Driver Drowsiness Detection System

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Abstract: This research paper presents a project aimed at developing driver drowsiness detection system which offers several benefits. Firstly, it enhances road safety by proactively alerting drivers and mitigating the risks associated with drowsiness. Secondly, it provides valuable data for analysis, enabling stakeholders to understand patterns of drowsy driving and formulate preventive measures. Lastly, the system can be integrated into existing vehicle infrastructure with relative ease, making it scalable and cost-effective for widespread adoption. The proposed system utilizes a combination of hardware and software modules to monitor the driver's physiological and behavioral parameters in real-time. The hardware components include a camera for capturing facial images, sensors to measure vital signs (e.g., heart rate, breathing rate), and an IoT-enabled device (e.g., Raspberry Pi) for data processing and communication. The software module employs machine learning algorithms and computer vision techniques to analyze the collected data and identify signs of drowsiness.

Index Terms: Detection, Sensors and Camera

I. INTRODUCTION

The aim of developing an IoT-based driver drowsiness detection system is to enhance road safety by proactively identifying and alerting drivers who exhibit signs of drowsiness. The system aims to leverage IoT technology to monitor various physiological and behavioral parameters of the driver in real-time, analyze the data using machine learning algorithms and computer vision techniques, and generate timely alerts when drowsiness is detected. The ultimate goal is to reduce the occurrence of accidents caused by drowsy driving by providing drivers with the necessary warnings and encouraging them to take appropriate measures, such as resting or taking breaks, to prevent accidents. Additionally, the system aims to contribute to a better understanding of drowsy driving patterns and provide valuable data for analysis to formulate preventive measures and interventions at both individual and fleet management levels. By integrating with existing vehicle infrastructure and other IoT devices, the system aims to be scalable, cost-effective, and widely adopted for safer roads.

II. OBJECTIVE

- The system aims to leverage IoT technology to monitor the driver's vital signs, facial expressions, and eye movements in real-time using sensors and cameras.
- The objective of an IoT-based driver drowsiness detection system is to develop a robust and efficient solution that can accurately detect and alert drivers about their drowsiness levels.
- The ultimate goal is to enhance road safety, prevent accidents caused by drowsy driving, and promote responsible driver behavior through timely and effective detection of drowsiness.

III. LITERATURE REVIEW

Drowsiness Detection of a Driver using Conventional Computer Vision Application (2020)

In this paper, pre-existing features for facial landmark detection are used. The methodology uses 68- facial landmark (a predefined landmark) for shape prediction to identify various regions of the face like eyebrows, eye, mouth region etc. High vision cameras are embedded to monitor, capture and extract frames one by one and generate the alerts accordingly. Each extracted frame is analyzed to study the pattern of facial features; using Haar Cascade Classifiers and determined Eye Aspect Ratio (EAR) and Mouth Aspect Ratio frame.


The Drowsy driver detection system is designed using Python and Dlib model. This model is trained to identify 64 facial landmarks. Dlib library is used to detect and localize facial landmarks using Dlib’s pre-trained facial landmark detector called Histogram of Oriented Gradients (HOG). In this method, frequencies of gradient direction of an image in localized regions are used to form histograms. It is used to map the coordinates of the facial landmarks of the input video and drowsiness detected by monitoring aspect ratios of eyes and mouth.

Alert System for Driver’s Drowsiness using Image Processing (2019)

Accidents occur all over the world cause of not being able to concentrate on the road while driving. concentration is missed due to driving the car without resting or if consumed alcohol which makes the person drowsy. This problem is overcome by developing various systems in detecting sleep. The system uses the Raspberry Pi and various sensors like Gas Sensor, Vibration Sensor for the detection of the type of drowsiness. The driver has been monitored by placing a camera which captures the vital sign. If the eye is closed for a longer period, then the image of the person is sent to cloud. Drowsiness Detection and Alert System (2018)

In this project we design goggle/spectacles in which IR sensors and buzzer are fitted. This entire set up is worn by the driver. The setups consist of many more things such as Arduino UNO, GSM SIM 800 module, 2batteries, two ON/OFF buttons each connect with one battery. Now what happens here is the first battery relates to microcontroller and the other one relates to GSM, module. This entire setup works in this way, as soon as the driver wears the goggle IR sensors check whether the eyes are closed or not, if the eyes are not closed then it again checks for it, this loop continues until the eyes are found closed. As soon as the eyes are found closed, it again goes for a second check and again if the eyes are found closed then the buzzer is blown, and red LED is on, and
it continues blowing for 1 minute and then buzzer and LED will be off. after 1 minute. We over here set a condition if the frequency is more than 50 then the driver is not drowsy as soon as it reads frequency less than 50 then the driver is drowsy. On the other hand, As soon as the driver is found drowsy the message is sent to the owner via GSM module which reads as “Driver is found drowsy”.

Driver Drowsiness Detection System and Techniques (2014) According to the experts it has been observed that when the drivers do not take break, they tend to run a high risk of becoming drowsy. Study shows that accidents occur due to sleepy drivers in need of a rest, which means that road accidents occur more due to drowsiness rather than drink-driving. Attention assist can warn of inattentiveness and drowsiness in an extended speed range and notify drivers of their current state of fatigue and the driving time since the last break, offers adjustable sensitivity and, if a warning is emitted, indicates nearby service areas in the COMAND navigation system.

Implementation of the Driver Drowsiness Detection System (2013) This paper is about making cars more intelligent and interactive which may notify or resist user under unacceptable conditions, they may provide critical information of real time situations to rescue or police or owner himself [2]. Driver fatigue resulting from sleep disorders is an important factor in the increasing number of accidents on today’s roads. In this paper, we describe a real-time safety prototype that controls the vehicle speed under driver fatigue To advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents is the purpose of such a mode. In this paper, we propose a driver drowsiness detection system in which sensors like eye blink sensor are used for detecting drowsiness of driver. If the driver is found to have slept, the buzzer will start buzzing and then turns the vehicle ignition off.

Detecting Driver Drowsiness Based on Sensors (2012) researchers have attempted to determine driver drowsiness using the following measures: (1) vehicle-based measures. (2) behavioral measures and (3) physiological measures. A detailed review of these measures will provide insight into the present systems, issues associated with them and the enhancements that need to be made to make a robust system. This paper reviews the three measures as to the sensors used and discusses the advantages and limitations of each. The various ways through which drowsiness has been experimentally manipulated is also discussed. It is concluded that by designing a hybrid, drowsiness detection system that combines non-intrusive physiological measures with other measures one would accurately determine the drowsiness level of a driver. A few road accidents might then be avoided if an alert is sent to a driver for that is deemed drowsy

IV. METHODOLOGIES
The basic workflow for face detection using OpenCV involves the following steps:

- Load the image or video frame: OpenCV provides functions to read and process images or video streams from various sources.
- Preprocess the image: It is often necessary to preprocess the image before applying face detection algorithms. Common preprocessing steps include resizing the image, converting it to grayscale, and enhancing the contrast.
- Load the face detection classifier: OpenCV includes pre-trained face detection classifiers, such as the Haar cascade classifier. These classifiers are XML files that contain the learned patterns for face detection.
- Apply the face detection algorithm: Using the loaded classifier, you can apply the face detection algorithm to the preprocessed image or video frame. OpenCV provides functions to perform this operation, such as the detect Multiscale function.
- Process the detected faces: Once the faces are detected, you can perform further operations on them, such as drawing bounding boxes around the faces or extracting facial features.

![Figure 1: Flowchart of the working of the model](image-url)
HARDWARE ARCHITECTURE
Raspberry Pi Model 3B
- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO

Raspberry Pi Camera Module
- 8-megapixel camera capable of taking photographs of 3280 x 2464 pixels.
- Capture video at 1080p30, 720p60 and 640x480p90 resolutions.
- All software is supported within the latest version of Raspbian Operating System.

V. CONCLUSION
In conclusion, the system uses eye movement in order to detect fatigue. Eye movement is detected using a camera. This is done to recognize the symptoms of fatigue in order to avoid accidents. It is based on the concept of eye-tracking. In order to obtain finer results, a hundred and fifty images of different people have been used. If the state of fatigue has been identified, an alarm system is turned on. Computer vision with embedded systems is used. A software algorithm is developed. It was partially tested and found to be effective. There is much scope for further improvements. The proposed system detects drowsiness if the eyes have been closed for a period of four or more frames. The detection system differentiates the normal eye blink from drowsiness. The developed system is a non-invasive system. The system can be further developed by adding various types of sensors. The system is based on computer vision. This system uses the concept of video processing.

REFERENCES
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