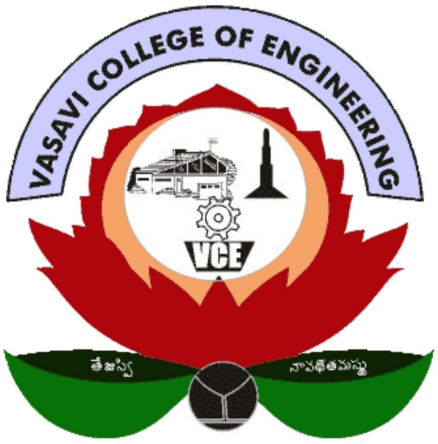

Department of Electronics and Communication Engineering

Vasavi College of Engineering (Autonomous)

ACCREDITED BY NAAC WITH 'A++' GRADE

IBRAHIMBAGH,HYDERABAD-500031

CERTIFICATE

This is to certify that the Mini Project titled **"TRAFFIC VIOLATION PROCTORING SYSTEM:** Helmet Detection" submitted by

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Students of Electronics and Communication Engineering Department,Vasavi College of Engineering in partial fulfillment of the requirement of the award of the Degree of Bachelor of Engineering in Electronics and Communication Engineering is a record of the bonafide work carried out by them during the academic year 2022-2023.

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E.C.E Department

HOD-ECE

INDEX

1.ABSTRACT

While riding a bike or when we are out for a ride on a vehicle, we come across the slogans and statements such as:

"WEAR HELMET","NEVER RIDE WITHOUT HELMET".
All over the world millions of people are loosing their lives due to road accidents.Most of them are loosing lives mainly in car and bike accidents. We know that two wheeler is the most used means of transport,but driving it,is associated with high risk due to less protection.To increase the protection one should be disciplined and habituated to wear helmet while driving it.

So we have proposed an approach called "TRAFFIC VIOLATION PROCTORING SYSTEM:HELMET DETECTION".

This helmet detection has been detected by machine learning algorithm known as YOLOv3,which uses tensorflow and keras libraries.
Our Aim is to decrease the danger of injuries in case of a bike accident without helmet,such that increase the safety while on the road.

2.Literature Survey

Literature Survey gives the research work related to this project done by several scholars ,scientists,reasearchers.Some of the reasearch work on this Project is:
Recently,most of the methods used for object detection are Haar,LBP,SIFT,SURF etc..

Silva et al.use methods such as histograms of orient gradient and wavelet transform for feature extraction for classifying motorcyclists with helmets and without helmets.

C.Vishnu et al. proposed an approach using Convolutional Neural Networks for Classification.CNNs performs both the automatic feature extraction and classfication,and dominated all other previously existed methods any many ways and improved the solutions for many problems.

Li and Shen use a deep convolutional neural network and long-short term memory for the license plate recognition and character extarction process.They use two methods for segmentation and recognition.

Finally,YOLOv3 which is capable of accurate object detection with near real-time performance(25 fps on HD images) in various driving conditions .For example:Bright and Overcast sky,snow on the streets and during night time.

3.Problem Statement

Existing system monitors the traffic violations through CCTV recordings,where the traffic police must investigate the frame where the traffic violation is happening,zoom into license plate in case rider is not wearing helmet.But this requires a lot of manpower.

Ours is a system,which would automatically look for traffic violation of not wearing helmet while riding motorcycle and if so,would automatically extract the vehicles license plate number.

Our miniproject mainly focuses on the detection of helmet using deep-learning algorithm called YOLOv3 which uses Convolutional Neural Network and extract the number plate,which in turn reduces the manpower and also creates a sense of fear among the persons and make them discipline to wear helmet while riding a motorcycle.

4.Existing Methods for Object Detection

Some of the Deep-Learning Approaches for Object detection are as follows:
a)Single Shot Multibox Detection

Single Shot MultiBox Detector SSD uses VGG16 to extract feature maps.For each cell also called the location,it makes 4 object predictions.Each prediction composes of a boundary box and 21 scores for each class,and we pick the highest score as the class for the bounded object.
b)R-CNN,Fast R-CNN,Faster R-CNN :
In this algorithms we try to draw a bounding box around the object of interest to locate it within image.There could be many bounding boxes drawn across the image to represent the different objects within the image.

The Major drawback of this Regional Proposals is that we cannot proceed with this with by building a standard convolutional network followed by a fully connected layer is that,the length of the variable is not constant,because of the number of the occurrences of the objects of interest is not fixed.
c)YOLOv3.
The detailed explanation Yolov3 is given below.

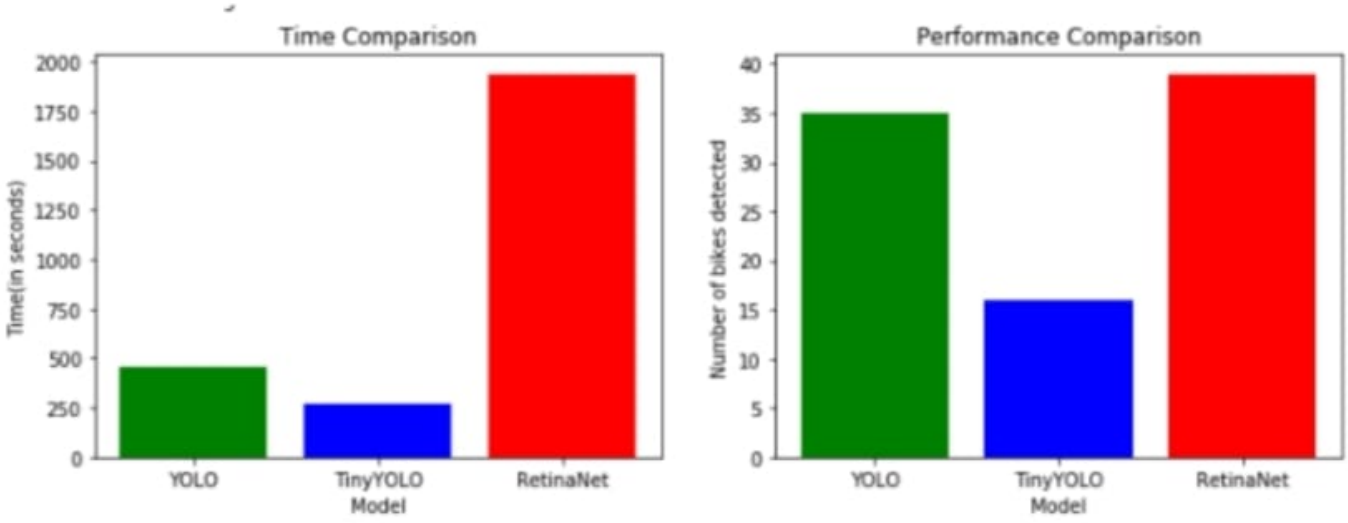

Figure 2.5. Algorithm comparison

5.Object Detection

YOLOv3

YOLOv3(You Only Look Once,Version 3)is a real time object detection algorithm that identifies specific objects in videos,live feeds or images.YOLO is implemented using the deeplearning libraries such as OpenCV,Tensorflow and Keras.

YOLOv3 algorithm consists of fully CNN and an algorithm for post-processing outputs from neural network.CNNs are special architecture of neural networks suitable for processing grid-like data topology.The distinctive feature of CNNs which bears importance in object detection is parameter sharing.In CNN architecture each member of the kernel is used at every position of the input,which means learning one set of parameters for every location instead a seperate set of parameters. This feature plays important role in capturing whole scene on the road.

This algorithm starts with extraction of single image from video stream, in a step extracted image is resized and that represent input to Yolo network.Yolo v3 neural network consist of 106 layers.Besides using convolutional layers,its architecture also contains residual layers,up sampling layers,and skip connections.

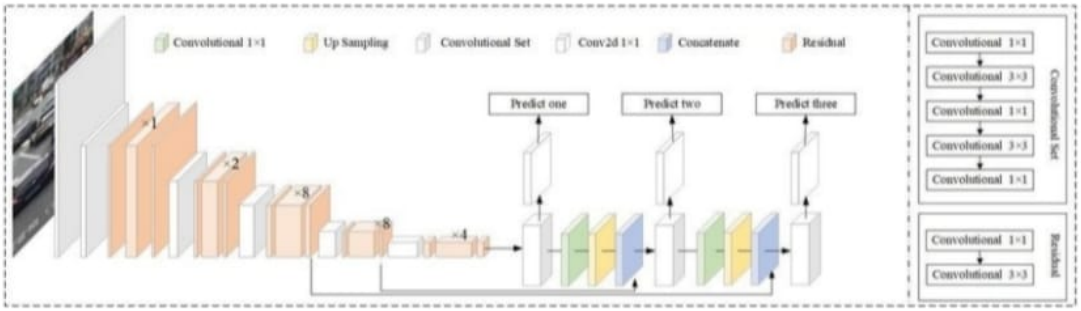

Figure 2.2. Overview of YOLOV3 algorithm.

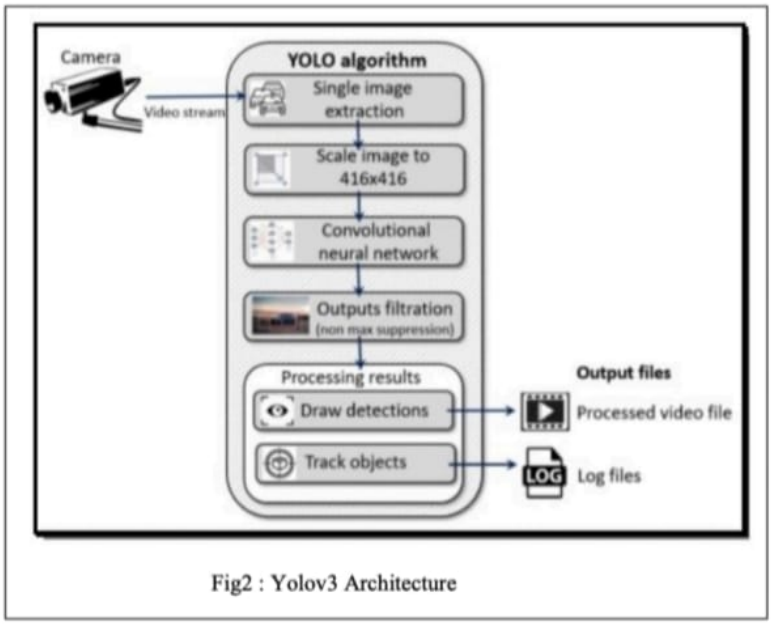

Figure 2.3. YoloV3 Architecture

6.Software Involved and environment used

PYTHON

Python: The programming style of python is simple,clear and it also contain powerful different kind of classes.Moreover,python can easily combine other programming languages such as c ,C++. As a successful programming language,it has it's own advantages:

- Simple and easy to learn.
- Open source
- Scalability.

This detection of helmet using deep learning is done in Python IDE,the deep learning libraries are involved are installed in it and the code is coded to get the required output.

VSCODE

It is a source code editor which can be used with a variety of programming languages,including

,c,c++,java,Python.This is based Electron framework,which is used to develop Node.

Visual studio code can be extended via extensions,available through a central repository.Out of the box, Visual studio Code includes basic support for most common programming languages.This basic support includes syntax highlighting,bracket matching,code folding,and configurable snippets.Visual Studio Code also ships with IntelliSense for JavaScript,TypeScript,JSON,CSS,and HTML,as well as debugging for Node.js.Support for additional languages can be provided by freely available extensions on the VS Code Marketplace.

7.Flow of the solution

The process begins with installation deep learning libraries such as:
a)Numpy
b)Tensorflow
c)Keras
d)Open CV

After installation of these libraries,already pretrained Yoloweights and configurations of helmet detection are loaded using OpenCV's dnn module. Again Using the same OpenCV library a input video is captured and and exception handling function written to detect the person with helmet and without helmet.

In our Code the model is trained in such a way that initially the Number plate gets detected,after detecting it the algorithm checks and gives the output of that a person is wearing helmet or not.
Using the classes.txt, Labels are given in it to display NO-HELMET and HELMET on the screen.
This helmet detection is carried in such a way that initially a rectangle bounding boxes are drawn across the helmet that is around the head region and gives the required output.

Numpy: In Python, there is data type called array. To implement the data type of array with python, NumPy is the essential library for analysing and calculating data. They are all open source libraries. NumPy is mainly used 22 for the matrix calculation

OpenCV: OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. The library is cross-platform and free for use under the open-source BSD license.
OpenCV supports the deep leaning framework TensorFlow, Torch/PyTorch and caffe. This library is

used in taking video input and splitting into many frames and and we know each frame is collection of many pixels and each pixel contain a colour, by default image is stored in BGR format so it is used to convert it into RGB format which is very helpful in detecting our license plate and motocycle[1],[3]

Pandas,Matplotlib: pandas is a fast, powerful, flexible and easy to use open source data analysis and manipulation tool,built on top of the Python programming language. Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible.

Keras: Keras is an open source neural network library written in Python. It can run on top of TensorFlow, Microsoft Cognitive Toolkit, or Theano Designed to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible Keras.This is done via the keras preprocessing image.ImageDataGenerator class. This class allows you to configure random transformations and normalization operations to be done on your image data during training instantiate generators of augmented image batches (and their labels) via .flow(data, labels) These generators can then be used with the Keras model method that accepts datainputs, fitgenerator, evaluategenerator and predictgenerator

Tensorflow: TensorFlow, an open-source software library for dataflow programming across a range of tasks. It is a symbolic math library and is also used for machine learning applications such as neural networks. It is used for both research and production at Google. Its flexible architecture allows for the easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices. TensorFlow computations

are expressed as stateful dataflow graphs. The name TensorFlow derives from the operations that such neural networks perform on multidimensional data arrays. These arrays are referred to as "tensors". Why TensorFlow for Object Detection:

- It allows Deep Learning.
- Known as the second-generation machine learning system, it performs numerical computations through data flow graphs.
- It is open source and free.
- It is reliable (and without major bugs). 26
- It is backed by Google and a good community.
- It is a skill recognized by many employers.
- It is easy to implement.
- With capability of running on CPUs and GPUs, it can be deployed in broad range of products of Google such as Speech Recognition, Google Photos, Gmail and even Search[2]

Image AI: is a python library built to empower developers, researchers and students to build applications and systems with self-contained Deep Learning and Computer Vision capabilities using simple and few lines of code One important element of deep learning and machine learning at large is dataset. A good dataset will contribute to a model with good precision and recall. In the realm of object detection in images or motion pictures.[2]

Coco Dataset for Motorcycle Detection: COCO is a large-scale object detection, segmentation, and captioning dataset. This version contains images, bounding boxes " and labels for the 2017 version. Coco defines 80 classes. COCO stands for Common Object Context. The COCO dataset contains the images which

are captured in our daily life scenes. COCO provides multi-object labeling, segmentation mask annotations, image captioning, key-point detection and panoptic segmentation annotations with a total of 80 categories, making it a very versatile and multi-purpose dataset. As we have mentioned above that the COCO dataset contains a total of 80 categories, we import the required libraries that are required to access the COCO dataset. The input contains many objects like Buses, Cars, and Motorcycles etc. The libraries imported will helps divide the required objects from all other objects and the detected objects will be given certain IDs to access them later. Coco.GetObjectIds is a function used to get the IDs for the differentiated objects Now the question is what if you want to create custom dataset object detection. Steps for creating a custom dataset for object detection:

- Annotate data
- Convert annotation files to COCO dataset format
- Train an instance segmentation model with mmdetection framework

Framework: Darknet is an open source neural network framework written in C and CUDA. YOLO first takes an input image.The framework then divides the input image into grids (say a 3 X 3 grid) Image classification and localization are applied on each grid. YOLO then predicts the bounding boxes and their corGathering 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+ imagesresponding class probabilities for objects (if any are found, of course). It is fast, easy to install, and supports CPU and GPU computation. 30 In our case, the framework is done in such a way that the motorcycle which is detected will be divided into three frames[4]

Table 5.1. COCO dataset objects

Person	Bicycle	Car	Motorcycle	Airplane
Bus	Train	Truck	Boat	Traffic light
Fire hydrant	Stop sign	Parking meter	Bench	Bird
Cat	Dog	Sheep	Cow	Elephant
Bear	Zebra	Giraffe	Backpack	Umbrella
Handbag	Tie	Suitcase	Frisbee	Skis
Snowboard	Sports ball	Kite	Baseball bat	Baseball glove
Skateboard	Surfboard	Tennis racket	Bottle	Wine glass
Cup	Knife	Spoon	Bowl	Banana
Apple	Sandwich	Orange	Broccoli	Carrot
Hotdog	Pizza	donot	Cake	Chair
Couch	Potted plant	Bed	Dining table	Toilet
Tv	Laptop	Mouse	Remote	Keyboard
Cell phone	Microwave	Toaster	Sink	Refrigerator
Book	Clock	Vase	Scissors	Teddy bear
Hair dryer	Toothbrush	Fork	Horse	oven

Procedure for training a YOLOV3 HELMET model:

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

Label Images: Label the all images with the help of LableImg tool. In this project, Helmet class was created with the help of LableImg tool. Create .xml file

corresponding to each image with the above following categories of classes Now that our dataset labels are in the required format, we need to create a train-test split. I chose to create a test set containing 10with your dataset. Now that we have created our train and test sets, we need to make some changes to train the YOLO model on the dataset.

Training: Now that our dataset is ready to use, we can begin training. Before we start, compile the darknet repository with the make command. To compile with specific options, such as GPU, CUDNN and OPENCV. This will create a darknet executable. Trained weights for model. You can set other parameters (learning rate, momentum, weight decay etc by editing the corresponding lines). Finally, model is ready to use[5]

- But in this project ,we already taken a pretrained model from online website.Generally, it requires complex coding and more technical knowledge in the training process.
- The major advantage of YOLO v3 is we can analyse multiple object detection according to user defined problem statements simultaneously with more faster rate.

4.2 Flowchart of Proposed System

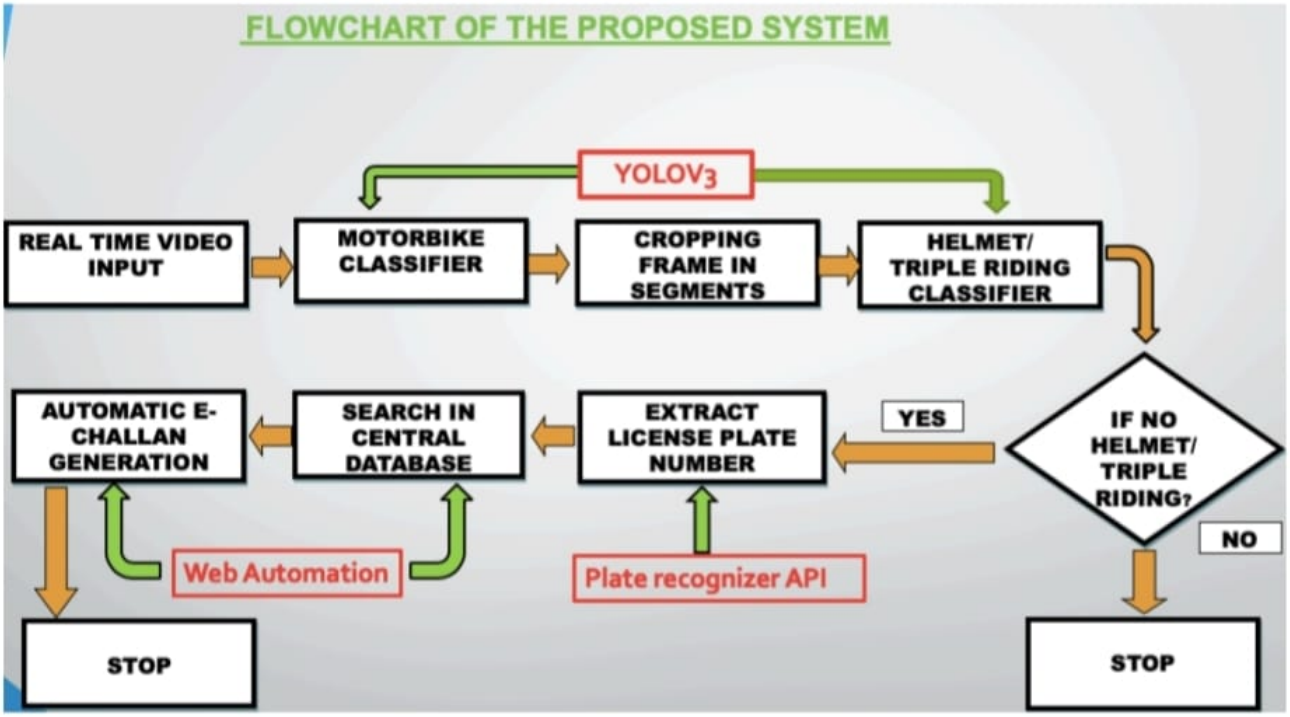

Figure 4.1. Flowchart of the System.

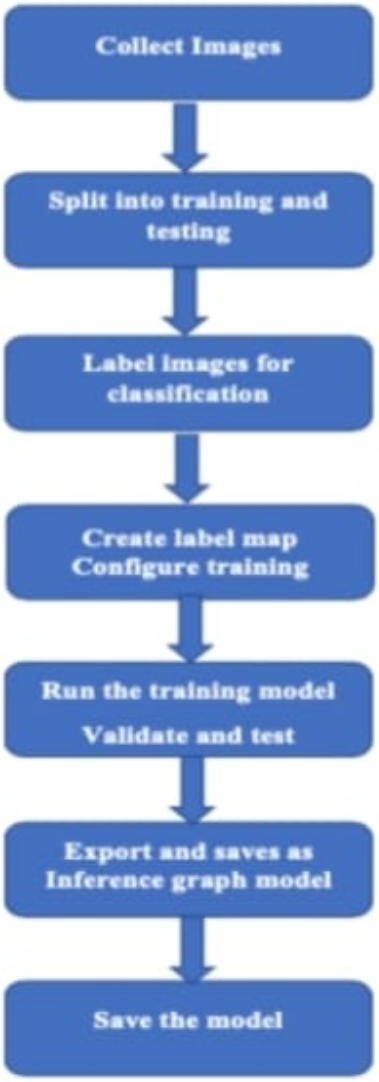

Figure 5.1. Flowchart for Helmet Model

8.Observations and Validations

A real time input video is given in the code after running the program it is able to detect a person with and without helmet while driving the bike.

The accuracy is not 100 percent and some times the algorithm got confused and given the result as "HELMET" for a person who is not wearing helmet.When the video clarity is not good, it got fluctuated and faced difficulty in detecting helmet.

When the algorithm was able to perfectly detect number plate,the results were so accurate.

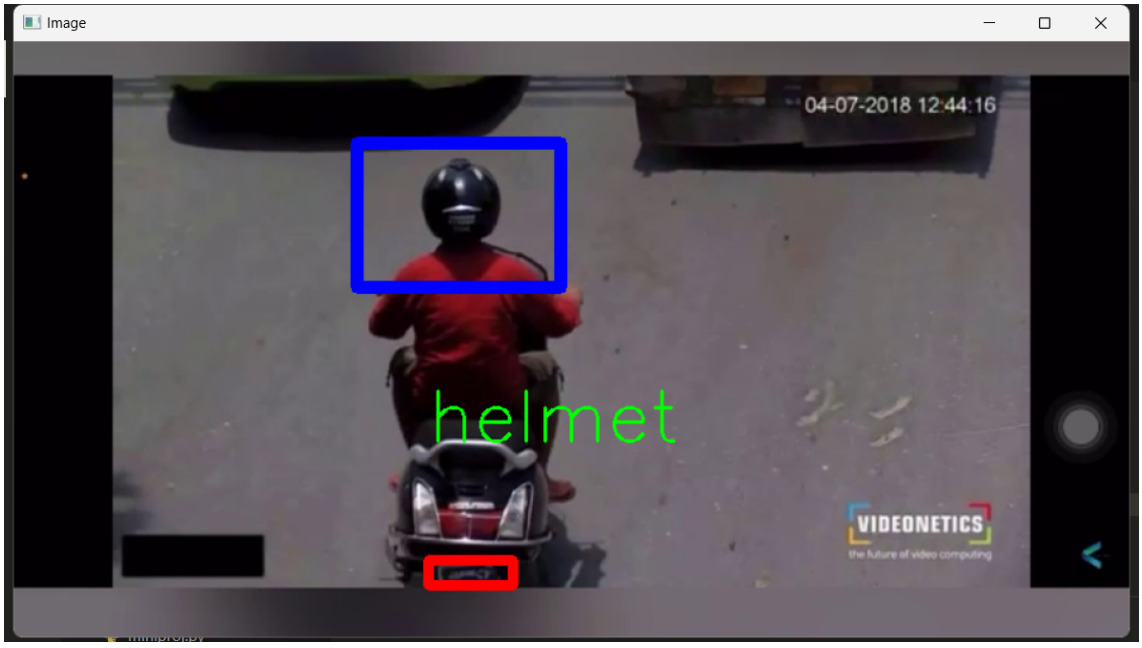


Image
helmet


Image
no-helmet

9.Difficulties faced in the project

Installing all the required had also taken lot of time and also came across many errors and rectified those with help of all the sources available and also by our knowledge and successfully got a error free code.

Firstly,training the large dataset is time consuming and needs good command over Machine Learning,We have taken already pre-trained weigths and configurations.

Actually,Our Project also includes Triple riding detection,since we are unable to get the pretrained dataset and also training our own dataset for detection of objects in motion is so difficult,we were unable to finish it so we had removed it from our project.

10.Future Work

The system implemented is just a prototype.It can be further expanded as we did not work on triple riding detection,we can detect triple riding and some other traffic violations such as wrong route and over speed,then extract the licensce plate of the motor cycle which violates the rules and immediately generate E-Challan,by maintaining a large database is created to maintain the record of violators ,and sent SMS to the registered mobile number with respective licensce plate. We need a high resolution camera to maintain precision and accuracy.

11.Conclusions

A Non-Helmet Rider detection is developed where a video file is taken as input.If the motorcycle rider in the video footage is not wearing helmet while riding the motorcycle,then the license plate number of that motorcycle is extracted and displayed for the above cases.Object detection principle with Yolo architecture is used for motorcycle,person,helmet and license plate detection.

12.References

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