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Real Time Driver Safety Monitoring and Alerting System

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ABSTRACT*: The purpose of this proposed is to avoid accidents and drinking and driving of the vehicles. The proposed system helps detect if the driver is drowsy by using eye capturing techniques and Machine Learning algorithms. It alerts the driver by a buzzer sound. Similarly, when the driver consumes alcohol it is detected by the alcohol sensors and is notified to a concerned authority. The concerned authority is notified for both conditions that is drowsy and drunk driving via a cloud platform.*

KEYWORDS: *EAR, MAR, IoT, Machine Learning, Cloud platform.*

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I. INTRODUCTION

Driver Drowsiness detection is a vehicle safety technology that helps to prevent accidents caused by the driver's sleep. Various studies have suggested that about 20 percent of all road accidents are related to fatigue, up to 50 percent of certain roads. Some current programs learn driver's patterns and detect when a driver is drowsy, to avoid accidents.

With the world's second-largest network of roads, behind the US, India's roads operate with more than 250 million registered vehicles of 2017. Rapid urban migration and traffic slow are marked line growth in cars over the past 70 years. Unfortunately, this increases road casualties, killing 16 people every hour and 20 children daily on Indian roads. A recent WHO report calculated human error such as drunk driving, drowsiness and distraction as main causes of road accidents. With unprecedented advances in technology, we can now use Internet of Things (IoT) and Machine Learning (ML) strategies for successfully designing a restraining system for road faults.

The aim of this project is to improve the existing system for detection of drowsiness. The focus will be on designing a system that will monitor the blink rate and alcohol consumption. In this project we use Pi camera to capture the face and Machine Learning algorithms to detect if the driver is drowsy. For the alcohol detection we use MQ-3 sensor which is mounted on the seat- belt. We alert the driver through a buzzer. If the driver is found to be drowsy and consumed alcohol or either, an authorised person is notified about the same through thingSpeak cloud platform

[1].An accident protection and safety assistance tool is developed that uses a raspberry pi and a pi camera to take continuous frames in a driver's video recording. The facial expressions of the face are continuously scanned and photographed using a pi camera. The collected historical frames are provided with an EAR algorithm to read eye-catching looks and a MAR algorithm to determine drowsiness. The proposed route sets the thresh-hold and predicts that the driver will fall asleep when the EAR rate goes below the limit or when the eye is kept close for a long time and when the MAR level exceeds the set limit. Immediately the system notifies the driver with the help of the sound system.

The driver is warned when he feels drowsy and such drowsiness are also stored in the cloud. One of the primary cause is also alcohol consumption, so use of alcohol sensor is a way to avoid accidents. The driver is alerted through the sound system.

[2].An eye condition analysis is an important step in diagnosing fatigue. The algorithm that scans and analyses the shape of the eye and mouth by removing the features of the container is suggested. First, the surface area is identified on the captured image website. Then, the eyes are captured by the EyeMap algorithm using a composite method to extract the sclera-fitting eye contour and calculate the aspect ratio. In addition, an effective algorithm is proposed to solve the contour insertion problem when the driver's eye area is affected by strabismus. At that point, the chromatist s value is determined in the RGB space, and the mouth is properly detected by lip separation.

Based on differences in lip colour, skin, and inner lip, the inner lip contour can be inserted to check the openness of the mouth; at the same time, another unique and constructive way of judging is based on the fact that the driver is tired. This paper is built on three different databases to determine the performance of the proposed algorithm, and it is not necessary to train with high calculation skills.

[3].The components of the fatigue testing system are IR-enabled camera, RPi microprocessor, LCD screen and a speaker or buzzer and the use of ML algorithms to identify sleep symptoms in driver behaviour. With the help of dlib facial mark predictor, eyes are found in the image. After that, we monitor eye aspect ratio (EAR). Similarly, with the help of facial dlib local forecast, mouth is found in the picture. After that, we monitor the 'd' distance between the top and lower lip. The system always monitors one framework 2 seconds. If the driver's eyes are closed at 3 in a row frames namely 6 seconds and / or driver yawning 5 times in the trip, the alarm goes off and the phone rings asks the driver to take a break.

[4].An alcohol sensor (mq3 gas sensor) that surrounds the surrounding area at a relative distance is used. This audible information is provided by the ATMEGA 16 Microcontroller which processes audio data in comparison to the set limit value. When alcohol is detected the output microcontroller signal on the Liquid Crystal Display (LCD) display and the Global System for Mobile communication (GSM) module informs the subject and other relevant themes for detection. The microcontroller also emits an operating signal on the relay which ensures that the vehicle is delivered to the stop immediately.

[5].In the proposed system the priority is to identify driver drowsiness in real time. It means that real-time data of the driver’s eyes will record for every 5 to 10 minutes or continuous monitoring will be done by capturing the position of the eye and inform the driver to avoid accidents. Second advantage of the proposed system is to use graphs to find the accuracy of the output. The proposed system consist of computer vision that can detect drowsiness automatically and ring an alarm if found drowsy. Final results with EAR values are evaluated to give 85-90% accuracy in identifying drowsiness.

II. COMPONENTS USED

A. Raspberry Pi 3

Fig. Raspberry pi 3

B. Camera

Fig. Webcam

The Raspberry Pi 3 is equipped with a quad-core 64-bit Broadcom BCM2837 ARM Cortex-A53 SoC processor running at 1.2 GHz, making it almost 50% more powerful than the Pi 2. The proposed system uses Raspberry Pi 3 microprocessor, shown in figure A, at its heart. It processes all data from IoT sensors and camera. It applies small computations and ML algorithms on it to know the driver’s behaviour. While RPi provides limited computational resources, they are sufficient for our usage. It uses Raspbian OS and has a 1 GB RAM. It is a Quad core processor with a speed of 1.2GHz.

This project uses a Frontech web Camera. It is a USB2.0 and is also compatible with USB1. With the sensor type as CMOS it has a 3.85mm Lens size. It has 10x Digital Zoom which is highly recommended for this proposed system. It contains light flash which is helpful in dim lights, to capture better quality images. It has movable head to adjust according to the drivers face. It consists of a cable which can be directly connected to the Raspberry Pi 3. It can be mounted on to the dashboard for easy capturing of the video. Hence, it also an important component in this proposed system.

C. **Alcohol Sensor**

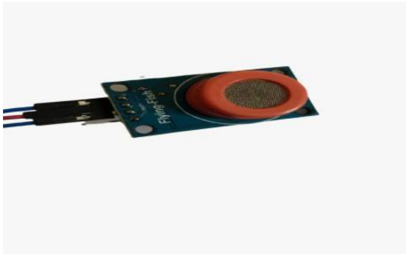

Fig. Alcohol sensor

This proposed system uses a MQ-3 sensor to detect alcohol gas as depicted in fig C. It is used to detect the alcohol content in the driver's blown breath. It also uses an analog to digital converter with MQ-3. The data received from the sensor is fed to the Raspberry Pi3 to analyse. If the driver is found to be drunk the alarm is raised and the authorised person is informed of the same.

There are two types of buzzers, active and passive. Active buzzers are easy to use. They allow us to use them on their own just by applying steady DC. So, in this proposed system we have used an active buzzer. With the DC voltage, it will buzz at a predefined frequency of about 2300Hz. It usually operated at 5V. The output voltage of the GPIO pins of the Raspberry Pi3 is only 3.3V. But the buzzer works at 3.3V also.

D. **Buzzer**

Fig. Buzzer

III. EXPERIMENTATION

We aim to achieve Detection of drowsiness and alcohol and the alerting system by implementing them module wise. Detection modules run parallel and are independent of each other. Explanation of implementation of all the modules are as follows:

Drowsiness Detection Module:

Drowsiness detection is done using a camera and RPi3, with the help of a OpenCV, dlib, and Python. The camera is mounted near the steering of the car in a position to capture the drivers face clearly . This camera continuously captures the video of the driver. The captured video is cut into frames. These frames are pre-processed by resizing it to have a width of 450 pixels and then converting it to gray-scale. The dlib library ships with a Histogram of Oriented Gradients-based face detector along with a facial landmark predictor .This dlib's face detector is used to find and locate the face(s) in each frame. Then the algorithm marks the *'facial landmarks'* ,on the face that is detected. Contours are drawn using OpenCV library for the visibility as shown. Using the landmarks of both the eyes, *Eye Aspect Ratio (EAR)* is calculated. Decision of the driver is drowsy or not is taken by comparing the calculated EAR and pre-set threshold.

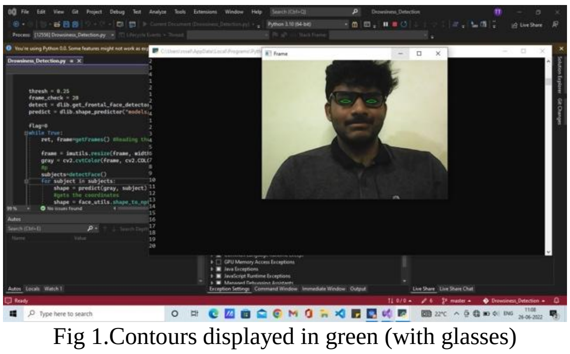

Fig 1.Contours displayed in green (with glasses)

If the EAR is less than the threshold, the driver is classified as being drowsy. Once the EAR results less than the threshold (0.25), the alerting and data transfer to the cloud are triggered. An alarm is also triggered immediately to alert the driver and data is sent to cloud . The system continues in monitoring soon after the alerting is done.

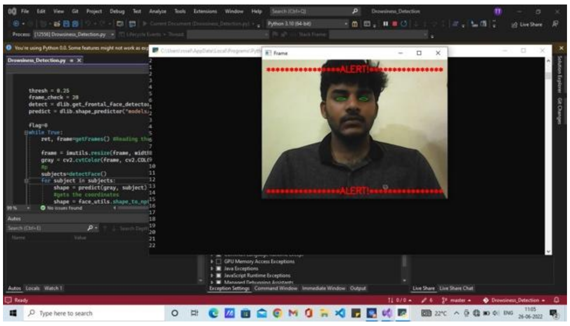

Fig 1.1 Alert message display

Alcohol detection module:

Alcohol Detection is done using the sensor, *'MQ3 Sensor'.* This sensor is connected to the RPi. The sensor is mounted on the seat belt of the driver from where it can sense the breath of the driver. If the sensor detects the alcohol consumption, the RPi triggers the alerting and sends the appropriate data to the cloud.

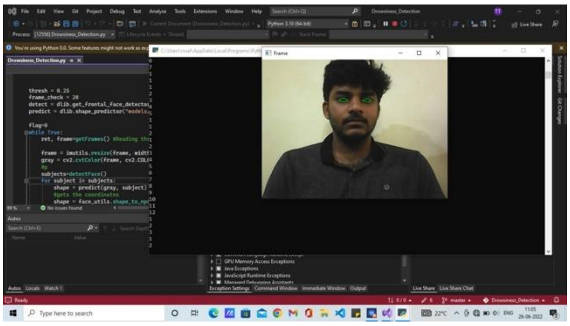

Fig 1.2 Contours displayed in green(without glasses)

Alerting module:

When the driver is Alerting is done whenever a detection is done in any one of the modules. An alerting buzzer is set to alert the driver. Along with alerting the driver, the data is sent to the cloud. The data sent to the cloud includes, time of the detection, type of detection (Drowsiness or Alcohol). Using this data, the cloud service provider will plot a graph, from which we can view in the dashboard of thingspeak website .that's accessible. The cloud service provider which has been used is *'Thingspeak'.*

Fig 1.3 webcam, buzzer connected to Rpi

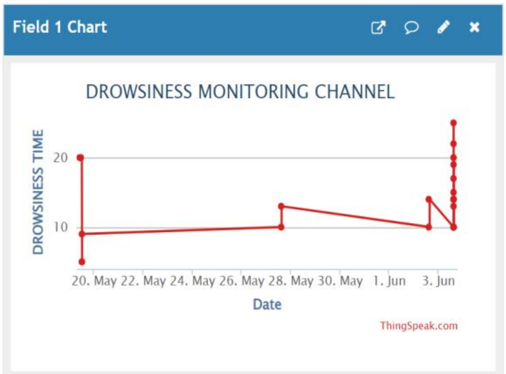

Fig. Drowsiness chart on thingspeak cloud

IV. CONCLUSION

This paper aims to lessen the number of accidents that occur due to some of the human errors and to contribute to the technology with a common goal to reduce these fatalities in coming days. The proposed system aims to reduce the accidents that occur due to the drivers fatigue or consumption of alcohol, which is becoming a common reason for accidents these days. The system is capable of detecting the condition of the driver and storing it in the cloud for any future analysis.

The proposed system is a real time monitoring and alerting system where the drivers real time video is analyzed for any patterns of drowsiness and consumption of alcohol using sensors.The real time data is analyzed to alert the driver and details of the occurred event is stored in a cloud. The dashboard can be monitored since these dashboards have driver's real time data of his/her current driving condition. The priority here is to detect whether the driver is drowsy or not along with alcohol consumption detection ,which we believe have played a major role in previous accidents.

The gap we observed in this model is a lack of any physical equipment which can alarm the driver. Any physical device like a water sprinkler can be installed inside the car to alarm the driver physically, which we believe will act as a preventive measure for a mishap. This could the future scope for this paper. Additionally the future work can include a system where the history of drivers data is used to determine driving patterns and alerting authorities if they observe frequent suspicious pattern in drivers condition. Better decisions can be taken using the drivers past history data stored in the cloud since two dashboards provide information about drivers fatigue and alcohol consumption.Similarly to this a application can be developed to inform/alert the family members or any other concerning authorities.

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