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"M.L & A.I based drowsiness detection of driver by using Raspberry Pi"

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1. INTRODUCTION

1.1 Project Specification:

- According to the survey, there are lots of road accident occurs by the driver drowsiness in the world.
- Drowsiness occurs due to poor sleep, variety of drugs, also disgust caused by driving vehicles for long time.
- Every year 1.24 million people die on the road; almost 6% of all the accidents are yield by drivers driving in a drowsy condition; and most of the accidents of this type result in casualties.
- To reduce this problem and to negate these deadly accidents, the driver needs to be constantly under observation.
- By using such kind of system which would prevent accidents and closely monitor and supervise, counsel the driver in order to prevent all of the above mentioned causes, of accidents due to human faults.
- Today in the market there are few drowsiness detection equipment that help in detecting drowsiness which are categories into four types.
- The first category includes based on biomedical signals. This is monitoring of biological parameters like EEG (Electro Encephalo Graphy), ECG (Electro Cardio Graphy), and heartbeat. This calculation is the best way to detect drowsiness because it uses the biological and technical signals used for fatigue detection.
- The second category includes methods based on driver performance that evaluate variations in the position of the vehicle, in the velocity, in the steering wheel angle and in other Controller-Area Network (CAN) signals.
- The third category is based on visual assessment. Computer vision can be a natural and nonintrusive technique for monitoring driver's state from face images. These approaches are effective due to sleepiness is reflected through the face and eyes appearance.
- The fourth category is based on the measurement of blinking. Increase in the blinking is often a signal of feeling drowsiness, based on which drowsiness is notice. This requires some hardware unit to be used around the drivers' eyes to note the blinks of eyes. But this technique is not that efficient when we compared with all the above techniques.

1.2 Literature survey

Many research works on emotion recognition and analysis have been carried out for a decade due to applications in the field of human-machine interaction.

Many studies on facial expression recognition and analysis have been carried out for a long time because facial expressions play an important role in natural human-computer interaction as one of many different types of nonverbal communication.

Their significant works have formed the basis of the existing automatic facial expression recognition systems. For automatic facial expression recognition system, a variety of research approaches have been proposed.

According to types of facial features that the proposed systems take more interest, they extract geometric features, appearance features, or a hybrid of geometric and appearance features on targeting face.

SI. No.	Title	Author	Description
1	**Driver monitoring in the context of autonomous vehicle.**	**Hamidur Rahaman, Shahima BEGUM, Mobyen Uddin Ahmed**	**This paper provide an overview on autonomous vehicles and un-obstructive driver monitoring approaches that can be implemented in future autonomous vehicles**

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2	**On the future of transportation in an era of automated and autonomous vehicle**	**P.A. Hancock, Illah Nourbakhsh, Jack Stewart**	**Automated vehicles (AVs) already navigate US highways and those of many other nations around the world. Current questions about AVs do not now revolve around whether such technologies should or should not be implemented; they are already with us.**

2. ANALYSIS AND DESIGN

2.1 Requirement Analysis

Now a days we are dealing with the main problem of accident which took place on roads. And the major cause of this accidents to take place are

1. Drowsiness
2. Disturbance while driving like communicating with others while driving
3. Anxiety
4. Frustration
5. Disobeying of traffic rules
6. Rash Driving

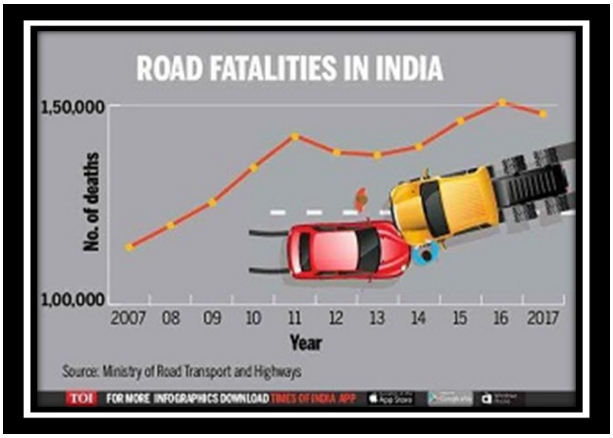

Fig (a). Road Fatalities in India Rate

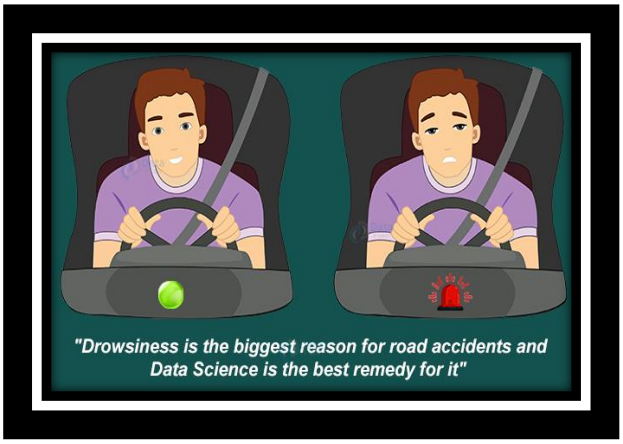

Fig (b). Drowsiness Condition

So to overcome on this types of problem we are taking one step ahead in this modern technological world. We are working on drowsiness detection project where this project includes direct working which consist of 68 facial landmark detector and also the face detector of the Dlib library. This 68 facial landmark detector is a robustly trained efficient detector which have already plotted points on face which detects the points on the human face which can be processed and helps to determine whether the eyes are open or they are closed.

We use Dlip library use for image processing python wrapper python binding. Dlip have two functionality first one is to detect face and it include HOG+Linear SVM face detector and second include deep learning MMOD CNN face detector. Both this function can be used to perform face detection.

We are using following modules.
Module I: Face Detection by Dlib and utils
Module II: Raspberry-Pi Hardware Implementation
Module III: Implementation of drowsiness detection system with software and hardware components.

And through below algorithm we use to detect points.

- Eigenface Algorithm:- It is Facial Recognition Algorithm(get_frontal_face_detector, face_landmarks)
- Euclidean algorithm :- Calculate distance between two points.

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2.2 Technology and Software Details

Here we are using following technology and software:

Software

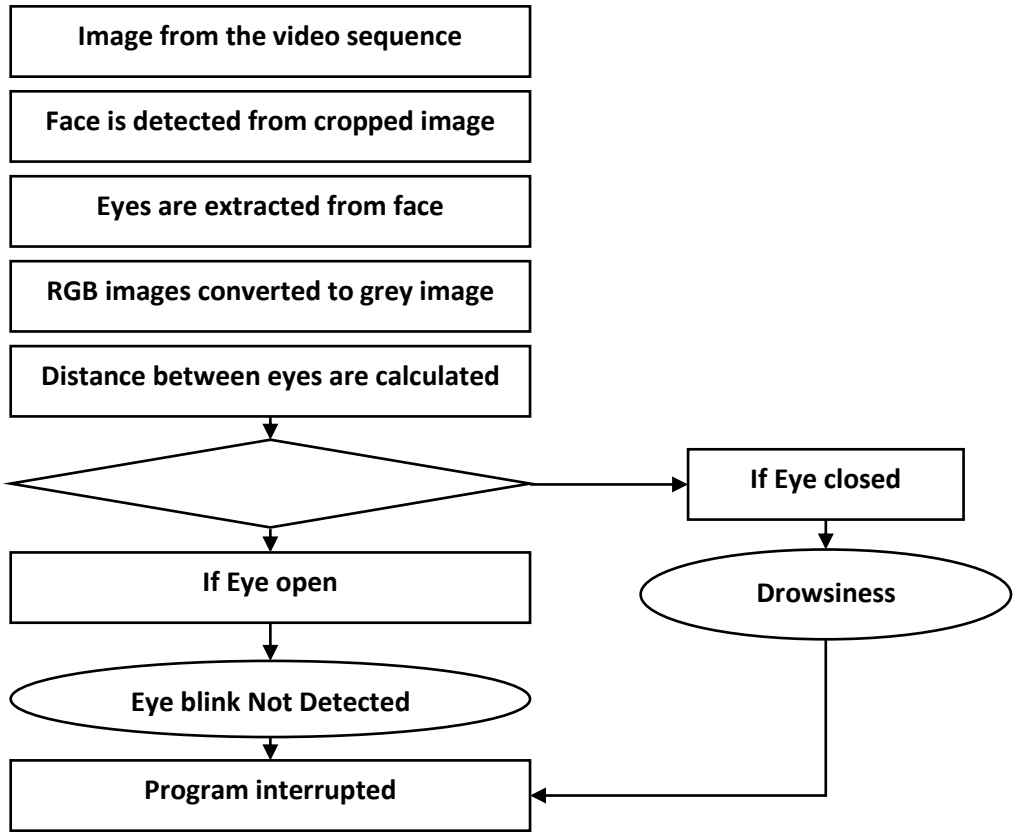
- Python
- Pycharm
- OpenCv
- Dlib
- Harcascade frontleface.xml & Harcascade eye.xml (Files)

Hardware

- Raspberry-pi (3 Model B+)
- Demo-Car
- Relay motors
- Pi-Cam

3. PROJECT DESCRIPTION

3.1 Design of propose of work



This will be our current proposed system which will go through following processes and once detected the blink it will send the interruption to program. Before that we will even more than 250px will be differentiate. This process will take place only with the images which will be gone through RGB to grey images.

```
detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor("shape_predictor_68_face_landmarks.dat")
```

Here we are detecting front face and then the dlip library is called for detecting front face which include 68 points on face. And they are saved in Shape_predictor_68_face_landmark.dat file. Dlip is the Inbuild function which is better then OpenCV harcasde.

This landmark detect facial expression like face, eyebrows, lips etc, i.e all augmented reality.

```
def compute(ptA,ptB):
    dist = np.linalg.norm(ptA - ptB)
    return dist
```

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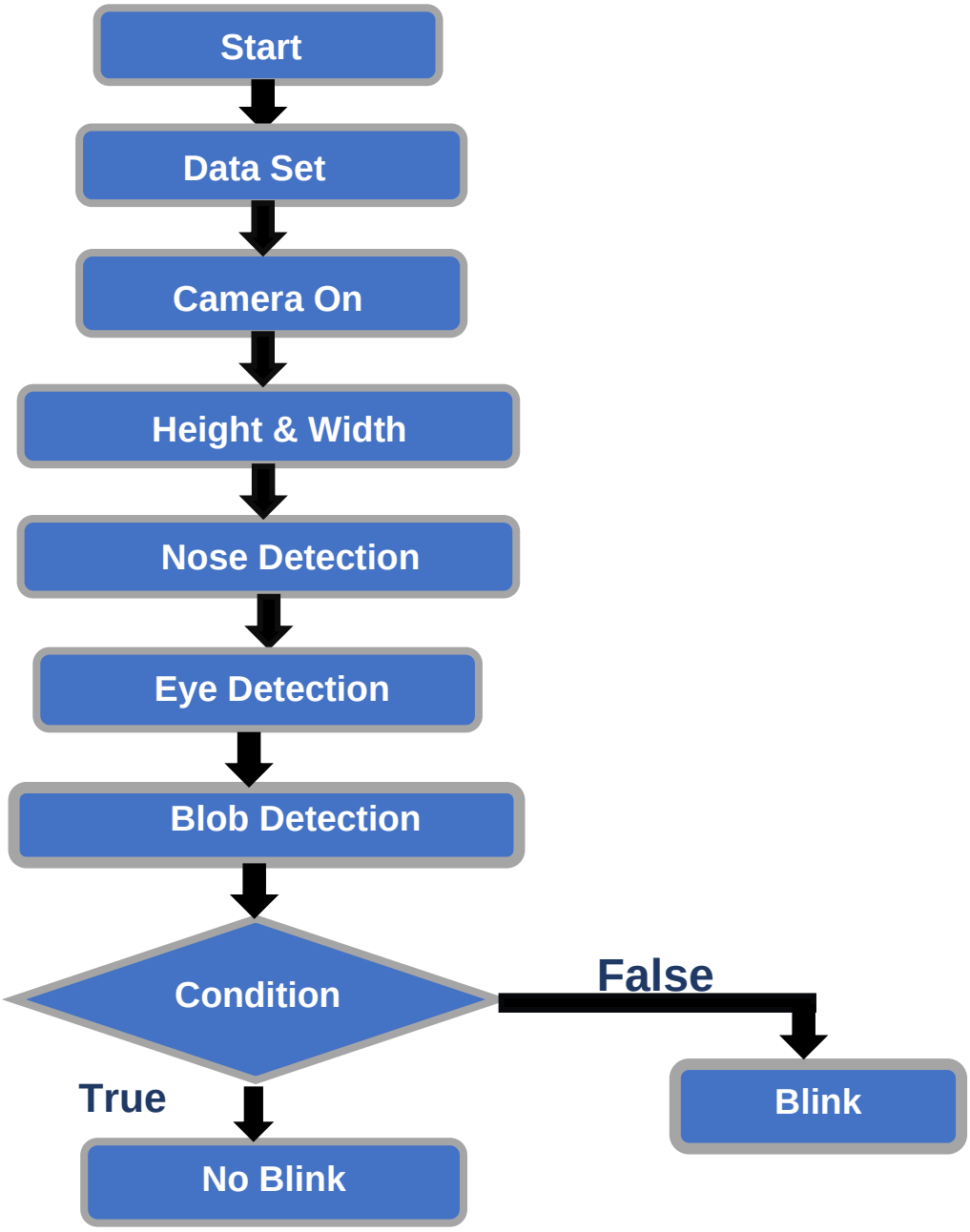
```
def blinked(a,b,c,d,e,f):
    up = compute(b,d) + compute(c,e)
    down = compute(a,f)
    ratio = up/(2.0*down)
```

After calling dat file we are defining two point which will help to notice only point which we have to work on. This points will help us recognizing two eyes distance and even the eyebrows.

3.2 Data Flow Diagram

As mentioned in above design, the driving drowsiness is a process of dynamic change. Which consists of two main condition one is eyes detection through points and another is eyes separation and working on separate eyes.



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4. PROJECT IMPLEMENTATION

The greater part of the machines that we work today are physically determined for example Which are worked physically by the worry of human (for instance the vehicles that are been driven by the people) ,yet as we can notice the majority of the auto crashes that happen on street are because of the issue of the human.

In the new overview it has been seen that practically around 80% of the auto collisions out and about are because of the absence of grouping of the drivers out and about while driving, this implies that the driver might be very little worried about driving

The Drivers are having a few issues like tiredness, mental disappointment, wretchedness, nervousness, outrage or at times possibly bliss, these are each of the a piece of human inclination however because of these conditions and once in a while because of the climate there are high dangers of mishaps.

- Many studies have found that sleep deficiency can affect driving as much as alcohol inebriation. About 20% of the people have admitted to falling asleep at the wheel with 40% of the people confessing that this has taken place at least once in their driving careers.
- Research shows, in India, 40% of highway crashes or near crashes occur due to drowsy driving whereas more than 50% of all deadly highway crashes which involve more than two cars are alcohol related.
- More than 65% of all deadly single car crashes are related to inebriation. Looking at these statistics, it is imperative that we develop a driver

In this automated vehicle monitoring system we would be at first recognize the users initial and current neutral facial expression and capture it and save it in our database.
While the user is driving the car if they face any sort of problem such as drowsiness, frustration or any of the problem due to sentiments etc.
The system would be able detect the current position of the driver driving the car and can predict if the person can really drive a car or not so that the accident rate is minimized. Along with that we are providing our system with a voice and vibration technique to make the driver aware.

(a) (b)

In this project Raspberry-pi and pi-cam will be used for detecting the expressions of driver driving the vehicle.
Dlib better version of harcascade because it provides 68 landmark of face.

Facial Landmarks Detection: After finding the face in the video the subsequent stage is to remove highlights area, for example, eyes, nose, mouth and so on. For this task we simply need position of eyes. There are various methods of facial milestone location yet for this specific venture I have utilized. The facial milestone indicator executed inside dlib produces 68 (x, y)- facilitates that guide to explicit facial designs. These 68-point mappings were gotten via preparing a shape indicator on the named .dat dataset.

Eye Blink Detection By utilizing EAR Ratio: After limit left and right eye organizes by utilizing facial milestones we will utilize ear viewpoint proportion (Based on the work by Soukupová and Čech in their 2016 paper, Real-Time Eye Blink Detection utilizing Facial Landmarks) to recognize squints in a video outline. I have utilized EAR esteem under 0.23 as a flicker count.

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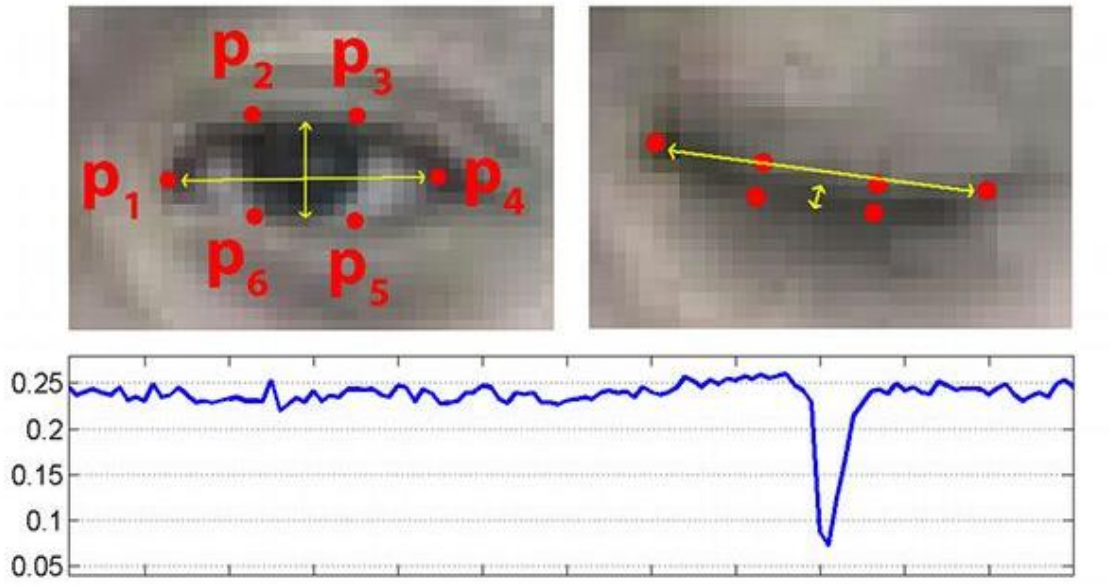
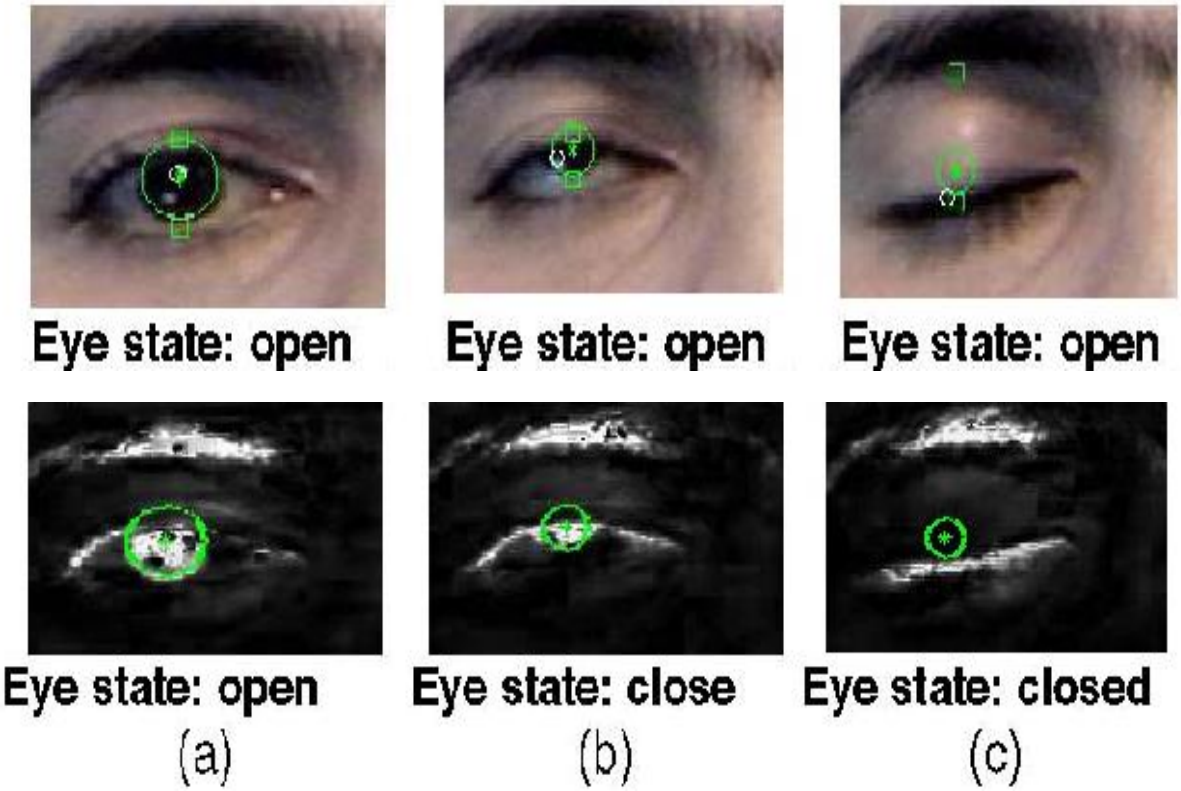


5. SCREENSHOT



6. ADVANTAGES & APPLICATION

6.1 Advantages

- This project have experimental control, it even increase efficiency, with low cost, safety, and ease of data collection are the main advantages of using AI system.
- This proposed system achieved more than 95% accurate result.
- It is the convenient approach to detect the drowsiness.
- This is the most effective technical problem possible for practical implementation.

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6.2 Application

- This system can be install in many heavy vehicles which can prevent from taking places of any accident on roads.
- Even apply this system can help us get the data of possibilities of working hours of drivers and keep a proper track.
- This can save our cost before getting into any heavy accident.
- We can even move forward to work on simulations and the motions of drivers.
- This algorithms we are using is the correct use in any real time detection system.
- The number of frames we are working on are more that any other algorithm used before.

7. CONCLUSION & FUTURE SCOPE

7.1 Conclusion

- As Life is the most precious gift of nature, here in this system of the drowsiness detection and estimation through live video streaming; the user/driver will be able to safeguard his/her life.
- In order to minimize and reduce the numbers of road fatalities we have presented with a system that would eventually detect the face of the driver and reveal, finds out the whether the driver is sleepy or not, it does so by using eye-blink detector which has been developed in python.
- This software implementation is further connected to the hardware been used in the system that is the Raspberry-pi so as to generate an alarm and alert the driver to awaken him/her.

7.2 Future scope

The accompanying elements could be carried out in our future works for this application.

- In the future degree this framework can be additionally reached out to have security like just specific individuals can get to the vehicle.
- If there should be an occurrence of robbery, the vehicle doesn't begin of the thief could be shipped off the proprietor of the vehicle.
- The camera allows users to explore their required products using a filter search option; based on category, specification, quantity, etc. It saves them valuable time and encourages them to purchase more items.
- In future, the frequency of yawning can also be used as a parameter to detect drowsiness. In order to detect drowsiness, certain facial features were identified. This system uses the concept of video processing

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