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Drowsiness and Driver Fatigue Monitoring and Alert System

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Abstract -The main idea behind this project is to develop a non-intrusive system which candetect fatigue of the driver and issue a timely warning. Since a large number of roadaccidents occur due to the driver drowsiness, this system will be helpful in preventingmany accidents, and consequently save money and reduce personal suffering. Thissystem will monitor the driver's eyes using a camera and by developing algorithm wecan detect symptoms of driver fatigue early enough to avoid an accident. So, thisproject will be helpful in detecting driver fatigue in advance and will gave warningoutput in form of sound.Moreover, the warning will be deactivated manually ratherthan automatically. For this purpose, a deactivation switch will be used to deactivatewarning. Moreover, if driver feels drowsy there is possibility of sudden acceleration ordeceleration.Drowsiness and Fatigue of drivers are amongst the significant causes ofroad accidents. Every year,they increase the amounts of deaths and fatalities injuriesglobally.

Key Words:Face Detection,Eye Detection,Drowsiness Detection,FatigueMonitoring

1.INTRODUCTION

The increasing number of traffic accidents due to a diminished driver's vigilance level has become a serious problem for society. Statisticsshow that 20% of all the traffic accidents are due to drivers with a diminished vigilance level Drivers drowsiness is an important factor in themotoring of vehicle accidents. It was demonstrated that driving performance deteriorates with increased drowsiness with resulting crashesconstituting more than 20% of all vehicle accidents. Being able to detect driver's state in each moment and using this information in a driver-vehiclesystem, may lead to the development of a more intelligent driver assistance system which will prevent car accidents. There arenumerous non-driver related causes of car accidents including road conditions, the weather and the mechanical performance of a car.However, a significant number of car accidents are caused by driver error. Driver error includes drunkenness, fatigue, and drowsiness. Manyfactors can affect a driver's ability to control a motor vehicle, such as natural reflexes, recognition and perception. The diminishing of thesefactors can eventually reduce a driver's vigilance level. Statistically, drowsiness by drivers results in an estimated 1,550 deaths, 71,000injuries, and $12.5 billion in monetary losses.

A research suggests that up to 25% of accidents on monotonous roads in India are fatigue related. Based on researches done by theRealAutomóvil Club de España (RACE), driver drowsiness involves a high percentage (30%) of traffic accidents. The International statisticsshows that a large number of road accidents are caused by driver fatigue. Therefore, a system that can detect oncoming driver fatigue andissue timely warning could help in preventing many accidents, and consequently save money and reduce personal suffering.

Thus, the goal will be to develop a safety system for the driver, detecting eye and estimating the driver status and generate warningaccordingly, facial feature extraction, provide refreshment centre to driver through notification. To overcome the challenge of driverdrowsiness and fatigue detection and reduce accidents caused because of the same.

II. LITERATURE

The modified approaches using various exploring techniques in the research papers for implementation of idea of project is done. Thestudy related to image processing used in various models and the comprehensive literature review of various researcher's works are stated.In paper [1], the authors have made an attempt to design a system that uses video camera that points directly towards the driver's face in orderto detect fatigue. If the fatigue is detected a warning signal is issued to alert the driver. The authors have worked on the video files recordedby the camera. Video file is converted into frames. Once the eyes are located from each frame, by measuring the distances between the intensity changes in the eye area one can determine whether the eyes are open or closed. 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 algorithm is proposed, implemented, tested,and found working satisfactorily. Driver Fatigue Detection System [2] proposes a method for detecting the early signs of fatigue/drowsinessduring driving. Analysing some biological and environmental variables, it is possible to detect the loss of alertness prior to the driver fallingasleep. As a result of this analysis, the system will determine if the subject is able to drive. Heart rate variability (HRV), steering-wheel grippressure, as well as temperature difference between the inside and outside of the vehicle, make possible to estimate in an indirect way thedriver's fatigue level. A hardware system has been developed to acquire and process these variables, as well as an algorithm to detect beats and calculate the HRV taking into account the others aspects mentioned before. The paper [3], Drivers Drowsiness Detection in EmbeddedSystem, proposes an efficient method to solve these problems for eye state identification of driver's drowsiness detection in embedded systemwhich based on image processing techniques. This method break traditional way of drowsiness detection to make it real time, it utilizes facedetection and eye detection to initialize the location of driver's eyes; after that an object tracking method is used to

keep track of the eyes;finally, we can identify drowsiness state of driver with PERCLOS by identified eye state.

Experiment results show that it makes good agreement with analysis. The paper [4] is Driver Drowsiness Detection using Eye-ClosenessDetection. The authors have implemented a Raspberry Pi device programmed with an innovative algorithm. This algorithm allows aRaspberry Pi camera module to be able to detect the face and eyes, which are considered two of the most significant activities when drivingthat can serve as factors to gauge the drowsiness level of drivers. Since precise detection was achieved using the interested values, the authorsexpect that the device can accurately gauge driver drowsiness. For the base computer, the research team selected Raspberry Pi 3 Model B.The Raspberry Pi camera was the visual device of choice. Moreover, hardware works great with well-designed software. As such, softwareis the most important part in any designed device. For video and photo manipulation, the research team chose OpenCV library for itscompleteness and convenience. In the paper [5], a module for Advanced Driver Assistance System (ADAS) is presented to reduce the numberof accidents due to drivers fatigue and hence increase the transportation safety; this system deals with automatic driver drowsiness detectionbased on visual information and Artificial Intelligence. They proposed an algorithm to locate, track, and analyse both the drivers face andeyes to measure PERCLOS, a scientifically supported measure of drowsiness associated with slow eye closure.

The summary of reviewed papers is included in following table: -

Sr. No.	Research Authors	Research Papers	Methodology	Conclusion
1	Oraan hunpisuth Taweechai Chotchinasri,Varakorn Koschakosai,Narit Hnoohom	Driver Drowsiness Detection using Eye-Closeness Detection	This paper experimented in abright room with constant light. In addition, there were several limitations including lightconditions and the darkness of the skin. This paper was concerned with drowsy drivers and their potential to cause car accidents. Therefore, the authors applied image processing and C++ language skills in order to build an embedded device that could alert drivers when feeling sufficiently drowsy.	The authors applied image processing and C++ language skills in order to build an embedded device that could alert drivers when feeling sufficiently drowsy. The embedded Device can calculate a drowsiness level from the driver using a combination of Raspberry Pi 3 Model B and Raspberry Pi Camera.
2	Belal ALSHAQAQI,Abdullah Salem BAQUHAIZEL, Mohamed ElAmine OUIS,Meriem BOUMEHED, Abdelaziz OUAMRI, Mokhtar KECHE	DRIVER DROWSINESS DETECTION SYSTEM	This system is able to determine the driver state under real day and night conditions using IR camera. Face and eyes detection are implemented based on symmetry. Hough Transform forcCircles is used for thedecision of the eyes states.	In this paper, we presented the conception and implementation of a system for detecting driver drowsiness based on vision that aims to warn the driver if he is in drowsy state. The results are satisfactory with an opportunity for improvement in face detection using other techniques concerning the calculation of symmetry.

3	TianyiHong ,Huabiao Qin	Drivers Drowsiness Detection in Embedded System	This paper presents a arithmetic based on new conceptio n to solve theproble m of drowsines s detection in embedded system, the arithmetic comprise d three stages: 1. Face detection using cascade and eye position detection based on horizontal projection ; 2. Eyes tracking bymean shift; 3. Identify eye state by complexit y function and eye corner feature.	It adopted a new conception tomake the wholesyste m real time; It identify eye state using complexity function to makehighe r accuracy of the identificati on result. All results show it an efficient way for driver's drowsiness detection.
4	Mandalapuarada Devi, Dr.Preeti R Bajaj	Driver Fatigue Detection Based on EyeTrack ing.	In this paper authors have used PERCLO S toMeasur e drowsines slevel in driver. If the threshold value for no. of frames is accurate then result with low false output is generated .	In this paper, non-intrusive driver monitoring system is implement ed which detects the fatigued state of the driver through continuous ly monitoring the eyes of the driver. The basis of the method used by authors was the horizontal intensity variation on the face.
5	E. Rogado, J.L. Garcìa, R. Barea, L.M.Bergasa, Member IEEE and E. Lopez	Driver Fatigue Detection System	Detecting the fatigue with a single physiolog ical parameter isnot possible, becoming necessary the study of diverse variables. Inthis work we have been studied the HRV variability during the conductio n and to account for this informati on, combinin g it with others to be able to evaluate thedriver' s state.	Main objective is to combine the HRV with visual informatio n and with the driving environme nt(road conditions, climate, etc.) to detect the drowsiness during the conduction and in this way to reduce the risks and dangers for thedrivers.

2. Proposed System

Input will be images from camera. Output will be notification to the driver if he is feeling drowsy.

Steps:

1. Camera input
2. Face recognition
3. Recognized face region + eye recognition
4. If calculated value is less than threshold value, generate alarm
5. Repeat from step1

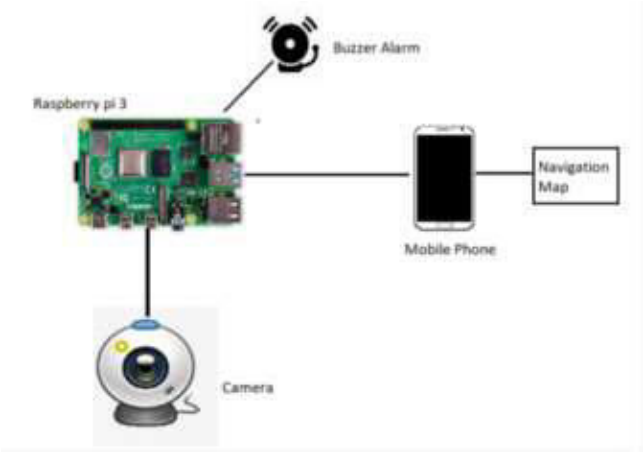

Fig 1: System Architecture

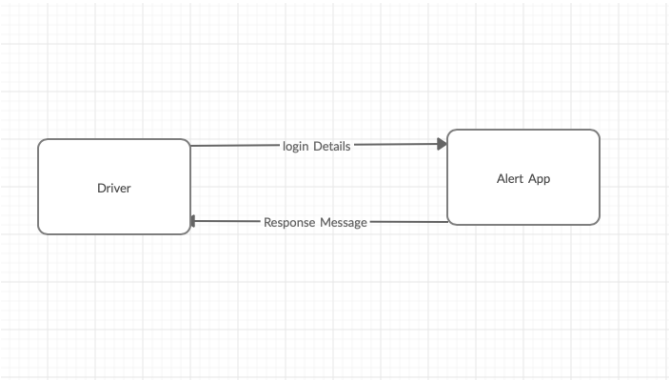

Fig. 2: DFD level 0

DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analysed or modelled.

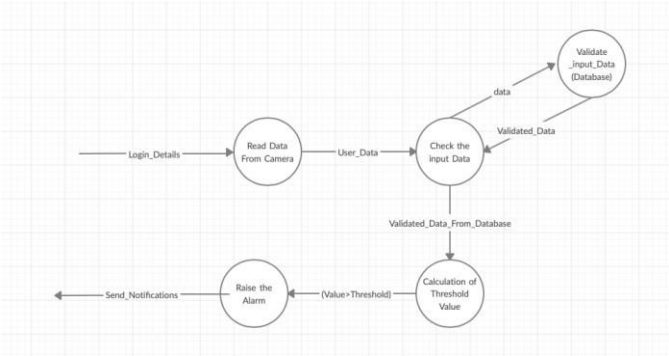

Fig. 3: DFD level 1

The Level 0 DFD is broken down into more specific, Level 1 DFD. Level 1 DFD depicts basic modules in the system and flow of dataamong various modules. Level 1 DFD also mentions basic processes and sources of information. It provides a more detailed view of theContext Level Diagram.

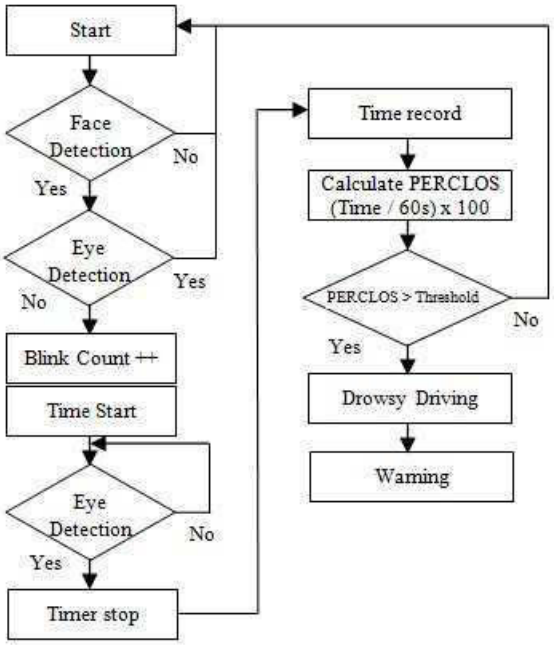

Fig. 4: DFD level 2

Fig. 4 shows the detailed flow in the proposed system. It shows the different processes that take place to perform the authentication.The proposed system will detect face and extract features using camera and process the image using algorithm. The aspect ratio of theeye will be checked for a certain appropriate threshold value and if it crosses that value an alarm will be generated. Also, the notification ofthe alarm will be sent to mobile which will have the facility to access real time location of the driver. The mobile application will be specifically created for the user to navigate to nearby refreshment centers if the user desires. Thus the driver can also take a break fromdriving with the help of the application we have designed. This will help to ease the driver and avoid fatigue or drowsiness which may leadto accidents.

ALGORITHM USED:

Convolutional Neural Network is a Deep Learning algorithm which can take image as input and assign importance to objects which canbe used to differentiate from each other. It helps extract and classify image with much less pre-processing and thus requires less time toprocess. Unlike traditional image processing methods where we have to manually feed features to classifiers, CNN automatically detects andclassifies the features which can be used to identify various image objects and in the scope of this research helps to identify eyes for whichthe drowsiness detection algorithm will work.

3. RESULTS

From the proposed system, we can prevent lot of accidents and Notify the Driver aboutnearby Refreshment centres. It will cover the major flaws existing in the previous systems.Combining some of the most useful algorithms the accuracy of this system isimproved.This system will increase the Driver Safety.

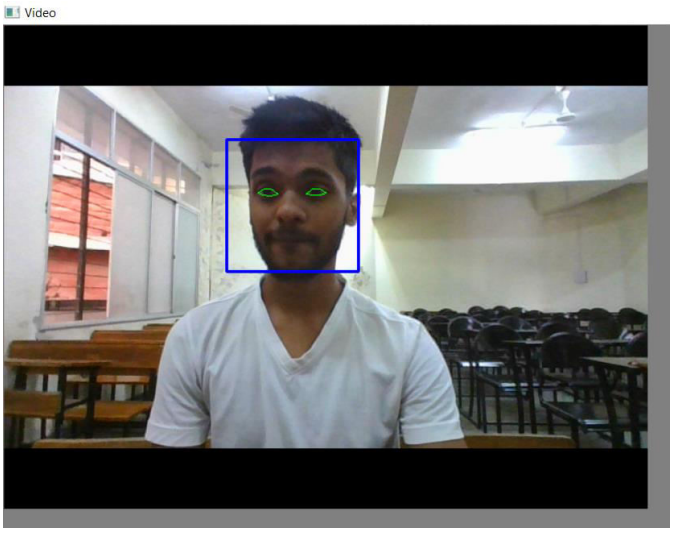

Fig. 5: Screenshot 1

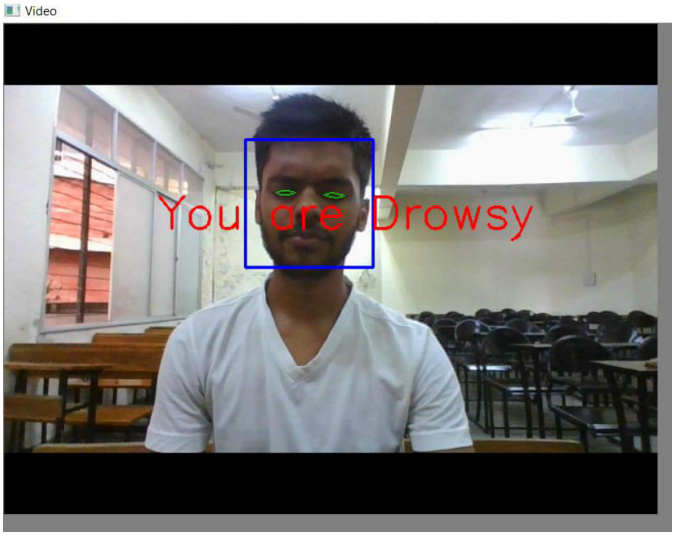

Fig. 6: Screenshot 2

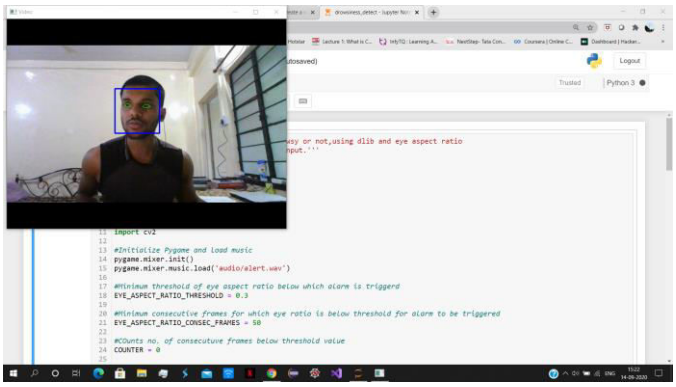

Fig. 7: Screenshot 3

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