in places where they shouldn't. When people park their cars in areas where they aren't supposed to, the roads get narrower, which causes traffic to back up. It is hard to physically keep an eye on people who park their cars in a no-parking zone. But we can keep an eye on the cars with the help of automatic license plate readers, especially those that are parked in a no-parking zone.

The work in this paper is divided into four stages.

- 1) No parking area detection
- 2) Vehicle detection
- 3) License Plate Detection
- 4) Notification to Concerned Authority

Machine learning is used to train the dataset that is needed for vehicle detection. Once a vehicle has been found, its license plate is captured using a camera in a traffic area, and the vehicle is then identified. This module also figures out how long a car has been parked in a no-parking zone. When the time is up, a warning message will be sent to the car's owner from the LPMS, and if the car isn't moved, the traffic department will be notified. Using a towing vehicle, the car will be removed from the site if it has been there for too long. Training on different data sets can be used to find vehicles, but license plate



recognition has problems with things like image clarity and noise in the image. All of these problems have been solved so that vehicle license plate detection is as accurate as possible.

STATISTICS ON NUMBER OF VEHICLES REGISTERED ANNUALLY IN INDIA

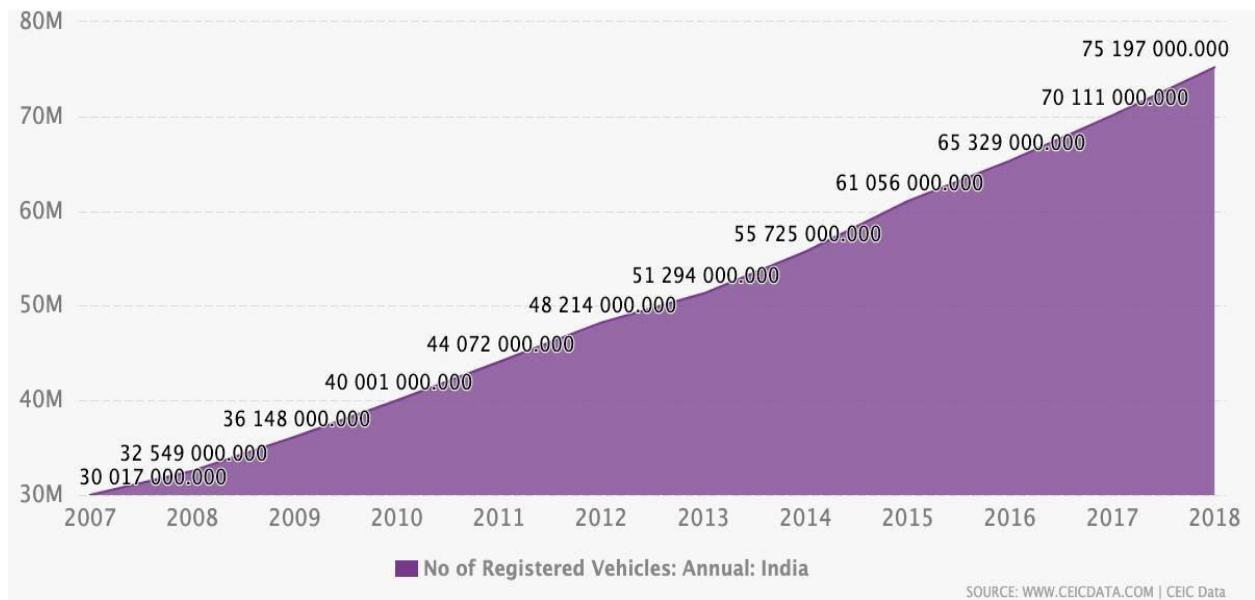


Figure 1: Statistics on number of vehicles registered annually in India

PROSECUTIONS MADE BY DELHI TRAFFIC POLICE FOR IMPROPER PARKING FROM 2014 TO 2020

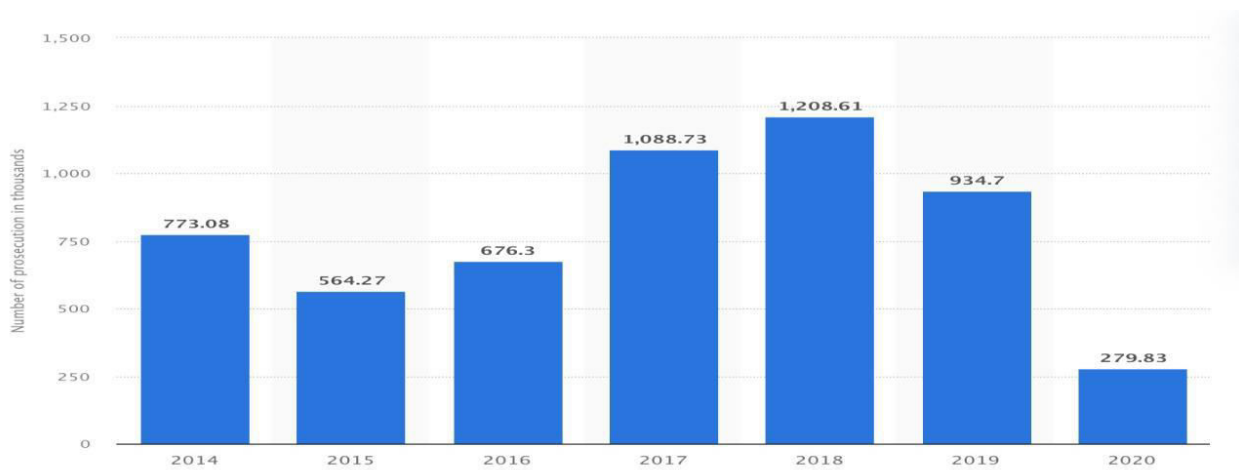


Figure 2: Prosecutions made by Delhi traffic police for improper parking from 2014 to 2020



II. EXISTING SYSTEM

The current system is the even/odd system, which lets people park on one side of the road on even days and the other side on odd days. This meets people's needs without causing too much traffic congestion.

III. PROBLEM STATEMENT

The most common and easy way to park is along the road, as long as there is enough room (cramping and slotting of vehicle in between others). Do we even think about how much of a problem this is for other people? Parking on the side of the road makes it harder for cars to get through, but bad parking habits and misuse often lead to cars being parked on the wrong side of the road.

IV. PROPOSED SOLUTION

The proposed system can find any car that is parked in a no-parking zone. The car is found by an image processing camera that gets a live feed from the no parking area. Once a car is found, its licence plate is sent to the on-board system so that it can be processed. When a violation is found, an embedded system (like a Raspberry Pi) sends a 10-second warning to the driver through a speaker. Even so, if the car stays on the property and doesn't leave, the system sends an e-mail to the local authorities about a parking violation.

V. LITERATURE REVIEW

1. Based on Deep Learning, this system can detect illegal parking in real time. By Guangming Shi, Guangmei Shi, Chenye Wang and Guangmei Xie in June of this year. Single Shot MultiBox Detector (SSD) method is used to identify and categorize unlawful vehicles seen on video. SSD speed will be boosted by adjusting the default box's aspect ratio to better accommodate our data. A second step is to follow and observe the unlawful cars in the target region (ROI). With 99 percent accuracy and 25 frames per second (FPS), the system is able to identify objects in complicated surroundings.

2. The authors are Santhosh G. Kashid and Sanjay Pardeshi, and the date is November 2014. Automated systems are made for a wide range of monitoring and security tasks, but most of the work of finding cars parked illegally in no-parking zones is still done by humans. This paper suggests a simple way to use image processing to find and identify cars that were parked illegally in a no-parking zone. This study suggests combining image processing algorithms for detecting, extracting, localizing, segmenting, and recognizing vehicle number plates from an image taken in a place with no parking. This system sends a message to the right people with information about cars that are parked illegally. This helps the authorities take action against the people who own the cars and get them out of the way quickly.

3. Sriashika Addala wrote a research paper in May 2020 about how to find and recognize vehicles. A CCTV camera is a very important part of a smart system for watching traffic. It is just an automated way to keep an eye on the traffic in a certain area and find cars so that something can be done about them. The images that are taken can give the police and other essential tracking services useful information, such as the license plate number of the vehicle, the time and location of the vehicle, details about the driver, etc., which could all lead to proof of a crime or other unlucky events. Manual work has always been slower and less effective than work done by machines. This is because people make mistakes and many other things that affect living things.

4. "Creating a Real-Time License Plate Recognition App" was published on the NVIDIA Developer Blog. Automatic license plate recognition (ALPR) is a frequent use of intelligent video analytics in smart cities. ALPR detects license plates on moving or stopped vehicles. It's fairly uncommon for automated toll booths, parking assistance systems, car registration and identification for port logistics, and hospitals to make use of these technologies. An object detection model is used to identify automobiles in a frame, then a plate detection model is used to locate the plate, and lastly a character recognition model is used to read the characters. When employing optical character recognition, deep neural networks are a common



method of recognising characters from many languages (OCR). To employ AI models like LPD and LPR that are competent enough for manufacturing. You can get your ALPR project up and going fast using ready-to-use models.

5. Python-based ANPR (Automatic License Plate and Number Plate Recognition): Adrian Rosebrock is the author and the date is September 2020. You may find a wide variety of devices that can read license plates without any human intervention. When the illumination is regulated and the kinds of license plates are known, basic image processing algorithms may be employed for ANPR. Advanced ANPR systems employ object detectors, such as, to locate licence plates in photos. Today's ANPR software helps OCR (optical character recognition) of text on licence plates by using Recurrent Neural Networks (RNNs) and Long Short Term Memory networks (LSTM). Advanced ANPR systems pre-process and clean pictures before OCR using specialised neural network designs. This improves ANPR's reliability. The real-time nature of Automatic License/Number Plate Recognition makes it much more difficult. Let's imagine an ANPR system is put in place on a toll road. When a vehicle's licence plate number is read, it has to be entered into a database so that the toll may be billed directly to the driver. Annotating ANPR datasets is very consuming and requires a large amount of staff work. There is a lot of competition for ANPR contracts with municipal and federal governments. It is for this reason that a company's dataset is frequently worth more than the trained model it has developed.

6. Sending and receiving emails through SMTP on a Raspberry Pi is one method of using the device (Simple mail transfer protocol). A Raspberry Pi will be used to connect to an SMTP server and send an email. In order for SMTP to operate, a session must be established between a user and a server. There are two types of mail transfer agents (MTAs) and mail delivery agents (MDAs). A TCP/IP network may provide email services using the SMTP protocol. Emails may be sent and received using this service. To send and receive email over the Internet, an application-layer protocol known as SMTP is required, which may be found here. The four basic components of SMTP may be found in an email client application. The mail user agent refers to the client-side software used by local users (MUA). There are three distinct roles for the server: the mail submission agent (MSA), the mail transport agent (MTA), and the mail delivery agent (MDA) (MDA). In order to get email notifications or a collection of data, the raspberry pi Python software comes in handy. The smtplib library is all we need in the Python script. The versions of Python 3.2 and 2.7 that operate best with pi are among the numerous that exist.

7. System for IoT-based security, which includes a Raspberry PI and a mail server: It was authored by S. Snigdha and K. Haribabu in September 2019. Together, an IoT device and a mail server ensure the security of the Internet. Snooping devices may be integrated into Raspberry Pis, which can then be used to transmit data and information about the end users. The Internet of Things (IoT) is more of an expansion than a revolution. Connected sensors and personal computers are used to gather and analyze data in an effective manner in the IoT.

In India, there is a big need for roads without traffic, and there are many ways to meet this need, such as flyovers, odd-and-even systems, etc. But the worst thing is traffic caused by people who park illegally and block roads. Smart parking cameras, which make parking easier, help to solve part of the problem. From this idea, we came up with a "no-parking system" that can find cars parked in these areas and sound an alarm. By putting together vehicle detection and image processing, we can make a system that is much more accurate than the ones we have now.

VI.SYSTEM DESIGN

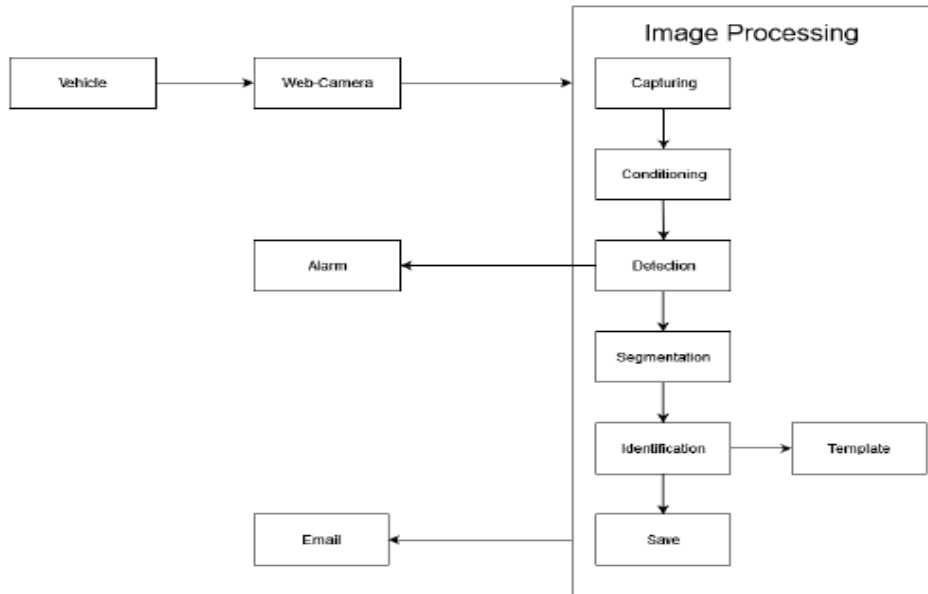


Figure 3: System Architecture

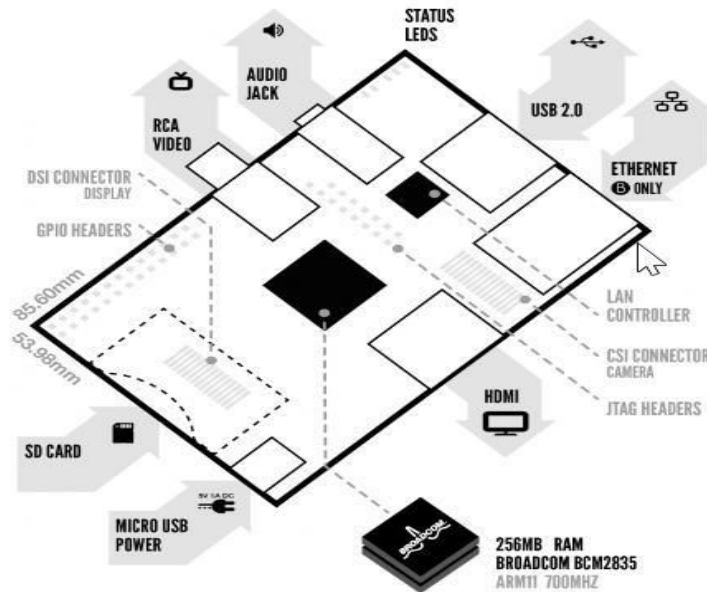


Figure 4: Raspberry PI 4B Architecture Overview

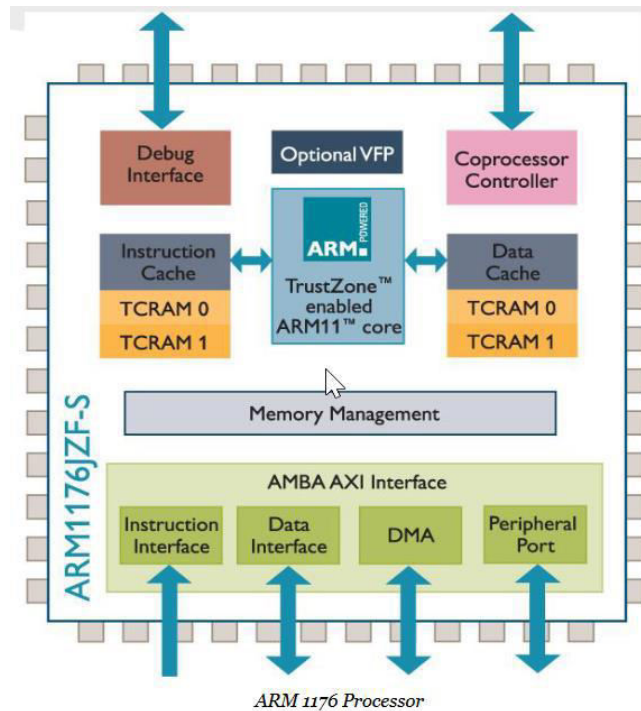


Figure 5: BCM2835: CPU Overview

VII.METHODOLOGY

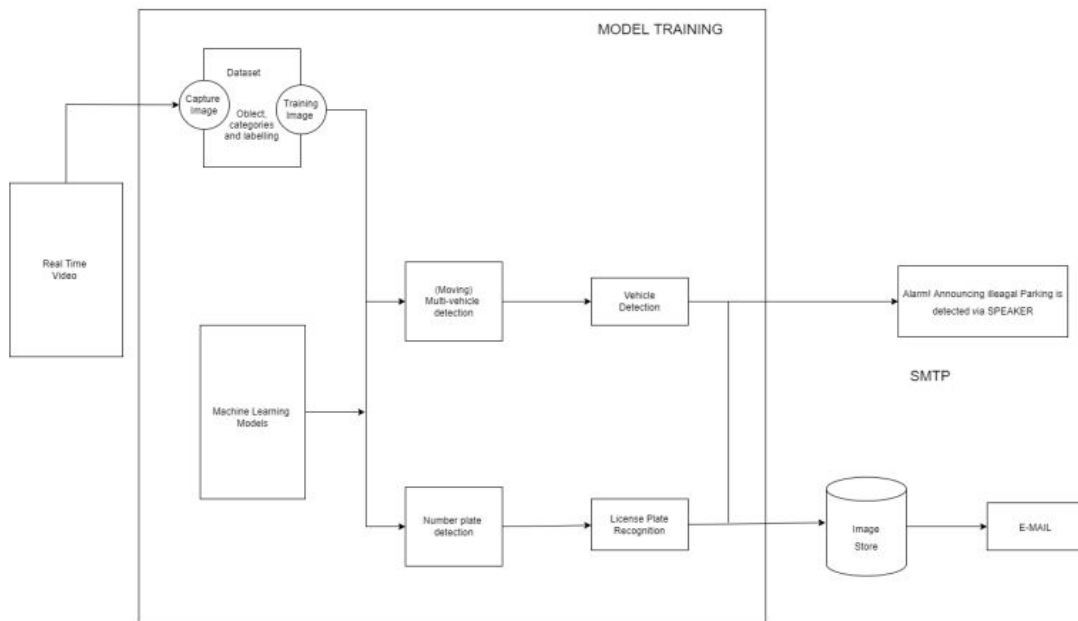


Figure 6: Detailed Description of The Methodology

Detailed Description of The Methodology

Real time video:

The live feed is sent, and an image will be taken and sent to the system when the car is found in the no-parking zone.

Datasets:

Acquisition of datasets is the process of getting the datasets needed for the proposed project. Here, we are gathering data on vehicles that is available to the public and training the model.

Pre-processing:

Data pre-processing is needed to clean the data and make it fit for a machine learning model. It also makes a machine learning model more accurate and efficient.

Labelling:

LabelIMG will save a file with the class and coordinates of the rectangle boxes for each image. A list of all classes is also saved to a.xml file.

Haar-cascade Detection in OpenCV:

According to a publication by Paul Viola and Michael Jones, Haar feature-based cascade classifiers are an effective approach to discover items quickly, as shown by the results of their experimentation. Using machine learning, a cascade function is learned using a large number of good and negative examples. When used to search for objects in other photos, though.

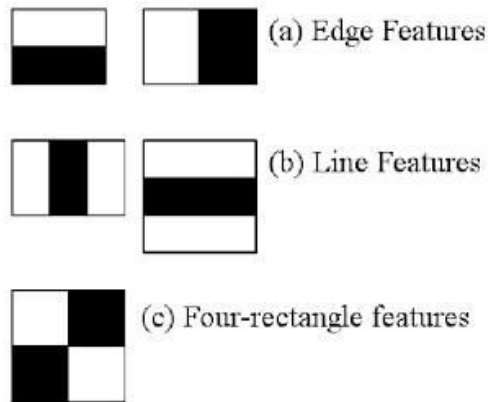


Figure 4.2.2: Feature Detection Scheme

An image's Haar-like feature is a square or rectangle that provides information about its content. Haar-like characteristics like those seen in Figures (a), (b), and (c) are prevalent. With Haar-like characteristics, you can quickly compute the number of pixels within a rectangle rather than the individual value of each pixel. The Haar-like feature value for object detection was calculated using an integral picture. When a previously scanned area with a Haar-like feature is used as the basis for a new picture presentation, an integral image may rapidly and reliably figure out values. The value of the integral picture was discovered by adding the preceding index values from left to right, from top to bottom. Figures (a) and (b) above demonstrate how Equation 1 may be used to get the integral picture.

$$s(x, y) = i(x, y) + s(x, y - 1) + s(x - 1, y) + s(x - 1, y - 1)$$

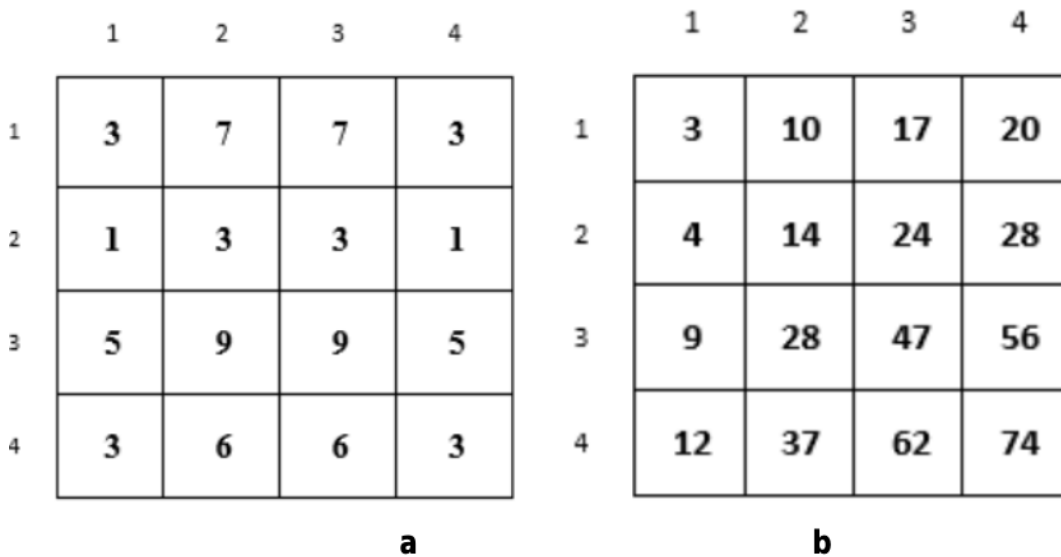


Figure 4.2.3: (a)Input Image and (b) Integral Image of Input Image

Finally, several AdaBoost features' threshold values will be compared to the estimated value. Because not all characteristics can be utilised to identify particular items, this should be done to locate possible features. AdaBoost combines the potential characteristics of a poor classifier to create a more powerful classifier. Poor classifiers provide inaccurate or illogical predictions.

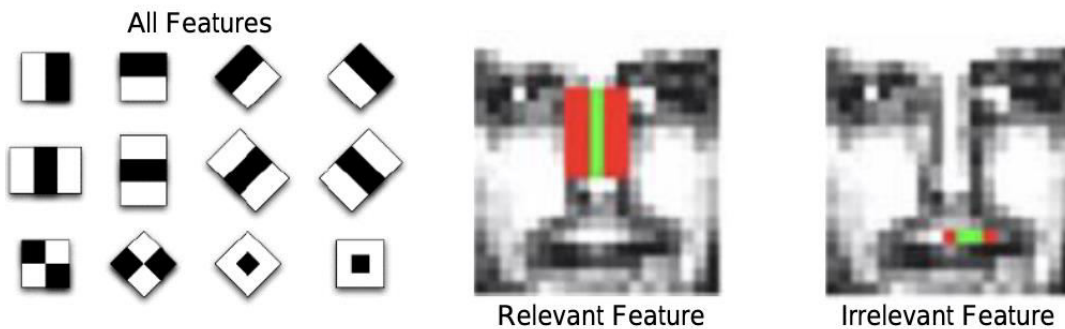


Figure 4.2.4 :Examples of Relevant and Irrelevant Features

AdaBoost is capable of creating a powerful classifier that can locate items in a cascade at successive levels. Each sub-window was examined for specified criteria at each stage. Finally, an item that looked like a vehicle made its way into the next level of filtering, which utilised even more detailed criteria until it came across a sub-window. Sub-windows without a positive object, on the other hand, were indicated as background and separated by sub-windows that did, as seen in Figure below.

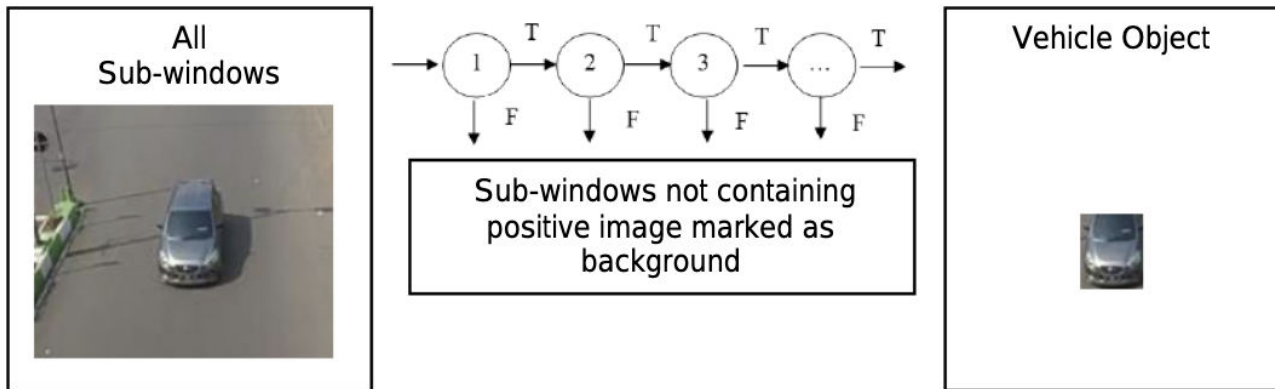


Figure 5: Cascade Object Detection Scheme

SMTP:

Any internet system with an SMTP address may receive mail via the smtpplib module, which specifies an SMTP client session object.

ALARM:

When a wrongly parked car is found, a warning will be sent through the speaker about the no-parking zone.



VIII.RESULTS AND DISCUSSIONS



Figure: Detection of car in no parking space

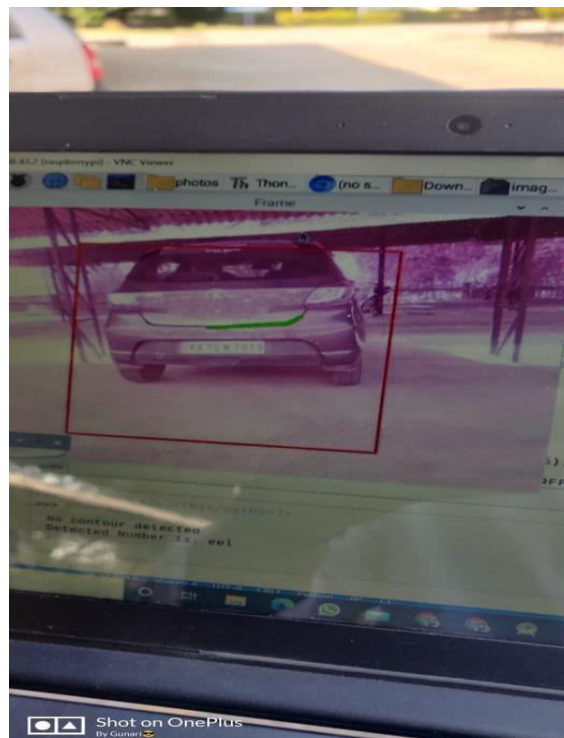


Figure: Identification of number plate

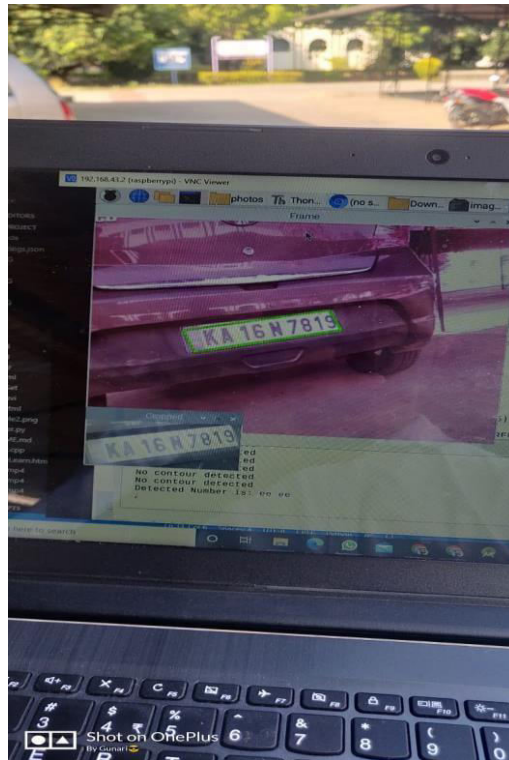


Figure: Cropped image of number plate



Figure: Sending number plate picture along with details of the parking time and date via E-mail.



IX.CONCLUSION

The traffic department will get a lot out of our product because it will help them keep track of violations. It will also make traffic easier to move by making the roads less crowded, which will help people who use the roads often. In reality, traffic is getting worse because roads are too crowded. When a problem like this is fixed, it affects the flow of traffic for a large number of people. The free space on the road, which is a convenience, also encourages and inspires people to strive for better services.

X.ACKNOWLEDGEMENT

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