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Smart Assistance System for Drivers

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Abstract - *One of the main reasons of accidents in the world is driver fatigue. Detecting the drowsiness of the driver is one of the assured ways of measuring driver fatigue. In this project we aim to develop a prototype drowsiness detection system. This system operates by monitoring the eyes of the driver and sounding an alarm when driver is drowsy. The principle of the proposed system in this paper is based on the real time facial images analysis for warning the driver of drowsiness or in attention to prevent traffic accidents using OpenCV (Open Source Computer Vision) library. Camera which is installed on the dashboard in front of the driver captures the facial images of driver. An algorithm and an interpretation are proposed to determine the level of drowsiness by measuring the eyelid blinking duration and face detection to track the eyes, and thus alert the driver. If the eyes are found closed for 5 or 8 consecutive frames, the system concludes that the driver is falling asleep and gives a warning signal. Present paper gives the overview of the technique for detecting drowsiness of the driver and impact of the problem, face detection technique, alcohol detection technique, drowsiness detection system and alcohol detection structure, system flowchart. The proposed system may be estimated for the effect of drowsiness and alcohol consumption level by warning under various operation conditions. We are trying to obtain the experimental results, which will propose the expert system, to work out effectively for increasing safety in driving. The detail of image processing technique and the characteristic also been studied.*

Key Words: **Driver drowsiness, Steering grasping, Head movement, Driving under alcoholic influence, Sensors, Raspberry Pi, Drowsiness Detection.**

1. INTRODUCTION

In today's world, everyone think about journey with their own vehicle. Driver fatigue causes the maximum accidents by cars, and lesser are by two wheelers. Due to comfort, four wheeler drivers go to resting mode easily and sometimes he/she enters to the sleepy state. The term drowsiness can be considered as the state of unconsciousness usually convoyed by performance and psychophysiological changes that result in loss of alertness. In the trucking industry, 54% of fatal truck accidents are due to driver's drowsiness. It is the prime reason of heavy truck crashes. 70% of American drivers details driving fatigued. The NHTSA (National Highway Traffic Safety Administration) estimates that there are 110,000 crashes that are caused by drowsy drivers and result in more than 2000 fatalities and 70,000 injuries. This problem will increase day by day.

The real time drowsiness behaviors are unsafe which are related to driver's fatigue in the form of the eye blinking, head movement and brain activity. The aim of this system is to detect the human behaviors and mood like eye blinking and the alcohol consumption level. There are mainly three parts in this system (1) Face detection (2) Detection of the eye portion (3) Detection of the closed or open eye. (4)Hence generate the alert to make the driver aware and prevent accident.

In this project, we are going to design a system using camera which is mounted on dashboard facing towards the driver and monitor the driver's eyes in order to detect drowsiness by self-developed image processing algorithm which can give information regarding drowsiness of drivers. In this system, we are also going to use alcohol detection technique for avoiding road accidents. We will generate alert in three levels based on threshold value of alcohol percentage. In 1st level, it will only display percentage of alcohol on lcd display. In 2nd level, it will generate alert to driver not to drive the car. In 3rd level, the car's ON/OFF switch will be locked.

2. LITERATURE SURVEY

Drivers fatigue is a significant factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its effects. The focus will be placed on monitoring the open or closed state of the driver's eyes in real-time and the yawing state. 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 a sequence of images of a face, and the observation of eye movements and blink patterns. Yawning is included to make the system more accurate by determining the movement of the mouth.

Once the position of the eyes and mouth is located, the system is designed to determine and detect fatigue.

- Background Elimination
- Face Detection

Face detections concerned with finding whether or not there are any faces in gray scale images and if present then returns the image location and content of each face. Face detection module was developed for single images but its performance can be further improved if a video stream is available. Face detection from a long database of face images with different backgrounds is not an easy task.

Steve Lawrence et al have discussed Real time visions modules. Real time visions modules have been facilitated due to advances in computing technologies. These modules interact with humans. The face detection is challenging as it needs account for all possible appearance variations caused by changes in illuminations, facial features, occlusions, etc. It also has to detect faces that appear at different scale pose with in-plane rotations.

The Face Detection can be of two types:

1. We want to find one particular person for a large database. In this type of search the system searches through the database and result is the most closely matched template. This operation may take time so it need not be done in real time.

2. We need to survey a particular area. Here we need rapid classification and identification i.e. the data needs to be identified in real time data. Here the continuous video stream is converted into frames for recognition.

3. SYSTEM SPECIFICATIONS

A. Hardware Specifications
   a) Raspberry Pi
   b) Webcam
   c) Buzzer
   d) LCD Display
   e) MQ3 Alcohol Sensor
B. Software Specifications
   Visual Studio Code

Table -1: Specifications of Hardware

Sr. No.	Component Name	Specification
1	Raspberry Pi	SoC: Broadcom BCM2837 CPU: 4xARM Cortex-A53, 1.2GHz GPU: Broadcom VideoCore IV RAM: 1GB LPDDR2(900MHz)
2	Webcam	A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet.
3	Buzzer	A buzzer or beeper is an audio signalling device,which may be mechanical, electromechanical, or piezoelectric typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.
4	LCD Display	A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.
5	MQ3 Sensor	Detection Gas: Alcohol Gas Concentration: 0.4mg/L-4mg/L Supply Voltage: <24V Heater Voltage: 5.0±0.2V(High), 1.5±0.1V(Low) Load Resistance: Adjustable Heater Resistance: 31Ω ±3Ω Heater Consumption: <900mW

4. METHODOLOGY

4.1 Block Diagram

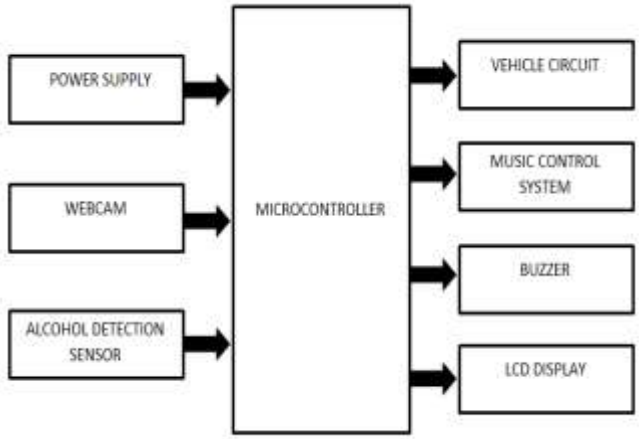

Fig -1: Block Diagram

Power supply 5V 2.5A is given to the microcontroller. Webcam is used to capture live video stream of driver to detect drowsiness. After detection of drowsiness, vehicle circuitry is used for various purposes like speed control, car locking system, etc. Also music control system is used to play songs with higher beats which will help the driver to control his/her drowsiness. Buzzer is used to alert the driver as well as passengers. Alcohol detection Sensor is used to detect alcohol consumption level by the driver. After the detection of alcohol content, the alert will be generated and displayed on LCD display.

IRJET sample template format, Define abbreviations and acronyms the first time they are used in the text, even after

they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

4.2 Algorithm

Steps of algorithm:

Step 1: System will start as soon as the car is unlocked.

Step 2: Webcam will be initialized and it will start detecting face of driver.

Step 3: When the face is detected, various features are extracted in order to detect eyes .

Step 4: After detection of eyes, if eyes are closed then the timer will turn on else it will reset the timer and start detecting face again.

Step 5: If eyes are closed and timer is on for more than 2 seconds then the drowsiness will be detected and alarm will turn on.

Step 6: If stop button is pressed by the driver then timer will reset and process will continue from step 2.

Step 7: If alarm remains on for certain time or it turns on for certain number of times then the specific high beat music will turn on music system.

4.3 Implementation of System

This system is totally innovative and can be used by a driver of a vehicle to get assistance while driving. In this system, we are using the Python OpenCV model based designing. In our algorithm, first the image is acquired by the webcam for processing. Then it is given to the Raspberry Pi. Raspberry Pi is small single board computer. Python is main programming language for Raspberry Pi. It performs a processing of the input video stream so to compute the level of fatigue of the driver. The analysis is based on calculating the number of frames of the data stream where the driver's eyes are closed. Video segments whose average eye state point exceeds the threshold value are detected as drowsy. For this process, Haarcascade algorithm is used. We use the Haarcascade file face.xml to search and detect the faces in each individual frame. If no face is detected then another frame is acquired. If a face is detected, then a region of interest in marked within the face. This region of interest contains the eyes. Defining a region of interest significantly reduces the computational requirements of the system. After that the eyes are detected from the region of interest by using Haarcascade_eye.xml.

Haar Features – All human faces share some similar properties. These regularities may be matched using Haar Features.

A few properties common to human faces:

1. The eye region is darker than the upper-cheeks.
2. The nose bridge region is brighter than the eyes.

Composition of properties forming matchable facial features:

1. Location and size: eyes, mouth, bridge of nose
2. Value: oriented gradients of pixel intensities

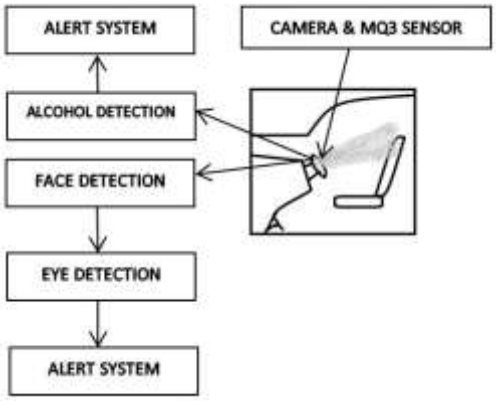

Fig -2: System

5. RESULT

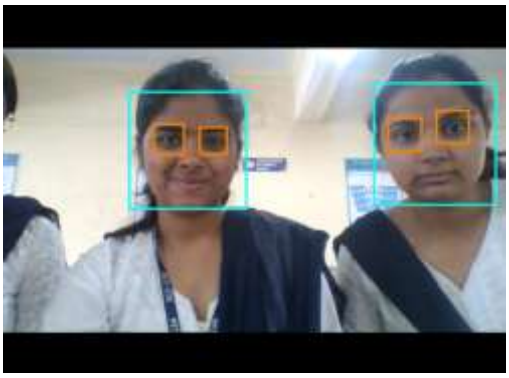

Fig -3: Result

We tried our method on twenty different subjects so that we could build our database and determine the respective accuracies. Our sample space consisted of ten subjects who wore glasses and ten who did not. Each time the code detected drowsiness when the subject's eyes were partially or completely closed for 3 seconds, we recorded a success. The algorithm involving detection of drowsiness yielded the best results with an overall accuracy of 80% for the people without glasses and 55% accuracy with glasses.

6. CONCLUSIONS

The aim of this thesis is to detect the drowsiness for drivers using image processing. Proposed system is about designing a system using camera that points directly towards the driver's face and monitors the eyelid blinks in order to detect fatigue or drowsiness by self-developed image processing algorithm which can give information about drowsiness of drivers. So the first step is the face detection. For face detection Haarcascade method is used.

The second step is Feature Extraction like detect the eye portion which has been done by Haarcascade algorithm. During detection of eyes, system will be able to decide if the eyes are open or closed and whether the driver is looking in front by self-developed algorithm and its pixels map. When the eyes will be closed for too long, a warning signal will be given in the form of alarm signal and also make the driver aware by playing high beat music. Also, the alcohol detection sensor mounted on the steering of vehicle will detect the alcohol level of driver. When alcohol level will be more than the threshold level then driver will face difficulties to start the vehicle.

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