IOT BASED DRIVER SLEEP DETECTION SYSTEM

A PROJECT REPORT

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CHAPTER 1

INTRODUCTION

In simple terms, the Internet of Things refers to the digitally connected universe of smart, automated devices. These devices are embedded with internet connectivity, sensors and other hardware that allow stable communication and control via the web or cloud. The IOT makes every devices smarter by enabling them to send data over the internet, communicating with people and other IoT enabled devices. The Internet of Things is all around us, constantly transmitting and receiving data and talking with other internet connected smart devices. IoT devices include smart home speakers, wearable health trackers and mobile app controlled thermostats.

Thus, an IOT application is a set of services and software that combines data from numerous IOT devices. It analyses the data and makes informed decisions using machine learning or AI technology. With the correct tracking system and IoT technologies, asset tracking, delivery, surveillance, traffic or transportation tracking, inventory control, individual order tracking and customer management may all be done affordably.

Drowsy driving is a significant issue that leads to many accidents every year. Current methods for detecting driver drowsiness are ineffective and inconvenient. There is a need for an effective and a real time solution to detect driver drowsiness and alert them before an accident occurs. This work aims to develop an IOT based system using sensors to detect signs of driver drowsiness effectively. Here this model will provide timely alerts to prevent road accidents.

1.1. Literature Survey:

There are lot of techniques are used in many of the research papers for driver drowsiness detection. There are reports on different aspects for developing a driver drowsiness system. W.J.Chang et. al. developed an eyeglass by integrating the IR sensor in an empty frame, which is connected to ESONode32S along with the battery and buzzer in a circuit board, ensuring the proper alignment for effective eye movement detection is done[1]. C. Minho et al defined PCB design principles and best practices for designing compact circuit boards and emphasized integration of hardware components with software algorithms[2]. Chen, Liang-Bi et al explored the use of web interface development techniques, HTTP communication and sensor integration to create a real time driver status monitoring system[3].

1.2. Objective:

The objective of this work is to design and develop a real-time system that can automatically detect driver drowsiness using sensors connected to an Arduino and to create a system that is useful and comfortable for the driver. Our aim is to create an alert mechanism that can immediately warn the driver when signs of drowsiness are detected and to ensure the system works effectively in various driving conditions which helps to potentially reduce the number of accidents caused by drowsy driving by providing early warnings to drivers.

Therefore, eye state analysis-based techniques should be a better methodology for detecting drowsy, fatigue, sleep statuses while meeting the requirements of being nonintrusive and having low computational cost, high robustness, high applicability, and a higher minima-maximum success rate (accuracy).

CHAPTER 2

METHODOLOGY

2.1. Components:

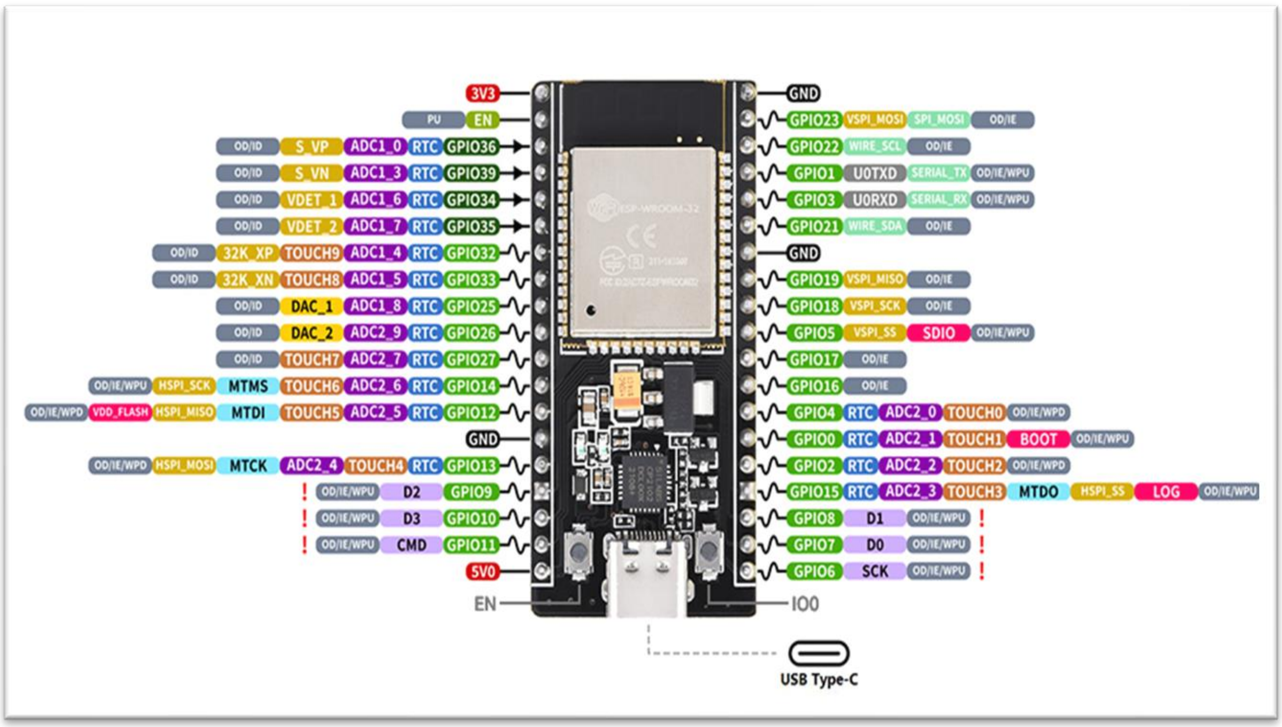


fig 2.1 : Espnode32 MCU

ESPNODE32s: Esp32 (fig 2.1) is a powerful microcontroller and WiFi module that is commonly used in IoT(Internet of Things) applications requiring wireless communication, sensor interfacing, and low power operation. It is used for home automation, smart agriculture, environmental monitoring and wearables in fitness trackers, smartwatches, etc. It is a low cost, low power system on a chip(SoC) series with WiFi and dual mode Bluetooth capabilities.

Specifications:

Processors:

- Main processor: Tensilica Xtensa 32-bit LX6 microprocessor
- Cores: 2 or 1 (depending on variation)
- All chips in the ESP32 series are dual-core except for the ESP32-S0WD, which is single-core.
- Clock frequency: up to 240 MHz
- Performance: up to 600 DMIPS
- Ultralow power co-processor: allows you to do ADC conversions, computations, and level thresholds while in deep sleep.

Wireless connectivity:

- Wi-Fi: 802.11 b/g/n/e/i (802.11n @ 2.4 GHz up to 150 Mbit/s)
- Bluetooth: v4.2 BR/EDR and Bluetooth Low Energy (BLE)

Memory:
Internal memory:

- ROM: 448 KiB
- SRAM: 520 KiB
- RTC fast SRAM: 8 KiB
- RTC slow SRAM: 8 KiB
- eFuse: 1 Kibit

External flash & SRAM:

- ESP32 supports up to four 16 MiB external QSPI flashes and SRAMs with hardware encryption based on AES to protect developers' programmes and data. ESP32 can access the external QSPI flash and SRAM through high-speed caches.

Security:

- IEEE 802.11 standard security features are all supported, including WFA, WPA/WPA2, and WAPI.
- Secure boot
- Flash encryption
- 1024-bit OTP, up to 768-bit for customers
- Cryptographic hardware acceleration: AES, SHA-2, RSA, elliptic curve cryptography (ECC), random number generator (RNG)

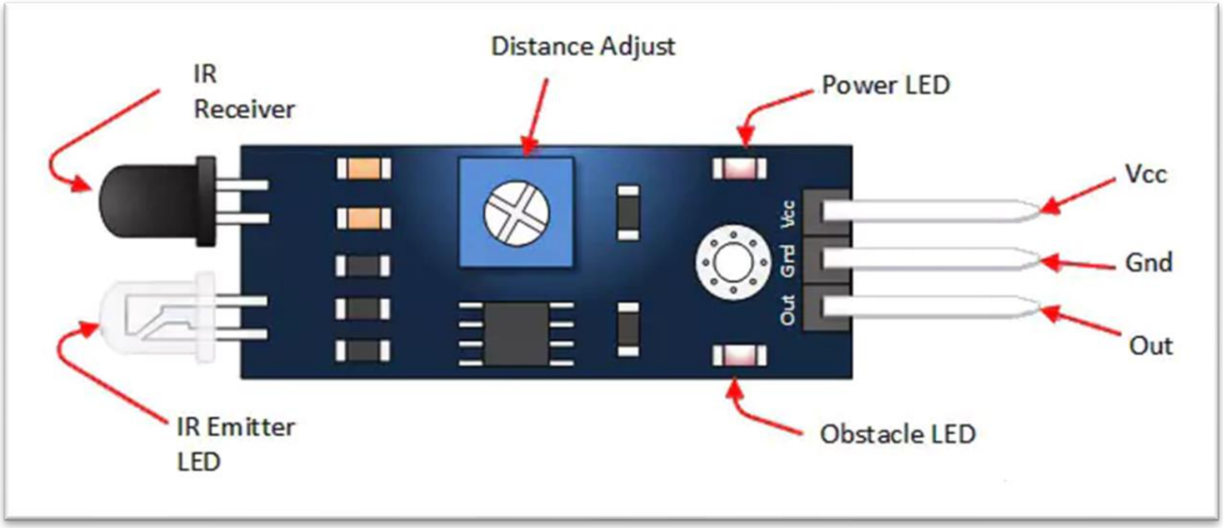


fig 2.2 : IR sensor module

IR Sensor Module: The IR sensor (fig 2.2) or infrared sensor is one kind of electronic component used to detect specific characteristics in its surroundings through emitting or detecting IR radiation. These sensors can also be used to detect or measure the heat of a target and its motion. In many electronic devices, the IR sensor circuit is a very essential module. This kind of sensor is similar to human's visionary senses to detect obstacles. The sensor gives both digital and analog output. The IR sensor module includes five essential parts like IR Tx, Rx, Operational amplifier, trimmer pot (variable resistor) & output LED. The pin configuration of the IR sensor module is discussed below. VCC Pin is a power supply input. GND Pin is a power supply ground. OUT is an active-high o/p.

fig 2.3 : Li-ion battery

Battery: E-Rex 3.7V, 6000mAh Rechargeable Li-ion Battery (fig 2.3) with JST PH2. The voltage of 3.7 to 4.2V is much too high for the ESP32, depending on the state of charge, and must therefore be reduced.

fig 2.4 : Switch

Switch: A switch (fig 2.4) is used to complete or break an electric circuit in order to use an electric appliance.

fig 2.5 : Piezeo buzzer

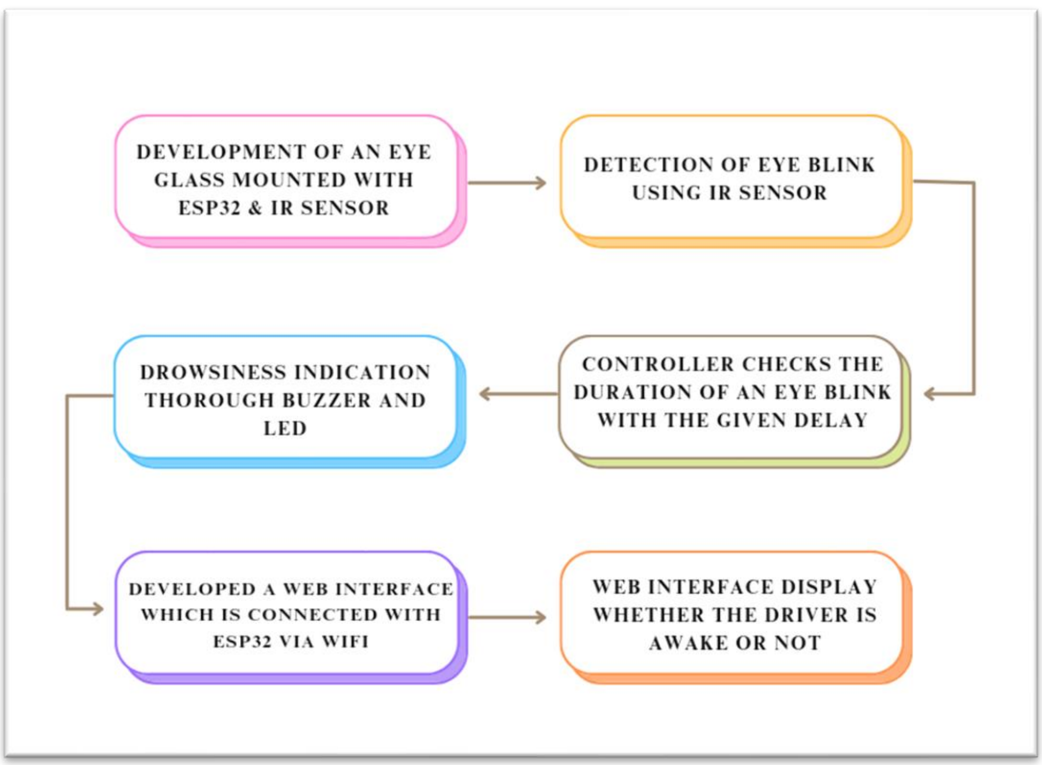
Buzzer: A buzzer (fig 2.5) is an audio signaling device that may be mechanical, electromechanical or piezoelectric.

Fig 2.6 : Led light

Led Light: A light emitting device (LED) (fig 2.6) is a semiconductor device which emits light when current flows through it.

2.2. Experimental Setup:

The proposed wearable smart glass has an IR sensor, buzzer, battery, an ESP 32 controller with an inbuilt WiFi module and a switch all mounted on the glass. The Infrared sensors are used to detect eye movement. By monitoring the closing and opening of eyelids, the IR sensor will detect the eye blink by turning on the IR led and the buzzer will be alarmed. As our aim is to detect drowsiness, such as sleeping, a delay has been set in the code to detect after 3 seconds that the eye is closed, avoiding detection of normal blinking. When the eyes are closed for 3 seconds, the IR sensor will detect the IR rays and send information to both the buzzer alarm and the cloud-based WiFi module through the ESPNODE32S.When the eyeblink is detected, the IR led will be on and the buzzer will make a sound along with the display indication in the web browser.



Scheme 2.1: Flow chart represents the methodology of this model

2.3. Hardware Setup:

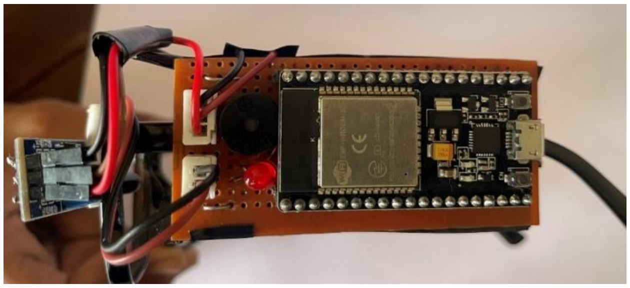


fig 2.7 a) side view(i)

PCB design(fig 2.8 a) soldered with ESPnode, buzzer and led which is mounted on left side of the glass.

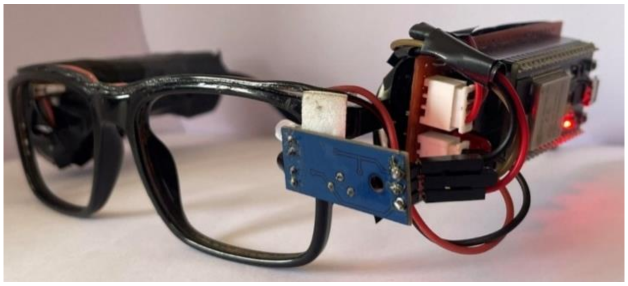


fig 2.7 b) side view(ii)

Glass mounted with IR sensor(fig 2.8 b) connected with PCB board in which potentiometer is adjusted according to distance of an eye.

fig 2.7 c) front view

The final design of eye glass(fig 2.8 c) developed for drowsiness detection which is controlled by an switch.

CHAPTER 3

RESULTS AND DISCUSSION

3.1. Web Interface Design:

Created a web application interface using HTML, CSS, and JavaScript and implemented a dashboard where the sleep status of the driver is displayed. Developed a backend server(fig 3.1 b) to receive data from the ESP32 with its WiFi module(fig 3.1 a) and implement authentication mechanisms to ensure that only authorized users can access the web interface(fig 3.1 c) and view the driver's sleep status.

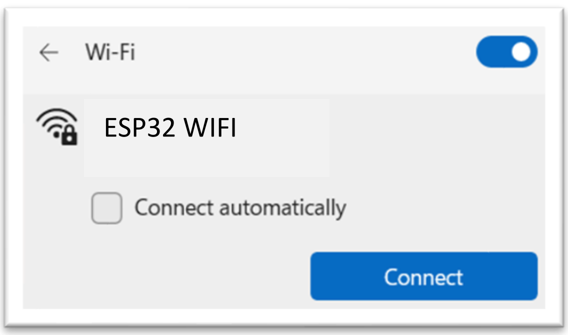


fig 3.1 a) WiFi connection

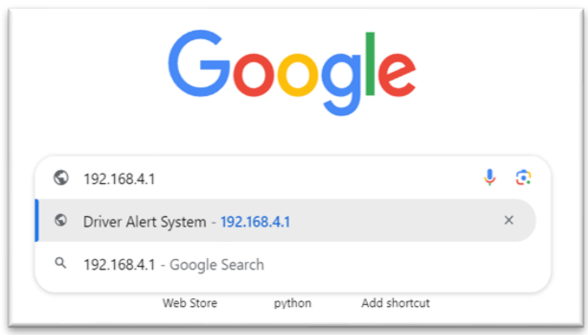


fig 3.1 b) IP address

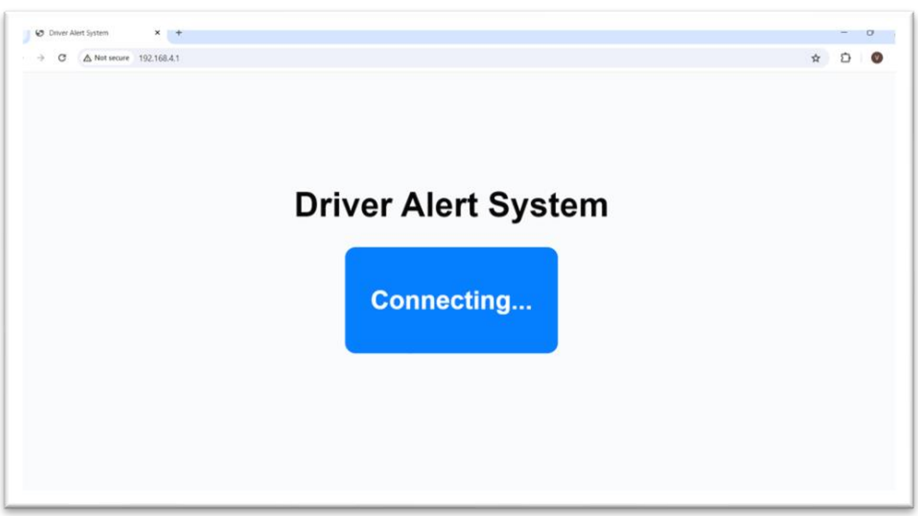


fig 3.1 c) Web interface

3.2. Web Interface Output:

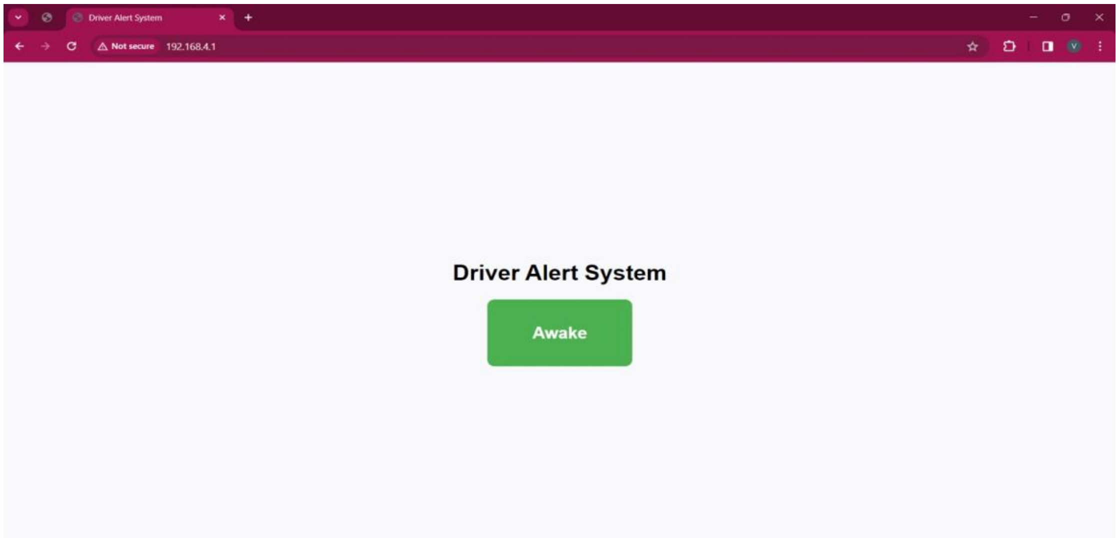


fig 3.2 a) web image(i)

The web interface system detects when the person is not drowsy.

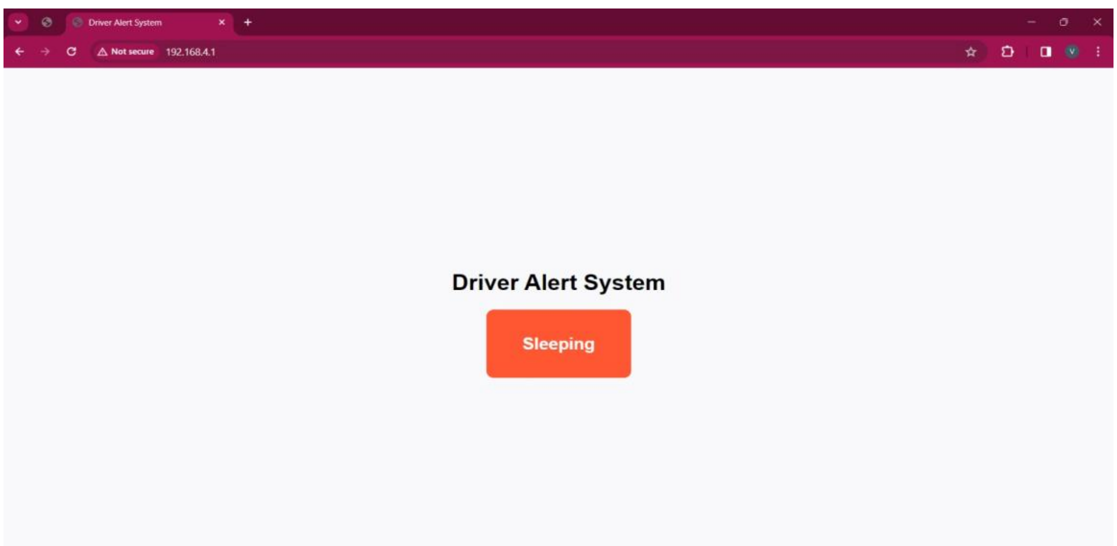


fig 3.2 b) web image(ii)

The web interface system detects drowsiness of the person.

3.3 Web Interface URL:

To use the web WiFi module, the device must be connected to the WiFi of the ESP NODE32S and a specific IP address is required. IP address:**192.168.4.1**. The algorithmic code to run this module is also included in the same code in the Arduino IDE. We can set any specific name for the WiFi module in the code itself. We can adjust the sensitivity of the system by fine tuning the placement and orientation of the IR components (potentiometers). This setup provides a basic demonstration of eye blink detection using IR sensors mounted on eyeglass and can be further developed for practical applications such as driver drowsiness detection or eye conntrolled interfaces. By following these steps and observations, you can gain insights into how eyeglass mounted with IR sensors can effectively detect eye blinks, paving the way for innovative applications in human-computer interaction and healthcare technologies.

CHAPTER 4

CONCLUSION

Drowsy driving is a significant issue that leads to many accidents every year. Current methods for detecting driver drowsiness are ineffective and inconvenient. There is a need for an effective and real time solution to detect driver drowsiness and alert them before an accident occurs. This work aims to develop an IOT based system using sensors to detect signs of driver drowsiness effectively. Here, this model will provide timely alerts to prevent road accidents.

In this project, we focused on developing a wearable smart glass for drowsiness detection using IoT. The exponential growth in road accidents has led to a need for continuous driver monitoring to enhance road safety. This work proposes a drowsiness detection system based on wearable smart glasses to increase road safety. The proposed work is composed of a pair of wearable smart glasses. The aim of this study was to construct a smart alert technique that can automatically avoid drowsy driver impairment. But drowsiness is a natural phenomenon in the human body that happens due to different factors. Hence, it is required to design an automatic alert system to avoid the cause of the accident.

In summary, this project aims to reduce the risk of road accidents and thereby saving many lives. The proposed system consists of a wearable smart glass, a buzzer, LED indications and a web interface. As a result, the proposed wearable smart glasses are lightweight wearable devices that meet the requirements of consumers. The proposed system can determine whether a driver is becoming drowsy or fatigued by wearing the proposed smart glasses. If drowsiness and fatigue are detected, a series of proactive reminders will be conducted, including the buzzer and LED indication for the driver and a web interface platform for the cabs.

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2. Chang, W. J., Chen, L. B., & Chiou, Y. Z. (2018). Design and implementation of a drowsiness-fatigue-detection system based on wearable smart glasses to increase road safety. *IEEE Transactions on Consumer Electronics*, *64*(4), 461-469.

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