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# Automatic Helmet Detection Using Surveillance Video in Real Time

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**ABSTRACT**— Motorcycles have always been the primary mode of transportation in developing countries. Motorcycle accidents have increased in recent years. One of the main reasons for fatalities in accidents is that a motorcyclist does not wear a protective helmet. The most common way to ensure that motorcyclists wear a helmet is by traffic police to manually monitor motorcyclists at road junctions or through CCTV footage and to penalize those without a helmet. But it requires human intervention and effort. This system proposes an automated system for detecting motorcyclists who do not wear a helmet and a system for retrieving motorcycle number plates from CCTV video footage. We have developed a system which identifies the number and the head portion is located and classified as a helmet or non-helmet. The system extracts objects class based on feature extracted. The system uses You Only Look Once (YOLO) which consists of Convolutional Neural Networks and combined with computer vision. Finally, the motorcyclist without a helmet is identified then extracts the characters of the number plate using OCR

**KEYWORDS** : - Helmet Detection, OpenCV, YOLO, CNN, OCR.

## 1. INTRODUCTION

Motorcycle accidents are growing consistently throughout the years. Wearing helmets is critical to decrease the danger of injuries during accidents. Here we propose an approach for programmed identification of bicycle riders without helmets and who are triple riding. Using the process of image recognition in digital image processing. Bike accidents without helmets are far more likely to result in death or brain trauma than ones where the riders' head was properly protected. In 2014, according to the Insurance Institute for Highway Safety, over 60% of deaths in bicycle crashes were people who were not wearing a helmet. Laws making helmet use compulsory are important in increasing the wearing of helmets, especially in low-income and middle-income countries where helmet-wearing rates are low, and where there are large numbers of users of motorized two-wheelers. There have been many studies that have evaluated the impact of motorcycle helmet laws on helmet-wearing rates, head injury or death. When mandatory helmet laws are enforced, helmet-wearing rates have been found to increase to 90% or higher; when such laws are repealed, wearing rates fall back to generally less than 60%. The primary aim of our project is regarding the safety of the motorcycle riders. Drivers without helmets are detected. Other benefits include; The Motor vehicle department is able to reduce the number of accidents, real time identification and punishment of defaulters is possible, software capability to detect the violation of rules, enforcement of law and order in society.

A helmet aims to scale back the impact of a force or collision to the head by an accident, that reduces a chance of great head and brain injuries by dissipating the force and energy of the impact, motorcyclists must take extra precautions to guard their bodies. As the law mandatorily tells that, every motorcyclist must wear a helmet while riding a motorbike. Wearing a helmet over non helmet wearer increase their possibility of survival.

## II. LITERATURE SURVEY

[1] Madhuchhanda Dasgupta, Oishila Bandyopadhyay, Sanjay Chatterji, Computer Science & Engineering IIIT Kalyani West Bengal, India, "Automated Helmet Detection for Multiple Motorcycle Riders using CNN". The ability to continuously monitor vehicle compliance with traffic rules is an important component of any effective traffic management system. In India, motorcycles may be one of the most prominent modes of transportation due to the fact that there are many citizens in urban areas. It has been stated that most motorcyclists have abstained from use of head



protection in city traffic or even in the roadway driving. Many studies have shown that using a helmet on motorcycles reduces the likelihood of head and brain injuries when one is involved in a collision. Most traffic and safety rules are now monitored by a traffic video surveillance camera system, which allows the rules to be observed by means of breach of today.

[2] Y Mohana Roopa, Sri Harshini Popuri, Gottam Gowtam sai Sankar, Tejesh Chandra Kuppili, Computer Science and Engineering Institute of Aeronautical Engineering, Hyderabad, India,” Convolutional Neural Network-based Automatic Extraction and Fine Generation. . It had helped me to come up with a great idea Humanity, particularly as a human beings, possesses a characteristic tendencies such as these: seeing correlations between causes and effects, ignoring what is related, and neglecting what has little bearing on the occurrence, and also perceiving faults in things that are not present.

[3] Bhavin V Kakani, Divyang Gandhi, Sagar Jani, E&C Engineering Department Institute of Technology Nirma University,” Improved OCR based Automatic Vehicle Number Plate Recognition using Features Trained Neural Network”. A major portion of the current focus in intelligent transportation is on expanding algorithms and discoveries in the research and development realm. A significant improvement is necessary in traffic and parking/facility regulation, and traffic control with the use of a rapid, integrated and highly reliable automatic recognition plates reading system. This paper is intended to be the starting point of departure for a new OCR techniques that have enhanced the neural trained features for object recognition

### III. PROPOSE METHODOLOGY

The system is divided into two modules:

- 2.1 Helmet Detection
- 2.2 Number plate Detection

#### 2.1 Helmet Detection

CNN that exists now helpless to regulate the challenges in real-world for helmet wear analysis like helmet detection of motorcyclists, so better to go with a new one that is faster R-CNN. This is because to seek out a sturdy and perfect model in accuracy for classification. Overlapping area of bike rider at a certain point of time is examined and also a set of coordinates dynamically depends on the position of the bounding boxes that are created around the motorbike and rider. The detected motorcycles were first manually classified into the helmet and non-helmet classes for training the device by cropping the image using coordinates of bounding boxes these cropped images from the frames are motorbike person combinations. Image classification model allows pictures to pass through it for the detection of helmet and thus if it is not helmet then it saves the image in a directory else it is simply removed.

#### 2.2 Number Plate

Detection Optical Character Recognition (OCR) is aimed towards the acknowledgement of the vehicle number. Line separation using the row segmentation have been performed. Later the line separation is applied for the columns to perform individual character separation. Different variables are accustomed store the separated characters. An alphanumeric database is taken into account like reference to compare with the OCR of every character.

### IV. IMPLEMENTATION

The implementation part of this research is carried out in 3 different parts. The first part consists of the Detection of Helmeted and non-helmeted motorcyclists from a video source using the Convolutional neural network algorithm. The second part follows a similar procedure, but the data would be trained with the YoloV3 algorithm. The fourth part involves applying OCR techniques for the detected license plate images to extract the alphanumeric characters.

#### 4.1 Flowchart of Helmet Detection Using YOLOV3:

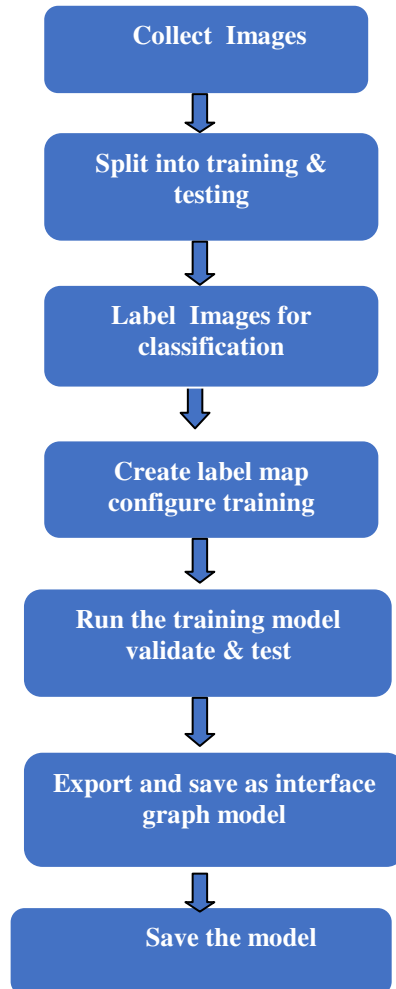


Figure3.1. Flowchart for Helmet Detection

#### 4.2 Helmet and Non-helmet detection

Gathering images (Creating data set): To detect a bike rider with helmet or without helmet. We need bunch of images of bike-riders with helmet, bike-rider without helmet and bike license plate. In this project, we used 1000+ images



Figure 3.2. Helmet Dataset

In this project, we used 1000+ images. For implementation, Google Colab has been used with a runtime set to use GPU for acceleration. The initial step is to mount Google drive to the Colab. The YoloV3 model that is needed to be implemented is cloned from the repository5 . For custom object detection for YoloV3, 3 significant files are to be created and modified. The first one is a custom configuration file where we can set custom filters and batch sizes for the neural networks. The batch contributes to the number of images processed per iteration. The batch number will be set as 64. Further, the smaller number of batches can be created using subdivision and this count will be set to 16. The maximum number of batches (max\_batch) sets the number of iterations for the darknet Yolo. 2000 iterations for a single class are ideal for this application. Since we have 2 classes (Helmeted riders and non-helmeted riders)  $2000 * 2 = 4000$  will be set as max\_batch.

The second file will be the object data file. The object data file contains the information regarding the number of classes, paths associated with the training, test and validation folders that contain both the images and corresponding annotations. Since the data is present in google drive which is mounted to Google colab, the corresponding path to data can be copied from the colab when it is connected to the runtime environment. The third file will be the object names file which contributes to setting the name of the classes that are to be detected from the video. ‘With Helmet’, ‘Without Helmet’ is set in this file Darknet algorithm is developed to take full advantage of CUDA and CUDNN architectures which are needed to run the models with the help of GPU. Hence CUDA and CUDNN are enabled for this purpose. The data is present in .zip format in Google Drive, these contents are unzipped to corresponding folders created in the colab. Training and Test files in .txt format contain the list of names of the data in corresponding folders. This is generated by invoking the process file in the model. Then the model training will be initiated. The Mean Average Precision (mAP) and the loss function calculation are carried out by the darknet detector for every 100 epochs. The threshold value is set to 0.5 to not include detections with a confidence score below 50%.

Now two cases Arise:

- Case 1: When the motorcycle rider is wearing helmet
- Case 2: When the motorcycle rider is not wearing helmet.

**Helmet Detection**

**Non Helmet Detection**



Case 1



Case 2

Figure 4.2.1 Helmet and No Helmet

After applying cropped image to helmet detection model, output is as shown. The bounding box around helmet along with the detection probability is displayed as shown in (Rider2.jpg). As the rider wearing helmet in Case 2, no further processing is necessary. Since in Case 1, rider is not wearing helmet, no bounding box is created

### 4.3 Number plate Detection

The image of non-helmet wearer from the previous step is used as the input for this process. The extraction of license plate is done using tesseract OCR. The YOLOv3 model which trained was successful in detecting license plate from the image and draw bounding box around it. Then using the coordinates of the bounding box only the portion inside the bounding box is cropped out. This this cropped image is used for image processing for making better reading by the OCR. Using the OpenCV library canny edge detection is done followed by dilation process. Then contours are drawn and also unwanted contours are filtered out. This image is then given as input to tesseract OCR. Then this OCR with extract the license plate number from the image processed image.

In our trained model, when we test our test images everytime we get human without helmet we crop the number plate part from the images with the help of the coordinates we defined in the annotation. Then the cropped image part is processed for registration number extraction.

#### 4.3.1 Implementing Optical Character Recognition for the License plate

Two significant steps are involved in extracting the alphanumeric characters from the license plate. The first one is to detect and isolate the region of interest (ROI). The second step involves applying Easy OCR, which is a python package that can be imported for performing text and numerical character extraction. The ROI is selected by using the scores of the bounding boxes created during the license plate detection phase. The image under the scores (xmin, ymin, xmax, ymax) are only retained and the rest of the image is ignored. The Easy OCR package will be applied to perform the alphanumeric extraction from the images.



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Figure 4.3.1.ROI Filtering

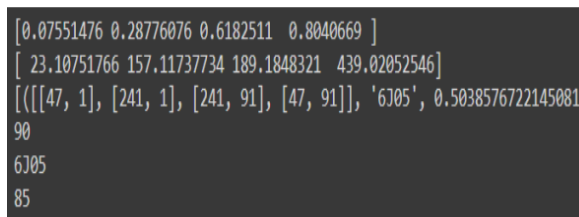


Figure 4.3.2.Performing OCR

If the helmet is found, there is no need for this step. However, if the helmet is not found, then the motorcycle image is given as input to license plate detection phase. Where the image is passed to this library to detect the License Plate Number and Return it and Store it for Further use.

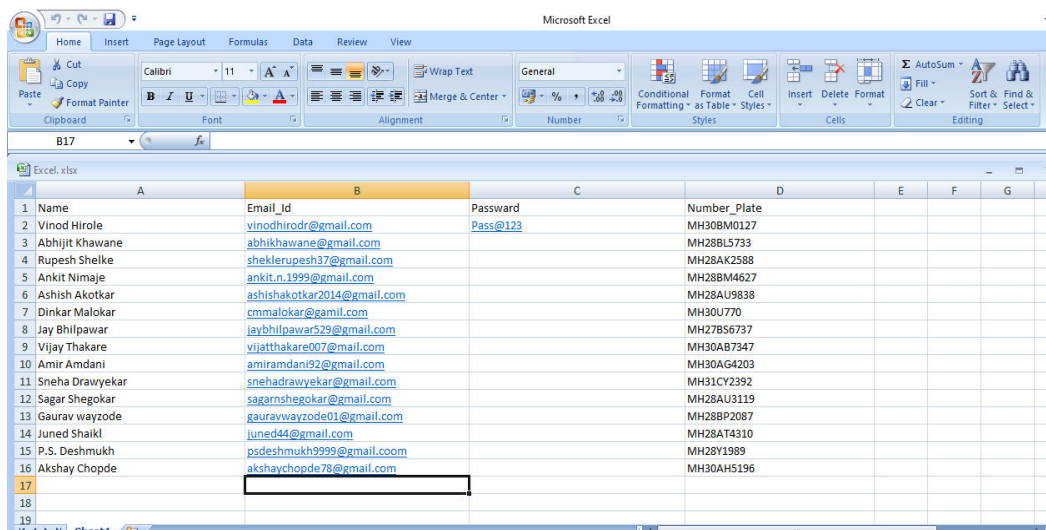


Figure 4.3.3 Database created in Spreadsheet

Platerecognizer is an open source Automatic License Plate Recognition library. The library analyzes images and video streams to identify license plates. The output is the text representation of any license plate characters. Further this Detected LP Numbers are injected to Database for extracting the further details of the Violator

#### 4 . RESULT

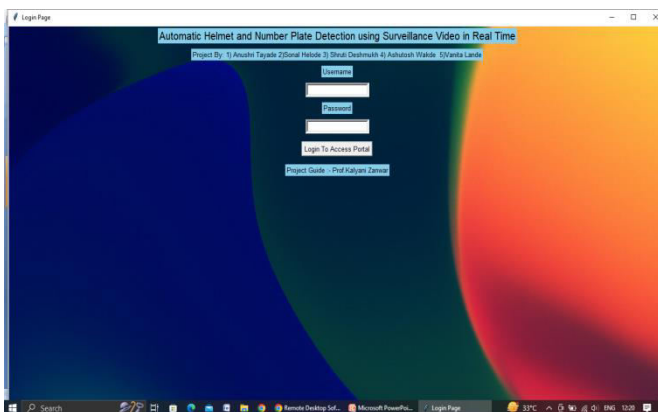


Figure 5.1 Login page

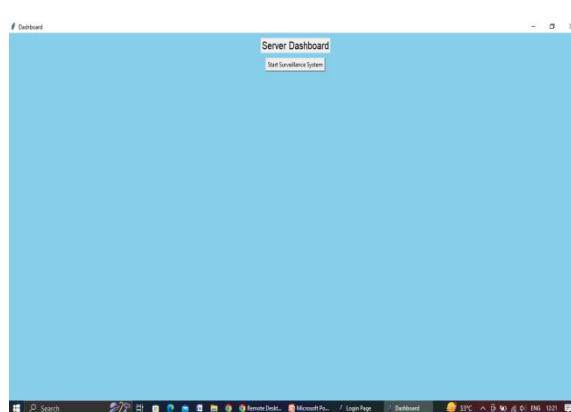


Figure 5.1 Server Dashboard

Firstly , We login the system with Id Password then system get start, after that server dashboard is open and Surveillance camera will be start for detecting biker without helmet

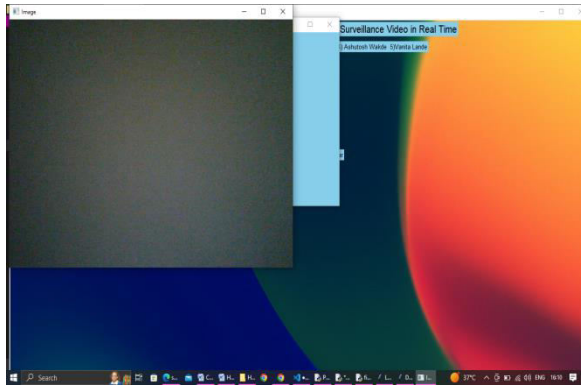


Figure 5.3 Start Surveillance Video



Figure 5.4 Output

Our system detected the person with helmet or without helmet head detected by blue frame and number plate detected by red frame.

## V. ADVANTAGES

1. Reduce Human Works.
2. If we use helmet it increases of survival by 42%, it also reduces the injuries up to 70%.
3. It will help to create awareness about the need to wear helmet during motorcycle riding.
4. It will help to reduce the number of road accident which are very frequent in a country like India

## VI. CONCLUSION

Motorcycle accidents have been growing consistently throughout the years. Because of different social and monetary elements, individuals pick motorbikes over other vehicles as it is significantly less expensive to run, less demanding to park and adaptable in rush hour gridlock. Here we propose a system to detect motorcycle riders without helmet and sending a message to the motorcycle owner if he/she is not wearing the helmet. This system can save many lives as about 400 motorcycle riders perish every day in India because of not wearing helmet. If we use helmets it could increase the chances of survival by 42 percent. It also reduces the injuries up to 70 percent. In future, the system can be expanded by detecting motorcycle riders without helmet along with those who are triple riding. The proposed system will also assist the traffic police for such violators in odd environmental conditions like hot sun, rain etc.

## VII. FUTURE SCOPE

The system implemented is a prototype. It can be expanded to process the day-to-day traffic video by attaining the permissions of the required authorities. A large database is created to maintain the records of the violators and their payment of the challans being monitored every few minutes. Also, the identification of the license plate becomes the core part of this project. So, a camera of high resolution is recommended to maintain precision and accuracy. For sending the challan directly to offender's mobile numbers, the subscriptions for SMS are required, as of now it is sent through mail ids, but the motto to send the challan to their mails as well as through SMS along with their violation photo, time and date. Our system is developed to process the above-mentioned future implementations.

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