Available onlinewww.ejaet.com

European Journal of Advances in Engineering and Technology, 2022, 9(4s):210-215
International Conference on Tech Trends in Science & Engineering (ICTTSE) 2022
Suryodaya College of Engineering & Technology, Suryodaya Polytechnic, Nagpur, Maharashtra, India

Research Article ISSN: 2394 - 658X

Implementation Paper on a Driver Drowsiness Detection and Alert System

[1]Prof. Pradip O. Balbudhe, [2]Madhuri Dasariya, [3]Shrikant Waghmare, [4]Anshul Dahiwale

[1]Assistant Prof., Dep. of Computer Engineering, Suryodaya College of Engineering and Technology, Nagpur, India
[2,3,4] Student, Dep. of Computer Engineering, Suryodaya College of Engineering and Technology, Nagpur, India
[1]pb6143@gmail.com, [2]madhuridasariya2000@gmail.com, [3]shrikantwaghmare@gmail.com, [4]anshuldahiwale@gmail.com

---

ABSTRACT

Nowadays, driving support systems, such as car navigation systems, are getting common, and they support drivers in several aspects. It is important for driving support systems to detect status of driver's consciousness. Particularly, detecting driver's drowsiness could prevent drivers from collisions caused by drowsy driving. This paper, does the detailed survey of the various methods to detect drivers fatigue, which can help to increase vigilance of the driver and make him alert from fatigue state. Drowsy Driver Detection System has been developed using a non-intrusive machine vision based concepts. The system uses a small monochrome security camera that points directly towards the driver's face and monitors the driver's eyes in order to detect fatigue. In such a case when fatigue is detected, a warning signal is issued to alert the driver. This report describes how to find the eyes, and also how to determine if the eyes are open or closed. The algorithm developed is unique to any currently published papers, which was a primary objective of the project. 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 face area is found, the eyes are found by computing the horizontal averages in the area. Taking into account the knowledge that eye regions in the face present great intensity changes, the eyes are located by finding the significant intensity changes in the face. Once the eyes are located, measuring the distances between the intensity changes in the eye area determine whether the eyes are open or closed. A large distance corresponds to eye closure. If the eyes are found closed for 5 consecutive frames, the system draws the conclusion that the driver is falling asleep and issues a warning signal. The system is also able to detect when the eyes cannot be found, and works under reasonable lighting conditions

Keywords: GPS, Speed detection, Alcohol detection, Bluetooth Technology, MQ5, Arduino UNO, Ultrasonic Sensor.

INTRODUCTION

Driver drowsiness is an important factor in the motoring of vehicle accidents [1,2,3,4]. It was demonstrated that driving performance deteriorates with increased drowsiness with resulting crashes constituting more than 20% of all vehicle accidents [9]. Traditionally transportation system is no longer sufficient. Recently artificial intelligence techniques have emerged and became a popular topic among transportation researchers. In recent years, there has been growing interest in intelligent vehicles. A notable initiative on intelligent vehicles was reported by the U.S. Department of Transportation with the mission of prevention of highway crashes [9]. The ongoing intelligent vehicle research will revolutionize the way vehicles and drivers interact in the future. The US National Highway Traffic Safety Administration estimates that in the US alone approximately 100,000 crashes each year are caused primarily by driver drowsiness or fatigue. Thus incorporating automatic driver fatigue detection mechanism into vehicles may help prevent many accidents. One can use a number of different techniques for analyzing driver exhaustion. One set of techniques places sensors on standard vehicle components, e.g., steering wheel, gas pedal, and analyzes the signals sent by these sensors to detect drowsiness [7, 9]. It is important for such techniques to be adapted to the driver. A second set of techniques focuses on measurement of Physiological signals such as heart rate, pulse rate, and Electroencephalography (EEG) [8]. It has been reported by researchers that as the alertness level decreases EEG power of the alpha and theta bands increase as shown in figure 1. Hence providing Indications of drowsiness. However, this method has drawbacks in terms of practicality since it requires a person to wear an EEG cap while driving. A third set of solutions focuses on computer vision systems that can detect and recognize the facial motion and appearance changes occurring during drowsiness [4,11]. The advantage of computer vision techniques is that they are non-invasive, and thus are more amenable to use by the general public. There are some significant previous studies about drowsiness detection using computer vision techniques. Most of the published research on computer vision approaches to detection of fatigue has been focused on the analysis of blinks and head movements [13,15]. However, in the fatigue detection systems developed to date, drowsiness warning system using image processing has become most widely used because it provides a remote detection [13]. Due to the increase in the amount of automobile in recent years, problems created by accidents have become more complex as well. Traditional transportation system is no higher sufficient. In recent years, the intelligent vehicle system has emerged and became a popular topic among transportation researchers. However, the research of safety in vehicle is an important subset of intelligent vehicle system research. Meantime, active warning system is one of the designs on active safety system. The safety warning systems, mostly active warning systems for preventing traffic accidents have been attracting researchers. Owing to the progress of digital signal processing technology, real time image processing is beginning to be achieved breakthroughs in the field of many practical applications. Typically, after high hours of driving or in absent of alert mental state, the eyelids of driver will become heavy due to fatigue. The attention of driver starts to lose focus, and that creates risks for accidents. These are typical reactions of fatigue, which is very dangerous. Usually many exhausted drivers are not aware that they are in falling asleep. In fact, many such drivers can fall asleep any time during their driving.

PROBLEM STATEMENT

Eye detection is a pre-requisite stage for many applications such as human–computer interfaces, iris recognition, driver drowsiness detection, security, and biology systems. In this paper, template based eye detection is described. The template is correlated with different regions of the face image. The region of face which gives maximum correlation with template refers to eye region. The method is simple and easy to implement. The effectiveness of the method is demonstrated in both the cases like open eye as well as closed eye through various simulation results A novel and simple eye detection scheme is proposed in this paper. An eye template is used to detect eye region from face image. The template is matched with eye region using cross correlation technique. The method does not require any complex mathematical calculation and prior knowledge about the eye. It is a simple method and can easily be implemented by hardware.

OBJECTIVES

Object detection is commonly defined as method for discovering and identifying the existence of objects of a certain class. Also it can be considered as a method in image processing to find out an object from images. There are several ways to classify and find objects in a frame. Out of that one way can be based on color identification. But it is not an efficient method to detect the object as several different size object of same color may be present. Hence a more efficient way is Haar-like features, developed by Viola and Jones on the basis of the proposal by Papageorgiou et. al in 1998. Haar-like features are digital image features used in object detection. Or we can say that these are rectangle shaped dark and light areas having similar kind of features like our face. The cascade classifier comprises of a number of stages, where each stage consists of many weak features. The system detects objects by moving a window over the entire image and by forming a strong classifier. The output of each stage is labeled as either positive or negative– positive meaning that an object was found and negative means that the specified object was not found in the image

LITERATURE REVIEW

One common definition of driver abnormality is: "Driver abnormality represents diminished attention to activities that are critical for safe driving in the absence of a competing activity." In-vehicle driving behaviour detection is a hot topic in the field of ITS. Several works have been done in the field of driver abnormality monitoring and detection systems using wide range of methods. Possible techniques for detecting drowsiness in drivers can be divided into sensing of physiological characteristics, driver operation, vehicle response and driver response [4]. Among these methods, the techniques that are the best based on accuracy are the ones based on human physiological phenomena [5]. This technique can be implemented in several ways such as measuring brain waves (EEG), heart rate (ECG) and open/closed state of eyes [6]. The first two methods being more accurate is not realistic since sensing electrodes to be attached directly onto driver's body and hence be annoying and distracting the driver. The technique based on eye closure is well suited for real world driving conditions, since it can be non intrusive by using cameras to detect the open/closed state of the eyes [7]. Eye tracking based drowsiness detection system has been done by analyzing the duration of eye closure using camera and developing an algorithm to detect the driver drowsiness in advance and warn the driver via in vehicle alarms. Drunken state analyzing systems are developed using breath and alcohol sensors, which can detect the alcoholic presence in the driver's breath. Works have been done by means of infrared breath analyzer placed on the steering wheel which detects the infrared light absorbed by the alcohol contained in the driver's breath. Though the research work had been started years ago, only a few systems are commercially released. The drowsiness detection systems developed by Volvo and Mercedes Benz find their use only in high end vehicles. The Attention Assist system in Mercedes Benz vehicles monitors the vehicle continuously, to adopt a practically oriented distance towards accident avoidance [8].

PROPOSED SYSTEM

There are several different algorithms and methods for eye tracking, and monitoring. Most of them in some way relate to features of the eye (typically reflections from the eye) within a video image of the driver. The original aim of this project was to use the retinal reflection as a means to finding the eyes on the face, and then using the absence of this reflection as a way of detecting when the eyes are closed. Applying this algorithm on consecutive video frames may aid in the calculation of eye closure period. Eye closure period for drowsy drivers are longer than normal blinking. It is also very little longer time could result in severe crash. So we will warn the driver as soon as closed eye is detected.

A. Sensing Phase

Eye Camera is used for sensing the eyes of the driver. Alcohol sensor is used for sensing the presence of alcohol content in the driver's breath. The accelerometer present on the vehicle suspension unit senses the downward acceleration of the vehicle toward the road humps and pits.

B. Detection Phase

The analysis of information from the sensors and camera are done to deduce the driver's current driving behaviour style. The open/closed state of eyes is deduced by means of image processing techniques using computer vision. The image processing techniques are performed inside PC.

C. Correction Phase

This phase is responsible for doing the corrective actions required for that particular detected abnormal behaviour. The corrective actions include in-vehicle alarms, turning of the engine and GSM communication with the authorities. The corrective measures vary according to the behaviour detected. Corrections for drowsiness include in- vehicle alarms and its repetition turns the engine off.

Drunken behaviour is rectified by in-vehicle alarms, if not GSM communication with the authorities are done. Reckless measures include in-vehicle alarms and repetition will turn off the engine Certain issues related to the low cost implementation of the proposed system with all its functionalities include the data fusion from different sensors and the image processing techniques. Also the addition of more sensors and algorithms to improve the accuracy and perfection of the system will be a challenge in front of this work.

D. System Process

(i) Eye detection function: After inputting a facial image, pre-processing is first performed by binarizing the image. The top and sides of the face are detected to narrow down the area of where the eyes exist. Using the sides of the face, the centre of the face is found, which will be used as a reference when comparing the left and right eyes. Moving down from the top of the face, horizontal averages (average intensity value for each y coordinate) of the face area are calculated. Large changes in the averages are used to define the eye area. The following explains the eye detection procedure in the order of the processing operations. All images were generating in Mat lab using the image processing toolbox.

(ii) Binarization: The first step to localize the eyes is binarizing the picture. Binarization is converting the image to a binary image. The background is uniformly black, and the face is primary white.

(iii) Removal of Noise: The removal of noise in the binary image is very straightforward. The key to this is to stop at left and right edge of the face; otherwise the information of where the edges of the face are will be lost.

The flowchart of the algorithm is represented in Figure 1

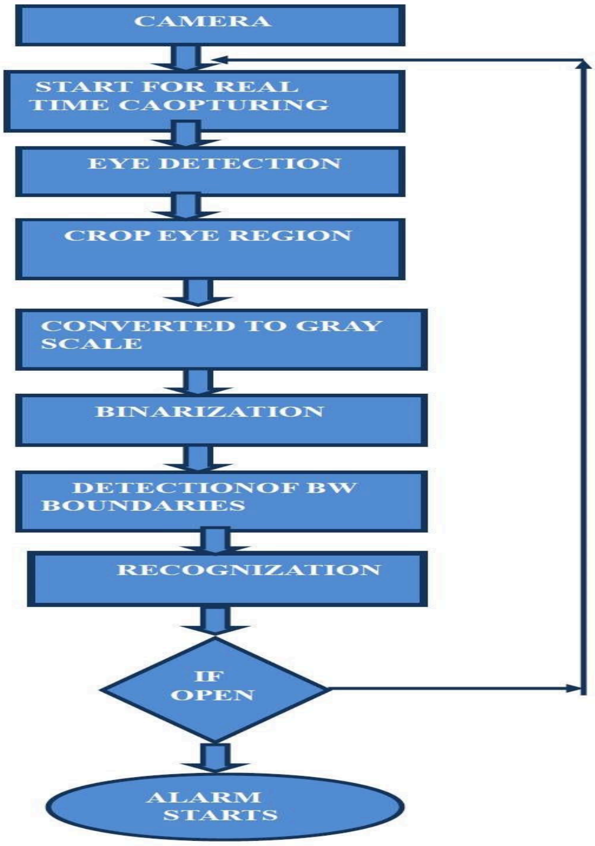

Fig. 1 Diagram of the Proposed System

(iv) Finding Intensity Changes: The next step in locating the eyes is finding the intensity changes on the face. This is done using the original image, not the binary image. The first step is to calculate the average intensity for each y – coordinate. This is called the horizontal average, since the averages are taken among the horizontal values. The valleys (dips) in the plot of the horizontal values indicate intensity changes. When the horizontal values were initially plotted, it was found that there were many small valleys, which do not represent intensity changes, but result from small differences in the averages. To correct this, a smoothing algorithm was implemented. The smoothing algorithm eliminated and small changes, resulting in a more smooth, clean graph. After obtaining the horizontal average data, the next step is to find the most significant valleys, which will indicate the eye area.

E. Detection of Vertical Eye Position

The first largest valley with the lowest y – coordinate is the eyebrow, and the second largest valley with the next lowest y-coordinate is the eye.

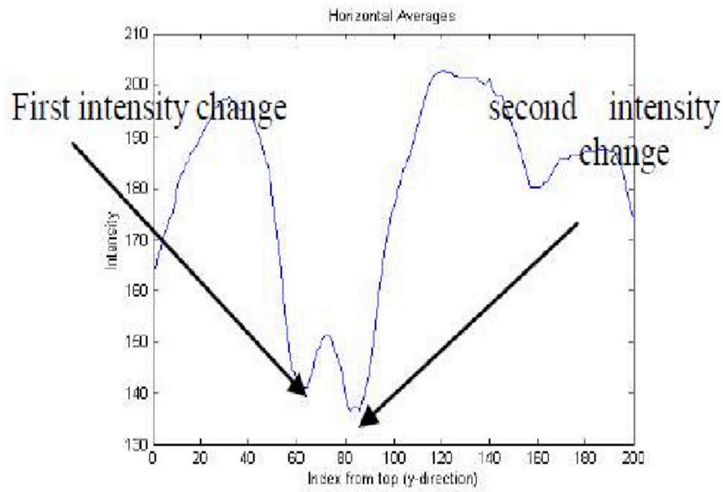

Fig. 2 Graph of horizontal averages of the left side of the face

The areas of the left and right side are compared to check whether the eyes are found correctly. Calculating the left side means taking the averages from the left edge to the centre of the face, and similarly for the right side of the face. The reason for doing the two sides separately is because when the driver's head is tilted the horizontal averages are not accurate. For example, if the head is tilted to the right, the horizontal average of the eyebrow area will be of the left eyebrow, and possibly the right hand side of the forehead.

CONCLUSION

This review paper describes the various methods for detecting driver's drowsiness by analyzing facial images taken by a camera. This system involves two steps firstly the eye detection then detecting the drowsiness of the eye. Detection of the eye is done by the image processing technique. In the second step we discuss various detection methods, the various movements of the body etc. lack of proper light after sunset can cause problems in reading the images. System detect the driver‟s eye wearing spectacles. In future implementation of the infrared light source could be a better solution for the lack of light after sunset.

ACKNOWLEDGEMENT

It would be my immense pleasure to take this as a chance to represent my appreciation and earnest because of our regarded **Professor Mr. Pradip O. Balbudhe** for the direction, knowledge, and bolster that he has given all through this work. Mypresent work would never have been achievable without his guidance inputs and tutoring.

I would also like to thank every one of my friends, faculty team and all staff of prestigious Department of computer Engineering for their amazing help all through our course of learn at this organization.

REFERENCES

[1]. Azim Eskandarian, Member, IEEE and Ali Mortazavi (2007). "Evaluation of a Smart Algorithm for Commercial Vehicle Driver Drowsiness Detection." IEEE Intelligent Vehicles Symposium Istanbul, Turkey, June 13-15

[2]. Eriksson, M and Papanikolopoulos, N.P(1997) "Eye-Tracking for Detection of Driver Fatigue", IEEE Intelligent Transport System Proceedings, 314-319.

[3]. Ibrahiem M. M. El Emary, "On the Application of Artificial Neural Networks in Analyzing and Classifying the Human Chromosomes", Journal of Computer Science, vol.2(1), 2006, pp.72-75.

[4]. N. Senthilkumaran and R. Rajesh, "A Study on Edge Detection Methods for Image Segmentation", Proceedings of the International Conference on Mathematics and Computer Science (ICMCS-2009), 2009, Vol. I, pp. 255-259.
[5]. Lin, S. H., Kung, S. Y., & Lin, L. J. (1997). "Face recognition/detection by probabilistic decision-based neural network." IEEE Transactions on Neural Networks,
[6]. S. Singh. and N. P. Fapanikolopaulas (1999), "Monitoring Driver Fatigue Using Facial Analysis Technologies", IEEE International conference on the Intelligent Transportation Systems. pp.316-318.
[7]. Nikhil R Pal, Chien-Yao Chuang, Li-Wei Ko, Chih-Feng Chao, Tzyy- Ping Jung, Sheng-Fu Lieng, Chin-Teng Lin, "EEG-Based Subject- and Session-independent Drowsiness Detection: An Unsupervised Approach".
[8]. Gabriela Dorfman Furman, Armanda Baharav, "Investigation of Drowsiness while Driving Utilizing Analysis of Heart Rate Fluctuations".
[9]. Azim Eskandarian and Ali Mortazavi, "Evaluation of a smart algorithm for commercial driver drowsiness detection" presented at Proceeding of the 2007 IEEE Intelligent Vehicles Symposium, June 2007
[10]. Tianyi Hong, Huabiao Qin, Qianshu Sun, "An improved real time eye state identification system in driver drowsiness detection," IEEE Control and Automation, 2007.
[11]. B.J. Wilson and T.D. Bracewell, "Alertness monitoring using neural networks for EEG analysis," in Proceeding of the 10th IEEE Workshop on NNSP, 2