VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELGAUM-590 014

2019-2020

A Project Report On

"Driver Drowsiness Detection System"

Submitted in partial fulfillment for the award of degree of

Bachelor of Technology
in
Computer Science & Engineering

by
TEJASWINI N (1AT16CS114)
KT SHUBHA THAARINI (1AT16CS042)
SUNEETHA R (1AT16CS080)

Under the Guidance of

MANJULA M
Asst Prof
Dept.of CSE, AIT

ATRIA INSTITUTE OF TECHNOLOGY
Computer science & Engineering Department
BANGALORE-560024
2019-2020

ATRIA
INSTITUTE OF TECHNOLOGY

CERTIFICATE

Certified that the project work entitled DRIVER DROWSINESS DETECTION SYSTEM carried out by Ms.TEJASWINI N bearing USN:1AT16CS114, Ms.KT SHUBHA THAARINI bearing USN:1AT16CS042, Ms SUNEETHA R bearing USN:1AT16CS080 a bonafide student of Atria Institute of Technology, in partial fulfilment for the award of Bachelor of Technology in Computer Science & Engineering of Visvesvaraya Technological University, Belgaum during the academic year 2018-2019. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies requirement in respect of project work prescribed for the said degree.

Name & Signature of the Guide

Name & Signature of the HOD

Signature of the Principal

External Viva

Name of the examiners	Signature with date
1. ____________________	____________________
2. ____________________	____________________

ABSTRACT

In recent years driver fatigue is one of the major causes of vehicle accidents in the world. A direct way of measuring driver fatigue is measuring the state of eye of the driver i.e. drowsiness. So it is very important to detect the drowsiness of the driver to save life and property. This project is aimed towards developing a prototype of drowsiness detection system. This system is a real time system which captures image continuously and measures the state of the eye according to the specified algorithm and gives warning if required.

Though there are several methods for measuring the drowsiness but this approach is completely non-intrusive which does not affect the driver in any way, hence giving the exact condition of the driver. For detection of drowsiness the per closure value of eye is considered. So when the closure of eye exceeds a certain amount then the driver is identified to be sleepy. For implementing this system several OpenCv libraries are used including Haar-cascade.

Also in order to improve the security and safety of the driver and also strictly monitor if the driver is following “do not drink and drive” rule. The alcohol is been sensed before the vehicle is started if at the the driver consumption of alcohol is detected by the driver the vehicle will not start. This avoids the driver to violate the rules and also to be safe at the same time.

ACKNOWLEDGEMENT

I express my gratitude to our institution and management for providing us with good infrastructure, laboratory, facilities and inspiring staff and whose gratitude was of immense help in completion of this seminar successfully.

I express my sincere gratitude to our principle **Dr. K V NARAYANASWAMY** for providing me required environment and for his valuable suggestion.

My sincere thanks to **Dr. AISHWARYA P**, Head of the Dept. Computer Science and Engineering, Atria Institute of Technology, for her valuable support and for rendering us resources for this seminar work.

I express my gratitude to **Manjula M**, Assistant Professor, Dept. of Computer Science and Engineering, Atria Institute of Technology, who guided me with valuable suggestions in completing this seminar at every stage.

My gratitude thanks should be rendered to everyone who helped in all possible ways.

TABLE OF CONTENTS

LIST OF FIGURE

Chapter 1

INTRODUCTION

1.1 Purpose:

The attention level of driver degrade because of less sleep, long continuous driving or any other medical condition like brain disorders etc. Several surveys on road accidents says that around 30 percent of accidents are caused by fatigue of the driver. When driver drives for more than normal period for human then excessive fatigue is caused and also results in tiredness which drives the driver to sleepy condition or loss of consciousness. Drowsiness is a complex phenomenon which states that there is a decrease in alerts and conscious levels of the driver. Though there is no direct measure to detect the drowsiness but several indirect methods can be used for this purpose. To detect alcohol consumption by driver, if the alcohol level sensed is above threshold the engine will not start and it will alert that the alcohol consumption is high.

Drowsy driving is one of the major causes behind fatal road accidents. One of the recent study shows that one out of five road accidents are caused by drowsy driving which is roughly around 21% of road accidents, and this percentage is increasing every year as per global status report on road safety 2015, based on the data from 180 different countries. This certainly highlights the fact that across the world the total numbers of road traffic deaths are very high due to driver's drowsiness. Driver fatigue, drink-and-drive and carelessness are coming forward as major reasons behind such road accidents.

Many lives and families are getting affected due to this across various countries. Real time drowsy driving detection is one of the best possible major that can be implemented to assist drivers to make them aware of drowsy driving conditions. Such driver behavioural state detection system can help in catching the driver drowsy conditions early and can possibly avoid mishaps. With this paper, we are presenting technique to detect driver drowsiness using of Open CV, raspberry pi and image processing. Several studies has shown various possible techniques that can detect the driver drowsiness. Such driver drowsiness detection can be measured using physiological measures, ocular measure and performance measure. Among these physiological measure and ocular measure can give more accurate results.

Physiological measure includes brain waves, heart rate, pulse rate measurements and these requires some sort of physical connection with the driver such as connecting electrode to the driver body. But this leads to discomfort driving conditions. But ocular measure can be done without physical connection. Ocular measure to detect driver eye condition and possible vision based on eye closure is well suited for real world driving conditions, since it can detect the eyes open/ closed state no intrusively using a camera.

In Real Time Driver Drowsiness System using Image Processing, capturing drivers eye state using computer vision based drowsiness detection systems have been done by analysing the interval of eye closure and developing an algorithm to detect the driver's drowsiness in advance and to warn the driver by in vehicles alarm. This section motivates how face is detected and how eye detection is performed for automotive application and their detection is necessary for assessing driver drowsiness.

1.2 Problem Statement:

In the 1990s, driver fatigue has continued to be a major industry and public safety concern. The 1995FHWA-sponsored Truck and Bus Safety Summit attended by over 200 national leaders in CMV and highway safety, including a large contingent of drivers, identified driver fatigue as the top priority CMV safety issue. Accordingly, the fatigue issue dominates current FHWA-sponsored human factors research on CMV driving safety.

Driver fatigue is a safety issue of special concern to CMV transportation. Under current U.S. Federal hours-of-service (HOS) regulations, CMV drivers may drive up to 10 hours after a mandatory 8-houroff-duty period. In Canada, the maximum driving time is 13 hours. Many CMVs often run at
night, and drivers sometimes have irregular and unpredictable work schedules.

Most of their mileage is compiled during long trips on Interstate and other limited-access highways. Because of the CMVs' high annual mileage exposure (often 5-10 times that of passenger vehicles) and other factors, commercial driver's risk of being involved in a fatigue-related crash is far greater than that of non-commercial drivers – even though CMV drivers represent a relatively small proportion of all drivers involved in fatigue-related crashes. In addition, many other crash causation factors, such as alcohol use, speeding, and other unsafe driving acts, are generally less common in crashes involving commercial drivers. Thus, fatigue is are relatively larger concern for these CMV drivers and their vehicles

1.3 Objectives:

The main aim of this is to develop a drowsiness detection system by monitoring the eyes; it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns.Fatigue warning systems (FWS) have been proposed as specific countermeasures to reduce the collisions associated with driver fatigue. These devices employ a variety of techniques for detecting driver drowsiness while operating a vehicle and signal a driver when critical drowsiness levels are reached. However, the detection of driver fatigue using valid, unobtrusive, and objective measures remains a significant
challenge. Detection techniques may use lane departure, steering wheel activity, ocular or facial characteristics. Along with this of course, Drivers have a duty not to exceed speed limits, exceed maximum work limits or breach minimum rest requirements. Complementing this, entities within the chain of

responsibilities must take reasonable steps to prevent driver fatigue or situations that lead to drivers breaching speed limits. It provides extensive information on the alertness, driving performance, and physiological and subjective states drivers.

1.4 Existing System:

It is said that the worst cause of death by car accident is drowsy driving. Many studies have been devoted to detect drivers' drowsiness from their behavior or biological signals such as electrocardiogram and arterial pulse wave to prevent drowsy driving. However, there has been few research focused on the relation between drivers' head motion and their drowsiness. In this study, we aimed to clarify the relationship between head driver's motion and their drowsiness. Two acceleration sensors were equipped to subject's head and car seat. Subjects were asked to drive a car under two conditions, i.e. in awakening state and drowsy state after over 20 hours sleep deprivation. The difference between the acceleration of head and car seat were calculated, and the results show that head motion decreases according to driver's drowsiness. Usability study is that it can be used in all types of motor vehicles, the vehicles driven through-out day and night. It is considered to be reliable unless there is no physical damage to the physical circuit. It is easy to maintain the instalment is one time and needs check-up once in one to two months. Financially it is affordable when it comes to the cost of life a few dollars, prevention is better than cure.

1.5 Proposed System:

This project can be executed in two ways: measuring changes in physiological signs, for example, brain waves, heart rate, and eye flickering; and measuring physical changes, for example, sagging posture, inclining of the driver's head and the open/shut conditions of the eyes. In spite of the fact that this procedure is most precise, it is not reasonable, since detecting electrodes would need to be put straightforward onto the driver's body, and thus be irritating and diverting to the driver. Also, long time driving would bring about sweat on the sensors, reducing their capacity to screen precisely. Hence this approach will be mostly focusing on amount of eye closure also called (PERCLOS) percentage of closure as it provides the most accurate information on drowsiness.

It is also non-intrusive in nature, hence does not affect the state of the driver and also the driver feels totally comfortable with this system. Environmental factors like road condition does not affect this system. The case of micro nap is also detected according the given threshold value. The development of this system includes face identification and tracking, detection and location of the human eye, human eye tracking, eye state detection, and driver fatigue testing.

The key parts of the detection framework fused the detection and location of human eyes and driver fatigue testing. The improved technique for measuring the PERCLOS estimation of the driver was to compute the proportion of the eyes being open and shut with the aggregate number of frames for a given period. And adding to it will be the Alcohol Sensor to detect the level of consumption of alcohol if the driver has consumed alcohol more than the threshold value the vehicle ignition is not enabled.

Chapter 2

LITERATURE SURVEY

Driver drowsiness system helps in detecting the drowsy state of the driver such that it helps in avoiding the accidents and property damage. Several studies related to the Driver Drowsiness Detection System are as follows:

1. Monitoring Physiological Characteristics:

Among these methods, the techniques that are best, based on accuracy are the ones based on human physiological phenomena [9]. This technique is implemented in two ways: measuring changes in physiological signals, such as brain waves, heart rate, and eye blinking; and measuring physical changes such as sagging posture, leaning of the driver's head and the open/closed states of the eyes [9]. The first technique, while most accurate, is not realistic, since sensing electrodes would have to be attached directly onto the driver's body, and hence be annoying and distracting to the driver. In addition, long time driving would result in perspiration on the sensors, diminishing their ability to monitor accurately. The second technique is well suited for real world driving conditions since it can be non-intrusive by using optical sensors of video cameras to detect changes

2. A Dedicated System for Monitoring of Driver's Fatigue K.Subhashini Spurjeon, Yogesh Bahindwar:

Describe about the road accidents. The road accidents happen due to the lack of attention of the driver. In this paper author describes a real time system for analyzing video sequences of a driver and determining the level of attention. For this purpose, author uses the computation of percent of eyelid closure. The eye closure acts as an indicator to detect drowsiness. Driver's fatigue and drowsiness are the major causes of traffic accidents on road. It is very necessary to monitor the driver's vigilance level and to issuing an alert when he/she is not paying enough attention to the road is a promising way to reduce the accidents caused by driver factors. The fatigue monitoring can be starts with extracting visual parameters. This can be done via a computer vision system. In the purposed work, author purpose a real time robust method for eye tracking under variable lighting conditions and facial orientations. In this paper the latest technologies in pattern classification recognition and in object tracking are employed for eye detection. [4] The tracking is based on the eye appearance. Visual information is acquired using a specially designed solution combining a CCD video camera with an IR illumination system. The system is fully automatic and detects eye position and eye closure and recovers the gaze of eyes. Experimental results using real images demonstrate the accuracy and robustness of the proposed solution. This could become an important part in the development of the advanced safety vehicle.

3. Drowsiness Warning System Using Artificial Intelligence, Nidhi Sharma, V. K. Banga:

In this paper author discuss about the various artificial intelligence methods for detecting the drowsiness of system. Driver's drowsiness is an important factor in motoring of vehicle from accidents. The driving performance deteriorates with increased drowsiness with resulting crashes constituting morel vehicle accidents. In recent years, there has been growing interest in intelligent vehicles. [5] The ongoing intelligent vehicle research will revolutionize the way vehicles and drivers interact in the future. The detection mechanism into vehicles may help prevent many accidents. There are various techniques used for analyzing driver exhaustion. Most of the published research on computer vision approaches to detection of fatigue has focused on the analysis of blinks and head movements. After long hours of driving or in absence of mental alert state, the attention of driver starts to loose and that creates risks of accidents. These are the typical reactions of fatigue, which are very dangerous. In image fatigue detection, correct and real time decision is very important. In this paper, author discusses the various artificial detection.

4. A Yawning Measurement Method to Detect Driver Drowsiness, Behnoosh Hariri, et.al:

Describe that the drowsy is the major issue behind the road accidents. The use of assistive systems that monitor a driver's level of vigilance and alert the driver in case of drowsiness can be significant in the prevention of accidents. In this paper author purposed a new approach towards detection of drives drowsiness based on yawning measurement. [6] This involves several steps including the real time detection and tracking of driver's face, detection and tracking of the mouth contour and the detection of yawning based on measuring both the rate and the amount of changes in the mouth contour area. In this paper several techniques are used, that are applied several techniques to ensure the robust detection of yawning expression in the presence of variable lighting conditions and facial occlusions. Test results demonstrate that the proposed system can efficiently measure the aforementioned parameters and detect the yawning state as a sign of driver's drowsiness.

5. Development Of A Drowsiness Warning System Using Neural Network, Itenderpal Singh1, Prof. V.K.Banga:

Describe the facial image analysis. As due to the increase in the amount of automobile the problems created by accidents have become more complex. The transportation system is no longer sufficient. Hence the research upon the safety of the vehicles is the recent topic nowadays. In this paper author discuss about the safety warning systems. This system is active warning systems for preventing traffic accidents have been attracting much public attention. Safe driving is a major concern of today's societies. There are thousands of accidents are happen in a day. [7] Due to which many people get injured and many out of them got die. The aim of this paper is to develop a prototype drowsiness detection system. The main focus is on designing a system that are used for l accurately monitor the open or closed state of the driver's eyes in real time. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident.

6. ‘***Camerabased Drowsiness Reference for Driver State Classification under Real Driving Conditions’. In June, 2010, Bin Yang et. al. [16] described***

They proposed that measures of the driver’s eyes are capable to detect drowsiness under simulator or experiment conditions. The performance of the latest eye tracking based in-vehicle fatigue prediction measures are evaluated. These measures are assessed statistically and by a classification method based on a large dataset of 90 hours of real road drives. The results show that eye-tracking drowsiness detection works well for some drivers as long as the blinks detection works properly. Even with some proposed improvements, however, there are still problems with bad light conditions and for persons wearing glasses. As a summary, the camera-based sleepiness measures provide a valuable contribution for a drowsiness reference, but are not reliable enough to be the only reference

7. ‘Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring’. In 2013, G. Kong et. al. [19] described.

They presented visual analysis of eye state and head pose (HP) for continuous monitoring of alertness of a vehicle driver. Most existing approaches to visual detection of non-alert driving patterns rely either on eye closure or head nodding angles to determine the driver drowsiness or distraction level. The proposed scheme uses visual features such as eye index (EI), pupil activity (PA), and HP to extract critical information on non-alertness of a vehicle driver. A support vector machine (SVM) classifies a sequence of video segments into alert or non-alert driving events. Experimental results show that the proposed scheme offers high classification accuracy with acceptably low errors and false alarms for people of various ethnicity and gender in real road driving conditions.

Chapter 3

SYSTEM REQUIREMENTS

Driver Drowsiness Detection is a very efficient system that helps in monitoring the drivers state of the eye and the alcohol consumptions if any will be detected by using this system. The components that are used to make this module are as follows:

Software Requirements:

1. Raspbian OS
2. open cv library

Hardware Requirements:

1. Raspberry pi
2. Pi camera
3. Alcohol Sensor
4. Buzzer
5. DC Motor
6. Relay
7. Sprinkler
8. LED's (Indicator)

1. Raspberry Pi:

Figure 3.1: Raspberry Pi

Definition:

The Raspberry Pi (fig 3.1) is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Specification:

The raspberry pi board comprises a program memory (RAM), processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. And various interfaces for other external devices. It also requires mass storage, for that we use an SD flash memory card. So that raspberry pi board will boot from this SD card similarly as a PC boots up into windows from its hard disk. Optional hardware specifications include USB mouse, powered USB hub, case, internet connection, the Model A or B: USB WiFi adaptor is used and internet connection to Model B is LAN cable. The raspberry pi model Aboard is designed with 256MB of SDRAM and model B is designed with 51MB.Raspberry pi is a small size PC compare with other PCs. The normal PCs RAM memory is available in gigabytes. But in raspberry pi board, the RAM memory is available more than 256MB or 512MB

Advantages:

The raspberry pi boards are used in many applications like Media streamer, Arcade machine, Tablet computer, Home automation, Carputer, Internet radio, Controlling robots, Cosmic Computer, Hunting for meteorites, Coffee and also in raspberry pi based projects.

2. Pi Camera:

Figure 3.2: Pi Camera

Description

The Raspberry Pi Camera v2 (fig 3.2) is the new official camera board released by the Raspberry Pi Foundation. The Raspberry Pi Camera Module v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. The Raspberry Pi Zero now comes complete with a camera port! Using the new Raspberry Pi_Zero Camera Adapter, you can now use a Raspberry Pi camera to your Zero It's capable of 3280 x 2464 pixel static images, and also supports 1080p30, 720p60 and640x480p90 video. It attaches to Pi by way of one of the small sockets on the board upper surface and uses the dedicated CSi interface, designed especially for interfacing to cameras.

Features:

- Fixed focus lens on-board
- 8 megapixel native resolution sensor-capable of 3280 x 2464 pixel static images
- Supports 1080p30, 720p60 and 640x480p90 video
- Size 25mm x 23mm x 9mm
- Weight just over 3g
- Connects to the Raspberry Pi board via a short ribbon cable (supplied)
- Camera v2 is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system

3. Alcohol Sensor:

Figure 3.3: Alcohol Sensor (MQ3)

The alcohol sensor (fig 3.3) is technically referred to as a MQ3 sensor which detects ethanol in the air. When a drunk person breathes near the alcohol sensor it detects the ethanol in his breathe and provides an output based on alcohol concentration. An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalysers.

4. Buzzer:

Figure 3.4: Buzzer

Definition:

The buzzer (fig 3.4) is an electrical device that makes a buzzing noise and is used for signalling.

Specification:

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perfect board friendly

Application:

- Alarming Circuits, where the user has to be alarmed about something
- Communication equipment’s
- Automobile electronics
- Portable equipment’s, due to its compact size

5. DC Motor

Figure 3.5: DC Motor

Definition:

A DC motor (fig 3.5) is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Specification:

- Standard 130 Type DC motor
- Operating Voltage: 4.5V to 9V
- Recommended/Rated Voltage: 6V
- Current at No load: 70mA (max)
- No-load Speed: 9000 rpm
- Loaded current: 250mA (approx.)
- Rated Load: 10g*cm
- Motor Size: 27.5mm x 20mm x 15mm
- Weight: 17 grams

Application:

- Toy cars
- Windmill projects
- Basic Electronics projects
- As Robot wheels

6. Relay Module:

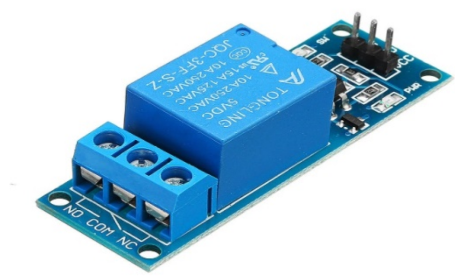

Figure 3.6: Relay Module

The relay module (fig 3.6) is a separate hardware device used for remote device switching. The Relay module houses two SPDT relays and one wide voltage range, optically isolated input. These are brought out to screw-type terminal blocks for easy field wiring. Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized.

7. Water Sprinkler:

Figure 3.7: Water Sprinkler

The Water sprinkler (fig 3.7) is a device that is used to awaken the driver when they are found asleep, by sprinkling the water on their face.

Features:

- Use advanced electronic components and high-quality wear-resistant shaft
- Smooth operation, high efficiency, good performance, long service life.
- Can be a long time continuously work, low noise, safety and environmental protection
- Widely used in industry, scientific research, aerospace industry.

Specifications:

1. Type: Vertical
2. Color: White
3. Material: ABS(Acrylonitrile Butadiene Styrene) engineering plastic
4. Vertical Type Size: Approx. 42.6 x 23.9 x 22.71mm/1.68 x 0.94 x 0.89 inch
5. Pump Outlet Diameter: 7mm
6. Voltage: 3-6V DC
7. Maximum Rated Current: 0.18A
8. Power: 0.36W
9. Max Flow Rate: 100L/H
10. Max Water Head: 0.5m
11. Max Circulating Water Temperature: -20~50 degree C
12. Package Included: 1 x Submersible Water Pump

8. LED (Light Emitting Diode):

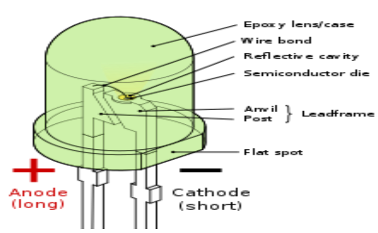

Figure 3.8 : LED/ Indicator

A light-emitting diode (LED) (fig 3.8) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. Recent developments have produced high-output white light LEDs suitable for room and outdoor area lighting.

Chapter 4

SYSTEM DESIGN

The system design depicts the dataflow diagram and the various algorithmic steps that describes every stages of the Driver drowsiness detection system, which makes the understanding easier.

Dataflow Diagram:

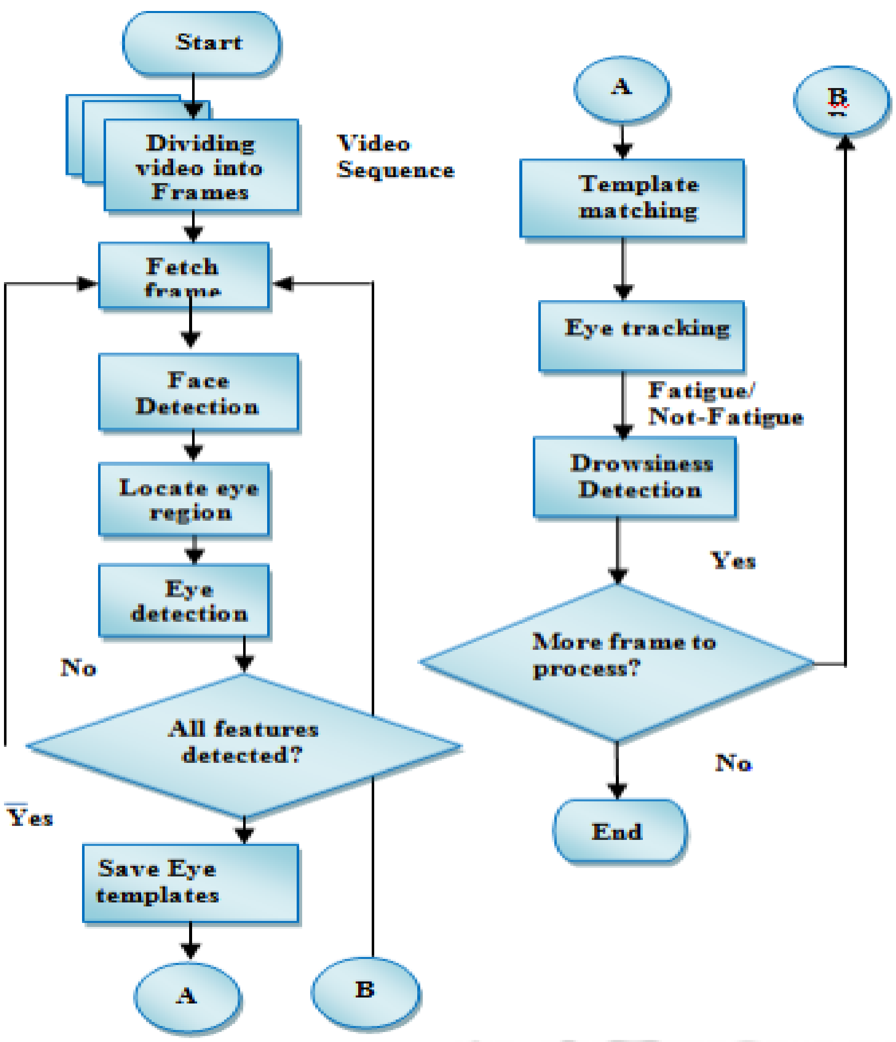

Figure 4.1: Flow Diagram

ALGORITHM STAGES:

The dataflow diagram (fig 4.1) makes us understand the detailed working procedures of the drowsiness detection system.

Image Capture:

Utilizing a web camera introduced inside the automobile we can get the picture of the driver. Despite the fact that the camera creates a video clip, we have to apply the developed algorithm on each edge of the video stream. This paper is only focused on the applying the proposed mechanism only on single frame. The used camera is a low cost web camera with a frame rate of 30 fps in VGA mode. Pi Camera is used for this process.

Dividing into Frames:

We are dealing with real time situation where video is recorded and has to be processed. But the processing or application of algorithm can be done only on an image. Hence the captured video has to be divided into frames for analysing.

Face Detection:

The proposed system will start by capturing the video frames one by one. OpenCV provides extensive support for processing live videos. The system will detect the face in the frame image for each frame. This system uses Viola-Jones object detector which is a machine learning approach for visual object detection (Paul Viola, 2004 and Paul Viola, 2001). This is achieved by making use of the Haar algorithm for face detection. Haar cascade is a well-known robust feature-based algorithm that can detect the face image efficiently. With the use of uses of cascade of stages, Haar algorithm able to remove the candidates that are no face. Each stage consists of combination of different Haar features and each feature in turn is classified by a Haar feature classifier. The inbuilt OpenCV xml “haarcascade_frontalface_alt2.xml” file is used to search and detect the face in individual frames. This file contains a number of features of the face and constructed by using a number of positive and negative samples. First load the cascade file then pass the acquired frame to an edge detection function, Which detects all the possible objects of different sizes in the frame.

Since the face of the driver occupies a large part of the image, instead of detecting objects of all possible sizes, specify the edge detector to detect only objects of a particular size i.e. for face region. Next, the output the edge detector is stored and this output is compared with the cascade file to identify the face in the frame. The output of this module is a frame with face detected in it.

Only disadvantage in Haar algorithm is that it cannot extrapolate and does not work appropriately when the face is not in front of the camera axis. Once the face detection function has detected the face of the driver, the eyes detection function tries to detect the driver's eyes.

Eye Detection:

Once the face detection function has detected the face of the driver, the eyes detection function tries to detect the automobile driver's eyes. After face detection find eye region by considering eyes are present only in upper part of the face and from top edge of the face, extract eyes Region of Interest (ROI) by cropping mouth and hair, we mark it the region of interest. By considering the region of interest it is possible to reduce the amount of processing required and also speeds up the processing for getting exact eyes. After the region of interest is marked, the edge detection technique is applied only on the region of interest.

Then search for eyes in ROI; Circular Hough Transformation is used here to find shape of eyes (Rhody Chester, 2005). The main advantage of the Hough transform technique is that it is liberal to gaps in feature boundary descriptions and is relatively unaffected by image noise, unlike edge detectors. The OpenCV function HoughCircles () is used to detect circles in an eye image. CHT ensure that at most two eyes found. With the eye detection technique we will only be able to detect the open state of eyes.

State of eye:

In this stage, we find the actual state of the eye that if it is closed or open or semi closed or open. The identification of eyes status is most important requirement. It is achieved by an algorithm which will be clarified in the later parts. We channelize a warning message if we obtain that the eyes are in open state or semi open state up to a particular threshold value. If the system detects that the eyes are open then the steps are repeated again and again until it finds a closed eye.

Alcohol level:

An alcohol system will continuously monitor the alcohol level of the driver, If the alcohol level is above the threshold values where the driver will not be able to drive vehicle, the vehicle will be turned off.

Chapter 5

IMPLEMENTATION

SYSTEM ARCHITECTURE:

In the proposed system shown in (Fig 5.1), the primary focus is given to the faster drowsiness detection and processing of data. The number of frames in which the eyes are kept closed is monitored and then counted.

Fig 5.1: System Architecture

If the number of frames exceeds a threshold value, then a warning message is generated on the display showing that the drowsiness is detected. The system should be capable of detecting drowsiness in spite of the skin colour and complexion of the driver, spectacles used by the driver and the darkness level inside the vehicle. All these objectives have been well satisfied by choosing the system using appropriate classifiers in OpenCV for eye closure detection. In this algorithm, first a driver's image is acquired by the camera for processing. In OpenCV, the face detection of the driver's image is carried out first followed by eye detection.

The eye detection technique detects the open state of eyes only. Then the algorithm counts the number of open eyes in each frame and calculates the criteria for detection of drowsiness. If the criteria are satisfied, then the driver is said to be drowsy. The display and buzzer connected to the system perform actions to correct the driver abnormal behaviour.For this system, the face and eye classifiers are required. The HARR Classifier Cascade files inbuilt on OpenCV include different classifiers for the face detection and the eyes detection. The inbuilt OpenCV xml "haarcascade_frontalface_alt2.xml" is used to search and detect the face in individual frames. The classifier "haarcascade_eye_tree_eyeglasses.xml" is used to detect eyes in the open state from the detected face. The system does not detect in the closed state of the eyes. The face detection and open eye detection have been carried out on each frame of the driver's facial image acquired from the camera. The variable Eyes total is assigned to store the number of open eyes (0, 1 and 2) detected in each frame. The variable Drowsy count is assigned for storing the number of successive frames in which the eyes have been Drowsy count gets incremented when Eyes total < 2. For an eye blink, Drowsy count value gets incremented to 1. If the eye blink occurs for more than 4 frames, i.e. Drowsy count >=4, then the criterion for drowsiness is satisfied.

METHODOLOGY:

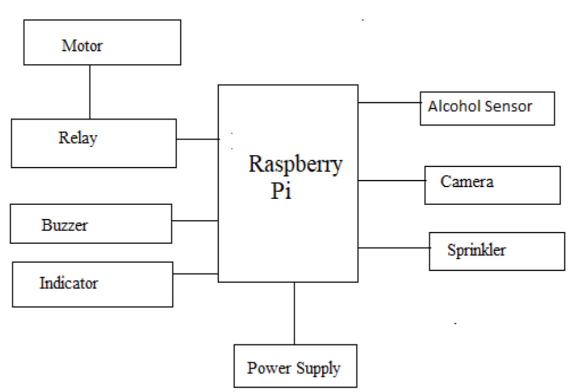

Figure 5.2: Block Diagram

Working Steps:

- Authentication using Keyword(password)
- Alcohol Check (if Drink don't start car)
- Once Ignition is on (Drowsiness detection)
- If driver Drowsy
- Step1: Alarm on (Buzzer)
- Step2: Sprinkler(water)
- Step3: ON Indicators and Switch off Ignition
- Step4:Mail with local Police and Authorised ID

Alcohol detection:

Alcohol is detected by the alcohol sensor, the values from the sensor is read by raspberry pi and only if the alcohol level is less than threshold value it switch on the relay which in turns on the ignition if the system.

Eye Detection:

Poor contrast of eyes generally creates a lot of problems in its detection. After successful detection of face eye needs to be detected for further processing. In our method eye is the decision parameter for finding the state of driver. Though detection of eye does not look complex but the actual process is quite hectic. In this case it performs the detection of eye in the specified region with the use of feature detection. Generally Eigen approach is used for this process. It is a time taking process. When eye detection is done then the result is matched with the reference or threshold value for deciding the state of the driver. Eye detection is divided into two categories: eye contour detection and eye position detection. Basically eyes are detected based on the assumption that they are darker than other part of the face. Hence Haar Features of similar type can be moved throughout the upper part of the face to match with the feature of eye leading to location of eye.

In this way, we need to discover eye-simple sets among a decreased number of potential eye regions. In recent years several eye detection methods have been developed. Deformable template is one of the popular method in identifying the human eye. In this method, a model of eye is designed first and then eye position is obtained by recursive method. But this method strongly depends on initial position of the eye which should be near the actual position of eye. In the template matching aspect, the proposed algorithm is based on eigen features and neural networks for the extraction of eyes using rectangular fitting from gray-level face images.

This method does not need a large set of training images in its advantage and does by eigenfeatures and sliding window. But this algorithm fails if the user uses glasses or having beard. We know that using Haar features in AdaBoost results in increasing computational efficiency and accuracy than other methods for face detection. But Haar feature has a limitation i.e. discriminant capability. Although the Haar features vary with different patterns, sizes and positions, they can only represent the regular rectangular shapes. But for our case of eye detection eye and iris is of round shape. Hence eyes can be represented by learning discriminate features to characterize eye patterns. So an approach towards probabilistic classifier to separate eyes and non-eyes are much better option for better accuracy and for robustness.

Chapter 6

RESULTS

The driver drowsiness can be measured using Eye Aspect Ratio (EAR). The ratio of the eye can vary for each and every person. The following case is tested for ten different set of people with two conditions. One is calculated for eye-opening condition and another one for eye closing condition.. Eye closing rate is measured after every 0.5 seconds and if the value crosses already existed threshold value, then the raspberry pi 3 receives the alert signal from alarm connected to the GPIO pins of Pi 3 board. When the person closing his eyes for more than fixed threshold range then the alert signal is generated to wake up the driver from sleepy state and also through the cloud service the alert message is sent to the owner of the car along with the car plate numbers.

GRAPHS:

OUTPUT SNAPSHOTS:

Chapter 7

CONCLUSIONS

Implementation of drowsiness detection with Raspberry Pi was done which includes the following steps: Successful runtime capturing of video with camera and Successful detection of alcohol level. Captured video was divided into frames and each frames were analysed. Successful detection of face followed by detection of eye. If closure of eye for successive frames were detected then it is classified as drowsy condition else it is regarded as normal blink and the loop of capturing image and analysing the state of driver is carried out again and again. In this implementation during the drowsy state the eye is not surrounded by circle or it is not detected and corresponding message is shown. If the driver is not drowsy and the alcohol level is less than on the vehicle ignition is started.

REFERENCES

1. W. Zhao, R. Chellappa, P.J. Phillips, and A. Rosenfeld, “Face Recognition: A Literature Survey,” ACM Computing Surveys, vol. 35, pp. 399-459, 2003.
2. M. H. Yang, D. J. Kriegman, and N. Ahuja, “Detecting faces in images
3. Nan-Ning Zheng,Shuming Tang,Hong Cheng and Qing Li,Guanpi Lai and Fei-Yue Wang,”Toward Intelligent Driver-Assistance and Safety Warning Systems”,Intelligent Transportation System,IEEE 2004.
4. Itenderpal singh, Prof. V.K.Banga ,DEVELOPMENT OF A DROWSINESS WARNING SYSTEM USING NEURAL NETWORK, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization) Vol. 2, Issue 8, August 2013
5. Drowsiness Warning System Using Artificial Intelligence, Nidhi Sharma, V. K. Banga: http://umpir.ump.edu.my/1978/1/Ani_Syazana_Jasni_(CD_5355_).pdf
6. A Yawning Measurement Method to Detect Driver Drowsiness, Behnoosh Hariri, et.al: http://www.ee.ryerson.ca/~phiscock/thesis/drowsy-detector/drowsy-detector.pdf
7. DEVELOPMENT OF A DROWSINESS WARNING SYSTEM USING NEURAL NETWORK, Itenderpal singh1, Prof. V.K.Banga: http://www.sae.org/events/gim/presentations /2012/sgambati.pdfO.
8. Khunpisuth, T. Chotchinasri, V. Koschakosai, and N. Hnoohom, “Driver Drowsiness Detection Using Eye-Closeness Detection”, 12th Int. Conf. Signal-Image Technol. Internet-Based Syst, pp. 661–668, 2016.
9. B. Sivakumar and K. Srilatha, “A novel method to segment blood vessels and optic disc in the fundus retinal images”, Res. J. Pharm. Biol. Chem. Sci, vol. 7, no. 3, pp. 365–373, 2016.

10. N. G. Prajapati, "Driver Drowsiness Detection with Audio-Visual Warning", vol. 3, no. 1, pp. 294–300, 2016. Suganya and A. Robertson, "On-Road Drowsiness Alarm of Drivers using Raspberry Pi", Int. J. Recent Trends Eng. Res, vol. 3, no. 11, pp. 199–204, 2017. S. Indexed and R. Agrawal, "A LOW-COST DESIGN TO DETECT", vol. 8, no. 9, pp. 1138–1149, 2017.
11. B. Sivakumar and K. Srilatha, "A novel method to segment blood vessels and optic disc in the fundus retinal images", Res. J. Pharm. Biol. Chem. Sci, vol. 7, no. 3, pp. 365–373, 2016.
12. N. L. Fitriyani, C. K. Yang, and M. Syafrudin, "Real-time eye state detection system using haar cascade classifier and circular Hough transform", IEEE 5th Glob. Conf. Consum. Electron. GCCE, pp. 5–7, 2016.
13. [G. J. AL-Anizy, M. J. Nordin, and M. M. Razooq, "Automatic Driver Drowsiness Detection Using Haar Algorithm and Support Vector Machine Techniques", Asian Journal of Applied , vol. 8, no. 2. pp. 149–157, 2015.
14. Weirwille, W.W. (1994). "Overview of Research on Driver Drowsiness Definition and Driver Drowsiness Detection," 14th International Technical Conference on Enhanced Safety of Vehicles, pp 23-26. T. Soukupová and J. Cech, "Real-Time Eye Blink Detection using Facial Landmarks", 21st Comput. Vis. Winter Work, 2016.