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# Bike Riders Unusual Behaviour Detection System Using Haar Cascade Algorithm

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***Abstract***
*Effective traffic management and ensuring the safety of people on the road is also of paramount importance and challenge. Traffic congestion is an unfortunate familiar companion of every city dweller living in busy, non-static cities. In order to control traffic both manually and automatically, accurate vehicle detection is very important. In this project, a model for detecting certain vital signs to ensure road safety was proposed, such as mobile use by drivers, people without helmets and people traveling in threes on motorcycles, as well as monitoring license plate recognition based on machine learning and image processing technology. This system first converts RGB street images into HSV images. Then it analyzes the value readings that identify the brightness of the images to determine the exact objects in the images by comparing the value readings to a calculated threshold parameter. In this phase, two different methods were used to detect people and objects such as vehicles and mobile phones. During object detection, comparison is made between the foreground image and the background image to extract the objects like vehicles and mobile devices using the object detection algorithm. On the other hand, during human detection, the Then a counting method is applied to count the number of faces detected in the frame to identify the number of people traveling in a motorcycle. The license plate number can be recognized using the OCR algorithm. Upon detection of one or all cases, the system sends an email notification to the traffic department using the SMTP protocol together with information about the detection and the picture taken at the moment of detection for the traffic department, which issues a penalty for this vehicle user. Traffic safety is thus effectively guaranteed. This proposed model is tested on different datasets and shows an average accuracy of 97% for object and face detection.*

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## I. Introduction

### 1.1 Overview

The standard traffic control systems used are very antiquated compared to our current fast pace. Manual control and automatic control are the two most commonly used systems. Manual control involves the presence of the traffic police, where the traffic signals are controlled by his commands. On the other hand, the automatic control system uses constant timer technology in which the signal changes after a fixed time interval. Image processing techniques can be implemented to manage a traffic control system and avoid the above disadvantages while providing a more efficient approach. they also developed an infrared object detector system. The systems implemented above require many hardware installations, which can often lead to erroneous results due to interference in signals. Therefore, image processing is an effective approach compared to these traditional methods. Another method used edge detection in their research to identify vehicles. However, the detection of the vehicles and the mobile phone can be done without the implementation of edge detection by using the comparison of pixels of foreground and background, thereby increasing the efficiency of the system. An HSV-based approach was implemented, where they experimented with the hue and saturation value of the image to determine the objects of interest in the images. Only the value parameter of the images was included in this study after analysis to distinguish between object and background. We eliminated the mentioned processes and directly converted the RGB foreground image to a black and white format with a threshold to keep only the spotlight pixels and eliminate any unnecessary ones, increasing the overall efficiency of this system. In addition, the efficient algorithm called HAAR cascade classifier is used to detect the human faces in the image, which in turn is helpful to detect the person not wearing a helmet and people traveling as a threesome.

**1.2 Objective**

The main goal of this project is to ensure road safety and traffic management in an effective way using artificial intelligence.

Implement real-time roadway monitoring in an autonomous way using image processing techniques.

Detection of people not wearing a helmet, people traveling as a three-wheeler, mobile use by the driver and also recognizes the vehicle license plate number and sends it to the relevant authority via email notification at the right time.

**Proposed System**

In this proposed work, we tend to implement three detection mechanisms to ensure public and driver safety on roads.

Using machine learning and video analytics, the driver using a cell phone that causes distracted driving can be detected using RGB conversion and object detection algorithms. Also, in this system, people riding motorcycles in triples are detected using a hair cascade algorithm, which first detects the presence of faces and then counts the number of faces in the frame.

When it reaches 3 or more, the intimacy is sent. In addition, this system uses the same facial recognition technique, even when it detects and identifies drivers who are not wearing a helmet and then captures their image, which is then sent to the necessary department to avoid future consequences.

The license plate number is also recognized using the OCR algorithm and sent to the email notification.

In this system, the SMTP protocol is used to mail the captured information along with the captured image immediately after the capture of one of the four parameters mentioned above has taken place, and the penalty is levied on that vehicle user.

**System Architecture**

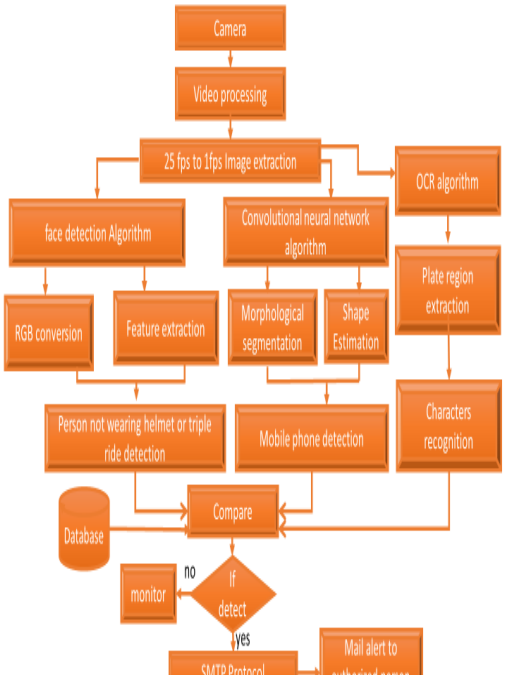


**Figure 1. Architecture design of the proposed system**

## II. Methodology

This section presents the proposed approach for real-time detection of motorcyclists without a helmet, which works in two phases. In the first phase we recognize a motorcyclist in the video image. In the second phase, we locate the motorcyclist's head and determine whether the rider is wearing a helmet or not, whether the rider is using a mobile phone while driving, and whether the rider is traveling with tricycles. To reduce false predictions, we consolidate the results from consecutive frames for the final prediction.

**Haar Cascade Algorithm**

Haar Cascade Detection is one of the oldest yet most powerful face detection algorithm invented. It's been around long before deep learning became famous. Haar features were not only used to detect faces, but

also for eyes, lips, license plates, etc. The models are stored on GitHub and we can access them using OpenCV methods.

**Vehicle Detection**

Image processing is the study of any algorithm that takes an image as input and returns an image as output. Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image.

**Morphological Operations**

Local pixel transformations to handle area shapes most commonly used with binary images. Logical transformations based on comparing pixel neighborhoods to a pattern. While point and neighborhood operations are generally designed to modify an image appearance for visual reasoning, morphological operations have been used to understand an image's structure or shape.

**Thresholding**

Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images. Image thresholding is a simple, yet effective, way of partitioning an image into a foreground and background.

Original image After thresholding image

**Figure 2. Thresholding image**

**Ocr Algorithm**

OCR (Optical Character Recognition) is the technique that identifies printed or handwritten characters. First, the coloured images are converted to gray for easier processing. Noise in the image is removed by performing operations such as erosion and dilation. The license plate is localized and divided into blocks for character recognition.

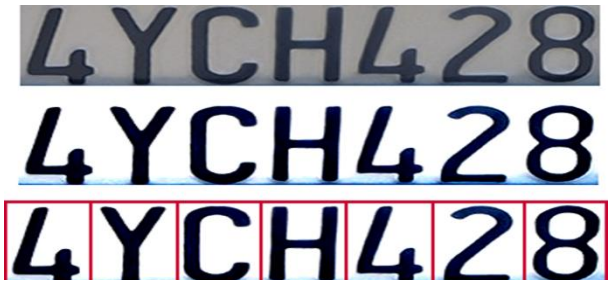


**Figure 3. Character recognition image**.

**DETECTION MODULE**

In this module, using the haar cascade classifier algorithm, the rider who does not wear a helmet and people who ride triples on motorcycles are detected using the face recognition technique. And by using the CNN algorithm for object recognition, drivers using mobile phones and vehicle license plates are recognized effectively and with high precision using the OCR algorithm.

**Figure 4. Mobile Usage and without Helmet detection**

**Figure 5. Triples riding detection**

**1.Face detection**

In this module, the HAAR cascade classifier is used to detect the presence of faces in the frames using the face detection algorithm. It uses a feature extraction technique to perform face recognition to identify the human face in the image frame.

**2.Object detection**

In this module, a specific CNN algorithm is used to detect the objects of interest (here mobile phones and vehicles) by implementing morphological segmentation and shape estimation techniques in the input images. Background subtraction is effectively used to eliminate unnecessary objects in the image.

**SMTP MODULE**

In this module, the warning email is sent to the concerned authority using the SMTP protocol after a parameter is detected. SMTP protocol is used to email the detected information along with the captured image right after detection and Penalty is charged for that vehicle user.

## III. EXPREMENTAL RESULTS

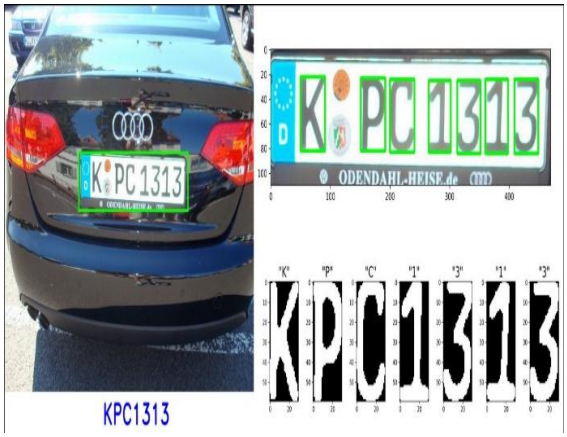


**Figure 6. Number plate recognition**

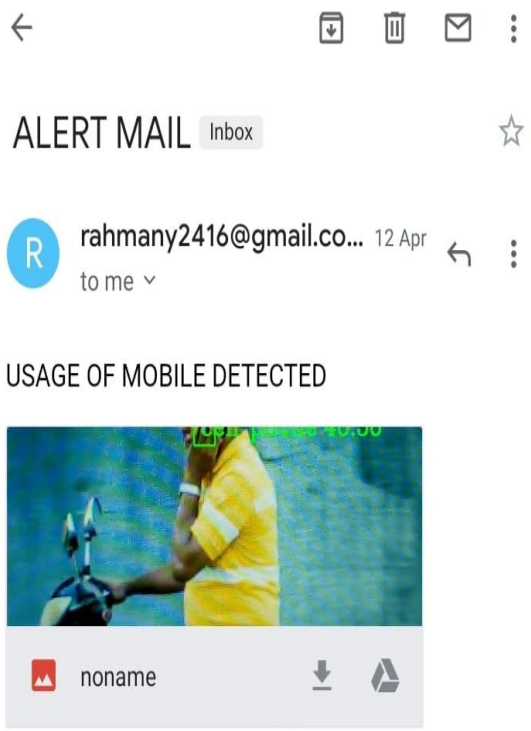


**Figure 7. Alert mail for usage of mobile detection**

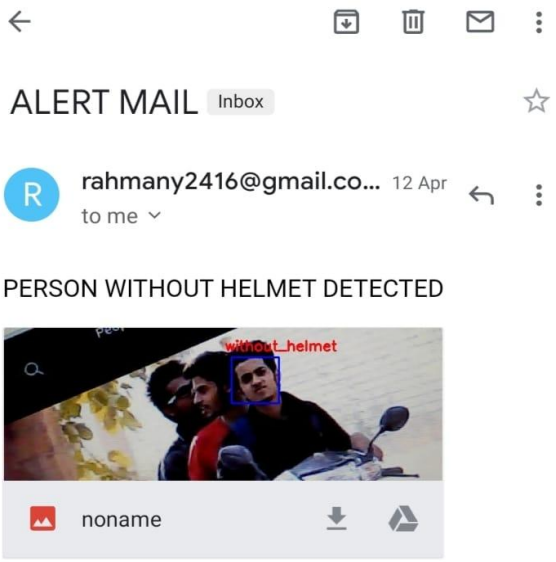


**Figure 8. Alert mail for person without helmet detected**

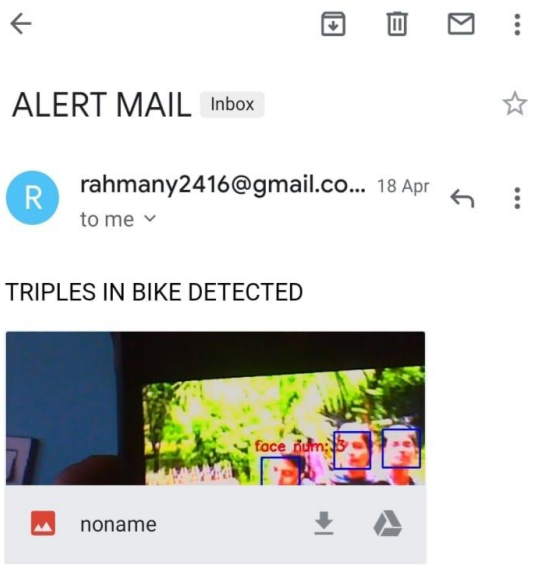


**Figure 9. Alert mail for triples in bike detected**

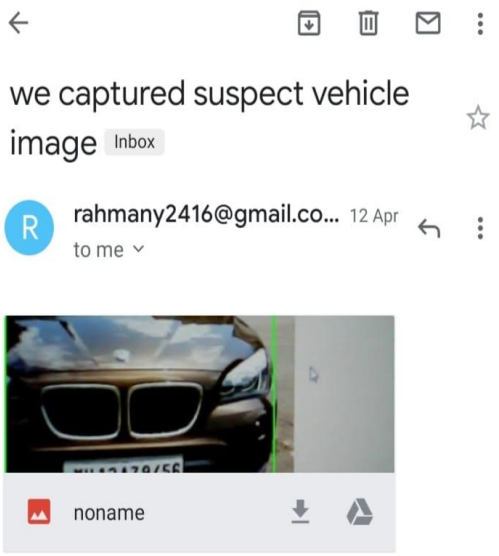


**Figure 10. Alert mail for suspected vehicle detected**

## IV. CONCLUSION

This project presented an algorithm that allows to extract features of an image to detect mobile phone usage by drivers in a car and a vehicle parked in a no-parking area. Usually the system has mobile detection or parking management. But our approach integrates both applications. Also, it includes detection of riders not wearing a helmet and triple rides in motorcycles using the HAAR cascade classification algorithm and license plate recognition using the OCR algorithm. Our technique showed better results in performance with the integration of four important detection parameters that play a crucial role in ensuring road safety and traffic management.

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