Journal of Critical Reviews

ISSN- 2394-5125 Vol 3, Issue 4, 2016

An Automatic Driver Drowsiness Alert System

G.Jyothi[1], T.Manusha[2]
Assistant Professor[1,2]
Department of ECE
Malla Reddy Engineering College

Abstract- Drowsiness detection system is regarded as an effective tool to reduce the number of road accidents.This project proposes a non-intrusive approach for detecting drowsiness in drivers, using Computer Vision. The algorithm is coded on OpenCV platform. The parameters considered to detect drowsiness are face and eye detection, blinking, eye closure and gaze. Input is captured and live fed from a camera that supports night vision as well. The algorithm is Hear trained to detect the face and the eye from the incoming frame. Once the eye is detected, further coding is done to track the eye and automatically set a dynamic threshold value. Depending on the values obtained from each of the incoming frames and deviations from the threshold values, eyelid closure/blink/gaze is detected. Warning system is designed to alert the driver. This system renders an efficient solution to road accidents and the cost of developing it into a real time system is also feasible when compared to the cost involved in the manufacture of car. 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.Taking into account that the knowledge 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

Index Terms- DC motor, UART, Drowsiness, FACS, MLR, EEG

I. INTRODUCTION

Fatigued or drowsy drivers have long been acknowledged to constitute a potential traffic safety hazard, and several research studies have addressed various aspects of the problem. Brown (1994) has presented a comprehensive review and discussion of the research literature on the nature of fatigue and its effects on driver behavior and traffic accidents, on the basis of which he concluded that fatigue is insufficiently recognized and reported as a cause of road accidents. In discussing the effects of fatigue, Brown further points out that the main effect is a progressive withdrawal of attention from road and traffic demands. A most extreme form of withdrawal of attention is obviously the closing of eyes due to sleepiness. To prevent accidentsrelated to drowsiness and sleeping behind the wheel, it is important to acquire precise knowledge about the extent of the problem as well as its preconditions and consequences. The following issues, all of which are investigated empirically in the present study, are considered relevant for a better understanding of sleep-related accidents.

Active Driving or On board Detection

Preventing accidents caused by drowsiness behind the steering wheel is highly desirable but requires techniques for continuously estimating driver's abilities of perception, recognition and vehicle control abilities. This paper proposes methods for drowsiness.

ISSN- 2394-5125 Vol 3, Issue 4, 2016

Basic Concepts:

As indicated earlier, the basic idea behind vehicle-based detection is to monitor the driver unobtrusively by means of an on-board system that can detect when the driver is materially impaired by drowsiness. The concept involves sensing various drivers related and driving related variables. Computing measures from these variables online and then using the measures in a combined manner to detect when drowsiness is occurring. Measures are combined because no single unobtrusive operational measure appears adequate in reliably detecting drowsiness. The most promising approach uses mathematical optimization procedures to develop algorithms with the highest potential detection accuracy.

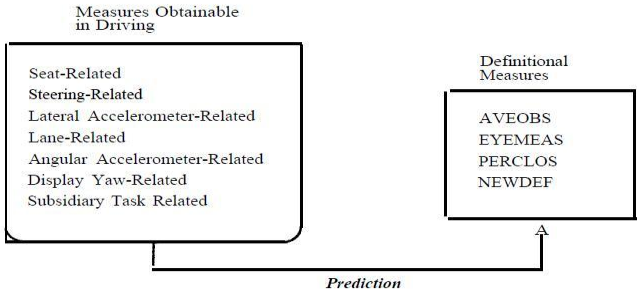


Figure 1.1concept of using operationalmeasures to predict definitional measures of drowsiness

In any case, operationally available measures (on the left) are used to detect the level of the definitional measure of drowsiness (on the right), with thresholds set to indicate when drowsiness has exceeded a pre-specified level.

II. Existing Work or Literature Survey

Drowsiness detection system is regarded as an effective tool to reduce the number of road accidents.This project proposes a non-intrusive approach for detecting drowsiness in drivers, using Computer Vision. The algorithm is coded on OpenCV platform. The parameters considered to detect drowsiness are face and eye detection, blinking, eye closure and gaze. Input is captured and live fed from a camera that supports night vision as well. The algorithm is Hear trained to detect the face and the eye from the incoming frame. Once the eye is detected, further coding is done to track the eye and automatically set a dynamic threshold value. Depending on the values obtained from each of the incoming frames and deviations from the threshold values, eyelid closure/blink/gaze is detected. Warning system is designed to alert the driver. This system renders an efficient solution to road accidents and the cost of developing it into a real time system is also feasible when compared to the cost involved in the manufacture of car. 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.

III. WRITE DOWN YOUR STUDIES AND FINDINGS(Proposed Work)

BLOCK DIAGRAM

The Block Diagram of this project is as shown in the figure below. It consists of following blocks:

Cam , OpenCV, Arduino, L293D, Motors

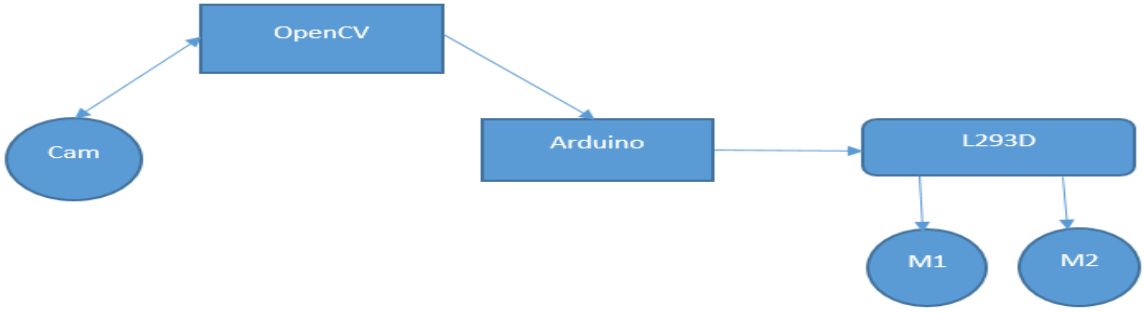


Figure 2.1 block diagram for driver drowsiness

ISSN- 2394-5125 Vol 3, Issue 4, 2016

OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCV interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a template interface that works seamlessly with STL containers.

OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. In simple language it is library

used for Image Processing. It is mainly used to do all the operation related to Images.

What it can do:

1. Read and Write Images.
2. Detection of faces and its features.
3. Detection of shapes like Circle, rectangle etc. in an image.

E.g. Detection of coin in images

4. Text recognition in images. E.g. Reading Number Plates.
5. Modifying image quality and colors e.g. Instagram, CamScanner.
6. Developing Augmented reality apps.

Some Advantages of using OpenCV:

1. Simple to learn, lots of tutorial available.
2. Works with almost all the famous languages.
3. Free to use.

2.2 Cam

A cam is a rotating or sliding piece in a mechanical linkage used especially in transforming rotary motion into linear motion. It is often a part of a rotating wheel (e.g. an eccentric wheel) or shaft (e.g. a cylinder with an irregular shape) that strikes a lever at one or more points on its circular path. The cam can be a simple tooth, as is used to deliver pulses of power to a steam hammer, for example, or an eccentric disc or other shape that produces a smooth reciprocating (back and forth) motion in the follower, which is a lever making contact with the cam.

Overview

The cam can be seen as a device that rotates from circular to reciprocating (or sometimes oscillating) motion. A common example is the camshaft of an automobile, which takes the rotary motion of the engine and translates it into the reciprocating motion necessary to operate the intake and exhaust valves of the cylinders.

Face Cam

A face cam produces motion by using a follower riding on the face of a disk. The most common type has the follower ride in a slot so that the captive follower produces radial motion with positive positioning without the need for a spring or other mechanism to keep the follower in contact with the control surface. A face cam of this type generally has only one slot for a follower on each face. In some applications, a single element, such as a gear, a barrel cam, or other rotating element with a flat face, may do duty as a face cam in addition to other purposes.

ISSN- 2394-5125 Vol 3, Issue 4, 2016

Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

2.3.2 Reset Button

Just like the original Nintendo, the Arduino has a reset button **(**10**).** Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

2.3.3 Power LED Indicator

Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' **(**11**).** This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

2.3.4 TX RX LEDs

TX is short for transmit, RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear – once by digital

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision

pins 0 and 1, and a second time next to the TX and RX indicator LEDs **(**12**).** These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

2.3.5 Main IC

The black thing with all the metal legs is an IC, or Integrated Circuit **(**13**).** Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL.

2.3.6 Voltage Regulator

The voltage regulator **(**14**)** is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

2.3.7Arduino Uno (R3)

The Uno is a great choice for your first Arduino. It's got everything you need to get started, and nothing you don't. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

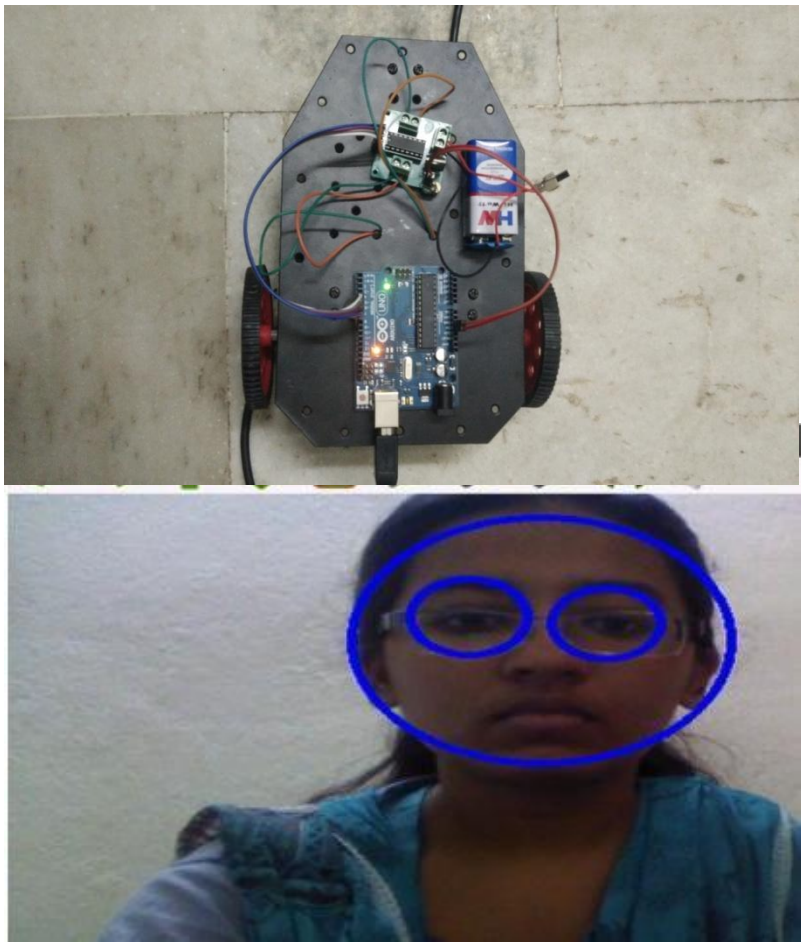
2.4 L293D

ISSN- 2394-5125 Vol 3, Issue 4, 2016

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins

IV. RESULTS AND DISCUSSION(IF ANY)



The eye related parameters used to detect drowsiness in the proposed system are namely eyelid closure, gaze detection and blink rate monitoring. A square wave has been used to recognize the different states of the eye. A logical 1 and 0 are respectively used to signify input of frames and otherwise. The following block diagram briefly depicts the algorithm involved. When the driver becomes drowsy, the mean amplitude of the eyes decreases and the frequency increases significantly. The fully awake states are characterized by low frequency. So, when the eyelid closes completely, eye movements decrease even further

ISSN- 2394-5125 Vol 3, Issue 4, 2016

with long eye closures. This detection of closure is recognized by mean time period of the acquisition of frames. In a period of 1 second around 25 frames.

The input frame is then laid across the face detection algorithm using the Haar Cascade Classifiers. After the detection of the face, the eyes are tracked and identified. The algorithm is able to detect the eyes even in the presence of glasses.

V. CONCLUSION

An Automatic Driver Drowsiness Alert System presented a system for automatic detection of driver drowsiness. Here, a system for automatically measuring brain waves, facial expressions and vehicle monitoring was employed to data mine spontaneous behaviour during real drowsiness episodes. This is the first work to our knowledge to reveal significant associations between facial expression and fatigue beyond eye blinks. The project also revealed a potential association between head roll and driver drowsiness, and the coupling of head roll with steering motion during drowsiness. Of note is that a behaviour that is often assumed to be predictive of drowsiness, yawn, was in factnegative predictor of the 60-second window prior to a crash. It appears that in the moments before falling asleep, drivers yawn less, not more, often. This highlights the importance of using examples of fatigue and drowsiness conditions in which subjects actually fall sleep. The real advantages of these following techniques are, these can be combined into one system and integration without affection or interrupting each other detection and function. This helps to give an exact alert level to avoid the accidents due to the driver drowsiness.

FUTURE SCOPE

- Currently there is not adjustment in zoom or direction of the camera during operation. Future work may be to automatically zoom in on the eyes once they are localized. This would avoid the trade-off between having a wide field of view in order to locate the eyes, and a narrow view in order to detect fatigue.
- This system only looks at the number of consecutive frames where the eyes are closed. At that point it may be too late to issue the warning. By studying eye movement patterns, it is possible to find a method to generate the warning sooner. Using 3D images is another possibility in finding the eyes. The eyes are the deepest part of a 3D image, and this maybe a more robust way of localizing the eyes.
- Adaptive binarization is an addition that can help make the system more robust. This may also eliminate the need for the noise removal function, cutting down the computations needed to find the eyes. This will also allow adaptability to changes in ambient light.
- The system does not work for dark skinned individuals. This can be corrected by having an adaptive light source. The adaptive light source would measure the amount of light being reflected back. If little light is being reflected, the intensity of the light is increased. Darker skinned individual need much more light, so that when the binary image is constructed, the face is white, and the background is black.

Here, we have devised a novel drowsiness detection system for drivers using OpenCV computer vision library. The system so developed is efficiently able to detect drowsiness based on eye-related parameters by monitoring the blink rate. Till date, there has not been a stable real time product incorporated in cars running on roads. The proposed system can suitably be ported onto a high speed automotive board and be used in cars. The camera used to capture the feed is also designed specially to cater to the dim or no light conditions around the driver. The economics involved in building a real time product will also be reasonable considering the car manufacturing costs. Our paper can be absolutely used to detect drowsiness and thus help reducing the number of road accidents

ISSN- 2394-5125 Vol 3, Issue 4, 2016

drastically. The hit rate for the proposed work was compared to previous experiments conducted on different platforms. The following table illustrates that this paper could achieve a hit rate with efficient algorithm.

REFERENCES

Vidyagouri B. Hemadri, Umakant P. Kulkarni, Detection of Drowsiness Using Fusion of Yawning and Eyelid Movements, Advances in Computing, Communication,and Control Communications in Computer and Information Science Volume 361, pp583-594 (2012)

Aihua Zhang, Jinhui Bi, Songsong Sun, A method for drowsiness detection based on Tsallis entropy of EEG, World Congress onMedical Physics and Biomedical Engineering May 26-31, 2012, Beijing,China, IFMBE Proceedings Volume 39, pp 505-508 (2013) .

Yabo Yin, Yunkai Zhu, Shi Xiong, Jiacai Zhang, Drowsiness Detection from EEG Spectrum Analysis, Informatics in Control, Automation and Robotics , Lecture Notes inElectrical Engineering Volume 133 , pp753-759 (2012).

Chin-Teng Lin, Hung-Yi Hsieh, Sheng-FuLiang, Yu-Chieh Chen, Li-Wei Ko,Development of a Wireless Embedded Brain - Computer Interface and Its Application on Drowsiness Detection

Belhassen Akrout, Walid Mahdi, Vision Based Approach for Driver Drowsiness Detection Based on 3D Head Orientation, Multimedia and Ubiquitous Engineering Lecture Notes in Electrical Engineering,Volume 240, 2013, pp 43-50 (2013).

Arduino Products: https://www.arduino.cc/en/Main/Products

Arduino Board Specifications: https://www.arduino.cc/en/Products.Compare

Arduino Uno: https://www.arduino.cc/en/Main/ArduinoBoardUno

Battery Power for Arduino: http://www.instructables.com/id/Powering-Arduino-with-a-Battery.