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A Review on Driver Drowsy Detection System

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ABSTRACT: Driver in-alertness is an important factor which is the major cause for the vehicle crashes. This study reviews the development of a drowsiness detection system using the concepts based on non-intrusive machine vision.A small security camera is implemented in the system which points towards the driver's face for monitoring the driver's eyes in order to detect the drowsiness. In a particular case when the drowsiness is detected in the driver, an alert signal is given to the driver. This review study describes how to detect the eyes, and also how to determine if the eyes are open or closed. The information obtained is used for binary version of image for detection of eyes and face and the area is narrowed where the eyes are detected. After the detection of the face area the eyes can be detected by computing the horizontal averages in that region. Taking into consideration that eye region in the face shows greater intensity changes so the eyes are detected by finding these significant changes in the face. After the eyes are located the distance between the intensity changes in the eye area are measured to determine whether the eyes are open or closed. If a large distance in the intensity changes is measured then it corresponds to eye closure. If the eyes are detected to be closed for 5 consecutive frames, then the system draws the conclusion that the driver is drowsy and issues an alert signal. This system helps to detect the drowsiness and works under reasonable lighting conditions.

KEYWORDS: Fatigue, Drowsy, System, Computer Vision, Face, Eyes, OpenCV, Binarization.

I. INTRODUCTION

Driver in-alertness is one of the major causes for accidents and vehicle crashes round the world. A driver may be distracted by many things, but among the various reasons of all, the main reason is the drowsiness, which may be due to anything like night shifts, heavy workload, excessive driving, etc.
Driver fatigue or tiredness has become a significant factor in a large number of vehicle accidents. According to research around 25% of the accidents on monotonous roads are fatigue related. Recent statistics state that annually 1,200 deaths and 76,000 injuries can be estimated due to fatigue related crashes. The innovations in the automobile industry has made the vehicles more powerful, easier to drive, user friendly but the developing technologies for detection or prevention ofdriver drowsiness or fatigue while driving is a major challenge in the field of research for accident avoidance systems. Because of the hazards that drowsiness cause on the road, there is requirement for development of methods as counter measures against its affects. The main purpose of this paper focuses on designing a system that will monitor the open or closed states of the driver's eyes in real-time.

The symptoms of driver fatigue can be detected early by monitoring the driver's eyes, to avoid the accidents. Detection of fatigue involves a taking into consideration a sequence of images of driver's face, and the observation of eye movements and blinking patterns of the eyes. The analysis of facial images is a popular research area and has applications such as face detection and identification, local binary patterns, and human face recognition security systems. This system focuses on the localization of the eyes, which can be done by analysing the entire image of the driver's face, and then determining the position of the eyes by image-processing algorithm. Once the positions of the driver's eyes are located, the system determines whether the eyes are opened or closed, and detect the fatigue.

II. RELATED WORK

Several systems have been developed and built to analyze and detect the driver's drowsiness, for example T.Danismanet al. [4] which presents an automatic driver drowsiness monitoring and accident prevention system which is further based on changes monitored in the eye blink duration.The paper proposed a method which detects the visual changes in driver's eye movement using the proposed horizontal symmetry feature of the eyes. The blinks of the eye

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can be detected using the standard web cam in real-time at 110fps.The new Advanced Driver Assistance System (ADAS) for automatic driver drowsiness detection which is based on visual information and artificial intelligence has been presented by Flores Javier macro et al. [5]. The aim of the algorithm is to locate and track the face and eyes of the driver to detect the drowsiness index. Garcia .i et al [1] has proposed a non-intrusive approach for detection of drowsiness based on computer vision.This system is installed in a car and works satisfactory under real operation condition.To detect the face of the driver and obtain the drowsiness from driver's eyes an IR camera is placed on the dashboard in front of the driver.This system works in a robust and automatic way without requirement of calibration. The first stage includes pre-processing where the face and eye detection and normalization are done. The second stage deals with performing the pupil position detection and characterization which is combined with an adaptive lighting filtering for making the system capable of dealing with outdoor illumination conditions. The last stage deals with computing PERCLOS from eyes closing information. For evaluating the effectiveness of the system an outdoor database was generated, which consists of several experiments which were carried out during about more than 25 driving hours.A novel approach for sending alert signals to the driver who tends to doze off while driving for avoiding the road crashes was presented by Sharma Nidhi et al. [3]. In this proposed system a small camera is implemented which points to the driver's face and the facial image of the driver is obtained. From the obtained image the face is segmented by using YCbCr color space and finally localization of eyes is done with fuzzy logic and the level of fatigue in the driver is detected and the driver is warned.

III. SYSTEM FLOWCHART

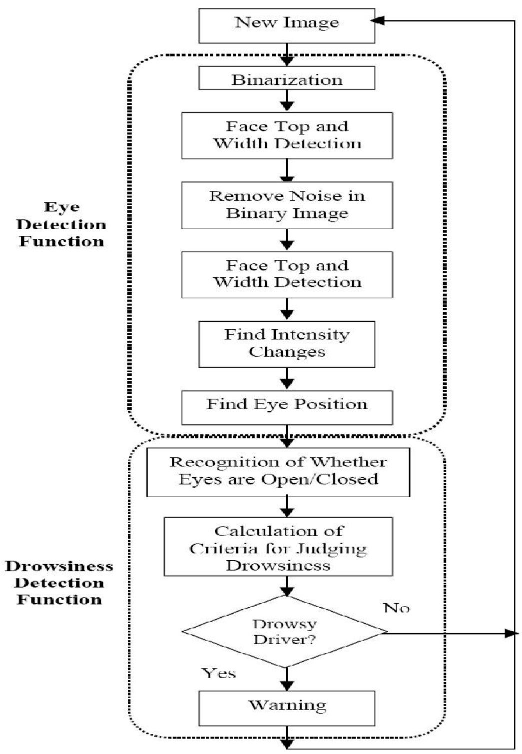

Fig.1.Proposed Algorithm

A.*Eye Detection Function:*

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After facial image is input the pre-processing is performed by the binarizing the image. Now the sides and the top of the face are detected and narrowed down in the area where the eyes exist. The centre of the face is found by using the sides of the face, this is then used as a reference in comparison of the left and right eyes. The horizontal averages of the face area are calculated, moving from top of the face.The large changes in the averages define the eye area.

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B.*Binarization:*

Binarization deals with converting the image to a binary image. Binarization of the image is the first step and it is done to localize the eyes.In a binary image each pixel assumes the value of only two discrete values. The assumed binary values in this case are 0 and 1, 0 represents black and 1 represents white. With the help of binary image it is simpler to distinguish the objects in background. With the use of thresholding the gray scale image can be converted to binary image. The output binary image obtained has values of 0 (black) for all pixels in the original image where the luminance is less than level and 1 (white) for all other pixels. Thresholdis determined based on surrounding lighting conditions and the driver complexion. After observing many samples of facial images under various lighting conditions a threshold value of 150 was found effective. The criteria for choosing the correct threshold was based on concept that the binary image of the driver's face should majorly be white, which allows a few black blobs from the eyes, nose or lips but an optimum binary image used in eye detection algorithm has the background which is uniformly black, and the face is primary white. This will facilitate in finding the edges of the face.

Fig.2.Threshold Value 100

Fig.3.Threshold Value 150

C.*Face Top And Width Detection:*

This step begins with determining the top and side of the driver's face. This is essential in finding the outline of the face as it narrows down the region in which the eyes are located. This makes it easier computationally to determine the position of eyes.Here the first step is to find the top of the face. Next is to find a starting point on the face. After the starting point on the face is found the y-coordinates are decremented till the top of the face is detected.If a person's face is approximately in the centre of the image then the initial starting point considered is (100,240). The starting of x-coordinate was chosen as 100, to insure that the starting point is a black pixel. The following algorithm describes how to find the starting point on the face;this can be used in finding the top of the face.

1. Start at coordinates (100,240), and then increment the x-coordinate till a white pixel is found. This considers the left side of the face.

2. If an initial white pixel is detected and followed by 25 more white pixels, then keep on incrementing x till a black pixel is found.

3. Now count the number of black pixels and the pixels found in step2, if a series of 25 black pixels are detected, thenthis is considered as the right side of the face.

4. Now consider the new starting x-coordinate value as (x1). This is the middle point of the left side and right side.

D.*Removal of Noise:*

The noise removal in binary images is very simple. Start with the top coordinates (x2, y2) move left on pixel. This can be done by decrementing x2, and then set each y value to white. The same procedure is to be repeated for the right side of the face. This procedure should be stopped at the left and right edge of the face; otherwise the edges of the face will

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be lost. After elimination of the black blobs from the face, the edges of the face can be found again. Fig.4 shows the binary picture after noise removal.

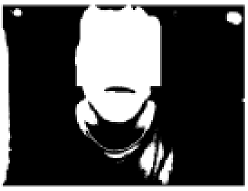

Fig.4.Binary Picture after Noise Removal

E. *Finding intensity changes on the face:*

The intensity changes on the face can be done by using the original image, not the binary image. At first the average intensity for each y – coordinate is calculated. This is called the horizontal average.When the horizontal values were plotted, it was found that there were many small valleys, which did not represent intensity changes, but small differences in the averages were seen. To correct these differences a smoothing algorithm was implemented due to which the smooth graph was obtained. Now the next step is to find the most significant valleys, which indicate the eye area. Taking into consideration that the person having a uniform forehead,from the top of the face, moving down, the primary intensity change is seen at the eyebrow and the next change is seen at the upper edge of the eye. The valleys are computed by finding the changes in slope, from negative to positive. And peaks are computed by changes in slope, from positive to negative. The valley sizecan be determined by finding the distance between the peak and the valley. After all the valleys are found, they are sorted by their size.

F. *Detection of Vertical Eye Position:*

At first the largest valley with the lowest y coordinate is determined, that is the eyebrow,then the second largest valley is determined and it has the next lowest y-coordinate, whichis the eye. This process is done for the left side of the face and then again for the right side of the face separately. The found areas of the eyesin the left and right side of the face are then compared to check whether the eyes are found correctly or not. Computing the left side can be done by taking the averages from the left edge to the centre of the face, and similarly computing for the right side of the face means taking averages from the right edge. The reason for computing the two sides separately is that when the driver's head is tilted the horizontal averages may not be accurate.

IV. ALGORITHM

Thealgorithm for drowsiness detection procedure is explained further. The video is captured from the camera.The images can be captured from a camera or video file into AVI format with the help of OpenCV. First the camera is initialized to captureby setting zero which grabs the frame from default camera. After getting the frame it is converted into Gray scale. The color image can be converted into Gray scale image by using OpenCV conversion. This Gray scale frame will give the binary image. Then the eyes are located using centroid method and thus this can also be used for face tracking purpose. To determine the centroid of an image, the image has to be binarized first. The centroid program will then calculate the centroid on the basis ofpositions of majority of the black pixels. After getting this centroid the eye is then marked with a rectangle with a connected component technique. With this technique the interconnections between the pixels can be easily found. If eyes are detected during tracking then its X and Y coordinates are also detected by finding the centroid of contours. This ultimately gives the centre coordinates of the eye pupil. This method is thus used for detection of eye blinking pattern. Based on blink patternsit can be detected whether driver is drowsy or active.

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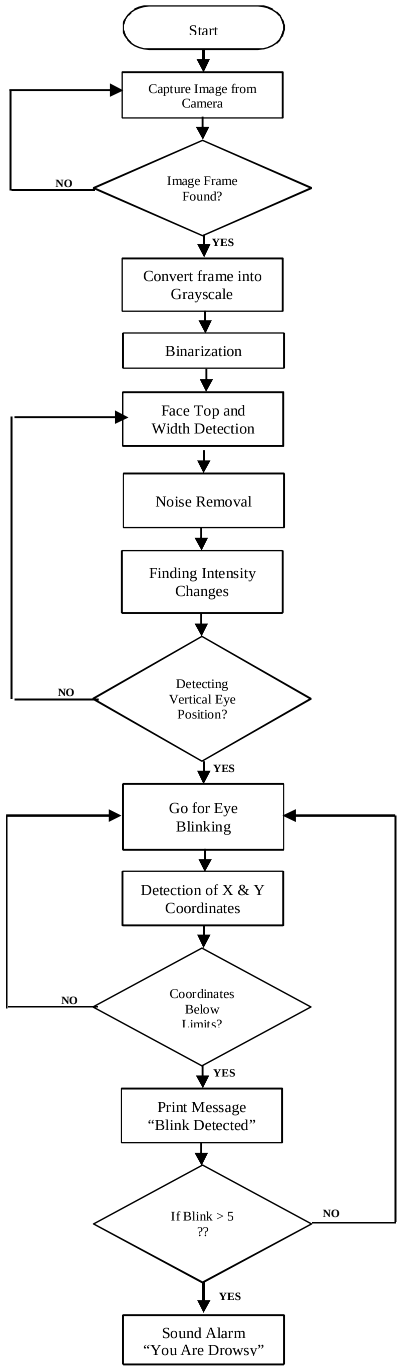

Fig.5.Drowsiness Detection Algorithm

V. CONCLUSION

As discussed throughout the paper, many technologies exist to detect driver fatigue or drowsiness. This paper tries to look at the emerging technologies and determines the best approach in trying to prevent the one of the major cause of fatal vehicle crashes.The system discussed functions as shown in Fig.1.This paper focuses on a system which localizes

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and tracks the eyes and head movements of the driver to detect drowsiness by thresholding the captured gray scale images as significantly shown in Fig. 2 and Fig.3 after which the noise removed image is used for further processing as shown in Fig.4. The system follows an algorithm as discussed in Fig.5. This system also uses a combination of featurebased matching and template based matching to localize the eyes. Also during tracking, the system will be able to decide if the eyes are open or closed. When the eyes will be closed for too long, a warning signal will be given in the form of buzzer or alarm author customized message.

REFERENCES

1. I. Garcia, S. Bronte, L. M. Bergasa, J. Almaz´an, J. Yebes. “Vision-based drowsiness detector for Real Driving Conditions” 2012 IntelligentVehicles Symposium Alcalá de Henares, June – 2012, pp. 618-623
2. M. Imran Khan, A. B. Mansoor, A. Campilho, and M. Kamel, "Real Time Eyes Tracking and Classification for Driver Fatigue Detection, " ICIAR 2008, LNCS 5112, pp. 729-738, 2008.
3. N. Sharma and V.K Banga. “Development of a drowsiness warning system based on the fuzzy logic”. International Journal of Computer
4. Applications 8(9):1–6, October 2010.
5. T.Danisman, I.M Bilasco, C. Djeraba, NacimIhaddadene “Drowsy Driver Detection System Using Eye Blink Patterns” IEEE,march 2010 , pp.230-233.
6. M.J Flores, J.M Armingol and Arturo de la Escalera “Real-Time Drowsiness Detection System for an Intelligent Vehicle” IEEE IntelligentVehicles Symposium Eindhoven University of Technology , June 2008, pp. 637-642.
7. j. S. Wang, R. R. Knipling, and M. J. Goodman, "The role of driver inattention in crashes; new statistics from the 1995 crashworthiness data system, " The 40th Annual Proceedings of Association for the Advancement of Automotive Medicine, 1995.
8. J. A. Horne, and L. A. Reyner, "Sleep-related vehicle accidents, " British Medical Journal, pp. 565-567, 1995.
9. M. J. Ghazi Zadeh, M. Ghassemi Noqaby, M. Ahmadi, and H. R. Attaran, "Effect of human factors on drivers of heavy vehicles fatigue and drowsiness using the regression model. ", The First National Conference of Road and Rail Accidents, Iran, 2009.
10. Q. Wang, J. Yang, P. Ren, and Y. Zheng, "Driver Fatigue Detection: A Survey, " The Proceedings of the 6th World Congress on Intelligent Control, 2008.
11. M. Imran Khan, A. B. Mansoor, A. Campilho, and M. Kamel, "Real Time Eyes Tracking and Classification for Driver Fatigue Detection, " ICIAR 2008, LNCS 5112, pp. 729-738, 2008.
12. A. Mortazavi, A. Eskandarian, and R. S. Sayed, "Effect of Drowsiness on Driving Performance Variables of Commercial Vehicile Drivers, " International Journal of Automotive Technology, Vol. 10, No. 3, pp. 391-404, 2009.
13. E. Vural, M. Jdatcetin, A. Ercil, G. Littlewort, L. Bartlett, J. Movellan, "Machine Learning Systems for Detecting Driver Drowsiness, " In-Vehicle Corpus and Signal Processing for Driver Behavior, Springer, PP. 97-110, 2009.
14. M. Rahmati, and A. R. Khan Taymoori, "A New Method for Recognition of Driver's Fatigue by Eye Detection and Tracking in an Image Sequence, " The 9th Annual Int.Computer society of Iran (CSI) Computer Conf., Feb 17-20, Tehran, Iran, 2003.

BIOGRAPHY

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