BEST: International Journal of Management, Information Technology and Engineering (BEST: IJMITE)
Vol. 1, Issue 1, Oct 2013, 37-42

A REAL TIME SYSTEM FOR DETECTING DROWSINESS OF DRIVER

PUJA MALVADKAR[1], BHAVANA PANSARE[2] & SACHIN PANSARE[3]

[1]Department of ENTC, SCOE, Pune, India

[2]Department of Computer, SIT, Pune, India

[3]SAP Competence Center, BEKAERT, Pune, India

ABSTRACT

According to National Highway Traffic Safety Administration [NHTSA], Drowsiness/sleepiness of driver is one of the major causes of road accidents. It would, therefore, be both cost and safety beneficial if a drowsiness detection system could be developed. This paper describes a real-time non-intrusive method for detecting drowsiness of driver. It uses webcam to acquire video images of the driver. Visual features like mouth &eyes which are typically characterizing the drowsiness of the driver are extracted with the help of image processing techniques to detect drowsiness. A study about the performance of this proposal & some results are presented.

KEYWORDS: Image Capturing, Digital Image Processing, Drowsiness Detection

INTRODUCTION

Generally, there are many reasons behind highway traffic accidents. According to National Highway Traffic Safety Administration [NHTSA], 91% of road accidents are caused by human errors such as drowsiness. Drowsiness is simply defined as “a state of near sleep due to fatigue”. It is technically distinct from fatigue, which has been defined as a “disinclination to continue performing the task at hand”. The effects of sleepiness and fatigue are very much the same. Fatigue affects mental alertness, decreasing an individual’s ability to operate a vehicle safely and increasing the risk of human error that could lead to fatalities and injuries. Sleepiness slows reaction time, decreases awareness, and impairs judgment. Fatigue and sleep deprivation impact all transportation operators (for example: airline pilots, truck drivers, and railroad engineers).In both conditions, driver can’t focus on primary task of driving which may enhance the likelihood of crash occurrence. With the ever-growing traffic conditions, this problem will further deteriorate. For this reason, it is necessary to develop driver alertness system for accident prevention.

SYSTEM OVERVIEW

The complete block diagram representation of the proposed system is as shown in Figure 1.

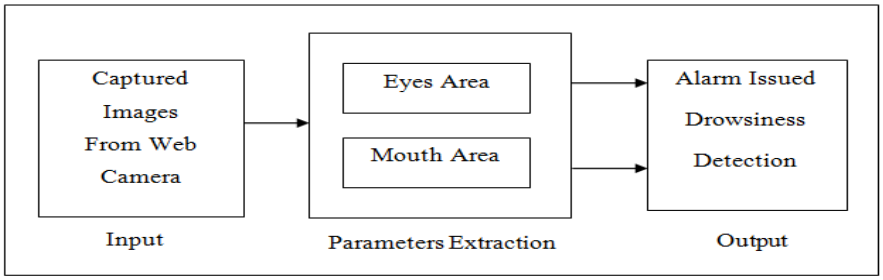


Figure 1: Complete Block Diagram of Proposed System

In literature, there were many drowsiness detection methods appearing & the best is visual feature based approach, as human face contained much information about physical condition. Here, mouth & eyes tracking done in real time using webcams to detect drowsiness of driver.

The continuous drowsiness estimate needs to be mapped to a decision whether the driver is feeling sleepy or not. There are different physical indicators of drowsiness and out of that a person's eyes show the most obvious signs of drowsiness. Therefore, one approach is continuous monitoring eye area & its statistical property. If 2-3 conservative frames found eye closed then warning is issued. The other approach is that continuous monitoring mouth area to detecting yawning, which is also good indication to find driver's drowsiness. Once mouth area is greater than predefined threshold, warning is issued.

IMAGE ACQUISITION METHOD

The proposed system used i Ball face2face CHD12.0 webcam having 5G wide angle lens, 6 LEDs for night vision, with brightness controller, interpolated 12Mpixels still image & 2M pixel video resolution. The camera is placed in front of the user, approximately 30 cm away from the face. The camera must be positioned such that the following criteria are met: First is the user's face takes up the majority of the image & second is the user's face is approximately in the centre of the image. After that converting it into gray scale, as RGB components are dependent on the lighting conditions thus the face detection may fail if the lighting condition changes. Next is face-detection step, the face region is found within the driver's entire facial image to remove unnecessary background.

FACE DETECTION

Viola-Jones method is adopted for face detection, which is easy to use & gives satisfactory results. The features that Viola and Jones used are based on Haar wavelets.

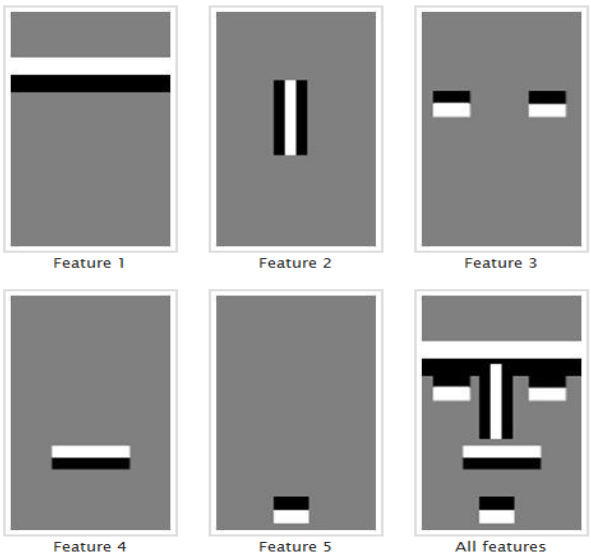


Figure 2: Haar like Features

Haar wavelets are single-wavelength square waves (one high interval and one low interval). In two dimensions, a squarewave is a pair of adjacent rectangles one light and one dark. The actual rectangle combinations used for visual object detection are not true Haar wavelets. Instead, they contain rectangle combinations better suited to visual recognition tasks. Because of that difference, these features are called Haar features or Haar like features, rather than Haar wavelets. Following Figure 2 shows the features that used. The presence of a Haar feature is determined by subtracting the average

dark-region pixel value from the average light-region pixel value. If the difference is above a threshold, that feature is said to be Present. After that cascade classifier are used to combined all Haar features to obtain face.

EYE BASED DROWSINESS DETECTION

To conclude drowsiness depending on eyes, edge detection technique is used. As edge detection is a fundamental tool in image processing, particularly in the areas of feature detection and feature extraction. If 2-3 conservative frames found eye closed then warning is issued. Roberts method is best suited than others for eye based drowsiness detection.

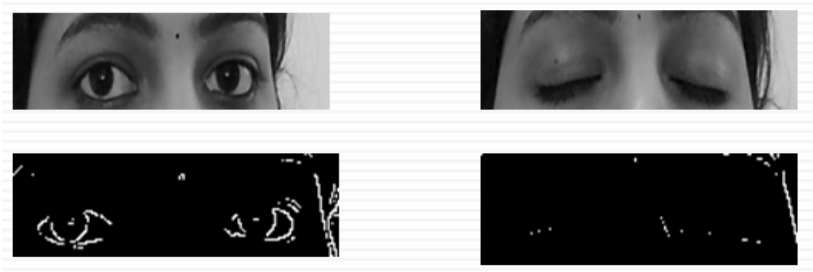


Figure 3: Edge Detection Results of Roberts Method

YAWN BASED DROWSINESS DETECTION

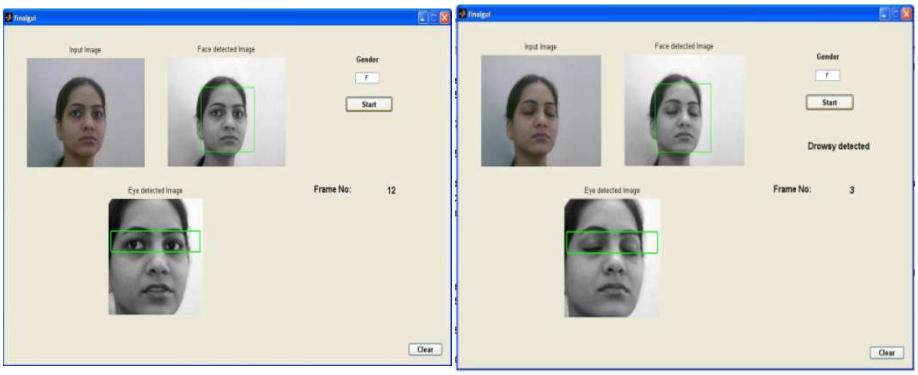
Instead of using any algorithm to detect yawning, here simple logic is used. Once face detection is finished, mouth area image cropped from face detected image as shown in Figure 4. After that one mask image is prepared, this covered the mouth area of cropped images. A mask image is nothing but a fully white image consisting of all ones & having same size of mouth area cropped image.

Figure 4: Mouth Area Image Cropped from Face Detection Image

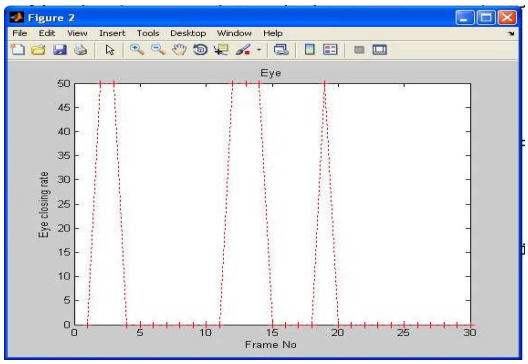
Figure 5: Simple Mask Image

After that the boundary of pixel positions of mouth area in mask image is being found. Then apply threshold technique, (for Male set the threshold value as 250 and for Female set the value as 10). Finally, count the total no of black pixel, if the count is greater than threshold means yawn detected.

EXPERIMENTAL RESULTS

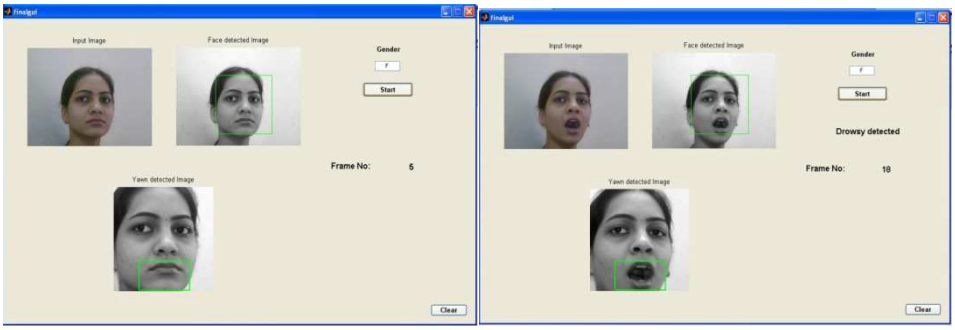


(a) **(b)**

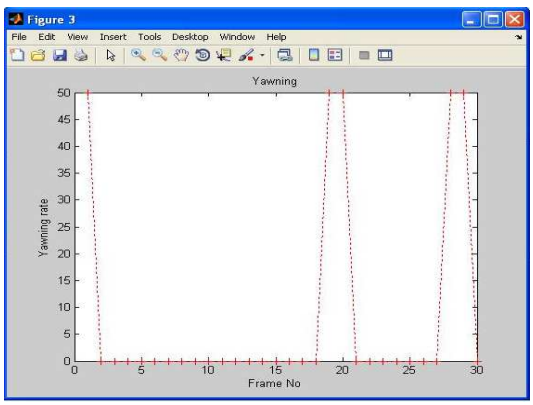


(c)

Figure 6: (a) Main GUI Window for Eyes Base Drowsiness, (b) Eyes Base Drowsiness is Detected, (c) Drowsiness Result for Different Frames & Eyes Area



(a) **(b)**



(c)

Figure 7: (a) Main GUI Window For Yawn Base Drowsiness, (b) Yawn Base Drowsiness is Detected, (c) Drowsiness Result for Different Frames & Mouth Area

CONCLUSIONS

The proposed system detecting drowsiness of driver by continuously monitoring mouth area & eyes. This non-intrusive approach to detecting drowsiness of driver without interference in both daytime & nighttime as webcam having 6 LEDs for night vision, with brightness controller. However, there will be some false detection, where the results are not good when there is quick head-movement. At that time face detection is failed so, future work will be done based on drivers quick head-movement and make it feasible to detect driver's drowsiness.

REFERENCES

1. A.K.Upadhyay; Arvind Kumar; "Road Accidents in India-2011," Government of India Ministry of Road Transport and Highways Transport Research Wing, New Delhi.
2. Cejun Liu; and Rajesh Subramanian; "Factors Related to Fatal Single-Vehicle Run-Off-Road Crashes," NHTSA Technical Report, November 2009
3. National Sleep Foundation White Paper on Drowsy Driving, Nov 16, 2012
4. Jane C. Stutts; Jean W. Wilkins; Bradley V. Vaughn; **"**Why Do People Have Drowsy Driving Crashes? Input from Drivers Who Just Did,**"** AAA Foundation for Traffic Safety, 1999
5. J. Todd Arnedt; Dave Davies; "Drowsy Driving," Canadian Sleep Society, 2003
6. Paul Viola; Michael Jones; "Robust Real-time Object Detection" , Second International Workshop on Statistical And Computational Theories of Vision – Modelling, Learning, Computing, and Sampling Vancouver, Canada, July 13, 2001.
7. Robin Hewitt, "Seeing With Open CV, Finding Faces in Images", Part 2.
8. JaeikJo, HoGi Jung, Kang Ryoung Park, Jaihie Kim, "Vision Based method for detecting driver drowsiness & distraction in driver monitoring system", Dec 2011
9. N. G. Narole; Dr. P. R. Bajaj; **"**A Neuro-Genetic System Design for Monitoring Driver's Fatigue," IJCSNS International Journal of Computer Science and Network Security,Vol.9,No.3, March 2009
10. Garcia, S. Bronte, L. M. Bergasa, J. Almazan, J. Yebes, "Vision based Drowsiness detector for Real Driving Conditions", 2012 Intelligent Vehicles Symposium, June 2012
11. Syed Imran Ali, Mayank Pathak, Dr. Ravindra Patel, **"**An Efficient System to Identify User Alertness based on Somnolence Detection" Published in International Journal Of Advanced Engineering & Applications, Jan. 2010