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DROWSINESS DETECTION SYSTEM USING MATLAB

Ms. Shalini Kashyap[1], Mr. V.K Sharma[2]

[1,2]*Department of Electronics, YMCA University of Sc. & Tech., Faridabad (India)*

ABSTRACT

Life is crucial and it is full of risk. Therefore safety precaution should always be taken before any kind of mishap penning occurs. Road accident is one of the major causes of life insecurity in now days. Every single second is important or crucial to take care while driving. Single moment carelessness can cause lifetime regret. Most of the studies say that more than half of the road accidents occur due to carelessness and inactiveness of the driver. People fatigueless, inactiveness and carelessness are the major causes of increasing road accidents especially accidents lead by cars. It is found that drowsiness is one the major factor that causes inactiveness of the driver. It leads to increased in number of road accidents per year. If drowsiness is detected early enough then it could save many road accidents. Drowsiness Detection System has been developed, using a machine vision based concepts. The system uses a small camera that points directly towards the driver's face and monitors the driver's eyes in order to detect fatigue or drowsiness. In a case if fatigue is detected, a warning signal or alarm signal is issued to alert the driver to wake up and come out of the drowsy state. First of all, the system detects the face and then the eyes, and then determines whether the eyes are open or closed. The system deals with using information obtained for the binary version of the image to find the edges of the face, which narrows the area of where the eyes may exist. Once the eyes are located, measuring the distances between the intensity changes in the eye area determine whether the eyes are open or closed. If the eyes are found closed for 5 or more consecutive frames, then the system finds the inactiveness of the driver and concludes that the driver is falling asleep and issues a warning signal or generate and alarm signal to wake him up.

Keywords: ***Eye blinking, Face detection, Haarcascade Face samples, Viola Jones algorithm***

I. INTRODUCTION

According to survey, driver fatigue results in over 50% of the road accidents each year. Using technology to detect driver fatigue/drowsiness is an interesting challenge that would help in preventing accidents. In the past various efforts have been reported in the literature on approaches for drowsiness detection of automobile driver. In the last decade alone, many countries have begun to pay great attention to the automobile driver safety problem. Researchers have been working on the detection of automobile driver's drowsiness using various techniques, such as physiological detection and Road monitoring techniques. However, all the research till date in this approach need electrode contacts on the automobile drivers' head, face, or chest making it non-implementable in real world scenarios. In this thesis I propose a direct approach that makes use of vision based techniques to detect drowsiness. The major challenges of the proposed technique include (a) Developing a real time system (b) Face detection (c) Iris detection under various conditions like driver position, with/without spectacles, lighting etc (d) Blink detection and

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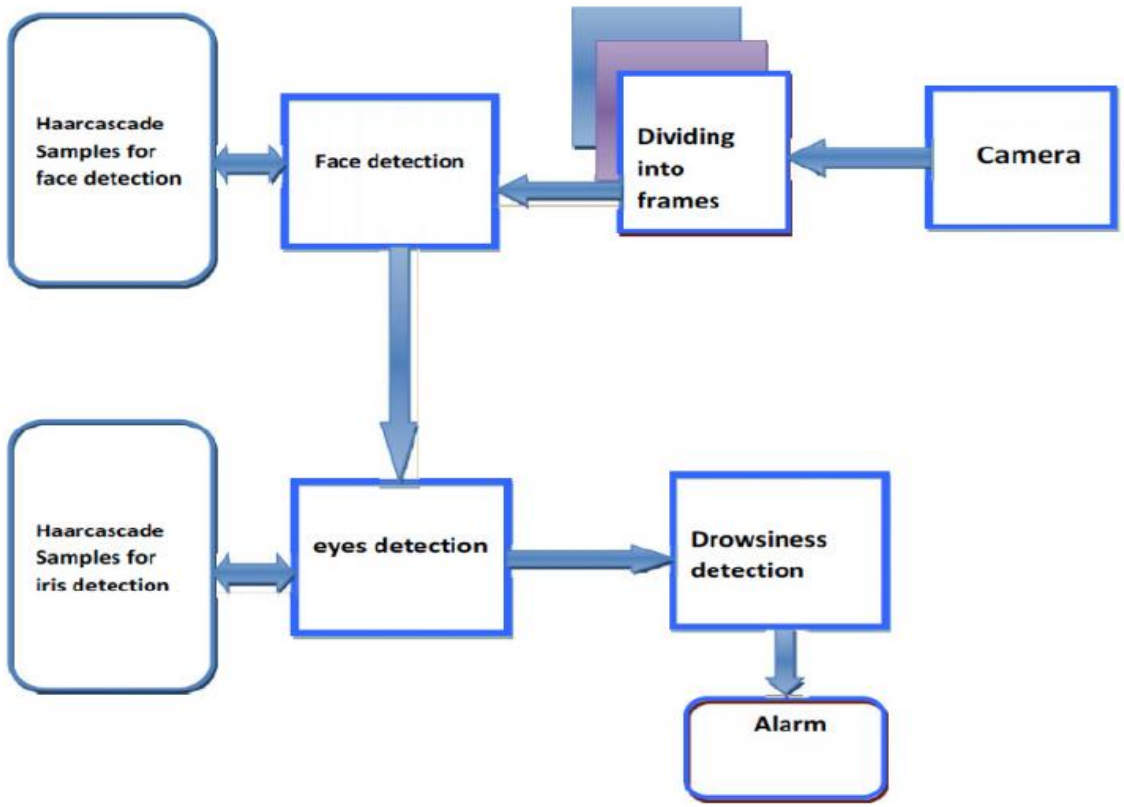
(e) Economy. The focus will be placed on designing a real-time system that will accurately monitor the open or closed state of the driver's eyes. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns in n a sequence of images of a face extracted from a live video.

II. PROPOSED WORK



2.1 Video acquisition: Video acquisition mainly involves obtaining the live video feed of the Automobile driver. Video acquisition is achieved, by making use of a camera and then dividing into frames: This module is used to take live video as its input and convert it into a series of frames/ images, which are then processed.

2.2 Face detection: The face detection function takes one frame at a time from t frames provided by the frame grabber, and in each and every frame it tries to detect the face of the automobile driver. This is achieved by making use of a set of pre-defined Haarcascade samples.

2.3 Eyes detection: Once the face detection function has detected the face of the automobile driver, the eyes detection function tries to detect the automobile driver's eyes. This is done by Voila Jones algorithm.

2.4 Drowsiness detection: After detecting the eyes of the automobile driver , the drowsiness detection function detects if the automobile driver is drowsy or not , by taking in consideration the state of the eyes , that is , open or closed and the blink rate.

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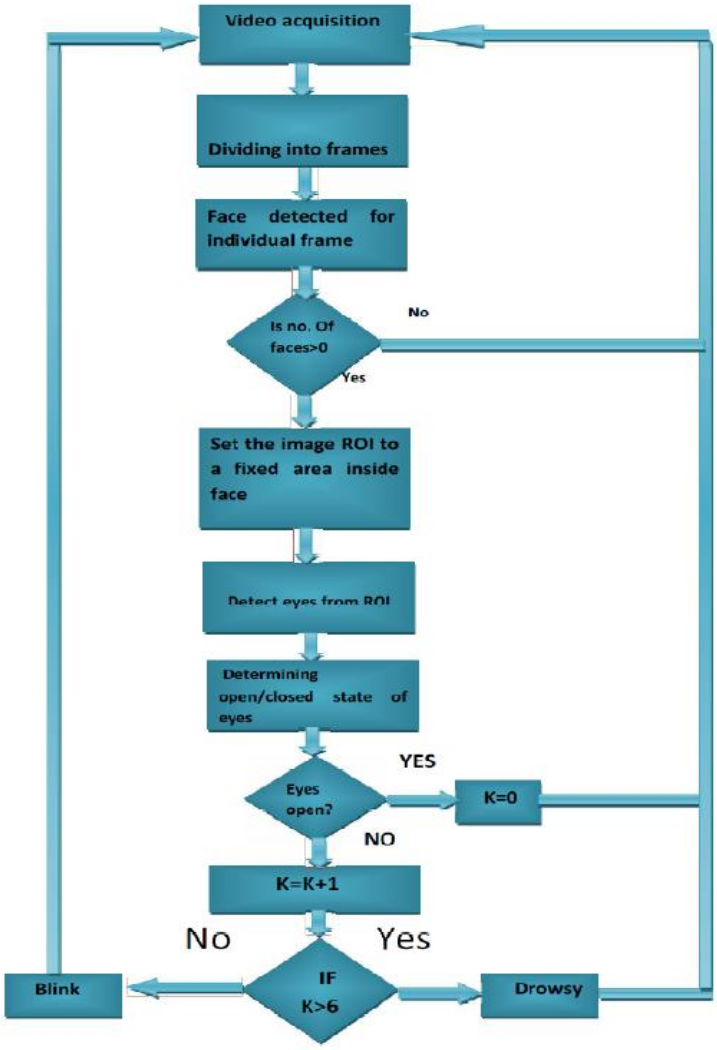
III. FLOW CHART



For detecting the face, since the camera is focused on the automobile driver, we can avoid processing the image at the corners thus reducing a significant amount of processing required. Once the region of interest is defined face has been detected, the region of interest is now the face, as the next step involves detecting eyes. To detect the eyes, instead of processing the entire face region, we mark a region of interest within the face region which further helps in achieving the primary goal of the proposed system. Next we make use of Viola Jones algorithm for eye detection, and detect the eyes by processing only the region of interest. Once the eyes have been detected, the next step is to determine whether the eyes are in open/closed state, which is achieved by extracting and examining the pixel values from the eye region. If the eyes are detected to be open, no action is taken. But, if eyes are detected to be closed continuously for two seconds, that is a particular number of frames depending on the frame rate, then it means that the automobile driver is feeling drowsy and a warning signal is generated. However, if the closed states of the eyes are not continuous, then it is declared as a blink.

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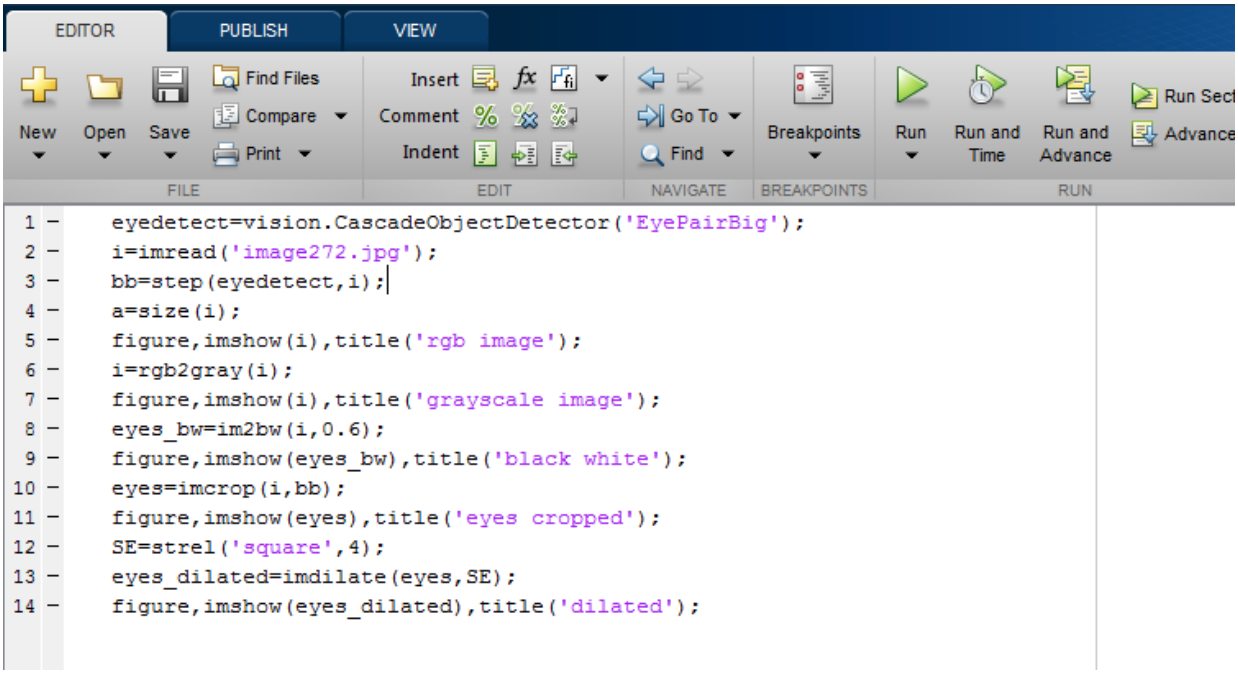
IV. DESCRIPTION

4.1 Processing a Static Image

The method is based on the Viola-Jones algorithm. The project started off with detecting the eyes of a static image stored in the computer. The first step involved storing the image in a variable mentioning the location and the type of image. From the given image, only the eyes are sectioned out and processed to detect for closure or fatigue. The image is processed only to detect the eye region of the image by giving the position, width and height of the region as inputs to the rectangle( ) function. The position, width and height are obtained by using the Vision class in MATLAB. The built in object detector function CascadeObjectDetector is used to detect the eyes. The Eye Detect object is given as input to the step function along with the image and the values returned correspond to the X-Coordinate, Y Coordinate, Width and Height of the eye region. The image is then cropped using the imcrop( ) function with one input as the n*4 matrix and the other being the image itself. The RGB image thus obtained is first converted to its equivalent grayscale form using the rgb2gray( ) function. This is followed by converting the thus obtained gray scale image to its black and white form using the im2bw( ) function. The BW image thus obtained is then dilated to get only the eyes. The purpose of performing the dilation function is to enhance the foreground features. IM2=imdilate(IM,SE) dilates the grayscale, binary, or packed binary image IM, returning the dilated image, IM2. SE is a structuring element object, or array of structuring element objects, returned by the STREL function. The basic effect of the operator on a binary image is to gradually enlarge the boundaries of regions of foreground pixels (white pixels). Thus Sleep Detection System Using MATLAB Image Processing areas of foreground pixels grow in size while holes within those regions become small.



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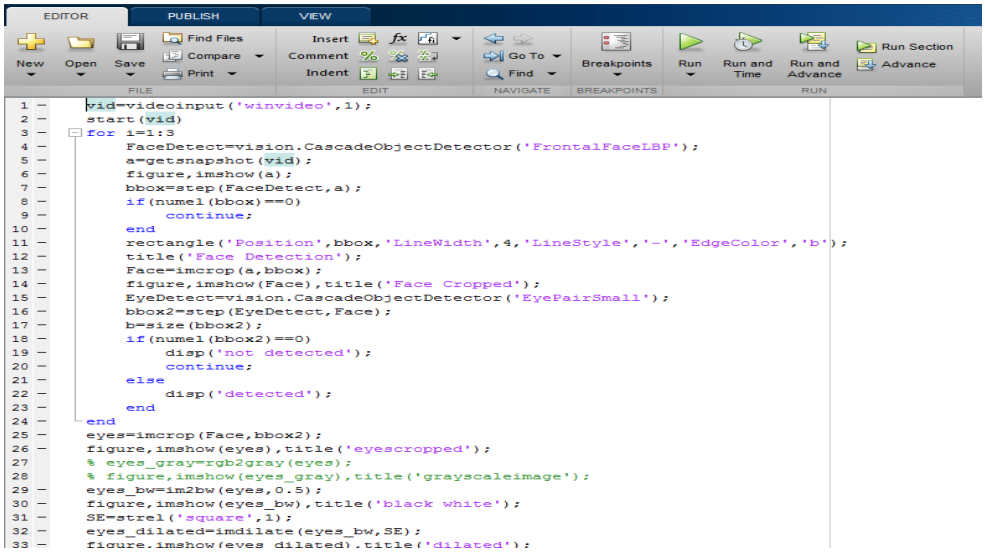
4.2 Processing a live feed

The next step of the project was to perform the same on a live video feed obtained by either using an external USB operated camera or by using the built-in webcam. The accuracy of this method of eye detection is based on the sensitivity of the camera. It is found to have a direct relationship with the accuracy. The greater the accuracy needed, the better quality of webcam has to be used. The first step towards implementing this is to first identify the webcam drivers installed and then configure the webcam to obtain the necessary video feed. The associated webcams were identified by using the imaqhwinfo( ) function. The next step was to configure the webcam and assign the video properties. This involved setting the Frames per Trigger and Returned Color Space properties of the video object. The live feed was then obtained using the start (video object) function. The vision CascadeObjectDetector statement for detecting the face was used to initialize an object FaceDetect. The next step was to crop the image such that only the face is retained static for further eye detection. This is achieved by visualizing the live video feed as individual frames and processing each frame distinctly. The vision CascadeObjectDetector for detecting the eye region was used to initialize an object EyeDetect. The video capturing was initially performed for the first 50 frames. The video was converted to individual frames using the getsnapshot( ) function which returns a matrix corresponding to an RGB image. The next step involved was similar to identifying the eye region in a static image, the difference being instead of the image being stored in the computer memory, it is stored virtually in a MATLAB script. Since the getsnapshot( ) function works by contacting the webcam every time it is called, the processing time is increased. In order to minimize the time taken by the getsnapshot( ), the triggerconfig( ) property of the video object was set to manual mode. The EyeDetect object is given as input to the step function along with the image and the values returned correspond to the X-Coordinate, Y-Coordinate, Width and Height of the eye region. The image is then cropped using the imcrop( ) function with one input as the n cross 4 matrix and the other being the image itself. The RGB image thus obtained is first converted to its equivalent grayscale form using the rgb2gray( ) function. This is followed by converting the thus obtained gray scale image to its black and white form using the im2bw( ) function. The BW image thus obtained is then dilated to get only the eyes.



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V. JUDGING DROWSINESS

Drowsiness of a person can be measured by the extended period of time for which his/her eyes are in closed state. In our system, primary attention is given to the faster detection and processing of data. The number of frames for which eyes are closed is monitored. If the number of frames exceeds a certain value, then a warning message is generated on the display showing that the driver is feeling drowsy. In our algorithm, first the image is acquired by the webcam for processing. Then we use the Viola Jones Algorithm to search and detect the faces in each individual frame. If no face is detected then another frame is acquired. If a face is detected, then a region of interest in marked within the face. This region of interest contains the eyes. Defining a region of interest significantly reduces the computational requirements of the system. After that the eyes are detected from the region of interest by using Viola Jones Algorithm. If an eye is detected then there is no blink and the blink counter K is set to '0'. If the eyes are closed in a particular frame, then the blink counter is incremented and a blink is detected. When the eyes are closed for more than 4 frames then it is deducible that the driver is feeling drowsy. Hence drowsiness is detected and an alarm sounded. After that the whole process is repeated as long as the driver is driving the car.

VI. LIMITATIONS

The following are some of the limitations of the proposed system.

- The system fails, if the automobile driver is wearing any kind of sunglasses.
- The system does not function if there is light falling directly on the camera.

VII. CONCLUTION

Thus we have successfully designed a prototype drowsiness detection system using MATLAB software and Viola Jones Algorithm. The system so developed was successfully tested, its limitations identified and a future plan of action developed.

VIII. FUTURE WORK

In the real time driver fatigue detection system it is required to slow down a vehicle automatically when fatigue level crosses a certain limit. Instead of threshold drowsiness level it is suggested to design a continuous scale driver fatigue detection system. It monitors the level of drowsiness continuously and when this level exceeds a certain value a signal is generated which controls the hydraulic braking system of the vehicle.

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