Driver Safety System

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***Abstract*—Road accidents are caused by both drowsiness and drunk driving. Our project's primary objective is to decrease the frequency of traffic accidents by providing an alert and safe driving experience. By gently notifying sleepy drivers, helping them restore their alertness while driving without startling them. In our project, we propose to embed an IR sensor in smart connected glasses to detect eye blinks and use them to estimate the driver's drowsiness level based upon blink frequency and average amount of time spent in closed eyelids state. This innovative solution is based on a detection threshold mechanism. The driver is alerted using audio message via audio output devices such as vehicle speakers, earphones/headphones and by sending vibration alert on driver's smartwatch. The results demonstrate that our project out-performs the CNN based eye-detection method in term of input processing time and time required for the model to respond to changes in external stimuli (driver eye movements). Moreover, increased overheads in terms of battery lifetime for running the IR sensor placed on the glasses and relative decrease in accuracy as compared to CNN based solutions are acceptable, also long exposure to the IR sensor are harmless for the driver's eye, thus making our system a viable and accurate-enough solution for drowsiness detection in wearable devices.**

Keywords—Drink-driving, fatigue, drowsiness detection, Over-speeding, vehicles-based notification, driver safety

I. Problem Identification

The steadily increasing accident rate is a serious issue in every nation. Roughly 1.3 million individuals are cut short because of a road traffic crash, 20-50 million additional individuals experience non-fatal injuries, with many causing a disability because of their physical issue.

Road traffic injuries lead to heavy losses in the form of heavy expense of treatment as well as lost efficiency for those killed or crippled by their injuries, and for family individuals who were emotionally/ economically dependent on them. Road traffic crashes cost most nations 3% of their GDP. The majority of accidents occur when a motorist has not gotten enough sleep, but it can also occur as a result of untreated sleep disorders, medications, alcohol inhalation, shift employment, or lengthy late-night travels. Driver's inattention might be the result of a lack of alertness when driving due to driver drowsiness and distraction. Fatigue and drowsiness are some of the leading causes of major accidents on Highways. Driver distraction occurs when an object or event draws a person's attention away from the driving task. Unlike driver distraction, driver drowsiness involves no triggering event but, instead, is characterised by a progressive withdrawal of attention from the road and traffic demands. Both driver drowsiness and distraction, however, might have the same effects, that is decreased driving performance, longer reaction time, and an increased risk of crash involvement.

To resolve this, we design a system that can alert the vehicle owner/loved ones as soon as any signs of an accident or may lead to an accident are detected. The main objective of this work is to detect early if a driver shows symptoms of sleepiness that indicate that he/she is falling asleep and, in that case, generate an alert to wake him/her up. The system stores all readings that lead and happened during the accident so that investigators may study exact causes of accident to avoid further such instances. The proposed solution improves road safety, reducing the number of accidents caused by drowsiness while driving.

II. Background & Motivation

In today's technologically advanced society, private transportation is rapidly expanding. When travelling a long distance, driving will be tiresome and boring. Long distance driving without adequate rest and sleep is one of the key factors contributing to the driver's lack of attentiveness. Driving when drowsy is possible for tired drivers. Drowsiness can cause severe and sometimes fatal mishaps in just a few fractions of a second. Continuous monitoring of the driver's attentiveness is necessary to prevent incidents of this nature, and the driver should be warned if sleepiness is detected. By doing this, we can significantly lower the number of accidents and save lives.
The cause of a lot of traffic accidents is drowsy driving. Drowsiness can be identified by continuously streaming video of the driver using a camera or mobile device. The overall goal is to develop a model that can tell whether or not someone is feeling sleepy, along with notifying. The model scans an image every second, looks for blinking eyes, and uses the Perclos algorithm to determine when an eye closes. When the blink rate is high and the eye is closed for a predetermined period of time, the driver will be alerted by a sound.

III. Literature Surveys

1. Driver Drowsiness Detection System Based on Visual Features

In the study entitled Driver Drowsiness Detection System Based on Visual Features, the issue of existing systems producing less accurate results because of poor picture and video quality has been resolved. They suggested a technique for detecting driving tiredness that measures the number of times the driver's eyes blink. In particular, the suggested

framework continuously monitors the driver's eye movement and alerts them of drowsiness by triggering the vibrator. A vibrator signal is generated to alert the driver if the eyes are identified to have been closed for an extended period of time. The experimental outcomes of the proposed system, which is implemented on Open CV and Raspberry Pi environments with a single camera view, show the good performance of the system in terms of accurate drowsiness detection results and subsequently lowers the number of traffic accidents. The system proposes a novel drowsiness detection algorithm using a camera near the dashboard.

A. Advantages

- They proposed a new drowsiness detection framework based on shape prediction algorithm
- Non-invasive approach, without any annoyance and interference.
- Uses eye blink counts for detecting the drowsiness, which solves the problem on low clarity images due to variations in the camera position.

B. Disadvantages

- Not much efficient, They're combining OpenCV and Raspberry Pi although it gives slightly more accuracy, but takes more resources.
- Detection of yawning is not implemented with the same framework.[1]

2. Driver Alertness Monitoring Using Fusion of Facial Features and Bio-Signals

This literature survey, outlines a It outlines a technique for assessing driver fatigue data using two different techniques, eye movement monitoring and bio-signal processing. A monitoring system is built into Android-based smartphones, which uses a wireless sensor network to collect sensory data and further process it to determine the driver's current level of driving skill. A meaningful assessment of the driver's behavior requires the integration and synchronization of multiple sensors. A video sensor and a bio-signal sensor have been used to collect the driver's photoplethysmography signal and image, respectively. The framework for evaluating driver weariness is a dynamic Bayesian network.

If a certain level of driver weariness is thought to have been reached, a warning alarm is activated. The system's extensive testing proves the usefulness of various aspects, especially when combined with discrete approaches, and their integration makes fatigue detection more accurate and comprehensive.

The driver's physiological data and facial expression are the key sources of information in their study. They've also mentioned the Future researches, which may concentrate on the use of environmental parameters for measuring fatigue, such as vehicle states, sleeping patterns, weather, mechanical data, etc. For them, the volunteers' input was encouraging, and it was suggested that further improvements will be made.

A. Advantages

- In order to prevent inaccurate information interpretation, the proposed method also makes use of a biomedical sensor module.
- TinyOS, an operating system designed primarily for low-power wireless devices, was utilised by them. On a cross-platform
- The actual awake condition has a good projected probability of 81%.

B. Disadvantages

- Based on this estimated probability, it is not a quintessential performance result that we are seeking
- They've only considered the healthy volunteers, so for the ill, it would false predict.
- A few photographs were not adequately processed because of the driver's abruptly large movements and changes in the lighting conditions.
- False awake condition is excessively high at 36%. [2]

3. Fusion of Optimized Indicators from Advanced Driver Assistance Systems (ADAS) for Driver Drowsiness Detection

In this study, the authors present a non-intrusive method for tracking driver drowsiness that combines a number of improved indicators based on data from simulated ADAS (Advanced Driver Assistance Systems) on driver physical and driving performance metrics. Instead of extended sleep/awake regulation prediction technology, the research focuses on real-time sleepiness detection technology. They have created their own visual system in order to produce reliable, optimised indicators suitable for usage in simulators and potential real-world settings.

These signs are primarily based on the physical capabilities and driving abilities of the driver. To find the ideal combination, a neural network and a stochastic optimization algorithm analyse the fusion of numerous indicators that has been suggested in the literature. They propose a novel approach for generating ground truth based on supervised Karolinska Sleepiness Scale (KSS). A thorough analysis of indicators was conducted using data collected from tests conducted on more than a third of the test subjects during various drive generating simulator with ng sessions. Included are the key findings regarding the effectiveness of individual indicators and the optimum combinations of them, as well as the future works resulting from this study. [3]

4. Tracking Eye State for Fatigue Detection

In this research article, the authors have proposed a hybrid fatigue system, and they have depicted a systematic flow diagram of the Hybrid Fatigue system. The Hybrid Fatigue system is bas s Following a significant increase in the frequency of traffic accidents, several nations turned their attention to the issue of road safety. Drowsy driving accidents frequently happen on highways as well as on key roads and even in populated areas. Today, with the advancement of computer vision technology, it is possible to control the driver's level of fatigue. According to physiological studies, an increase in the frequency of yawning signals the initial stage of a loss of alertness. the investigation of a non-stationary, non-linear signal's spatial and temporal characteristics. Their Oue MiraclHB databases and YawDD both evaluate this strategy.

The evaluation reveals a number of encouraging findings and demonstrates the potency of the suggested strategy. There are gaps in the level of the many works that we have just provided, according to an analysis of the descriptors employed in the literature for drowsiness detection. In order to determine the distances DOO and Dy, Teishing Wang et al. and Yufeng's studies do, in fact, require a thorough localisation of the mouth zone. When the motorist turns their head, this work demonstrates a failure. Even a slight rotation has an impact on where the mouth is located. The stage of the descriptors lips extraction begins when the interest zone has been found using Viola and Jones' approach. This step is crucial for being able to identify yawning states. In actuality, this stage's objective is to identify the lips' outward outline.

The contouring techniques that enable the segmentation of the lips are generally based on deformable models of contours. This approach demonstrates resilience at the level of segmentation and real-time tracking of non-rigid objects, in this case the driver's lips. This kind of approach entails selecting a mathematical model that can conform to the contours of the target item. The minimization of an energy function directs the deformation of the starting model. This function consists of an energy external component that is determined from the features of the image and an energy internal term that describes the geometrical characteristics of the contour. The concept of active contours is represented by this function.

A. Advantages

- The authors have chosen a mathematical model so that it adapts to contours of the interest object.

B. Disadvantages

- Shows a failure when the driver turns its head.[4]

5. A Real Time Embedded System Application for Driver Drowsiness and Alcoholic Intoxication Detection

The purpose of this research paper iis to address the issue of, Road accidents have become quite regular in today's globe. Not only do they harm property, but they also put travellers' lives at danger. The planned system is supposed to contain two webcams, one to detect the lane and the other to watch the driver's face. Road safety is a matter of national significance. Now, the webcam will start continually recording video whenever the automobile begins, and the system will sample the footage into picture frames. Each image will be put into the processor, which will then use a transform to identify the lanes and the eyes as seen in the findings above.

Now, whenever a motorist crosses a lane line without indicating, either an alert signal sounds or the wheels are braked to reduce speed in an effort to prevent a potential accident. Similar to this, the eye frames will be regularly checked for open eyes. Again, the system sounds an alarm or signals the engine to brake to slow down the car if it detects more than 10 consecutive frames of closed eyes.

A. Advantages

- They've outlined and came up with a novel approach for driver drowsiness and alcohol intoxication.
- Used open-source products, including a 5 megapixel digital camera.

B. Disadvantages

- Partially tested
- Could not produce a hardware product; just the system's basic framework has been constructed and it is still in the research stage.
- The authors acknowledge that there is still much to learn and develop in this area.[5]

6. Finger Vein Recognition Based Driver Authentication and Alertness System Using GSM

The authors have proposed a unique, innovative and new technique for the authentication purpose which is Finger vein recognition, which uses recently discovered physiological and biometric behavioural technology to identify each individual. A finger vein is a network of tiny vessels that is hidden from view beneath the skin of the finger.

- The pros and cons of comparing the various methods and classifying the existing strategies into three groups based on behavioural, vehicular, and physiological aspects are reviewed. The research frameworks are also illustrated in diagrams for easier comprehension. Finally, general research findings-based methods.
- Second, the best supervised learning methods for detecting sleepiness are examined.
- The third goal of our approach is to carry out the localization and segmentation of the interest zone in order to extract a signal that describes various states of the mouth and, as a result, to identify the states of driver yawn. This will aid young researchers in discovering potential future work in the relevant field.

Based on the examination of the spatial-temporal characteristics, the depicts the stages of weariness detecting states. This stage involves integrating the camera with the MATLAB software, at which point the command "imaqhwinfo" is broadcast. This command permission allows you to find out what the software's camera's name is; in this example, it's "WinVideo." The command "imaqhwinfo ('WinVideo', 1)" is then executed to check the resolution and other properties of the connected camera. Two settings are selected for the image capture; the first is a daytime setting, and the second is a nighttime one. The driver's face is the primary focus at the time of image acquisition.

An algorithm is created in the programme that produces a frame with a rectangle to the face, indicating that there is a face to be processed. This procedure is carried out to detect sleepiness patterns more accurately.

A. Advantages

- Their proposed design is cost-effective and very accurate in the real application.
- Authentication with Finger vein has high accuracy than all other authentication which has less than 0.001% for false rejection rate and 0.0001% for false acceptance.

B. Disadvantages

- Research is partially tested, and is still in progression state to develop into infancy mode.

- Region of Interest for the face is not much accurate for the proposed model.
- They are overclocking the processor speed of the device, which may damage, and significantly affect the performance of other gadgets like the Raspberry Pi.[6]

7. A Vision Based System For Monitoring the Loss of Attention in Automotive Drivers

This research suggests a reliable real-time embedded platform to track driver distraction both during daylight hours and at night. As a measure of attentiveness, the Percentage of eyes closed (PERCLOS) has been utilised. This method uses a Kalman filter to track the face once it has been recognised using Haar-like features. Principal Component Analysis (PCA) is used to identify the eyes during the day, and block Local Binary Pattern (LBP) characteristics are used at night. The indicator of attention level has been the percentage of eye closure (PERCLOS).

This method uses a Kalman filter to track the face once it has been recognised using Haar-like features. Principal Component Analysis (PCA) is used to identify the eyes during the day, and block Local Binary Pattern (LBP) characteristics are used at night. Finally, Support Vector Machines are used to categorise the eye state as open or closed (SVM). Affine and Perspective Transformation have been used, respectively, to account for in-plane and out-of-plane rotations of the driver's face. Bi Histogram Equalization is used to compensate for variations in lighting (BHE). A Single Board Computer (SBC) with an Intel Atom processor, 1 GB of RAM, a 1.66 GHz frequency, x86 architecture, and the Windows Embedded XP operating system has been used to build the algorithm after it was cross-validated using brain signals.

A. Advantages

- The authors have Utilized Haarlike features, and one benefit of doing so is that, in addition to being a real-time algorithm, it is scale invariant.
- Used LBP, where the Illumination invariance property of LBP features a major advantage in using them for their purpose.

B. Disadvantages

- The accuracy of detection drops as the motorist turns or moves their head.
- User interface is not much user friendly, since it can be confusing to many and hard to use. [7]

8. An Arduino based embedded system in passenger car for road safety

In this research article, they've built an Arduino based embedded system, which works by limiting the vehicle's speed in school zones and other zones like bridges, highways, cities, and suburbs, they were able to build an embedded system based on Arduino that makes the passenger's journey even safer and more secure. Horn Control of Vehicle in No Honking Zone is also included. Detect drunk driving by controlling horn disruptions in places where horns are forbidden, such as hospitals, public libraries, courts, and schools.

They've also discussed some of the key causes of traffic accidents in this essay, including running red lights and drink-driving. They employ the MQ3 Alcohol Sensor, which works similarly to a typical breathalyser in terms of detecting alcohol levels in your breath. It responds quickly and with great sensitivity. Based on the amount of alcohol detected, the sensor outputs an analogue resistive signal. [8]

9. Design of Smart Helmet for Accident Avoidance

In this thesis, they've created a smart helmet that can detect accidents, alcohol use, and validates two crucial conditions before the bike starts.

- It first verifies that the user is actually wearing the helmet and not merely keeping it. The IR sensor can be used to detect it.
- Second, there must not be any alcohol on the user's breath. Gas sensors can be used to detect it. The helmet receives it. The gas sensor will feel the riders' breathing to determine how much alcohol is present when the person is heavily intoxicated.
- Third, if a person is involved in a serious accident, the sensor will assess the bike's condition and send the person's location to surrounding hospitals through GPS to the hospital's main server. There is a button on the bike that needs to be pressed if the collision is mild. This suggests that neither the rider nor the bike are hurt. The helmet uses a vibration sensor that is readily available in the area to detect accidents.

They also added a sensor which is a locally accessible gas sensor that also checks the rider's breath to determine whether the current amount is above the estimated limit. Use of MEMEs sensors helps prevent reckless driving. It is based on the vehicle's handle bar control and detects the motion of the handle. Through the use of vibration, load monitoring, MEMEs, and heavy alcohol consumption, the system is accurate in identifying accidents. [9]

A. Advantages

- In their work, they've mentioned that the accuracy is high for the detection.

B. Disadvantages

- There is no system in place to verify whether the rider is donning a helmet or not.
- Less precision in accident location
- IR Sensor range limitation [9]

10. Alert System for Driver's Drowsiness Using Image Processing

The authors have focused on a significant social issue, which is accidents due to the driver being not focused. The inability to focus on the road while driving is a leading cause of accidents across the world. When driving when fatigued or after drinking alcohol that makes a person drowsy, focus is lost. By creating several systems for detecting sleep, this issue is solved. Additionally, the suggested system's architecture is displayed. The employs a Raspberry Pi along with a number of sensors, including a vibration sensor and a gas sensor, to identify the kind of sleepiness. A camera that records the driver's vital signs is installed to keep an eye on him or her. The person's image is transferred to the cloud if the eye is closed for a prolonged length of time.

They've also used a vibration sensor, which picks up the accident, and the server is alerted by providing latitude and longitude. The inbuilt IOT modem in the automobile transmits the vehicle's position. With the aid of a gas sensor, this technology goes a step further and determines if the driver has drank alcohol. An alert message is issued to the motorist if it is determined that they are not fit to drive. This device not only identifies tiredness but also recognises whether the automobile is involved in a minor collision and transmits data to the cloud. [10]

11. Arduino based real time driver drowsiness detection and Alert System

The goal of the design proposed in this study is to identify driver drowsiness in order to reduce accidents and increase highway safety. On an Arduino microcontroller board based on the Atmega328P, a method for identifying driver fatigue or drowsiness is created for real-time monitoring. A mobile device with an Android operating system can display the readings obtained from the many sensors utilised in this project. It has a relay circuit to prevent the driver from operating the vehicle if alcohol has been consumed, as well as a MQ-2 alcohol gas sensor to detect alcohol if it has been consumed by the driver. In order to determine the temperature inside the car, the MPU-6050 Micro-Electro-Mechanical-System (MEMS) accelerometer, gyroscope, and temperature sensor are used.

Additionally, the system has the ability to track the physiological parameters of the driver, including heart rate, eye blink detection, and pulse and eye blink sensors, respectively. The alert will sound if the driver has taken alcohol, if their head nods regularly, if their heart rate exceeds the safe level, or if their eyes start to close. The system attached to the board and the Arduino exchange information.

A. Advantages

- An advantage of this proposed design is that it can monitor the driver physiological conditions such as heart pulse rate, eye blink detection using pulse sensor and eye blink
- User Friendly, which makes it easy to understand and operate the system.
- Uses very low power.

B. Disadvantages

- Level of Drunkenness are not properly classified
- Given design implementation required lot of trial and errors to make a successful system
- IR sensor's limited range and easily getting blocked. [11]

12. HybridFatigue: A Real-time Driver Drowsiness Detection using Hybrid Features and Transfer Learning

In this research article, the authors have proposed a hybrid fatigue system, and they have depicted a systematic flow diagram of the Hybrid Fatigue system. The Hybrid Fatigue system is based on combining non-visual signals from heart-beat (ECG) sensors and visual features from the PERCLOS measure.

A hybrid system incorporates aspects that are visual and non-visual. Advanced deep-learning-based architectures extract hybrid features and categorise them as driver weariness in real time. To detect driver weariness using hybrid features, a multi-layer based transfer learning strategy utilising convolutional neural networks (CNN) and deep belief networks (DBN) is applied.

The following stages are used to build the proposed Hybrid Weariness system: -

- The first stage involves using 68 different landmark points to track driver fatigue from the backdrop video frames.
- The next stage is to extract various visual features together with ECG non-visual information after detecting and segmenting the landmarks points from two mounted cameras on the vehicle.
- These hybrid parameters are gathered using the CNN model at the collection site, and after that, this intelligent data is sent to automated and operator-assisted applications that are created using the DBN model for classification.

A, Advantages

- HybridFatigue is obtained higher accuracy than CNN of 56% and CNN&DBN of 84% value.

B, Disadvantages

- Resource hungry, even with 2 GB NVidia graphics GPU, their system was showing some lags
- Also, the deep-learning architectures are required to be more powerful in terms of their computational power for real-time recognition of driver fatigue. [12]

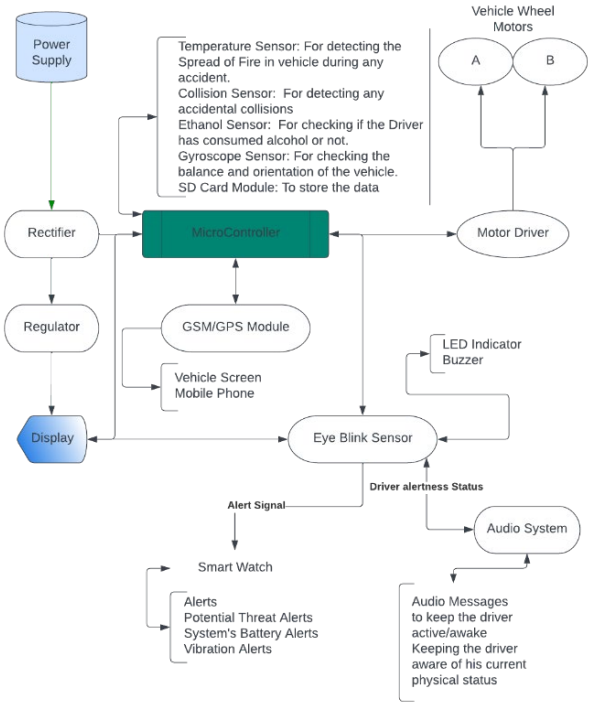
IV. Proposed Methodology

In this project we design spectacles in which IR sensors and buzzers are fitted. This entire setup is worn by the driver. The setup consists of many more things such as 2 Arduino UNO (connect with each other to work in unison), GSM SIM 800 module, 2 batteries, two ON/OFF buttons each connect with one battery. Now what happens here is the first battery is connected with 1 microcontroller and the other one is connected with the other microcontroller. The first arduino is connected with the ir sensor, sim module, buzzer, sd card module and earphone and this part of the system is worn by the driver as a headset. The second arduino is connected to rgb light, lcd display, vibration sensor, ultrasonic and various such sensor which are embedded on the vehicle.
Both the arduino are connected with each other and work in unison as one system .

This entire setup works in this way, as soon as the driver wears the goggle IR sensors checks 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 that 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 driver via the smartwatch in the form of text message, via earphones in the form of audio message, via rgb light and lcd display in the form of visual alert display which reads as “You are about to sleep in x minutes please wake up and be alert, eyes on the road”.
The same process keeps repeating.
In short we can say whenever the driver feels drowsy his eyes starts to blink with a smaller frequency, the second this status is detected by the IR sensor and the buzzer is blown to make the driver conscious and the text message is sent to the owner immediately.

V. Architecture & Block Diagram



VI. Proposed Methodology

Our proposed system contains 2 arduino uno which are connected to eachother via I2C Serial connection, which can be achieved by connecting the A4, A5 and ground pins of both the arduinos. The 2 arduino now can communicate and share data with eachother. 1 Arduino board is used as a car simulator, it contains various sensors: fire, collision, temperature and proximity sensor connected to it, giving constant sensor input which is used to gain insight into the vehicle's current state. car simulator also has a LCD display attached simulating the car screen. The other arduino board is connected to IR sensor, SD card module, SIM800L V2 module, alcohol sensor and Red led. The IR sensor is used to monitor eyelid movement, with the help of a threshold function we identify whether the current eye blink frequency and eyelid shut time is within critical value, if its not the driver is alerted and his/her attention is brought back to driving. We gently alert the driver using audio message, vibration through smartwatch and messaging. Using the SD card module we play recorded audio alert message to the driver to bring him/her back to alert state. The message is delivered to the driver via earphones/vehicle speakers. SIM800L module is used to message the driver regarding his/her drowsiness status, it is also used to call the driver's smartwatch which makes the smartwatch to vibrate worn by the driver, as a result alert the driver to stay awake through vibration signals. SIM800L is also used to send constant vehicle's state update to the driver. If any of the onboard sensors on the vehicle shows any critical state the driver is alerted regarding that. And if any of the sensor detects emergency situation such in case of an accident concerned officials/institution are automatically alerted inorder to reach the driver's location in time for rescue. All sensor data is stored on a SD using the SD card module providing insight into driver's behaviour and helps us to fine tune our system.

VII. Components

- dht11

The DHT-11 Digital Temperature And Humidity Sensor is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and gives out a digital signal on the data pin. It will provide constant temperature and humidity updates of the driver’s surroundings, it will be instrumental in case of an accident to check for extent of fire’s spread within the vehicle.

- ethanol sensor

To check for alcohol content in the driver's breath before every drive. (in any vehicle)

- ir eye sensor

The infrared sensor is mounted on the glass and is positioned in a way so that it lines up with the user’s eye, enabling us to keep constant watch on the driver’s eye movements giving us an insight into driver’s alertness. The infrared gives an HIGH output signal when the sensor detects a certain frequency of blinks, that is the driver closes their eyes for significantly longer period of time indicating a state of drowsiness.

- ultrasonic sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal to find the object's distance. In our project it will provide constant proximity updates of the vehicle's surroundings.

- buzzer

Alert's using audio signal when driver's drowsiness level goes below optimum levels.

- vibration sensor

A vibration sensor, or vibration detector, measures vibration levels in vehicles and useful in providing collision updates during accidents.

- fire sensor

Detects presence of fire during accidents.

- sd card module

This module transfers data to the earphones/audio outputting device and from a standard SD card. It holds various pre-recorded messages which are used to alert the driver if the driver's drowsiness level is beyond the normal threshold.

- earphones

To provide audio alert messages to the driver.

- rgb bulb

Producing visual output in the form of light, each unique color of light indicates a presence of unique faults in the vehicle such as red for vehicle's proximity alert, green for vehicle's collision alert, orange for fire alert and so on.

smart watch

Providing alert messages and keeps the driver active by using vibration signals if the driver's drowsiness level goes below the threshold value.

- arduino uno

This will be the brain behind our system, a microprocessing unit providing communication for data between all devices present in the system. In our project we will be using 2 Arduino uno units which will be connected to each other to work in unison.

- lcd display

This will act as vehicle screen's decoy to provide alert messages to the driver.

- spectacles

To hold the ir sensor in place, to monitor driver's eye movements to get insight into the driver's drowsiness.

GSM 800 Module

To send messages to concerned individuals in case of an accident.

VIII. Implemented Model

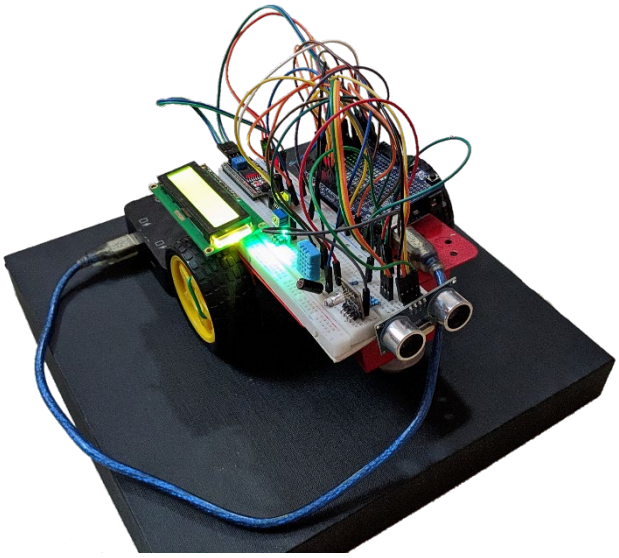


Fig. The Vehicle Module

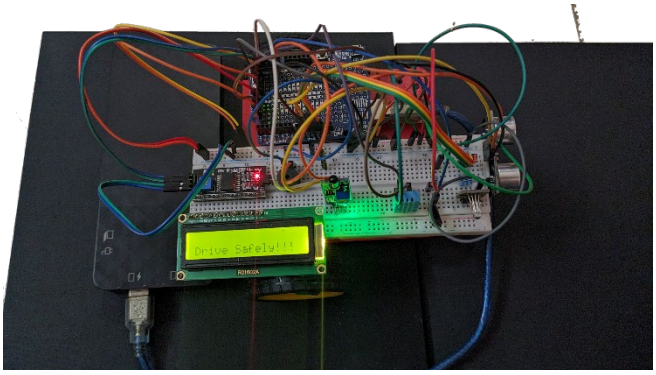


Fig. The Vehicle Module's Top view

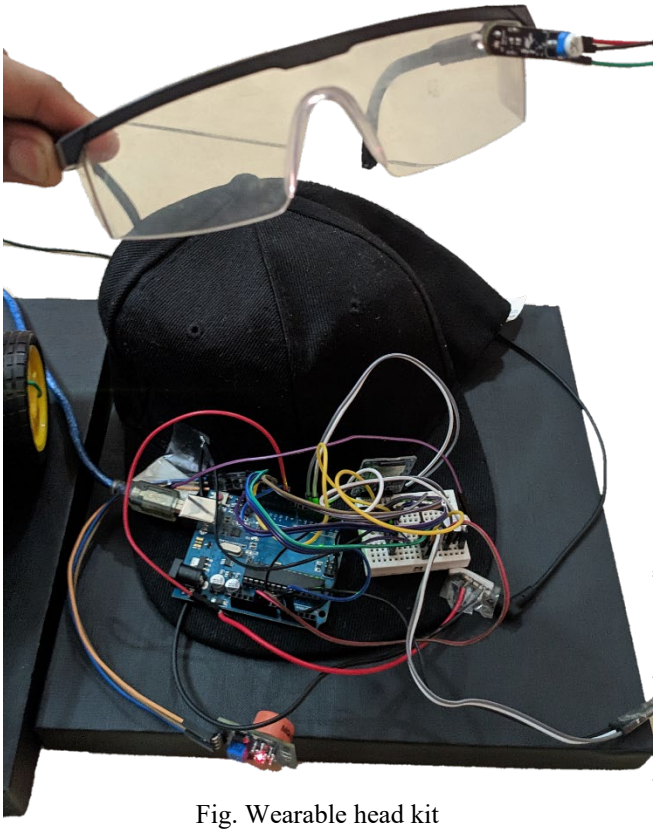


Fig. Wearable head kit

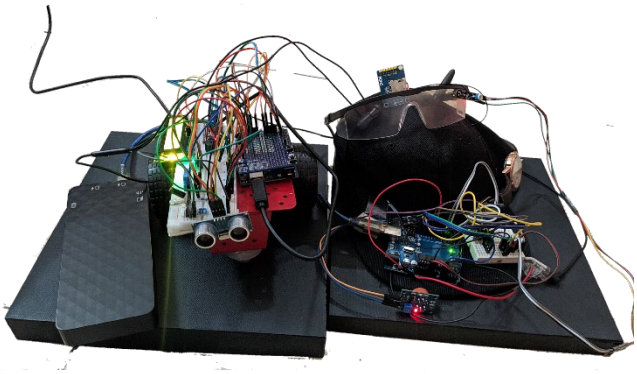


Fig. Our Full complete integrated kit.

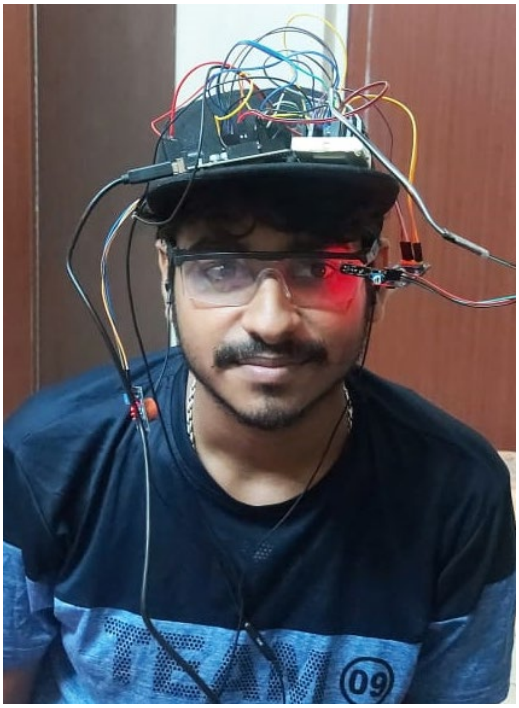


Fig. Wearable Kit demonstration

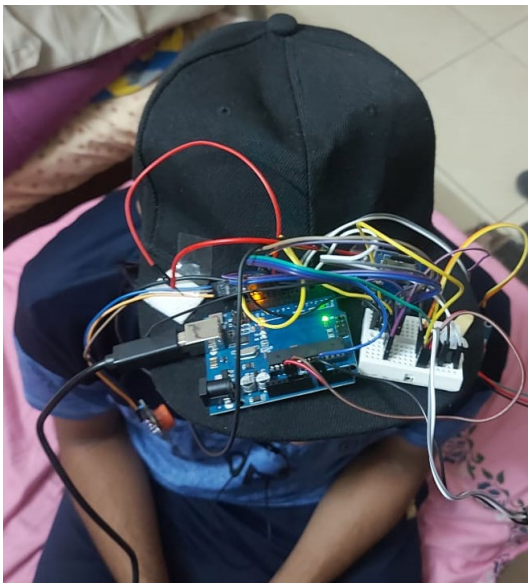


Fig. Wearable Kit demonstration top view

IX. Novelty

Use of smartwatch to send alert messages to the driver when the driver becomes drowsy, the smartwatch will also use vibration signals to keep the driver awake.
Using SIM 800 module to send message to concern individuals/authorities if the driver is faced with an accident.
Using SD card module and earphones/headphone to provide audio messages to the driver to keep him awake/alert during the drive.

X. Feasibility Analysis

After performing a deep literature survey on the mentioned articles, our project ensures complete safety of the driver during the journey by constantly monitor various aspects of the driver and the health and condition of the vehicle itself, which includes monitoring:

- Alcohol Level of the driver
- Temperature of the vehicle
- Orientation of the vehicle
- Impact of collision in case of an accident
- Drivers' alertness (notifying at any slightest sign of drowsiness)

Past projects on similar topics do not contain such a variety of monitoring parameters to determine the current status of the driver and its vehicle. They mostly contain 2 parameters at max whereas we are using around 5 parameters to determine vehicles and drivers condition giving a more accurate real-time in-sight.
Our project not only monitors but also alerts the drivers and concerned officials in case of any potential danger to the driver or the vehicle. Our system alerts in the form of message/call to registered numbers notifying them about the current status of the driver and vehicle in case of an accident or pinging them about any upcoming potential danger depending upon current status of driver or vehicle. The System alerts when:

- Speed is beyond threshold
- Driver's Alcohol levels are abnormal
- Vehicle Temperature levels are high (signifying vehicle is on fire)
- Vehicle is under the risk of toppling over (issues in vehicle's orientation)
- In case vehicle undergoes any external collision
- Driver alertness is not at optimal levels

Driver himself is altered by message/call alerts and also by various vibration, ear-friendly buzzer, LED indicator which is communicated to the driver via a smartwatch worn by him or via glass worn by him which is constantly measuring the driver's drowsiness levels in real-time.

1. *Cons*

With so many monitoring parameters, alerting methods and GPS system in place, this may make the system burdensome or confusing and messy to implement and it will also cost a good amount of energy to run the system for long driving hours.

2. *Solutions*

We will be implementing our project using Arduino Mega/2 Arduino UNO as base microcontroller of our system enabling organised system design and reducing any connection confusion. Regarding the power consumption issue all the sensors used in the project ranging from eye activity detector to ethanol detector to collision sensor will be Infrared based sensors which by nature consume very less power which hugely reduces the overall system's power requirements.

Source Code: https://github.com/Ashutosh-Ardu/Driver-Safety-System-using-Arduino

Project live demonstration link: https://youtu.be/lGitoWjo3aw

XI. Concllusion and Future Works

In this paper, we have proposed a driver drowsiness safety system using Arduino based hardware. Our system uses threshold-based functions to identify driver's drowsiness level. Once the drowsiness level is below the critical value, the driver is alerted gently to restore his/her attention on driving. Using IR sensor, we constantly track the eyelid movements which is then used for determining drowsiness levels. For alerting the driver we use audio command message, smartwatch vibration and vehicle screen alert methods to restore his/her attention which is where our novelty lies. In future works, several suggestions should be taken into account. First, we will optimize the hardware structure by using specialized and modern hardware equipments in the proposed framework for real world application to reduce the wearable kit's size and also make the kit more ergonomical to wear. It would also improve the computational efficiency without performance degradation. Second, we will develop an on-line updating method in order to improve the drowsiness detection reliability of the model through continuous updating and we can record data to understand driver's behaviour. Third, we can apply machine learning/deep learning model to perform drowsiness detection which will probably increase our model's accuracy.

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