International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 10 | Oct-2016 www.irjet.net p-ISSN: 2395-0072

Drowsiness Detection Using RASPBERRY-PI Model Based On Image Processing

Miss. Rajeshwari Sanjay Rawal[1] , Mr.Sameer.S.Nagtilak[2]

[1]P.G Students, Department of Electronics Engineerin , KIT's College of Engineering,Kolhapur,Maharashtra,India

[2] Assistant Professor,Department of Electronics Engineering, KIT's College of Engineering,Kolhapur,Maharashtra,India

---

Abstract - *- There are various reasons for accidents on road. The major reasons for accidents on road are fatigueless of driver and second one is the alcohol intoxication. These are the two reasons due to which probability of road accidents increases. These road accidents can be overcome by different ways. In recent years, technologies are developed and various techniques are generated for the detecting the road accidents and also preventing the road accidents. The different technologies which are developed are depending on vehicle, behavioral and physiological. In vehicle based approach, it continuously monitored position of steering wheels, position of lane and pressure on acceleration pedal. In behavioral based approach, it continuously sensed mouth's opening area, eye closure, blinking frequency of eye and head posture. In physiological based approach, it checks ECG, EOG .The proposed system used to detect real time drowsiness along with alcohol intake of car driver. Computer vision and embedded system are used to design the system. The system is based on behavioral based approach, in which we consider eye closing rate, eye blink frequency, and pupil and iris edge detection. Image processing techniques such as Haar features and Hough transform are used for acquiring details of given eye object and further processing. On the other hand, an alcohol gas sensor is used to calculate Blood alcohol content (BAC) from Breath alcohol content (BrAC). Raspberry-pi processor is used for image processing.*

***Key Words*: Coupled camera, Eyelid movements, Raspberry pi, Open CV, Python, Haar Cascade classifier, MQ-3, buzzer.**

1.INTRODUCTION

Now days, road accidents are major problem and its percentage increases per year. The major problem behind the road accidents are drowsiness of car driver and if the driver is alcoholic. To overcome this problem, different technologies are developed. These technologies are used for detecting drowsiness and also preventing the road accidents.

The different technologies are developed for drowsiness detection. First one is based on vehicle, in which it continuously monitored steering wheel position, lane position and pressure on acceleration pedal. Second one is based on behavioral, in which it continuously monitored blinking frequency of eye, eye closure and head pose. Third one is based on physiological, which checks heart rate and brain activity by ECG (Electrocardiogram), EEG, EOG(Electrooculogram) and EMG(Electromyogram).

There are 4 main factors due to which driver gets fatigue. These are sleep, work, time of day and physical condition. According to our body clock, we can do maximum work during day time and take rest (sleep) during night. Suppose the car driver works during day and travels a car during night without taking rest then, human body clock affects on him. Next is the work. The type of work (light/heavy) also affects on car driver during night. Because of heavy work, he becomes fatigue and wants rest. If he does not take proper rest and travels car then car driver becomes drowsy. And the last one is the physical condition of the car driver. If the person is weak or ill and he takes medicines then, medicines affect on his body and car driver becomes drowsy.

The medical reason for drowsiness is also different. The drowsiness of a car driver depends on the secretions in the body. The body secretions also affect the activities of a person. There are two types of activities in our body namely sympathetic and parasympathetic. Sympathetic activities are controlled by adrenalin secretion. And parasympathetic activities are controlled by acetylcholine secretion. When adrenalin secretion in body is maximum at that time, the opening area of eye is maximum means the person is alert. Similarly, when acetylcholine secretion is maximum at that time, the opening area of eye is minimum means the person is drowsy. Whenever, the driver gets fatigue at that time, the acetylcholine secretion in body is maximum, due to this iris part of eye is constricted and pupil gets dilated.

1.1 Methodology

There are different methodologies developed for detecting the driver drowsiness and also preventing the road accidents.

(A) Vehicle based approach-It is one of the techniques to find out driver drowsiness. The technique continuously monitored position of lane, steering wheel position and pressure on acceleration pedal. If it crosses the threshold values then it indicate that the driver gets drowsy.

(B)Physiological based approach-In this technique, we continuously observed pulse rate, heart rate and brain activity information. ECG is used to calculate the variation in heart rate and also detect different conditions for drowsiness. EEG is used to calculate the different electrical activities of brain. In order to determine the brain activities, electrodes are placed around the scalp of the car driver. These electrodes detect the voltages produced in the brain cortex. This voltages contain three frequencies related to alpha , beta and gamma waves. These frequencies can be further processed to calculate drowsiness and different sleep stages.

(C)Behavioral based approach-This approach includes yawning (opening area of mouth), eye closure, eye blinking frequency and head pose. This can be done by placing camera in front of the car driver. The camera continuously captures images of the car driver. The car driver's image is further processed for detecting drowsiness of the driver.

1.2 Methodology of Implementation

Practically, Physiological based approach is not suitable for drowsiness detection. It is unsafe for driver and environmental conditions also affected the electrode. Also Vehicle based approach is not suitable. Because vehicle based approach is based on monitoring the driving pattern of the car. But the problem is, it is difficult to determine when the driver is in micro sleep or in a deep sleep? This situation is dangerous for the driver and also car. Hence we are using Behavioral based approach in our project.

Due to secretion of adrenalin and acetylcholine, the area of opening eye changes. Basically, our eye movements are controlled by six muscles namely superior rectus, inferior rectus, lateral rectus, medial rectus, superior oblique and inferior oblique. And this six muscles activity is controlled by the nerve. Due to the movements of these muscles, pupil part of eye is dilated or constricted and iris part of eye is also constricted or dilated. In order to monitor the eye movements along with the iris and pupil area, we have to use a camera for capturing the real time images of eye.

1.3 Block diagram

Our proposed system consists of open source 5 megapixel digital camera for capturing real time images of car driver. For further processing on that image, we need to send the image to Raspberry-pi system board. The Raspberry-pi system is loaded with Raspbian OS and Python packages for Open CV (Computer Vision). Haar features are used to calculate required part of the eye (pupil and iris).

Further, Hough transform is used for edge detection of pupil and iris. Pupil and Iris area is calculated and then it compares with threshold value. If it exceeds the threshold value then driver drowsiness condition is detected and alarm indicated by buzzer. Buzzer is directly connected to PIC 16F controller and the PIC controller is serially interfaced with Raspberry-pi system board.

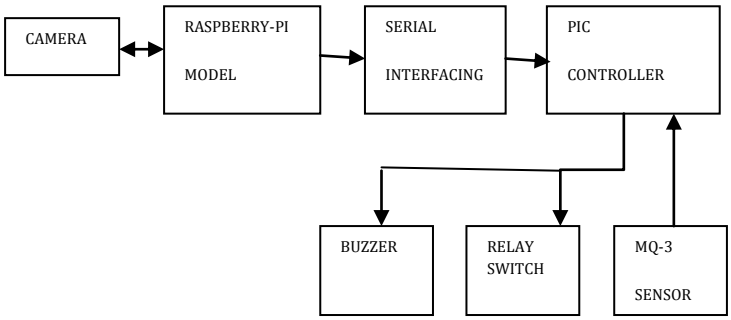

Fig -1: Block diagram of proposed system

In order to detect the alcoholic condition of car driver, an alcohol gas sensor MQ-3 is used. The MQ-3 gas sensor is high sensitive to alcohol concentration and high resistance to smoke, gasoline and vapour. It calculates the blood alcohol content (BAC) from breath alcohol content (BrAC) and if it crosses the threshold value then alarm indicates.

1.4 Programming Algorithm

(A)Algorithm for RASPBERRY –PI Model:-

The different steps involved in algorithm for Raspberry-pi model are as follow.

(a) Image capture-To read an image from the Raspberry-pi camera; we first open the camera inside the Open CV using the function

Cap=cv2.VideoCapture (-1)

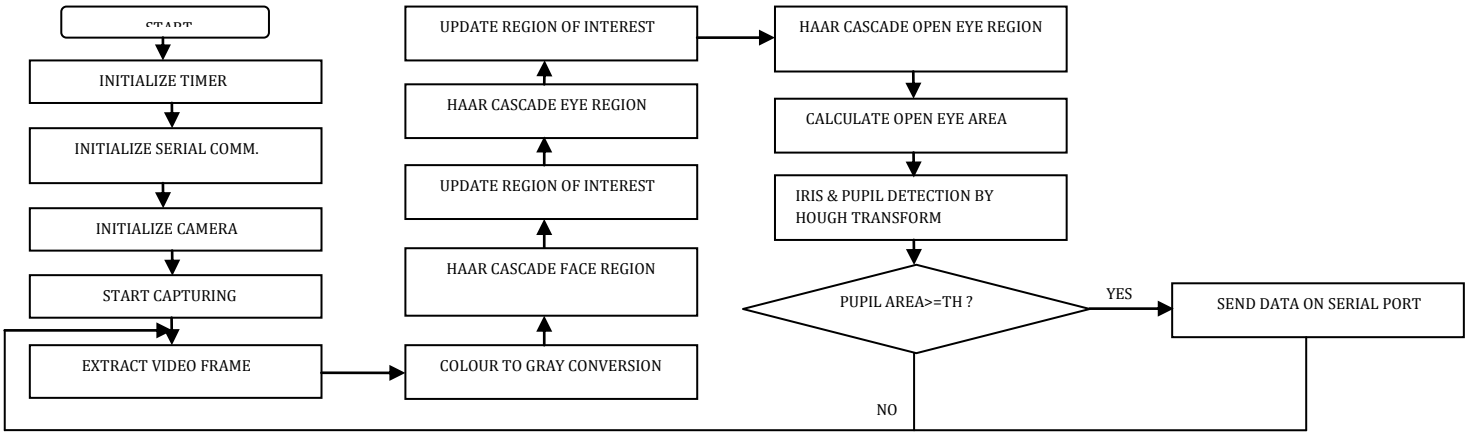

Fig -2: Flowchart for Raspberry pi Python Programming language

After opening the camera using above function .It starts capturing the video for processing purpose. We need image, hence use function

Success, frame=cap. read ( )

This function is to read a frame from the camera. In order to display the image use function

Cv2.imshow (frame)

This function makes sure that the image in a window is properly getting.

(b) Image Thresholding- In our image, we have to find the area in which pupil is located. So the color image must be converted to Binary image. Also locate eye, pupil and iris in the image. Open CV has in build function namely **inRange ( ).** The function adjusts the color of the required part (eye, pupil and iris) which we required. The function adjusts the Hue, Saturation and Value of the required part. This Hue, Saturation and Value vary in different range from low value to high value. These two values of Hue, Saturation and Value are used for image Thresholding process. ImgThresholded variable contains another image, but unlike the original frame, it is black and white.

(c) Haar-like features – Haar like features are complete set of 2-D Haar functions. These Haar functions are used to encode a specific object in given image. Haar functions consist of two or more rectangular regions, which are enclosed in a template. Haar features are used to detect human frontal faces in digital photographs and to detect cardiac structures from magnetic response imaging (MRI).

Haar features give more accurate and faster response than other object detectors. The result of Haar feature function consists of K rectangles. The main advantage of Haar features is that, it provides a very attractive trade-off between accuracy and evaluation's speed. Haar features are differing according to the template, by no of rectangles and orientation of the rectangles. The Haar features are mainly Edge features, Line features and Center-surround features.

(d) Morphological Operation –Morphological filter are used for gray level image. There are basically 2 functions.

i. erode( ) function – It shrinks the size of the mask.

ii. dilate ( ) function – It expands the size of the mask.

For doing this erosion and dilation operation, we required structuring element.

i. Structuring element-It is 5*5 matrixes. The element can be formed by neighborhood window operator.

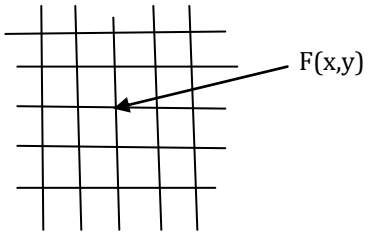

Fig -3: 5*5 matrix of structuring element

F(x,y) is surrounded by 24 elements. And apply Window function on that F(x, y) element.

ii. Binary erosion – It shrinks the size of 1 valued object. It also smoothes the boundaries of the objects. It removes peninsulas, fingers and small object in the given object. It removes unwanted object.

iii. Binary dilation – It expands the size of 1 valued object. Because of dilation operation, it smoothes the object boundaries. Dilation operation closes holes and gaps of the object. It expands the main object.

iv. Opening and Closing – After performing erosion and dilation operation on the object, we can't get back the original image. In order to overcome this problem, we have two more functions namely **Opening ( )** and **Closing ( )** function. The main function of Opening ( ) and Closing ( ) is that, it smoothes the object without size change.

1.5 Result

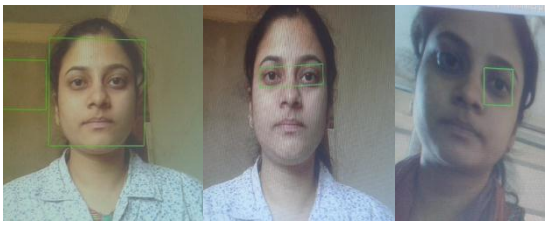

Fig -4: Haar cascade Face region, Eye region and Open eye region respectively.

2. CONCLUSIONS

Hence, we have successfully interface Raspberry-Pi camera with the processor. Raspberry-Pi camera is properly initialize , video and images are captured. Image is further used for Haar feature extractions. Haar cascade Face region, Eye region and Open eye region is calculated.

REFERENCES

[1] Anirban Dasgupta, Anjith George, S. L. Happy, and Aurobinda Routray, "A Vision-Based System for Monitoring the Loss of Attention in Automotive Drivers" Member, IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 14, NO. 4, DECEMBER 2013

[2] Ralph Oyini Mbouna, Seong G. Kong, Senior Member, IEEE, and Myung-Geun Chun"Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring" IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 14, NO. 3, SEPTEMBER 2013

[3] Dwipjoy Sarkar, Atanu Chowdhury "A Real Time Embedded System Application for Driver Drowsiness and Alcoholic Intoxication Detection" M.Tech student, Assistant professor, Department of Electronics & Communication EngineeringNIT Agartala, IndiaTripura, IInternational Journal of Engineering Trends and Technology (IJETT) – Volume 10 Number 9 - Apr 2014

[4] Moritz Kassner, William Patera, Andreas Bulling, "Pupil: An Open Source Platform for Pervasive Eye Tracking and Mobile Gaze-based Interaction",30April 2014

[5] Mohamad-Hoseyn Sigari , Muhammad-Reza Pourshahabi ,Mohsen Soryani and Mahmood Fathy, "A Review on Driver Face Monitoring Systems for Fatigue and Distraction Detection", International Journal of Advanced Science and Technology Vol.64 (2014), pp.73-100

[6] Narender Kuamr, Dr. N.C. Barwar, Narender Kuamr et al, "Analysis of Real Time Driver Fatigue Detection Based on Eye and Yawning" /(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014, 7821-7826

[7] Swati Kale, Rashmi Bhadke, Anuja Sali, Nanasaheb Kadu,P.R.E.C Loni, "Drowsiness Detection And Warning System" International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014)© 2014, IJARCST All Rights Reserved 62 ,Vol. 2, Issue 2, Ver. 1 (April - June 2014)

[8] Jay D. Fuletra, Viral Parmar, " Intelligent Alarm System for Dozing Driver using Hough transformation" 2014 IJEDR | Volume 2, Issue 2 | ISSN: 2321-9939

[9] Garima Turan, Sheifali Gupta"Road Accidents Prevention system using Driver's Drowsiness Detection" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 11, November 2013

[10]Vanaja Roselin E. Chirchi and L. M. Waghmare,"Feature Extraction and Pupil Detection Algorithm Used for Iris Biometric Authentication System" International Journal of Signal Processing, Image Processing and Pattern Recognition Vol.6, No.6 (2013), pp.141-160

[11] Muhammad Shahid, Tabassam Nawaz, Hafiz Adnan Habib, "Eye-Gaze and Augmented Reality Framework for Driver Assistance" Life Science Journal 2013

[12] K.Subhashini Spurjeon 1, Yogesh Bahindwar, "A Dedicated System for Monitoring of Driver's Fatigue" International Journal of Innovative Research in Science, Engineering and Technology Vol. 1, Issue 2, December 2012

[13] Su Yeong Gwon1, Chul Woo Cho1, Hyeon Chang Lee, Won Oh Lee1 and Kang Ryoung Park, "Robust Eye and Pupil Detection Method for Gaze Tracking", Received 6 Sep 2012; Accepted 14 Dec 2012

[14] Muhammad Fahad Khan and Farhan Aadil, "Efficient Car Alarming System for Fatigue Detection during Driving" International Journal of Innovation, Management and Technology, Vol. 3, No. 4, August 2012

[15] Milad Soltany 1, Saeid Toosi Zadeh and Hamid-Reza Pourreza, "Fast and Accurate Pupil Positioning Algorithm using Circular Hough Transform and Gray Projection" 2011 International Conference on Computer Communication and Management