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E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"



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23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang

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A-ST055: SAFE DRIVE: REAL-TIME MICROSLEEP AND DROWSINESS DETECTION SYSTEM

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ABSTRACT

The Real-Time Microsleep Detection System is designed to enhance driver safety by monitoring critical indicators of drowsiness and oxygen levels in real time. This project integrates an oximeter sensor, eye blink sensor, LCD display, buzzer, and vibration motor, controlled by an Arduino Uno, to detect early signs of driver fatigue and provide timely alerts. The system demonstrated its effectiveness through simulations, accurately detecting low oxygen levels and prolonged eye closure and triggering alerts to prevent potential accidents. The results validate the system's design and functionality, highlighting its potential to reduce road accidents by providing immediate feedback to drivers, thereby promoting safer driving practices and enhancing overall road safety.

Keywords: Microsleep Detection, Vehicle Safety System, Arduino Uno, Oximeter Sensor, Eye Blink Sensor

1. Product Description

The Real-Time Microsleep Detection System for Drivers is an advanced safety device designed to monitor and alert drivers to early signs of drowsiness, thereby preventing potential accidents. It integrates an oximeter sensor to monitor oxygen levels and an eye blink sensor to detect prolonged eye closure, both of which are critical indicators of driver fatigue. The system uses an Arduino Uno microcontroller to process data from these sensors and trigger alerts through an LCD display, buzzer, and vibration motor. The LCD provides visual feedback, the buzzer emits an auditory alert, and the vibration motor offers tactile feedback, ensuring the driver receives immediate and clear warnings. Simulated using the Wokwi environment, the system demonstrated its effectiveness in detecting low oxygen levels and prolonged eye closure, validating its design and functionality. This comprehensive monitoring and alert mechanism significantly enhance road safety by promoting safer driving practices and reducing the risk of accidents caused by microsleep. The system ensures safe driving by monitoring the driver's physiological and alertness levels. It begins by checking the driver's heart rate and oxygen saturation, displaying a "REST FIRST" message if the heart rate is outside the safe range. Once cleared, it activates an eye blink sensor to detect prolonged eye closure (2-3 seconds) as a sign of drowsiness, triggering a buzzer and vibration motor to alert the driver and prevent potential accidents. This process is as shown in **Figure 1**. In **Figure 2a** and **2b**, the simulation shown the LCD showing appropriate response when value of oxygen is measured.

2. Project Flow Charts

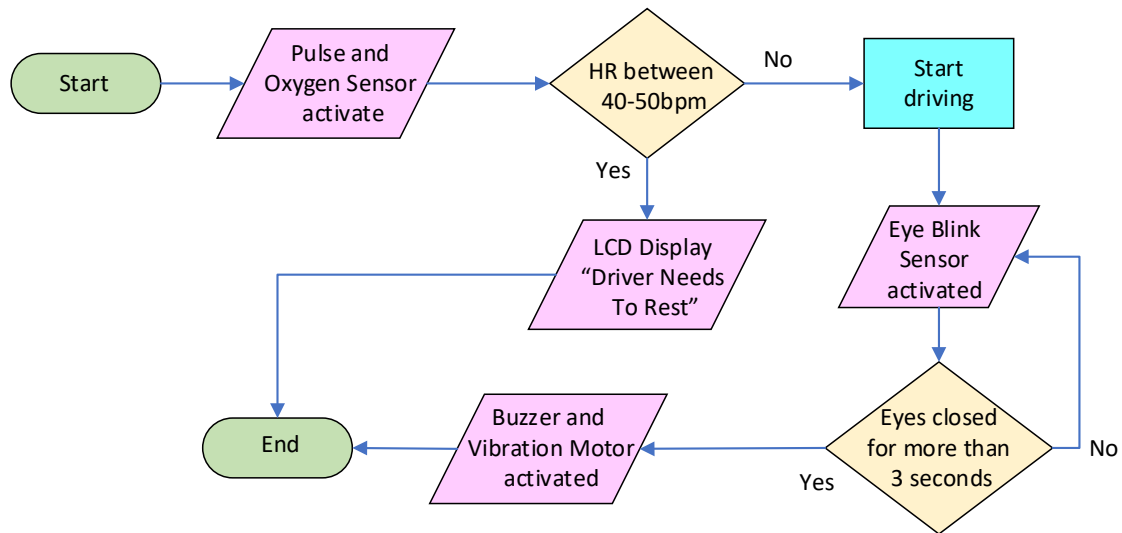


Figure 1. Flow chart of the real-time microsleep detection system for drivers

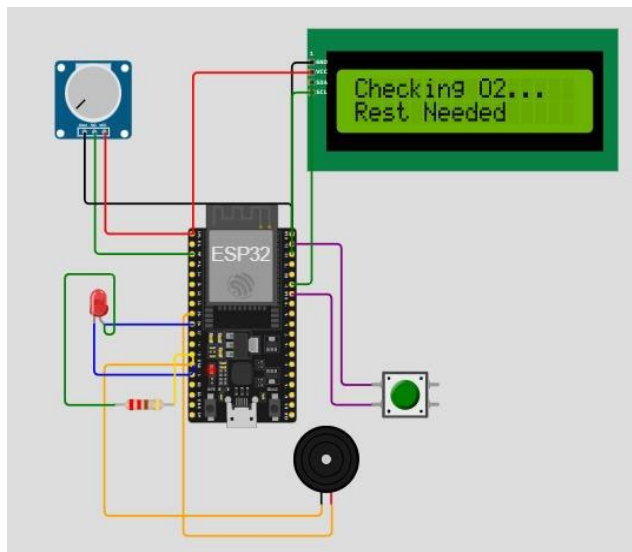


Figure 2a.

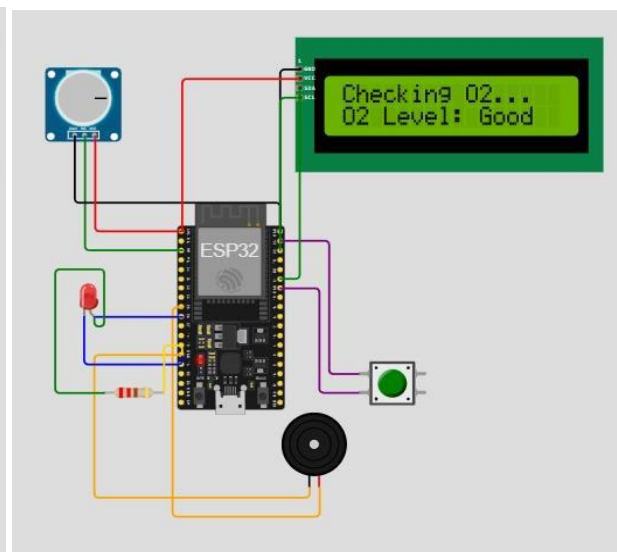


Figure 2b

Figure 2a and 2b. Simulation results showcases the adjustment made on the oximeter sensor to measure the oxygen level.

3. Novelty and uniqueness

The Real-Time Microsleep Detection System stands out for its innovative integration of multiple sensor technologies and real-time data processing to address the critical issue of driver drowsiness. Unlike conventional methods that rely on manual intervention or visual observation, this system employs an oximeter sensor to monitor oxygen levels and an eye

blink sensor to detect prolonged eye closure, providing a more accurate and reliable detection of early signs of fatigue. The use of an Arduino Uno microcontroller to process sensor data and trigger immediate visual, auditory, and tactile alerts ensures that drivers receive timely and effective warnings. This comprehensive and proactive approach not only enhances the system's reliability but also significantly improves road safety by preventing accidents caused by microsleep episodes, making it a unique and valuable addition to automotive safety technology.

4. Benefit to mankind

The Real-Time Microsleep Detection System holds significant potential for improving road safety, especially in developing countries, where traffic accidents due to driver fatigue are a major concern. In these regions, long working hours, inadequate rest, and challenging driving conditions often contribute to driver drowsiness, leading to a higher incidence of road accidents. Implementing this system can provide immediate benefits by offering real-time monitoring and alerts, helping drivers stay awake and focused. The system's affordability and ease of integration into existing vehicles make it accessible for widespread adoption, even in areas with limited resources. Additionally, by reducing accidents, the system can lower healthcare costs and economic losses associated with traffic incidents, contributing to overall societal well-being. The potential for partnerships with local governments, NGOs, and automotive companies can further drive its implementation, creating safer roads and enhancing public health in developing countries.

5. Innovation and Entrepreneurial Impact

The Real-Time Microsleep Detection System introduces innovative use of sensor technology and real-time data processing to address the critical issue of driver drowsiness, significantly enhancing road safety. By integrating an oximeter sensor and an eye blink sensor with an Arduino Uno microcontroller, the system provides immediate visual, auditory, and tactile alerts to drivers, ensuring they remain alert and focused. This comprehensive approach not only improves the reliability of drowsiness detection but also offers a proactive solution to prevent accidents. The entrepreneurial impact includes the potential to develop a marketable product that can be integrated into new vehicles or sold as an aftermarket device, appealing to automotive manufacturers, consumers, and insurance companies. The system's ability to provide real-time feedback and enhance driver safety can drive demand in the automotive industry, foster partnerships and create new business opportunities in the field of automotive safety technology.

6. Potential commercialization

The Real-Time Microsleep Detection System has strong potential for commercialization due to its innovative approach to enhancing driver safety. It can be marketed to automotive manufacturers as an integrated safety feature in new vehicles or as an aftermarket device for existing vehicles. The system's ability to provide real-time alerts for driver drowsiness using advanced sensor technology makes it highly appealing to consumers, insurance companies, and regulatory bodies focused on reducing road accidents. By partnering with tech companies and vehicle manufacturers, the system can achieve widespread adoption, creating new business opportunities and driving market demand in the automotive safety

technology sector. Its effectiveness in preventing accidents and promoting safer driving practices positions it as a valuable addition to the automotive industry, with significant potential for market penetration and growth.

7. Authors' Biography



Muhammad Danish Najmi Bin Norzaidi is a final-year student of the Diploma in Electrical Engineering (Electronic) at UiTM. He has excelled in numerous subjects, including Microprocessor Systems, Electronics, and Digital Systems. He plans to pursue his engineering degree in 2025.



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