DRIVER DROWSINESS DETECTION SYSTEM

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ABSTRACT

This document is a review report on the project made in the field of computer engineering to develop a system for driver drowsiness detection to prevent accidents because of driver fatigue and sleepiness. The report proposes the results and solutions on the limited implementation of the various techniques that are introduced in the project. Whereas the implementation of the project gives the real world idea of how the system works and what changes can be done in order to improve the utility of the overall system.

Furthermore, the project states the overview of the observations made by the authors in order to help further optimization in the mentioned field to achieve the utility at a better efficiency for a safer road.

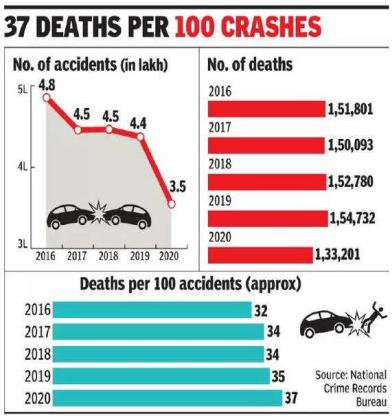
Keywords—Driver drowsiness; eye detection; yawn detection; blink pattern; fatigue.

1. INTRODUCTION

Humans have always invented machines and devised techniques to ease and protect their lives, for mundane activities like traveling to work, or for more interesting purposes like aircraft travel. With the advancement in technology, modes of transportation kept on advancing and our dependence on it started increasing exponentially. It has greatly affected our lives as we know it. Now, we can travel to places at a pace that even our grandparents wouldn't have thought possible. In modern times, almost everyone in this world uses some sort of transportation every day. Some people are rich enough to have their own vehicles while others use public transportation. However, there are some rules and codes of conduct for those who drive irrespective of their social status. One of them is staying alert and active while driving. Neglecting our duties towards safer travel has enabled hundreds and thousands of tragedies to get associated with this wonderful invention every year. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, the automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of the people on the road. One kind of carelessness is not admitting when we are too tired to drive. In order to monitor and prevent a destructive outcome from such negligence, many researchers have written research papers on driver drowsiness detection systems. But at times, some of the points and observations made by the system are not accurate enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done.

Present Condition

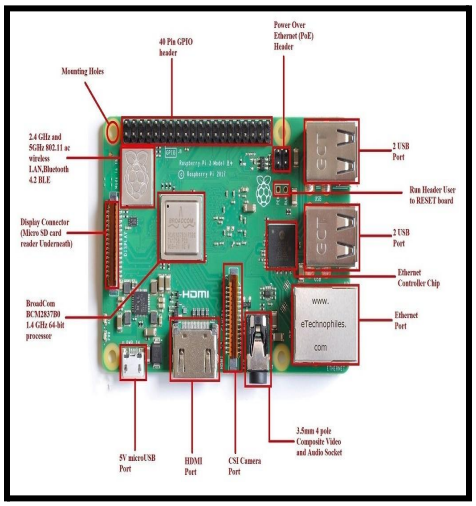
Our current statistics reveal that just in 2020 in India alone, 1,33,201 people died due to car related accidents. Of these, at least 20 percent were caused due to fatigue causing drivers to make mistakes. This can be a relatively smaller number still, as among the multiple causes that can lead to an accident, the involvement of fatigue as a cause is generally grossly underestimated. Fatigue combined with bad infrastructure in developing countries like India is a recipe for disaster. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without the former as driving for long hours is very lucrative. When there is an increased need for a job, the wages associated with it increases leading to more and more people adopting it. Such is the case for driving transport vehicles at night. Money motivates drivers to make unwise decisions like driving all night even with fatigue. This is mainly because the drivers are not themselves aware of the huge risk associated with driving when fatigued. Some countries have imposed restrictions on the number of hours a driver can drive at a stretch, but it is still not enough to solve this problem as its implementation is very difficult and costly.



2.SYSTEM DESIGN

A. HARDWARE AND MODULE

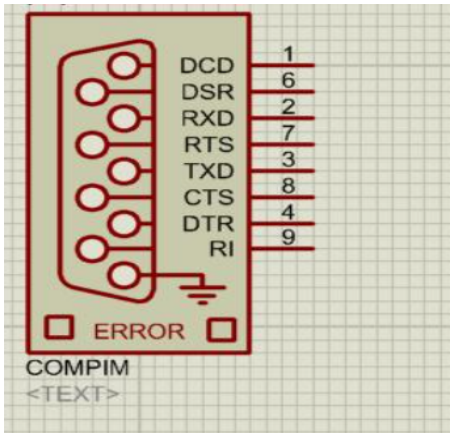
1) RASPBERRY PI :- The Raspberry Pi is a small single-board computer developed in the United Kingdom by the Raspberry Pi foundation. The processor speed ranges from 700MHz to 1.4GHz. The on-board memory ranges from 256MB to 1GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or Microsdhc sizes. For video output, HDMI and composite video are supported, with a standard 3.5mm phone jack for audio output. Lower level output is provided by a number of GPIO pins which support I2C.



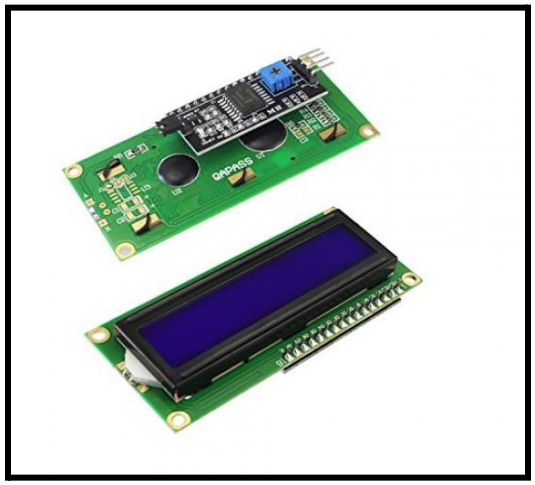
2) **COMPIM :-** COMPIM models a physical serial port. It buffers received serial communication and presents it as digital signals to the circuit. Any serial data transmitted from the UART model or the CPU will also travel through the computer's serial port. There are workarounds that can be used to create a virtual serial port using Bluetooth or USB connectivity. Another feature of the COMPIM model is its ability to provide baud rate conversion. There is also optional software and hardware verification which can be implemented to address the physical and virtual aspects of the device.

In order to check this functionality, we will use Proteus. If we add a serial port model and connect the RXD and TXD, transmitted data should immediately be returned to the computer. This verifies the ability to enact serial communication in Proteus.

Ideally, a virtual serial port would be created in Proteus that would simulate the interaction with a physical interface. Then you could just run the device simulation and use Serial Port Terminal as the host program to test the connection. Unfortunately, the virtual port is not created in the Proteus simulator without the help of additional software.



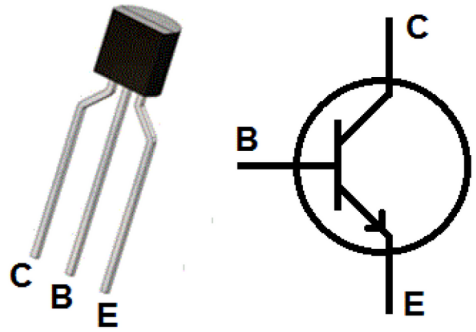
3) LCD DISPLAY :- A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.



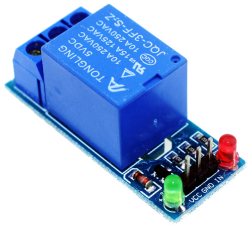
4) NPN TRANSISTOR :- NPN transistors are a type of bipolar transistor with three layers that are used for signal amplification. It is a device that is controlled by the current. A negative-positive-negative transistor is denoted by the abbreviation NPN. A p-type semiconductor is fused between two n-type semiconductor materials in this configuration.

It is divided into three sections: emitter, base, and collector. In an NPN transistor, the flow of electrons is what causes it to conduct.
The direction of current flow through the device is clearly shown by the outward arrow at the emitter terminal in the symbolic representation. Electrons make up the majority of carriers in NPN transistors.

NPN Transistor



5) RELAY MODULE :- The relay module is an electrically operated switch that can be turned on or off deciding to let current flow through or not. They are designed to be controlled with low voltages like 3.3V or 5V.



6) BUZZER :- A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

B. SOFTWARE DESCRIPTION

The programming language being used is Python. Python is an interpreted high-level programming language for general-purpose programming. Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

Some of the libraries being used are:

- OpenCV
- Imutils
- Dlib

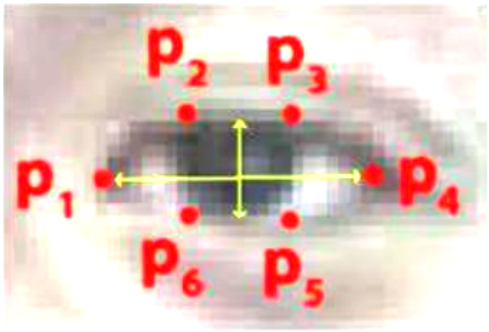
3.EXPERIMENTAL PROTOTYPE

WORKING PRINCIPLE

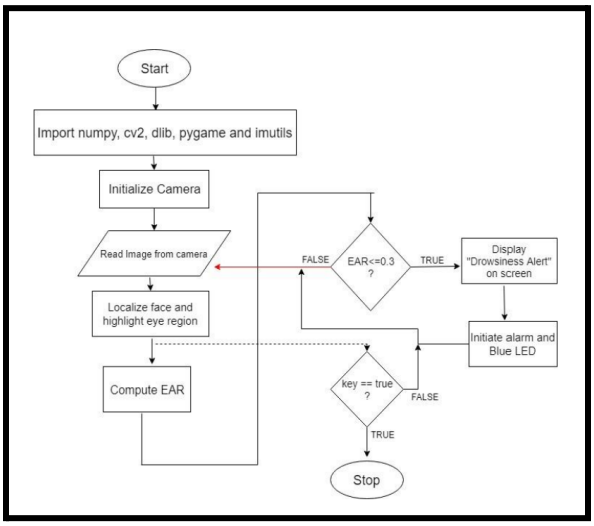
The driver drowsiness detection is based on the Perclos algorithm.The system begins recording the driver's eye behavior the moment the trip begins.Using the facial detection points we calculate Eye Aspect Ratio(EAR) which is then compared to already established values in Perclos Algorithm. It then recognizes changes over the course of long trips, and thus also the driver's level of fatigue.

$$EAR = \frac{(\,|p2 - p6| + |p3 - p5|\,)}{2 * |p1 - p4|}$$

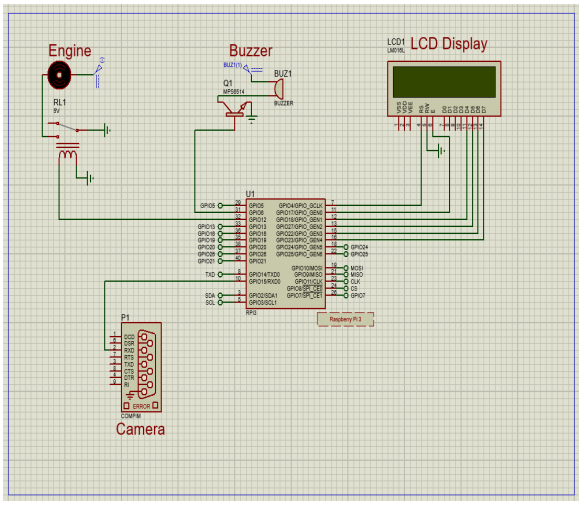
Open Eye: EAR>0.25
Blinking : 0.25>EAR>0.21
Closed : 0.21>EAR



The flowchart in the figure explains how the system will work.



SCHEMATIC DIAGRAM



4.CONCLUSION

The driver abnormality monitoring system developed is capable of detecting drowsiness of drivers in a short time. The Drowsiness Detection System developed based on eye closure of the driver can differentiate normal eye blink and drowsiness and detect the drowsiness while driving. The proposed system can prevent accidents due to sleepiness while driving. The system works well even in case of drivers wearing spectacles and even under low light conditions if the camera delivers better output. Information about the head and eyes position is obtained through various self-developed image processing algorithms. During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. Processing judges the driver's alertness level on the basis of continuous eye closures.

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