Design and Implementation of Driver Drowsiness and Alcohol Intoxication Detection

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Abstract : Fatigue and drowsiness of drivers are amongst the significant causes of road accidents. Factors like increased stress level in working environments, reduced sleep, variation in sleep pattern and time due to the adaptation of global time zone in working environments, increase in alcohol consumption, larger distance travel using high power automobiles contributes to increased level of driver drowsiness and fatigue which reduces driver perception level and decision making capability and hence negatively affect the ability to control the vehicle. In the past decade, steep increase in accidents and loss of life was experienced mainly due to the increase in the driver drowsiness and fatigue. Drunk driving, or officially Driving Under the Influence (DUI) of alcohol, is also a major cause of traffic accidents throughout the world. This paper proposes a novel approach for real time detection of driver's drowsiness as well as alcohol intoxication and subsequently alerting them. The aim is to reduce the number of accidents due to driver's fatigue and alcohol intake to increase the transportation safety.

Key words: Fatigue, Drowsiness detection, alcohol intoxication, real time detection.

I. INTRODUCTION

Statistical Tally (Global Scenario):

Drowsy driving is among the main causes of accidents throughout the world. There is an immense increase in the use of automobiles in recent years and along with that problems created due to drowsy driving as well as driving under the influence of alcohol has became multifarious as well.

Drowsy driving is hard to quantify for a number of reasons. Today there is no standard test to determine sleepiness of the driving person and although there are breath analyzers to detect intoxication but it cannot prevent a person from driving in improper state.[10] There is almost no police training in identifying drowsiness or fatigue as a crash factor. Every accidental state currently addresses fatigue or sleepiness to be the reason directly or indirectly in their crash report forms.

About one million such crashes annually are thought to be produced by driver inattention/lapses. According to data from Australia, England, Finland, and other European nations, all of whom have more consistent crash reporting procedures than the U.S., drowsy driving represents 10 to 30 percent of all crashes.[11]

According to the report in 2005 of National Sleep Foundation's Sleep in America poll, it was found that 60% of adult drivers – about 168 million people – have driven a vehicle while feeling drowsy in the past year, and more than one-third, (37% or 103 million people), have essentially fallen asleep at the wheel! In fact, among those who have nodded off, 13% admitted that they have done so at least once a month. Four percent that is approximately eleven million drivers disclosed that they have had an accident or near accident because they dozed off or were too tired to drive.

The National Highway Traffic Safety Administration conservatively estimates that 100,000 police-reported crashes are the direct result of driver fatigue each year. This leads to estimated 1,550 deaths, 71,000 injuries, and $12.5 billion in monetary/property losses. These figures may be the tip of the iceberg, since currently it is difficult to characterize crashes related to sleepiness.

At least 1500 people, die each year in crashes which are related to fatigued or drowsy drivers in the United States of America. This is according to the statistics assembled by the federal government. This number is most likely underrate. Unless someone witnesses or survives the crash and can give evidence to the driver's condition, it is complicated to determine if the drive had fallen asleep at the wheel or not.

Table 1.1: Statistical Analysis of Causes of Road Crashes.[13]

Estimated Figure	Causes of Road Crashes
100,000 crashes	caused by drowsy drives, each year.
40,000	people are injured in drowsy driver crashes, each year.
62%	American adults (72% of men and 54% of women) reported driving while feeling drowsy.
37%	adults (49% of men and 26% of women) said they have dozed off while driving at least once.
27%	American adults (36% of men and 20% of women) said they have dozed off while driving in the past year.
20%	Canadian adults said they have dozed off while driving in the past year.
40%	Irish adults said they have experienced driver fatigue in the past year.
12%	people say sleeplessness affected their driving

Indian Scenario:

Experts have calculated that more than 150,000 Indians will die in traffic accidents this year, which is the highest road toll in the world. Another 3 million are likely to be hospitalized as a result of crashes. Within a decade, road accidents could be one of the major causes of death, surpassing diseases such as tuberculosis and AIDS. This toll also leads to high economy loss and monetary losses. Accidents costs India 1 to 3 per cent of its gross domestic product.

There were only about 5 million cars in India thirty years ago; but now there are more than 75 million. That means the road toll is rising at 8 percent a year and, on current trends, it is liable to reach 200,000 by 2015.[9]

Table 1. 2: Statistical Analysis of reasons of accidents.[12]

% of People	Reasons of Accidents
93%	Of all accidents are caused due to human factors.
80%	Crashes involve driver inattention within 3 seconds before the event.
30%	Talking on phone
30%	Dialling phone
40%	Drowsiness
28%	Accidents are rear-end collision
67%	Accidental cases to rise by 2020 as per WHO

II. Problem Statement:-

Due to increase in the amount of automobiles in recent years, problems created by accidents have become complex as well. There are large number of accidents which takes place due to fatigue or alcohol intake of the driver. According to the report of year 2013 by World Health Organization (WHO) approximately 105000 road deaths occurred in India. Road accidents also create enormous monetary looses which accounts to $20 billion annually. Driver's fault was accounted for 77.5% of total road accidents while pedestrian & cyclist fault was accounted for 3.7%.[14] Hence safe driving is a major concern of societies all over the world.

We have rules saying "DONT DRINK AND DRIVE" but there is no system that would prevent a person to drive if he is drunk hence with the help of this system driver won't be able to start the car if he has consumed alcohol as car's ignition will be turned off.

If the driver's eye pupil is not read by the camera module for more than the time limit set in timer then the buzzer alarm will be given to give alertness to the driver hence preventing the road crashes that may occur due to drowsiness.

III. PROPOSED SOLUTION

Operating Scenario:

After understanding the problem statement and analyzing it I have come up with a solution whose operating scenario is shown in figure 1. Block diagram of the drowsiness and alcohol intoxication detection system, it basically consists of Processor i.e. Raspberry Pi board in this case, camera, alcohol sensor, buzzer and relay switch. The heart of the system is Raspberry pi board through which all other modules such as camera and buzzer are connected.

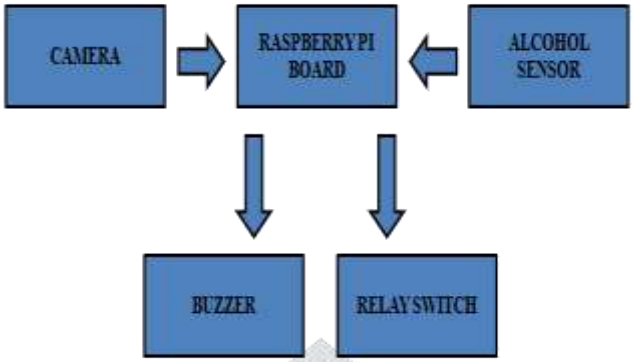

Figure 3.1: Block Diagram of Proposed system

Basic concept is that detection of eye region is done using camera module which is connected to the raspberry pi board. On the other end alcohol sensor is connected to detect the alcohol intake of the driver. Based on the detection of drowsiness or alcohol intoxication an alarm will be generated through buzzer and car's power source can be cut down through relay switch to stop the car. This technique will not let the driver start the car in initial state if he has consumed alcohol.Hence the mentioned device provides solution to prevent accidents caused by drowsy driving and alcohol intoxication to a great extent.

Raspberry pi:

Figure 3.2: Raspberry pi B+ model.[15]

The Raspberry Pi is a credit card-sized single-board computer which was developed in the UK by the Raspberry Pi Foundation with the intent of promoting the teaching of basic computer science in schools. The Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which is cost improved, full HD multimedia processor for embedded and mobile application. It include ARM1176JZ-s700 MHz processor. Raspberry Pi supports Linux (Raspian, Debian Gnu Linux),RISC OS Operating system.

Raspberry pi Model B has 256 megabytes of RAM which was then upgraded in B+ model with 512 RAM. The system has four USB and one micro USB port for power supply and one HDMI port. It has Micro SD slot for booting up the media and persistent storage. Raspberry pi has 40 pin GPIO that is general purpose input output. It primarily support Linux kernel based operating system. It is not possible to run windows on raspberry pi. Price for model A is 25$ and model B is 35$.

IV. Operating Algorithm Flow Chart:-

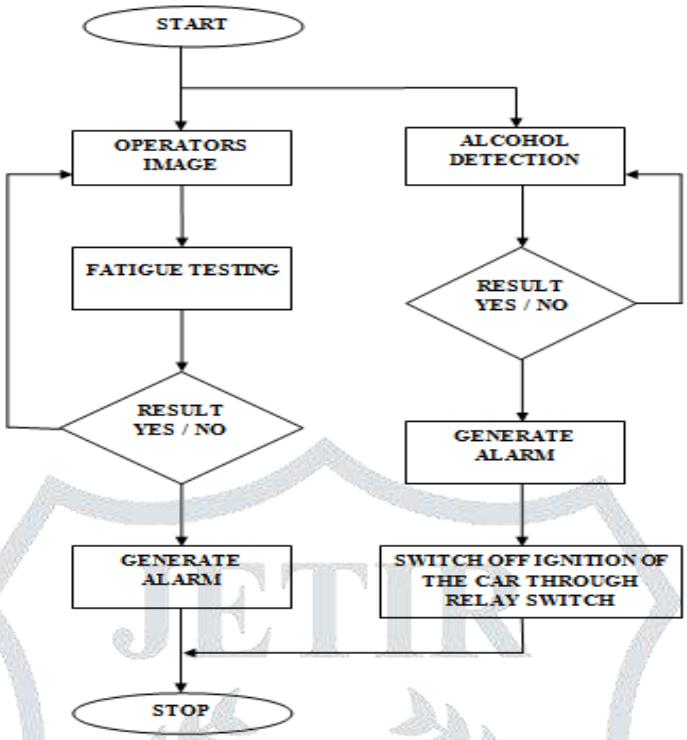

Figure 4.1: Operating Flow

Flow chart Description:

- Initially driver's image will be taken via camera.
- After that the created program will start monitoring the driver's eyes.
- When the eye's pupil is not read by the camera or if eyes are found to be closed for more than the time set in timer than an alarm notification will be given through buzzer.
- So upon detection of the fatigue an alarm can be generated and alertness can be provided to the sleepy driver.
- Corresponding to this an alcohol intoxication test is also done initially before the car is started.
- Alcohol intake will be detected through alcohol sensor and if the result is positive then an alarm will be generated and car's power source will be cut down through relay switch.
- Hence if the driver is drunk then he would not be able to start the car in initial state only and this system will help in preventing driver to drive in inappropriate state.
- With the help of this system alertness can be provided to a drowsy driver through alarm and drunk driving can also be prevented simultaneously.

V. CONCLUSION

This project is targeted to overcome the problems faced due to drowsiness while driving by drivers and preventing drivers to drive under the influence of alcohol. Hence the project provides solution to prevent accidents caused by drowsy driving and alcohol intoxication to a great extent. Mentioned device will provide alertness to driver if in case drowsiness is detected by the system and will switch off the ignition of the car through relay switch to prevent drunk driving.

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