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Real Time Drowsy Driver Identification Using Eye Blink Detection

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Abstract - HUMAN COMPUTER INTERFACE (HCI) systems are designed for use in assisting people in various aspects. Driving support systems such as navigating systems are getting commoner by the day. The capability of driving support systems to detect the level of driver's alertness is very important in ensuring road safety. By observation of blink pattern and eye movements, driver fatigue can be detected early enough to prevent collisions caused by drowsiness. The analysis of face image are widely used in security systems, face recognition, criminal focusing etc. In this specific study a non recursive system have been designed to detect shutting of eyes of the person driving an automobile. Real time detection of driver's eyes is processed using image processing in MATLAB to detect whether the eye remains closed more than the fixed duration thus indicating condition of fatigue and raise an alarm which could prevent a collision. The driving support systems have been found lacking in detecting the influence of drug or alcohol causing great degree of risks to the commuters. This study has found that eye blink patterns are starkly different for persons under the influence of drugs and can be easily detected by the system designed by us.

Keywords - Eye blinks detection, eye symmetry, and drowsiness detection Driver vigilance.

I. INTRODUCTION

Considering that there are numerous types of assistance devices to enhance human tasks and a great deal of research has been going on around the globe on HUMAN COMPUTER INTERFACE SYSTEM(HCI), A system have been designed with computer vision research which is dedicated precisely for detecting human blink. It is of utmost importance to measure eye movement during psychophysical tasks and experiments to study; Eye movement control; Gaining information about behavior patterns generally in accessible to conscious introspection; Examining information processing strategies; controlling task performance during experiments requires fixation; Control task performances that require precise knowledge of the subject.

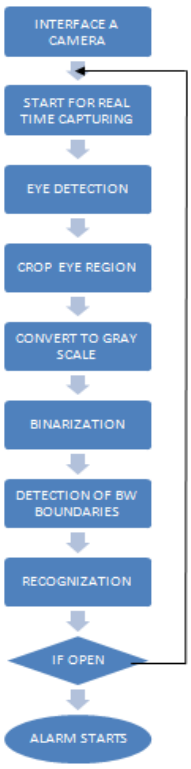

Figure 1: Flow Chart

Going by statistics collected by various surveys around the world, tens of thousands people looses their lives or are maimed every year to road accidents accused due to the loss of driver's alertness Along with this it has also been pointed out that loss of driver's alertness is almost always precede by psycho-physiological drowsiness and unfortunately the drivers are often unaware of their own deteriorating condition or even if they are aware are motivated to keep driving .The term drowsiness stands for a state of reduced alertness usually accompanied by performance and psycho-physiological changes that results in loss of alertness. Another term driver fatigue or the driver being "asleep at the wheel" is also widely used to describe this condition in accidents reports of the police. More than 20% motor accidents recorded worldwide are attributed to one single factor of drowsiness , caused by various factors distraction fatigue lack of sleep or an inebriated state of mind. So after taking into view the point that since the drivers are themselves usually not aware of their own conditions a real time drowsy detection system is designed to prevent road accidents and save precious lives.

II. DETAIL DESCRIPTION

Modern digital technology has made it possible to manipulate various signals with system. In our work, at very first step a camera is attached with a computer and also used inbuilt webcam of our laptop.Where by using these cameras real time video has been captured. When the camera is attached with the system the real time video capturing starts by providing a simple command in our system.

input1 = videoinput('winvideo', 1,'YUY2_640x480');

Where, 'winvideo' is used for capturing real time video by using inbuilt camera of LAPTOP. Then proceeding further after the completion of capturing of real time video, an image is randomly picked from that video and used for detecting the eye of driver by applying a inbuilt function of MATLAB

EyeDetect = Vision.CascadeObjectDetector('EyePairBig'); where 'EyePairBig' is used for detecting the both eyes. When the both eyes are detected, the system will highlight the eye section by providing a rectangular shape over them.

Fig.2

After completing the process of detection our system will crop the inner region of that rectangle marked over the eyes for further proceedings. Image cropping of inner region of rectangle is done by assigning a function in our coding or program.

Eyes=imcrop(I,BB);

1. Gray Scale Conversion-After detecting the eye region from the input image (rgb) is converted into gray scale by using the syntax 'rgb2gray(RGB)' which is a inbuilt function in MATLAB. It converts the true color image RGB into grayscale intensity image. The basic function of conversion of RGB to gray scale is to eliminate the hue and saturation information while retaining the luminance.

Figure 3: Input image

Figure 4: Converted To Gray Scale

2. Binarization-Digital image that has only two possible values of each pixel is known as binary image. Typically only two colors are used for binary image that are black & white. Binary images are also called bi-level or two levels which imply each pixel is stored as single bit that is 0 or 1. Binarization is performed through the inbuilt function of MATLAB where syntax 'BW=im2BW (I, level)' is used and all conversions are threshold based. Im2bw executes or produce binary Images from RGB image that is captured by camera or input image from source. For this execution it converts the input image to gray scale format. The values of this binary image BW is 0 for black and 1 for white pixels.

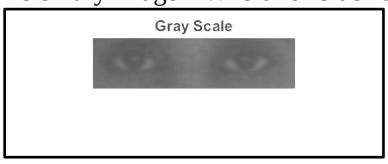

Figure 5: Gray Scale Image

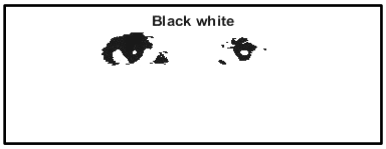

Figure 6: Binary Image

3.Detection of BW Boundaries-Proceeding further after gray scale conversions and Binarization of image, to detect the BW boundaries of image, it imply that our system will trace the region boundaries of binary image by tracing the exterior boundaries of object as well as boundaries of holes inside the object. B=BW (BW, Conn, Option) specifies an optional argument where 'holes' which is by default and search both object and holes boundaries. And other is 'no hole' which search for object only and provide better performance

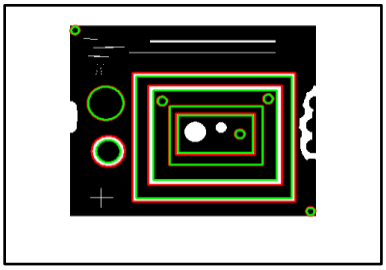

Figure 7: Holes and Object

4. Recognition-This is the final destination of our system, where it has to combine the details and give us the responses for which the whole system is designed. Here our system will decide what decision should be made after going through all the results achieved from whole process done earlier. If our system found the Driver Drowsy it will end up with ringing an alarm. If it found the eye open then it will return to for capturing the real time video again.

5. Vision.CascadeObject Detector-Detection and tracking of object are important in many human computer interface systems many applications including activity recognition, automotive safety and surveillance. Considering the same the detection of eye behavior through live video stream captured by camera (webcam/USB Camera) of computer or any PDA is possible. As explained earlier in this paper about the research work in which a system to detect drowsy driver through real time video capturing is designed. Vision.CascadeObjectDetector is used which is inbuilt function in MATLAB. Using the Viola-Jones algorithm it detects the face objects which includes human faces, noses, eyes, mouth or upper body. This is in our hands to give command to the system about the part to be detected. Thus a set up of cascade object detector using the constructor is defined.

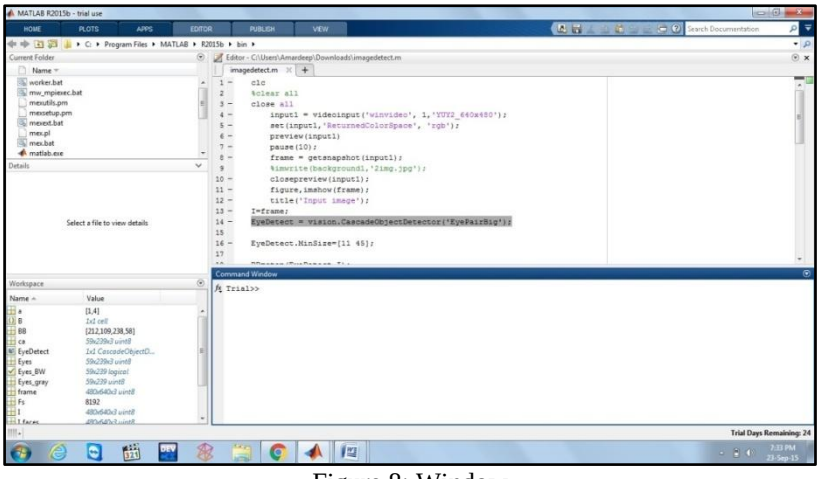

Figure 8: Window

EyeDetect = Vision.CascadeObjectDetector('EyePairBig');
This command is used to detect both eyes of driver, if we have to detect only single eye of driver, (EyePairSmall) is used instead of (EyePairBig).
For obtaining the results, the cascade object detector is called with the input image 1 and then preceded further.

III. RESULTS

The system has been tested and examine on many people to check its accuracy, it has responded successful with 98%accuarcy.

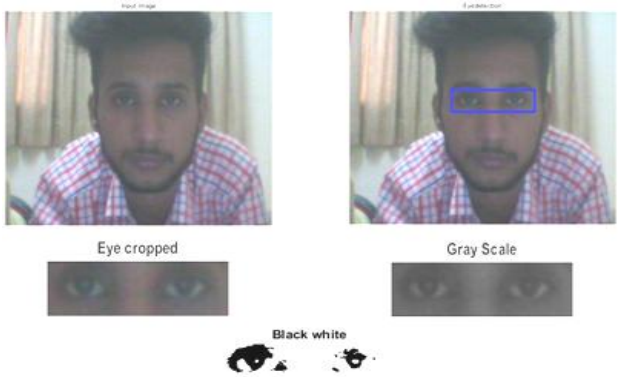

Figure 9: Experiment with OPEN EYES

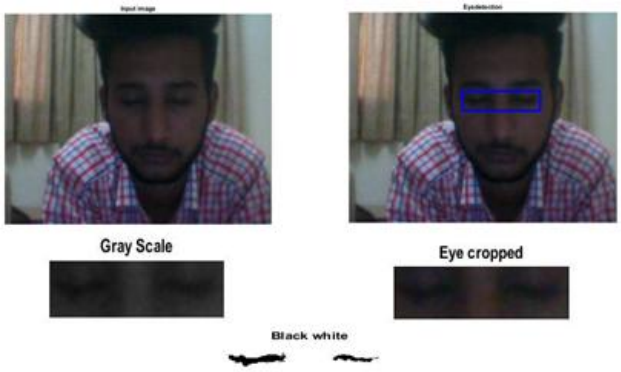

Figure 10 Experiments with CLOSE EYES

Figure 11: Experiment with CLOSE EYES

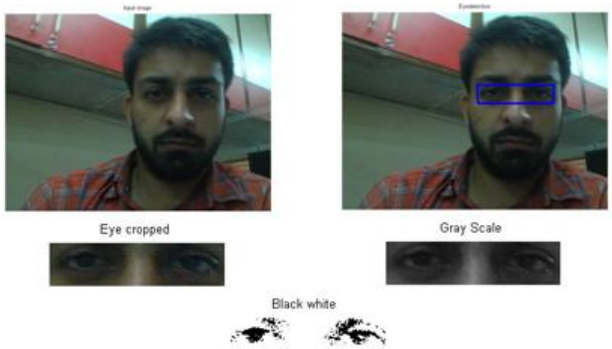

Figure 12: Experiment with OPEN EYES

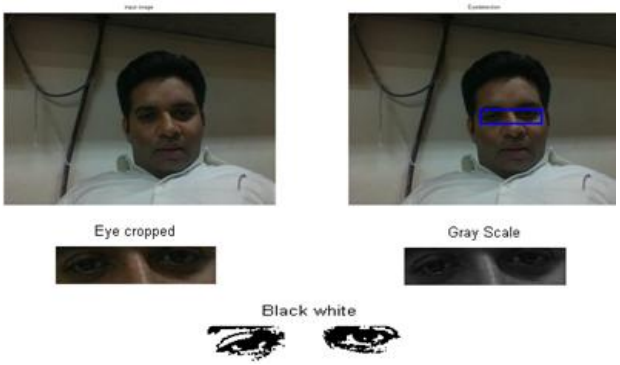

Figure 13: Experiment with OPEN EYES

Figure 14: Experiment with OPEN EYES

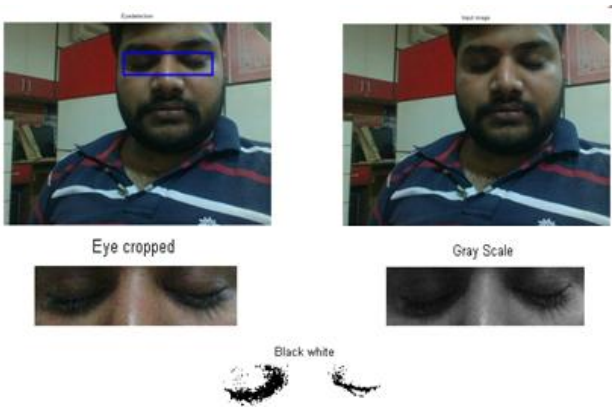

Figure 15: Experiment with CLOSE EYES

IV. CONCLUSION

The findings after numerous tests carried out by us suggest that is very much possible to detect drowsiness in drivers by analyzing their blink pattern but works on an assumption that all individual develop drowsiness in the same way and it could take further researching to drowsiness triggered by consumption of alcohol, drugs etc. When the test were carried out using BAUMER txg13 ,their tests failed to deliver satisfactory RESULTS as the BAUMER Camera could work only on MATLAB2015a version and also required GigE adaptors settings, further high resolution of the said camera produced fluctuated results to the experiments. In additional tests it was proved that while the system was found in effective in darkness or lack of lighting causing errors due to non detection of eyes it performed impeccably in normal light giving up to 99% accuracy.

V. FUTURE SCOPE

In the real time drowsy driver identification using eye blink detection if the parameters exceed a certain limit warning signals can be mounted on the vehicle to warn the driver of drowsiness. Further it is a viable option to design a continuous scale of drowsiness and on crossings a certain threshold value level the systems could generate a signal which would automatically slow down or switch off the motor. Further preliminary test have been conducted with very suitable changes in the coding and found the system very viable to be used for assistance to paralytic patients. This system can be used with minor alteration to assist the patients with severe paralytic condition such as bulbar paralysis where patients fails to communicate by hand gestures and verbally due to advance muscular dystrophy. The system proposed would be very helpful if installed on the patient's bed or chair detecting and analyzing signals for every need.

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