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Driver Drowsiness Detection using MATLAB

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Abstract: ***Drowsiness is major cause of accidents. So, this drowsiness detection system alerts the drowsy drivers in order to reduce the risk of potential accidents. The proposed system uses computer vision and image processing technology of MATLAB for detecting the drowsiness. MATLAB detects if eyes are closed or open using various image processing techniques performed using Viola-Jones face features detecting algorithm and skin y,cb,cr values detection function ,converting image into a binary image which was further employed to extract eye characteristics, and its closing frequency, determining drowsiness.***

Index Terms**: *MATLAB, Eye closure, Skin detection, Viola-Jones algorithm, Y,cb,Cr colour mapping***

I. INTRODUCTION

[1] Around 1.3 million people die every year on roads throughout the world and driver drowsiness contributes majorly in that. [2]Drowsiness, also called as microsleep is a temporary sleep that lasts for a few seconds where individual loses response and alert mechanism of its body and loses awareness for a few moments. Behavior wise, microsleep is marked by droopy eyes and closed eyelids Using these behavioral changes, this drowsiness detection system is designed.

II. METHODOLOGY

The project uses the MATLAB image acquisition, image processing and computer vision toolbox to detect whether eyes are closed or not using integrated webcam of PC For the project we have used MATLAB 8.1 R2013a version to perform the eye closure detection. Functions from the IMAGE PROCESSING, IMAGE ACQUISION and COMPUTER VISION toolboxes of MATLAB are used in the project. As the driver starts driving, and if it feels drowsy during the journey, it will start closing his eyes and a continuous closure of eyes for more than 4 seconds detects the drowsiness. The real time video acquiring for the eye blink detection requires personal computer‘s web camera. But to get proper fine quality pictures, web camera would require its properties to be set according to the ambient light variations.But the problem was how to set up thresholding when ambient light conditions are ceaselessly varying. So firstly eye state detection was performed using Viola-Jones algorithmic function, ‘*cascadeObjectDetector’* in MATLAB. Then,to detect the state of the eye, amount of skin present in the cropped eye image was found using y,cb,cr colour mapping technique. YCbCr is a type of color space which is used in photography systems. Y is the luminance component and Cb and Cr are the blue-difference and red-difference chroma components Y, Cb, Cr values for skin as been found in previous researches [3] is –

$$Y > 80$$
$$80 <= Cb <= 120$$
$$133 <= Cr <= 173$$

By setting up this threshold of values for the y, cb and cr components by converting the rgb image to ycbcr color map using MATLAB, we have segregated the skin region in the eye portion of the image. The image after applying the above threshold gets converted to the black and white image where the white portion is the detected skin portion. Then, the percentage of black portion in the converted black-white image was calculated. Since, in a closed eye amount of skin portion will be higher, black portion will be less and after a few observations, threshold was set accordingly.

III. RESULT AND DISCUSSIONS

After observing for different images, the percentages of black portion for a closed eye and corresponding open eye was calculated and observed as-

Table-I : The black portion percentages for different images

Percentage of black	*Open Eye*	*Closed eye*
1	80%	58%
2	81%	66%
3	85%	65%
4	77%	54%
5	80.5%	48%
6	75%	50%
7	78%	44%

After Observing the aforementioned ―Table-I: The percentage of black portion in different images”, it was observed that there is a huge difference between the percentages for a closed eye and an open eye which makes it easier to decide a threshold. So, after going through all the images, the threshold of 70% is decided for distinguishing closed eye and an open eye. Videos at different light intensities were acquired in real time to monitor the drowsiness. If the eye blink is detected continuously for more than 4 seconds, that is , for more than 2 frames, driver is considered drowsy.

IV. LIMITATIONS

Poor lighting conditions hinders the proper detection of the eye by the system.

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Also the system acquires problem when an optimum distance is not maintained between the eye and the camera; optimum alignment and orientation is also required .Wearing spectacles can also countervail proper results. Multiple faces if detected by the webcam also renders the system to fail.

V. FUTURE SCOPE

In future, this prototype can be extended to park the car before sleeping by calculating the heart beat measure without physical disturbance i.e., non intrusive method using modified ECG methods. This will lead us to a way to find out the optimum level of drowsiness. Further, this prototype will be extended to monitor the reflect ray from eye using nano camera. If the reflection ray is absent, then eye is closed otherwise eye is opened. We believe that this will create a better opportunity to detect drowsiness. Dynamic thresholding techniques for eye blink detection can be adopted to comply with changing ambient illumination. More powerful embedded systems like FPGA with microcontroller and more powerful cameras should be adopted in order to make system more efficient. To make driver's situation be monitored for more control and security, various techniques like GPS and GSM can be adopted to send driver state details in real time to the concerned people. Infra-red cameras can be used to ensure proper eye detection at night time at which a normal camera fails. More parameters needs to be incorporated for a more reliable system in the future.The alcoholic sensor is also used for drunk drivers. The ultrasonic sensor can also be used for detecting any sort of people or traffic around the car to ensure safe parking .

VI. CONCLUSION

The system avoids accidents caused by drowsy drivers. This project involves controlling accident due to unconsciousness through Eye closure. Experimental results show decent accuracy which makes this system reliable for driver drowsiness detection. The system faces a lot of limitations due to ambient lighting conditions and other environmental real time problems which can be overcome in future by using advanced machine learning alrorithms, artificial neural networks and high quality cameras along with infrared cameras for higher accuracy. Also, Image processing is a very reliable technique to detect drowsiness efficiently, which involves not much interference and invasion of other factors and tools

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