**ENHANCING ROAD SAFTY USING MACHINE LEARNING TECHNIQUES**

1. **ABSTRACT**

The most important aspects in an accident investigation are the license plate detection and driver drowsiness detection. License plate detection uses the novel algorithm. It is divided into three stages: license plate detection, individual number and character extraction, and number and character recognition. The Gaussian blur filter is used to remove noise in the image and then using modified canny algorithm the numbers and characters are recognized using k-nearest neighbour classifier. Driver drowsiness detection algorithm is based on the state of eyes of the driver which is determined by his iris visibility. If eyes remain in one state either open or closed longer than expected time as well as if the driver is not looking straight front, it is an indication that driver is drowsy and then the system warns the driver. It uses Viola\_Jones algorithm to detect the objects such as nose, mouth or upper body and captures the image. After capturing an image, rectangular eyes area was adjusted to reduce the noise. The drowsiness detection is done based on the conditions like Black to White pixels ratio, number of pixels in the column greater than the threshold value and eye's shape. The ALCHO-LOCK function is used to prevent drink and drive scenarios.

1. **INTRODUCTION**

It is a well-known fact that young generation prefers bikes and motorcycle over four wheelers. Moreover speeding and drunk driving have become common issues. Due to lack of experience or focus and violation of traffic rules, result in severe accidents.So with the help of technology problems mentioned above are avoided and their effects are minimized. The idea of developing this work comes from our social responsibility towards society.

Almost all vehicle black boxes store only driving images so it is not easy to detect and recognize license plate correctly. To overcome this problem, we propose an algorithm that automatically recognizes license plate using a vehicle black box. . A license plate detection and recognition is one of important processes in investigating a car accident.

The new license plate format is made up of ## (letter) #### where # is a number. The colour scheme is a simple design which is black and white to detect license plate. Driver Drowsiness Detection is one of the car safety feature that helps prevent accidents caused by the drowsy driver. According to the National Sleep Foundation’s Sleep in America poll, 60% of adult drivers (168 million people) have driven a vehicle while feeling drowsy. 37% (103 million) people have actually fallen asleep at the wheel. Thus, driver drowsiness detection feature is very important to prevent accidents and save lives.

However the main goal of our work is to make it mandatory for the rider to wear a helmet during the ride meanwhile providing solutions to other major issues for accidents.

1. **RELATED WORK**
   1. **DROWSYNESS DRIVER DETECTION**

By using a non intrusive machine vision based concepts, drowsiness of the driver detected system is developed. Many existing systems require a camera which is installed in front of driver [4]. It points straight towards the face of the driver and monitors the driver‟s eyes in order to identify the drowsiness. For large vehicle such as heavy trucks and buses this arrangement is not pertinent. Bus has a large front glass window to have a broad view for safe driving. If we place a camera on the window of front glass, the camera blocks the frontal view of driver so it is not practical. If the camera is placed on the frame which is just about the window, then the camera is unable to detain the anterior view of the face of the driver correctly. The open CV detector detects only 40% of face of driver in normal driving position in video recording of 10 minutes. In the oblique view, the Open CV eye detector (CV-ED) frequently fails to trace the pair of eyes. If the eyes are closed for five successive frames the system concludes that the driver is declining slumbering and issues a warning signal [4]. Hence existing system is not applicable for large vehicles. In order to conquer the problem of existing system, new detection system is developed in this project work.

* 1. **AUTOMATIC NUMBER PLATE DETECTION**

ANPR System using OCR at the hub of the system is the OCR (Optical Character Recognition system) which is used to extract the alphanumeric characters present on the number plate. To do this it first uses a series of image manipulation techniques to detect, normalize and enhance the image of the number plate. There are two components in the system, the cameras at the front-end and the remote computers at the back-end. Usually two cameras are used at a time to increase efficiency. The cameras as shown in the Fig. 1 just perform the task of capturing the images of number plates and sending it to the remote computers. The remote computers then perform further operations like OCR on the stored images sent by the cameras at the lane-level. In order to process the high amount of images stored, a “server farm” is used which comprises of many computers working together. An example of a server farm can be the London Congestion Charge project. The remote computers can be linked with the database which stores the details of the car owners and thus the required information can be obtained. Using this information the culprit can be caught.

The ANPR system using OCR was found to have the following shortcomings /disadvantages:

1. Misidentification: In case the number is read partially, the remote computer might identify the number plate incorrectly or would not be able to decrypt at all.

2. Hazy images: Hazy images can also make the detection process erroneous or there is a possibility of no detection at all. 3. Flaws in angular detection: Angular detection is not possible in case of ANPR as the rectangulation algorithm, implemented in OCR is not possible thus characters may be misread/ overlapped.

* 1. **SMART HELMET BIKE STARTER WITH ALCOHOL DETECTION**

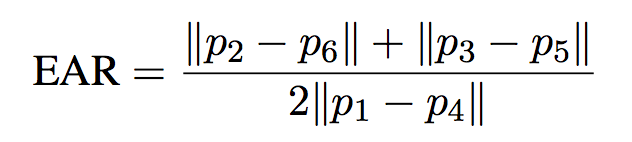
The existing project basically has a wireless telecommunication and is connected to a smart phone. This prototype uses sensors to detect a crash or accidents and the communication hardware is used to automatically dial a predefined emergency contact. The other existing system is to control the speed in which the biker is going in. The helmet is fixed with all the components and sensors that read the speed of the bike and accordingly instruct the rider to reduce or increase the speed based on the obstacles ahead the bike.

This has following disadvantages:

* Rider does not wear helmet in regions where traffic checking is not done.
* Testing alcohol content present in blood in each individual rider in big countries like India is impossible.
* Difficulty of implementation of traffic rules by traffic police.

1. **PROPOSED SYSTEM**
   1. **DROWSYNESS DRIVER DETECTION**
      * 1. **EUCLEADEN**

Blink detection can be estimated by measuring EAR (Eye aspect Ratio) using OPENCV functions and DLIB’s pre trained Neural network based prediction and detector function. EAR can be measured from eye coordinates returned from OPENCV using EAR formula given in section-1. Abrupt dip in EAR value against a set threshold can be used for blink detection and micro sleep detection.

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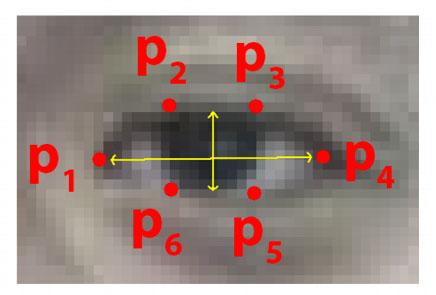


Figure-1 : Results of facial Landmark detection and identification of eye coordinates.

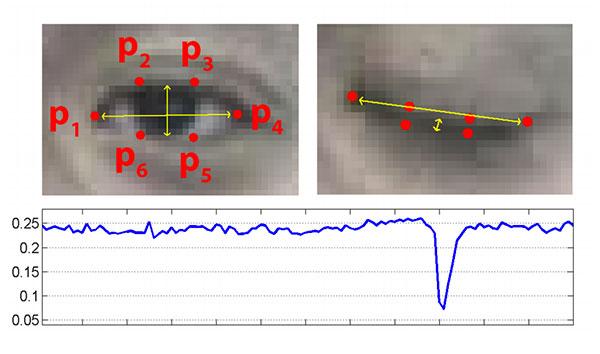


Figure-2 : Results of eye blinking detection

**Python Function for calculating EAR**

def eye\_aspect\_ratio(self, eye):

A = dist.euclidean(eye[1], eye[5])

B = dist.euclidean(eye[2], eye[4])

C = dist.euclidean(eye[0], eye[3])

ear = (A + B) / (2.0 \* C)

return ear

**Algorithm for detection of Blinks and Microsleep**

if ear < Threshold: # EAR

Threshold COUNTER += 1

if ear < Threshold:

DBAR+=10

if ear> Threshold:

DBAR=0 if COUNTER > 2 : # Blink Detection

if ear > Threshold:

TOTAL +=1

COUNTER=0

if DBAR>TDBAR: # Micro sleep Detection

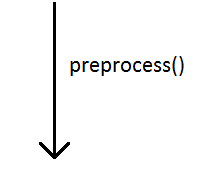
DEVENT+=1

* 1. **AUTOMATIC NUMBER PLATE DETECTION**
     + 1. **KNN ALGORITM**

We first introduce how to locate license plates and extract their corresponding regions, then segment these characters on located license plate, and finally use K-nearest neighbour (KNN) classifiers to recognize these segmented characters. The K-nearest-neighbour (KNN) algorithm measures the distance between a query scenario and a set of scenarios in the data set. KNN is more appropriate than PNN (Probabilistic Neural Network) and its recognition rate is up to 98.51 % on average. The recognition rate on average is about 95.87 % for the PNN classifier and about 98.51 % for the KNN classifier. The highest recognition rate for all arguments and block types for PNN are 97.14 %, the highest recognition rate for all ks and block types for KNN are 100 %. The highest recognition rate for block type is block 5x5, and the second is 10x5, no matter which classifier. Their recognition rates are 96.97 % (PNN) and 99.77 % (KNN), respectively. The KNN classifier uses features of testing image returns recognized character.

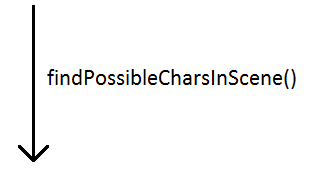










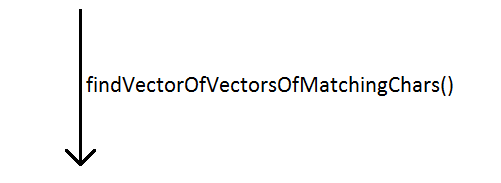


(2362 w/MCLRN F1 image)

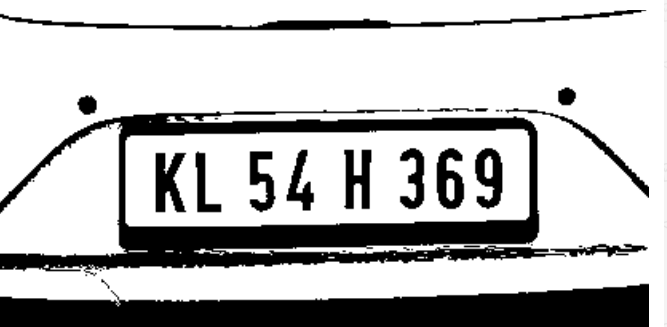


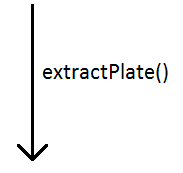
 (131 w/MCLRN F1 image)





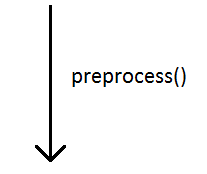
 (13 w/MCLRN F1 image)





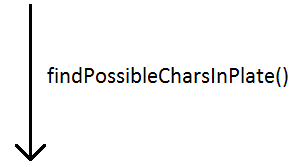
 (13 w/MCLRN F1 image)







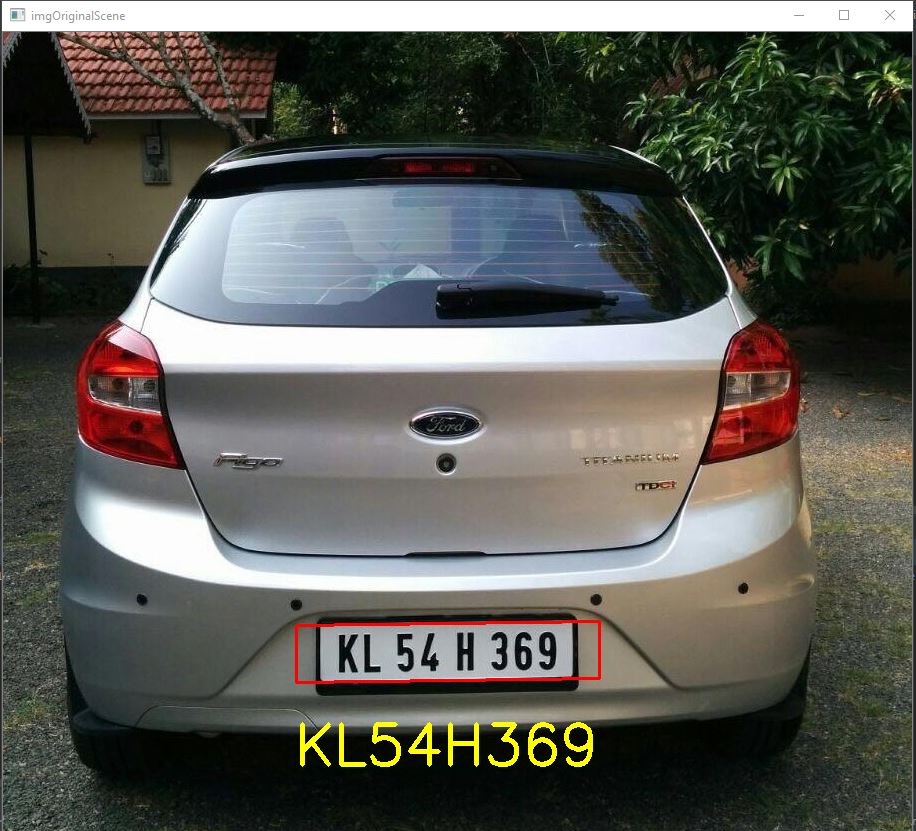




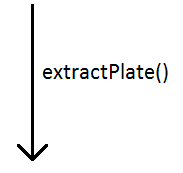
**listOfPossibleCharsInScene**

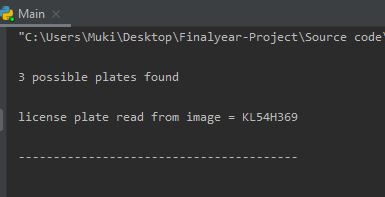
**findListOfListsOfMatchingChars()**

**listOfPossiblePlates**



**Extracted Number 0f vehicle**

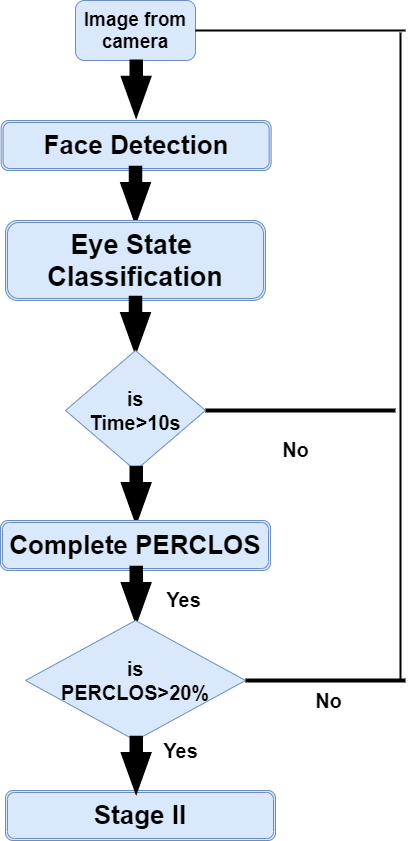




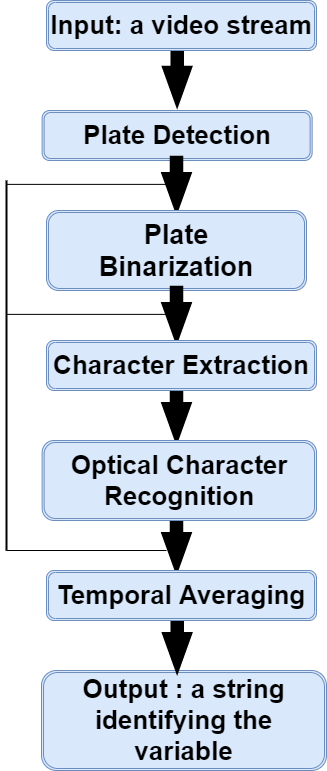
* 1. **SMART HELMET BIKE STARTER WITH ALCOHOL DETECTION**

The helmet checks if the rider is drunk and driving. If the rider is drunk then the ignition of the bike is avoided and the hence not letting the rider to ride the bike. In this system we use an Arduino microcontroller interfaced with alcohol sensor and it is used to monitor user’s breath and constantly sends signals to microcontroller. The microcontroller on encountering alcohol signal from sensor and send the data to motor using RF transmitter and we connect a RF receiver to the motor driver which stops dc motor to demonstrate as engine locking. The system need push button to start the engine. If the alcohol is detected the system locks the engine.

1. **ARCHITECTURE**
   1. **DROWSYNESS DRIVER DETECTION**

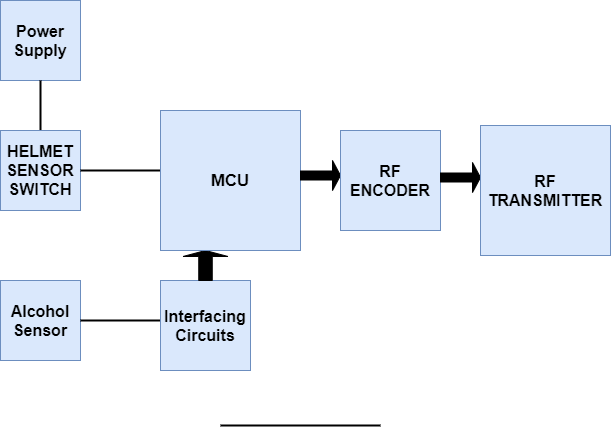
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* 1. **AUTOMATIC NUMBER PLATE DETECTION**

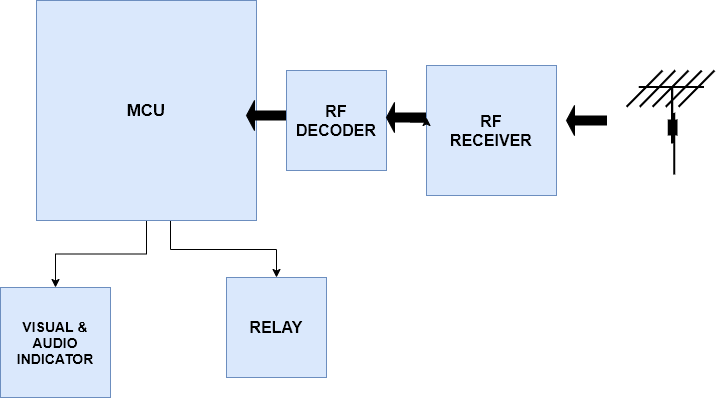
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* 1. **SMART HELMET BIKE STARTER WITH ALCOHOL DETECTION**

**HELMET SECTION**

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**BIKE SECTION**

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1. **DISCUSSION AND COMPARISON**
   1. **DROWSYNESS DRIVER DETECTION**

The selected and used hardware in the experiments of this thesis consists of the following:

• The standards webcam of the HP laptops

• HP laptop (Pavilion DV6)

• CPU-Core-I5, 2.4 GH

• RAM-4.0 GB

• Graphic card: GeForce GT 230M

• 64-bit windows operating system

• The video frames were acquired at 60 frames per second (also the system was tested on lower and higher frame rates).

The inexpensive hardware was selected in order to demonstrate that the proposed approach is efficient and can work under low-quality images generated by the standard laptop webcam.

Table 1 describes the results of the proposed system in this study for six test instances (each experiment instance has been conducted by a different user); the following terms describe the used measures in the experiments:

• Total frame means the total number of frames in each produced experiment instance

• Detection failure means the count of drowsiness detection failuresp.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instance | Age | Gender | Eye Size | Eye Glasses | Total Frame | Detection Failure | Correction Rate % | Total Correction Rate % |
| Instance 1 | 25 | Male | Medium | No | 4,000 | 19 | 99.5 |  |
| Instance 2 | 23 | Male | Medium | No | 3,500 | 18 | 99.4 |  |
| Instance 3 | 31 | Female | Large | No | 3,800 | 15 | 99.6 | 99.45 |
| Instance 4 | 27 | Male | Medium | No | 4,300 | 22 | 99.4 |  |
| Instance 5 | 29 | Female | Large | Yes | 3,100 | 12 | 99.6 |  |
| Instance 6 | 38 | Male | Medium | No | 4,200 | 30 | 99.2 |  |

Table 1: Experiment instances, measures 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instance | Closed Eyes | Real Drowsing | Generated  Waring | False Positive | Flase Negative | Correct Warning | Precision Rate % | Average Precision Rate % |
| Instance 1 | 43 | 9 | 9 | 0 | 0 | 9 | 100.0 |  |
| Instance 2 | 48 | 12 | 14 | 2 | 0 | 12 | 85.7 |  |
| Instance 3 | 37 | 16 | 18 | 2 | 0 | 16 | 88.8 | 90.5 |
| Instance 4 | 40 | 8 | 8 | 0 | 0 | 8 | 100.0 |  |
| Instance 5 | 44 | 11 | 12 | 1 | 0 | 11 | 91.6 |  |
| Instance 6 | 37 | 10 | 13 | 3 | 0 | 10 | 76.9 |  |

Table 2: Experiment instances, measures 2

• Correct rate of drowsiness detection is defined as in the below equation which is ratio of (Total Frame-Detection Failure) to total frames. Figure 3 represents the calculated values of the correct rate for each tested instance:

http://docsdrive.com/images/knowledgia/ajaps/2015/img1-2k15-149-157.gif

As described in Table 1, the correct rate of drowsiness detection is higher than 99.2% and the average correct rate can achieve 99.45%.

Table 2 describes other measures regarding the conducted experiments (same instances of measure (1) to find the precision rate. Figure 4 represents the calculated ratio of precision for each instance:

http://docsdrive.com/images/knowledgia/ajaps/2015/img2-2k15-149-157.gif

The gained result shows the efficiency of the proposed learning system. The result varies with respect to the following factors:

• No. of captured frames

• Size of the eye

• Eye clearance (with or without eyeglass)

Furthermore, the training data play the main role in indicating the performance of the system. The performance directly proportional with quantity (number of the eye images) and the quality (variety of eye images) of the training data.

Fig. 3: Correct rate for each experiment instance

Fig. 4: Precision rate for each experiment instance

The experiment results demonstrated the effectiveness of the proposed methodology. In this methodology the most promising and efficient techniques have been selected and used in the developed system (Haar Face detection algorithm, Haar cascade eye detection algorithm, Support Vector Machine for machine learning classification). As compared with other similar researches in the literature (Park et al., 2011) achieved a correct rate of 93.74%, whereas our approach achieved correct rate of 99.45%.

* 1. **AUTOMATIC NUMBER PLATE DETECTION**
  2. **SMART HELMET BIKE STARTER WITH ALCOHOL DETECTION**

1. **CONCLUSION**

The aim of this study is to address a solution to one of the major causes of the road accident, the driver drowsiness; the proposed solution does track the driver’s eyes and then notify him when his eyes get closed in order to avoid losing the control of the car and causing traffic accidents.

The present proposed method based mainly on two main phases, the first phase is to detect and pre-process the eye images using the image processing technique and the second phase is to build a classification model that will be able to classify whether the eye is opened or closed and then start an alarm accordingly.

The most important value this research has added to the literature in this domain is to find the simplest and most efficient approach to solve the automatic drowsiness detection problem; using simplest approach in order to utilize this system in the real time situation, so the processing time will be minimized. This study has achieved this simplicity and efficiency through the following:

• The most promising and efficient approach to locate the eye image efficiently, using Haar Cascade techniques were used

• This study bypassed the template matching step used in the literature and instead performed histogram equalization and then entered the pre-proceed eye image directly to the SVM classifier

The results show that this method is flexible for developing practical and ready to use drowsiness detection application and comprehensive solution.

1. **FUTURE WORK**
2. **REFERENCE**
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