Study of Different Approaches to Develop an Automatic Traffic Rule Violation Detection System

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***Abstract* - Automatic Traffic Rule Violation Detection and Number plate Recognition Using ML replaces the requirement of human traffic police by Virtual Traffic Police. The traffic violations and number plate detection can be monitored by virtual traffic police. Violations include detection of motorcyclists without helmets and triple riding. In order to simplify traffic congestion, the Automatic number plate recognition system plays a crucial role. The main motive of this project is to help in reducing the different violations on the road. Based on automated number plate recognition system, advanced systems to identify and trace stolen, uncertified vehicles are introduced.**

Keywords* - *Virtual Traffic Police, number plate detection, violations, Machine Learning.

I. INTRODUCTION

Violation of traffic rules has become a major issue in today's developing world. The rise in the number of vehicles every day has eventually led to a gradual increase in the sum of traffic rule violations. Automation in daily life has gained a lot of importance in the recent years. The main reason for the increase in number of violations is because of the violating rules such as breaking traffic signals, over-speeding, driving on wrong sides etc. In order to prevent these traffic violations, the police department should be present on the road and must continuously monitor the vehicles violating traffic rules [1]. According to the traffic rules, wearing helmet is mandatory and violating this rule results in huge fines. Despite implementing this rule, many motorcyclists are ignorant. To the present day all the developed cities have already installed video surveillance network to keep an eye on threats. Exploiting such kind of an already existing security system is a cost-effective decision, but this system includes most of the human performance which isn't effective for a greater period of time. As per studies performed in the recent times, it has been proven that human surveillance was not very effective, when the length of observation of videos increases, the errors performed by the humans will jointly increase. It has become a tough task even though the entire system of traffic management has been automated, due to the difference in plate formats, different scales, and non-uniform illumination conditions during image acquisition [3]. Capturing of number plate image, triple riding violations and detection of number plate can be performed by the suggested system. Identification of the license plate is done by License plate recognition application with image processing algorithm following which an SMS will be sent to the rule violator in case of a violation scenario. Nearly 75% motorbike riders who were involved in road crashes continued to wear helmets, shows the crash records. Also, the crash records show that nearly 75% of the motorcycle riders who were previously involved in road crashes continued to wear helmets. One of the main causes for dangerous accidents is the riders riding under consumption of alcohol which is a violation of traffic rule. The policemen receive the images of violation along with place, time, date and also an image of the vehicle through deriving devices in and around the location where the violation was caused [5]. Helmetless riding and triple riding detection are some of the issues that are covered under this system. This system helps in performing faster character recognition of the license plate. There are three steps included in this process. First step is encryption of license plate, irrespective of the size of license plate. The next step involves separation of the characters and the third step involves recognition of the characters from the license plate.

II. LITERATURE REVIEW

The paper [1] aim to facilitate traffic law enforcement through the use of a plate. Application for license recognition. The automated number plate detection system uses image analysis technology to identify vehicle number plates that will be used for car use in terrorist activities, smugglings, illegal number-plates, stolen vehicles and a few illegal activities. The system may also detect traffic violations in densely populated areas, near malls, universities and hospitals. Automatic tax collection and fine parking can also drive the use of this image recognition system. Car plate detection and monitoring is used in many applications, including traffic rating, traffic counts on highways, violators of signals, and inspection

requests. Automatic number tests are used to identify the car number plate using ANN and image segmentation. The program developed in MATLAB can make detection and recognition of a number plate. In paper [2] the Plate Recognition Identifies the number plate on the vehicle and extracts letters from it. LPR being a hot topic of research has a wide range of applications ranging from automated tax collection, to parking spots to traffic detection system. The purpose of the LPR program in this paper is to compare average precision, correctness and number of computations between various techniques. The LPR system here uses the Viola Jones Machine learning algorithm to detect and recognize the vehicle number plate. An identity photo is taken and processed using a number of algorithms including Local License Local Change and General, Feature Classification etc. to obtain a number plate. In paper [3] Application of License Recognition is a great and inexpensive alternative to motorcycle recognitional activities. Automatic license Recognition (ALPR) is employed to determine the number plate position. These techniques and technologies differ in supported contexts such as image quality, vehicle in mounted areas, flashing lights, single image etc. It addresses the similarities and differences of license plates from completely different nations. This method works seamlessly with a variety of flexible characters on plates or on size plates within a captive image. The target is the acquisition and recognition of a multi-vehicle registration number in one building. The paper [4] describes involuntary detection of motorcycle riders while not wearing a helmet, this is done through surveillance videos in real-time. The motor-cyclist while not wearing a helmet is first identified following the removal of the domain and certain classifications. The automatization of approach is particularly appealing as it is dependable and robust observation of such additional offences because it dramatically reduces the number of personnel needed. The approach is based on recovery time for motorcycle riders while not wearing helmets works in 2 stages. The paper [5] makes use of Optical Character Recognition (OCR) that is being used as smart travel applications to obtain licenses of the vehicles. a solid FPGA system based on the OCR system has been developed and tested with incomplete and noisy numerical images. The OCR system is housed in a neural feed network that uses an efficient and accurate neuron. The paper [6], To address the inefficiency of ancient computer-assisted visualization technology. the technique at ZYNQ is used to gain some gear speeding up of the algorithms plate detection system. This environment contains systematic thinking and process planning. In paper [7] in order to conform to the security measures, as to ensure safety estimates, detection of violators can be very desirable but due to several hurdles such as exposure, lighting, non-video surveillance quality, exceptions in any case, etc. The motorcycle auto-discovery framework is designed to drive while not wearing helmets for test video. The research paper [8] the awareness of increasing vehicles in every household is being highlighted. In last ten years, the range of vehicles is expanded considerably. Thus, it had become extremely tough on keeping trace of individual traffic for the purposes of traffic-management, its enforcement. According to paper [9] to any vehicle to be identified, the receipt of a plate number can hold a vital role in this operating world. To identify the most used vehicles in the field of safety and security, LPDR takes up a major contribution and is obliged in determinization of the vehicle identification number for a specific distance. In paper [11] Advanced Driver Assistance Programs, smart and autonomous vehicles are constantly promising solutions to strengthen road safety, road issues and passenger comfort. Such applications require advanced pc viewing algorithms that require high-power computers for high-speed process capability. The paper [12] signifies an automated automatic plate recognition system can be a key feature in traffic management. This can result in reducing various traffic violations. Advanced systems for tracking and detecting stolen, unauthorized vehicles mimic the support of automatic number recognition technologies. The main purpose here is to review some strategies associated with the proposal with an algorithm. In paper [13] the image-based retrieval method is used to recognize the car number plate using a smart phone to create a smart office car management system.

III. METHODOLOGY

Automatic Traffic Rule Violation Detection and Number plate Recognition mainly consists of three parts, helmet identification, triple riding and license plate recognition of motorcyclists, cars and trucks. The image is given to the camera as an input, where it is further being processed and checked for violation. The violation is categorized into two types – riding without helmet and passenger overloading. During these events the number plates of the vehicle is being detected, and then extraction of the characters from the number plate is done using OCR technique.

The use case diagram Fig 1.1 illustrates the client's relationship with the application, it demonstrates the client's relation to the distinctive use cases. The vehicle's image along with rider is clicked, which is then pre-processed. Post pre-processing, violation is detected. Then the system also recognizes the number plate in image.

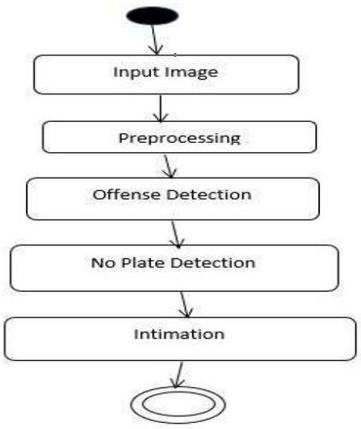

Fig 1.1: Work-Flow Diagram

A. HELMET DETECTION

YOLO refers to You Only Look Once. It is a convolutional neural network that does object detection in real-time. Working of YOLO is that, it makes use of one neural network for the input image, and then splits it into regions where it detects the bounding boxes along with probability for each of the regions. YOLO being a real-time object detection algorithm, here in our project Darknet framework is being used to train the neural networks which is basically in C and CUDA, and is the base for the YOLO algorithm. Object detection involves both detection and localization of object inside the image. So, detection is basically combination of classification and localization. YOLO uses CNN for object detection, yolo being one of the fastest algorithms in terms of detection and accuracy. The exact of them will be retained. While classification of the objects in image is one problem, the detection of the object and its localization is another. Classification can be done using neural network as classifier, yolo is a powerful neural net which tells what is in the image, it draws bounding boxes on all sides of the object. YOLO is a powerful neural network that has the ability to identify the objects in image in one single pass. In this project, there is a use of YOLOv3 which is a recent version of yolo that was released in April 2018. Also, Darknet, an open-source neural network framework for training YOLO, is used it sets the architecture for the network.

B. MORE THAN TWO PEOPLE DETECTION

Haar-Cascade is basically a machine learning approach for object identification, it identifies object present in the image based on some features. Here, it is used for face recognition. For this purpose, the model is first fed with positive and negative images. Positive images consist of images that should be identified by the classifier. Everything else is the negative images, which doesn't have the object in it which are intended to detect. In our case training is done on the classifier using bunch of images that contain both faces and also non-faces. This is used to detect the faces in real time. OpenCV is used to implement Haar-cascade algorithm. In order to detect face using Haar-Cascade algorithm, first, model needs to be fed with lot of positive as well as negative images. The important features are being extracted; features are nothing but the numerical information from the images. Features help us distinguish between different images. Also, the image is divided into grids, and if the grid is non-face window then it is directly discarded in single shot. This is an efficient technique that has been introduced by Paul Viola and Michael Jones. Features include Edge features and Line features. Subtraction of sum of pixels under the white rectangle and sum of pixels under the black rectangle gives the value of the features. There are more than 16000 features, Adaboost helps us find the most relevant ones among the huge number of features. All of the features are being fed to training images, then best threshold is
chosen such that it organizes the image to be a positive and a negative image. Then select those features that best classifies the image that is the feature with minimum error rate. Algorithm are used. Gaussian Blur Algorithm is used as a pre-processing step, where the image is smoothened out and is slightly blurred. The blurring of image is mainly done to shove off the noises and any kind of distortion from the image. But, during this process the edges of the object in the image can also be lost. The gaussian blur filter is designed keeping this factor in mind. It blurs out the overall image but retains the edges, which is crucial for cropping out the number plate section from the image.

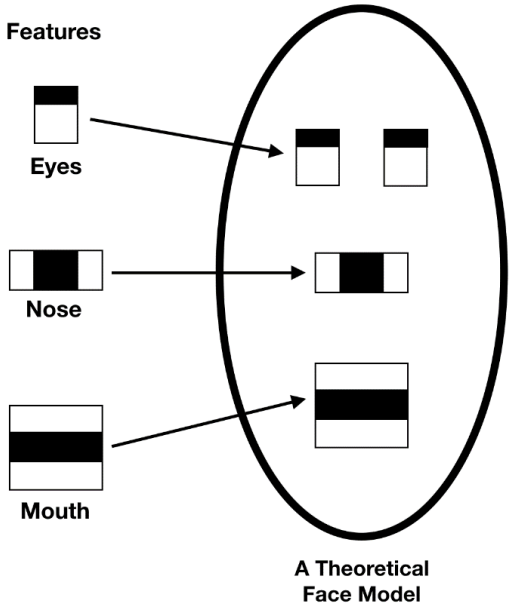

Fig 1.2 Haar-Features

C. OPTICAL CHARACTER RECOGNITION

Optical Character Recognition (OCR) is a technique applied to extract characters from image or pdf's or any kind of handwritten documents. This is one of the methods used in scanners, where each character or feature of the images are extracted and then made as a copy. OCR is been an effective algorithm to identify the registration

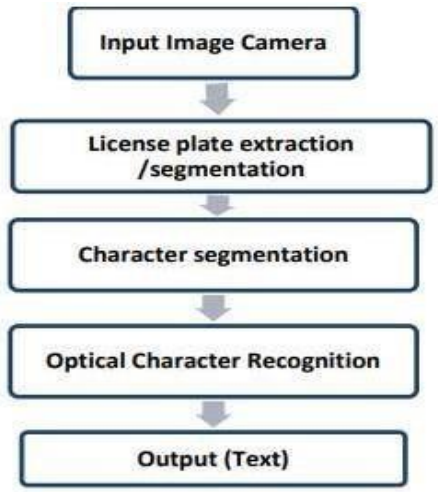

plate of the vehicles and obtain the characters which is

further used to match with the database the find the violator.

Fig 1.4 Steps in OCR

the violator. The number plate recognition using OCR starts with image acquisition, then the image is being pre-processed to remove any distortions and noise from the image. Then number plate is then localized irrelevant part and characters in the number plate are segmented and then the recognized and output. Acquisition includes acquiring input image either from a digital or a mobile camera. Images are taken under various frames and lighting, distance factor that are of course obligated for the distortion at the time of photographs. These images are generally in RGB format. The image will be transformed into grey-scale, binarized image in this step. It's further processed to remove any distortions or noise in the image. The unwanted region should also be removed other than the number plate section. This is done with help of few edge detection techniques and blur algorithms. In our project Canny Edge detection and Gaussian-Blur Algorithm are used. Gaussian Blur Algorithm is used as a pre-processing step, where the image is smoothened out and is slightly blurred. The blurring of image is mainly done to shove off the noises and any kind of distortion from the image. But, during this process the edges of the object in the image can also be lost. The gaussian blur filter is designed keeping this factor in mind. It blurs out the overall image but retains the edges, which is crucial for cropping out the number plate section from the image.

IV. CONCLUSION

Automatic Traffic Rule Violation Detection and Number plate Recognition Using ML detects the traffic rule violators like motorcyclists without helmet and passenger overloading. The system is fully automated and works in absence of Traffic police. Also, the deployed system will be capable of detecting and recognizing different dimensions, contrast, colors license plates with variety of character font style therefore providing high accuracy for heterogeneous number plates. The program consists primarily of three parts– helmet identification, triple riding and license plate recognition of motorcyclists violating the traffic rules. Important regions of number plate recognition system are flourishingly developed. First the input is acquired from the camera of Laptop, in pre-processing step noise is removed and part in the image is found where the plate is, then the license plate is localized and is extricated by use of edge detection method, then dissolution of every character is done independently. Finally, Tesseract OCR is used to derive the characters from the number plate. The license plate recognition detects number plates of all types of vehicles like car, truck and motorcycle. It also works on different number plate styles and fonts with high accuracy.

V. REFERENCES

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