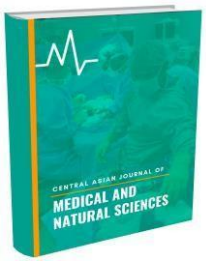

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Article

Manufacture of A Device That Warns Drivers of A Heart Attack or Drowsiness

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Abstract: Injuries resulting from accidental crashes are the 8th leading cause of global mortality.Sleepiness greatly undermines neurological function, creating a significant risk for road traffic accidents. This systematic review seeks to assess the relationship between driving fatigue and road incidents. Official data from the U.S. government indicates that drowsy driving is responsible for only 1%–2% of motor vehicle collisions; however, numerous studies suggest a more extensive issue. Our research investigates driver drowsiness prior to crashes, examining data from a thorough naturalistic driving study that monitored over 3,500 individuals using in-vehicle cameras and tracking equipment. By employing validated metrics based on the duration of eye closure, drowsiness was identified in 8.8%–9.5% of all crashes analyzed and in 10.6%–10.8% of those that resulted in significant damage or injury.It is essential to maintain driver focus and alertness.For longer journeys, it is advisable to have alternate drivers or to take regular breaks to reduce fatigue-related risks.Despite taking precautions, drivers frequently fall victim to drowsiness, resulting in serious consequences.Therefore, the implementation of smart features and devices to proactively alert drivers is necessary.With around 1.3 million traffic fatalities each year attributed to various factors, including driver fatigue and health problems, our device aims to reduce accidents by preventing operation by individuals who are sleep-deprived or medically unfit, thereby enhancing pedestrian safety and public trust in road travel.

Keywords: Heart Attack Detection, Driver Drowsiness Monitoring, Arduino Uno, MAX30100 Sensor, Real-time Health Monitoring

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1. Introduction

Sleep, a dynamic physiological process, profoundly influences bodily functions. Sleepiness, characterized by difficulty in maintaining wakefulness during activities, often stems from sleep deprivation—a condition marked by insufficient or poor- quality sleep, encompassing both voluntary and involuntary sleeplessness [1]. The repercussions of sleepiness extend to impaired brain function, manifesting as reduced reaction times and compromised decision-making abilities. Notably, sleepiness stands as a significant precursor to road traffic accidents, whether due to drowsiness behind the wheel, sleep disorders, sleep deficits, alcohol intake, or medication [2].

Globally, road traffic accidents claim around 1.3 million lives annually, exacting a substantial toll on countries' economies with a 3% loss in gross domestic product [3]. The US National Highway Traffic Safety Administration estimates that over 100,000 road

accidents worldwide annually result from drowsy driving, causing over 1500 fatalities and more than 70,000 injuries. Across nations, road traffic accidents pose significant public health challenges, entailing immense societal and financial burdens. Sleepiness engenders neurological disruptions, exacerbated by factors such as driving despite feeling drowsy, physical ailments, insufficient sleep duration, extended work hours, and dietary imbalances [4]. Over the past two decades, numerous studies have underscored sleepiness as a primary catalyst for road traffic accidents, contributing to 3% to over 30% of such incidents globally. This phenomenon may stem from various sleep disorders or, more commonly, sleep deprivation. Alarmingly, over 20% of drivers report needing to halt driving due to sleepiness. This systematic review aims to elucidate the intricate relationship between sleepiness and the propensity for road traffic accidents, crucial for informing preventive strategies and enhancing road safety measures [5].

1.1 The Problem Statement

In contemporary society, road safety continues to be a paramount issue, with a considerable number of accidents arising from health-related problems among drivers, such as heart attacks and drowsiness.

Despite the progress made in automotive technology, there exists a deficiency in effectively addressing these health-related hazards in real-time during driving.

Current solutions are inadequate in their capacity to detect and notify drivers of potential health emergencies, resulting in an increased risk of accidents and fatalities on the road. Consequently, there is an urgent requirement for the creation of an innovative device that can accurately monitor drivers' physiological indicators in real-time and provide prompt alerts regarding imminent heart attacks or drowsiness.

This device must be dependable, non-intrusive, and seamlessly integrated into existing vehicle systems to improve road safety and avert accidents stemming from driver health-related issues.

1.2 The Solving of Problem

The suggested approach entails the incorporation of a sophisticated physiological monitoring system within vehicles to consistently monitor drivers' vital signs and identify signs of drowsiness as well as early indicators of heart attacks .Utilizing cutting-edge sensors and algorithms, the system would provide immediate notifications to the driver through various signals, encouraging necessary actions such as pulling over or obtaining medical help .Moreover, it could automatically implement safety protocols to reduce the likelihood of accidents .Engineered to be user-friendly and seamlessly integrated into current vehicle systems, this groundbreaking solution seeks to improve road safety by proactively tackling health-related hazards.

Collaborative initiatives among automotive engineers, healthcare professionals, and technology specialists propel its development to transform driver safety.

1.3 Objectives

To enhance road safety by proactively detecting and alerting drivers to potential health-related risks while operating a vehicle. Specifically, the objectives include:

a. Early Detection: Develop a system capable of detecting subtle physiological changes associated with drowsiness and early signs of a heart attack in real-time.
b. Immediate Alerting: Ensure the device promptly issues alerts to drivers upon
c. detecting indicators of drowsiness or a potential heart attack, using auditory, visual, or haptic cues.
d. Prompt Action: Prompt drivers to take necessary actions, such as pulling over to rest or seeking medical assistance, to prevent accidents or mitigate the severity of a health event.
e. Automatic Safety Measures: Design the device to automatically engage safety measures, such as slowing down the vehicle or activating hazard lights, in critical situations to reduce accident risks.
f. User-Friendly Integration: Ensure the device is user-friendly and seamlessly integrated into existing vehicle systems to facilitate widespread adoption and effectiveness.

g. Collaborative Development: Foster collaboration between automotive engineers, medical professionals, and technology experts to optimize the device's functionality and reliability.
h. Overall, the objective is to revolutionize driver safety by addressing health-related risks on the road through the development and deployment of an innovative physiological monitoring system for vehicles.

1.4 Literature Review

In the manufacturing process of a device that warns drivers of a heart attack or drowsiness, conducting a literature review is crucial. It provides valuable insights into existing research, technologies, and methodologies related to drowsiness detection, driver monitoring, and medical emergency detection [6]. Here's a breakdown of key areas to explore in the literature review:

1. Drowsiness Detection Systems [7]:
   a. Investigate existing literature on various drowsiness detection methodologies, sensor technologies, and algorithms.
   b. Examine studies assessing the effectiveness and accuracy of different detection approaches, including physiological monitoring and behavioral analysis.
   c. Explore advancements in machine learning and artificial intelligence techniques to enhance detection accuracy and minimize false alarms.
2. Driver Monitoring Technologies [8], [9], [10]:
   a. Explore research on driver monitoring technologies used to assess attentiveness, cognitive workload, and physiological state.
   b. Review studies on the integration of sensors such as heart rate monitors, EEG sensors, and eye-tracking cameras for real-time monitoring of driver behavior.
   c. Examine developments in non-intrusive methods for continuously monitoring driver state across various driving conditions.
3. Medical Emergency Detection Systems [11]:
   a. Review literature on systems designed to detect and respond to sudden health events like heart attacks while driving.
   b. Investigate the use of wearable sensors and health monitoring devices for continuous monitoring of physiological parameters relevant to cardiovascular health.
   c. Examine algorithms and decision-making processes employed in medical emergency detection systems to ensure prompt and accurate alerts to drivers and emergency services.
4. Human Factors and User Behavior [12], [13], [14]:
   a. Explore studies on human factors and user behavior related to drowsiness, fatigue, and driver performance.
   b. Review research on the impact of drowsiness and fatigue on driving behavior, reaction times, and crash risk.
   c. Investigate interventions and warning systems designed to mitigate the effects of drowsiness and improve driver alertness.
5. Regulatory Standards and Guidelines [15]:
   a. Examine relevant regulatory standards, guidelines, and recommendations pertaining to automotive safety systems and medical device integration.
   b. Investigate industry best practices for designing and implementing drowsiness detection and medical emergency warning systems in vehicles.

By thoroughly reviewing literature in these areas, manufacturers can gain insights into existing research, identify gaps in knowledge or technology, and inform the design and development of a device that effectively alerts drivers to potential health issues while driving.

2. Materials and Methods

Proposed Methodology

a. Research and Requirement Analysis: Investigate existing systems and user needs.

b. Sensor Selection and Integration: Choose and integrate sensors for accurate detection.
c. Algorithm Development: Develop algorithms for precise detection and reduced false alarms.
d. Hardware Design and Prototyping: Design and prototype hardware components.
e. Software Development: Develop software for data processing and user interface.
f. User Interface Design: Design intuitive interfaces for driver interaction.
g. Testing and Validation: Test device under various conditions for accuracy and reliability.
h. Regulatory Compliance and Certification: Ensure adherence to safety standards.
i. Manufacturing and Production: Establish processes for consistent production.
j. Deployment and User Education: Roll out the device and educate users on proper use.
k. Continuous Improvement and Updates: Gather feedback and iterate for ongoing improvement.

This methodology ensures the development of a reliable drowsiness detection device, enhancing road safety and saving lives.[35].

2.1 Arduino Uno

The Arduino Uno is a well-known microcontroller board that utilizes the ATmega328P microcontroller. It is extensively employed for prototyping and developing electronic projects because of its straightforwardness, adaptability, and user-friendliness. The board features numerous input and output pins, enabling users to connect sensors, actuators, and various electronic components to build interactive projects.

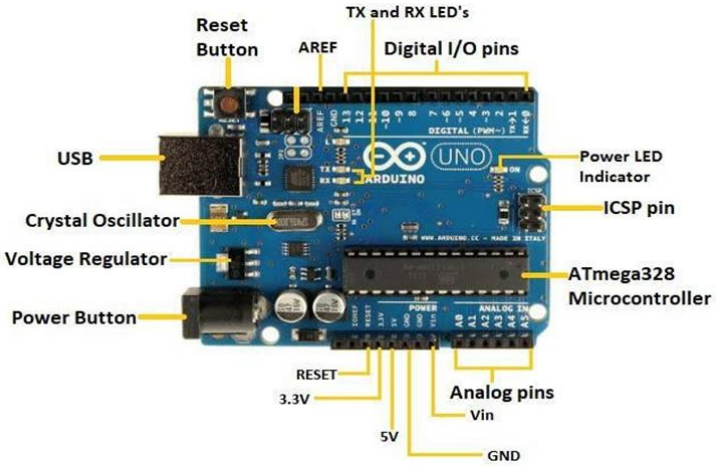

Figure 1. Arduino Uno

2.2 Max30100

The MAX30100 is a highly adaptable pulse oximeter and heart-rate sensor module recognized for its incorporation of elements such as LEDs, photodetectors, and signal processing features. It is employed in wearable technology to track fitness and health indicators, including pulse rate and blood oxygen saturation (SpO2) levels.

The module's enhanced optics and low-noise analog signal processing facilitate precise measurements, establishing it as a favored option in numerous scenarios where non-invasive monitoring of vital signs is crucial.

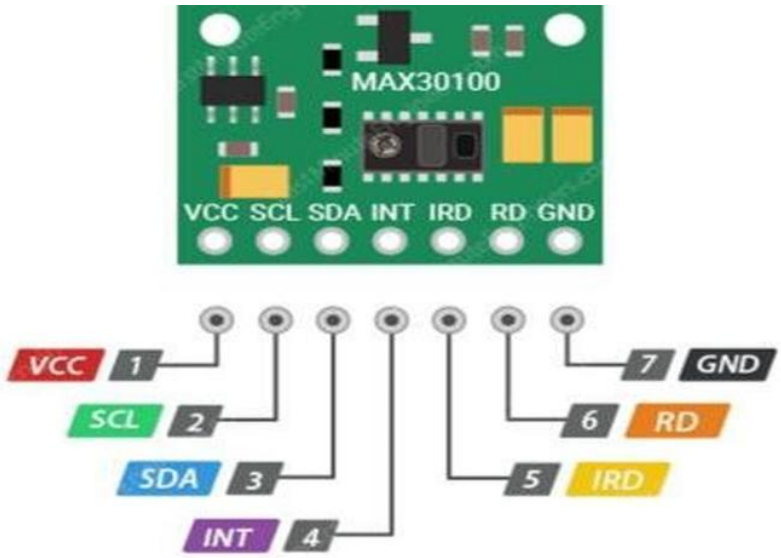

Figure 2. Structure of Max30100

2.3 GSM sim800l

The SIM800L GSM/GPRS module is widely recognized for its small form factor and capability to facilitate cellular connectivity across numerous projects, particularly those related to remote communication or IoT applications.It functions on the Global System for Mobile Communications (GSM) and General Packet Radio Service (GPRS) networks, ensuring dependable communication via cellular networks It offers functionalities such as SMS, GPRS data transmission, and voice calls, rendering it adaptable for a diverse array of applications.

Moreover, its minimal power consumption renders it ideal for devices powered by batteries.

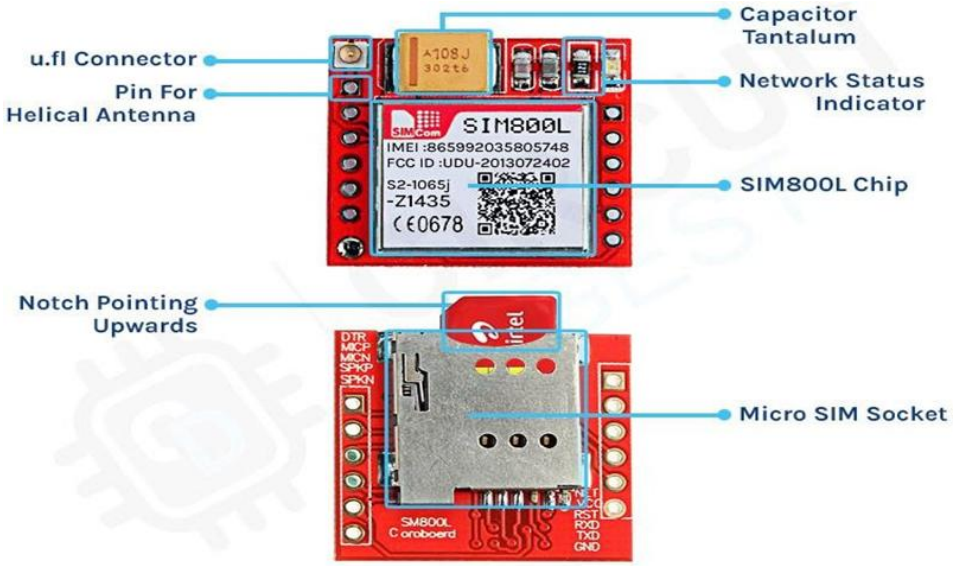

Figure 3. Structure of GSM Sim800l

2.4 Bread Bord

A breadboard serves as a prototyping instrument in electronics, allowing for the construction and testing of circuits without the need for soldering. It features a grid of holes where electronic components can be inserted and linked with wires, facilitating the creation of circuits for testing and experimentation.

This tool is particularly useful for rapidly experimenting with various circuit designs without the commitment associated with soldering.

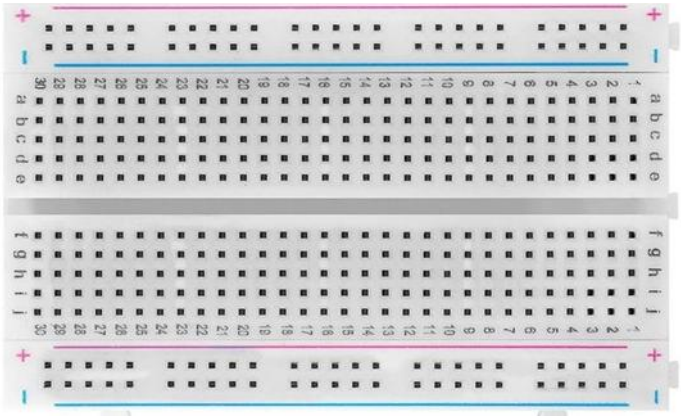

Figure 4. Structure of Bread Bord

2.5 Battery

The main advantage of equipping warning devices for drivers who are suffering from heart attacks with a battery is their portability and dependability. A device powered by a battery can function autonomously from the vehicle's power source, guaranteeing ongoing monitoring and alerts even in the event of a failure in the vehicle's electrical system. This portability facilitates broad implementation across different vehicles and driving environments, which could ultimately save lives by delivering prompt warnings to drivers undergoing cardiac incidents.

2.6 GPS NEO 6M

Utilizing a GPS module such as the NEO-6M in a device intended to alert drivers about heart attacks or drowsiness may prove advantageous. The GPS can assist in monitoring the vehicle's position and offer context for the warning system, including suggestions to pull over to a secure area or notify nearby emergency services. Nevertheless, it is important to remember that identifying health concerns like heart attacks or drowsiness would probably necessitate supplementary sensors and algorithms in addition to the GPS.

Figure 5. Structure of GPS NEO 6M

2.7 The working principle of the device

Our initiative focuses on creating a device designed to notify drivers of potential heart attacks or drowsiness. Moreover, it incorporates components that assess the driver's oxygen saturation and heart rate through a sensor, which is subsequently processed by the Arduino.

Following this, we ascertain the driver's location using GPS and transmit the patient's information via GSM in a message to the designated number programmed into the GSM system integrated with the SIM card. These components are assembled, interconnected, and programmed in accordance with the specifications illustrated in the accompanying image. Through this cohesive system, our device aims to improve road safety by delivering timely alerts to drivers experiencing health issues or fatigue.

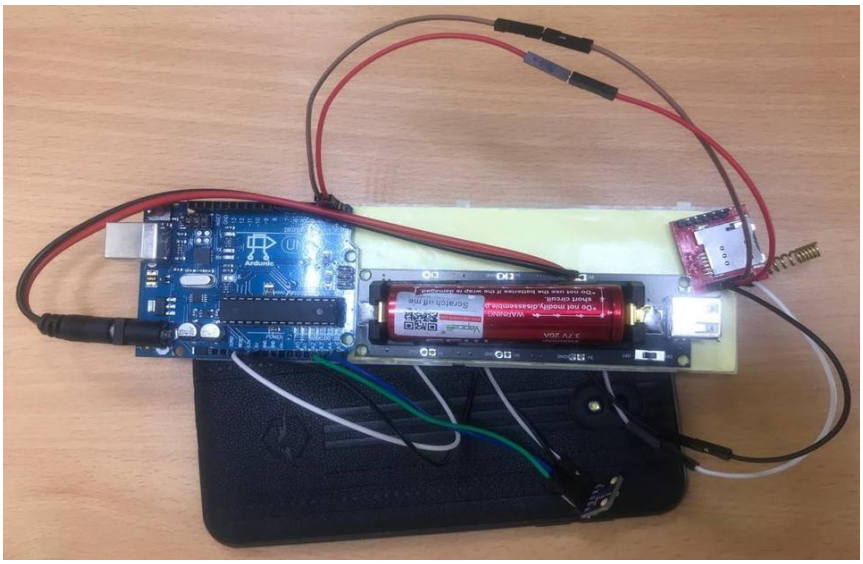

Figure 6. The device that warns drivers of a heart attack or drowsiness

3. Results

Developing a device that alerts drivers to heart attacks or drowsiness necessitates the integration of sophisticated sensors alongside real-time monitoring and alert systems.

This endeavor would demand highly accurate algorithms capable of identifying indicators of drowsiness or cardiac irregularities, and the device must effectively convey warnings to the driver to avert potential accidents.

Moreover, guaranteeing the device's precision and dependability is essential for its broad acceptance and the enhancement of safety.

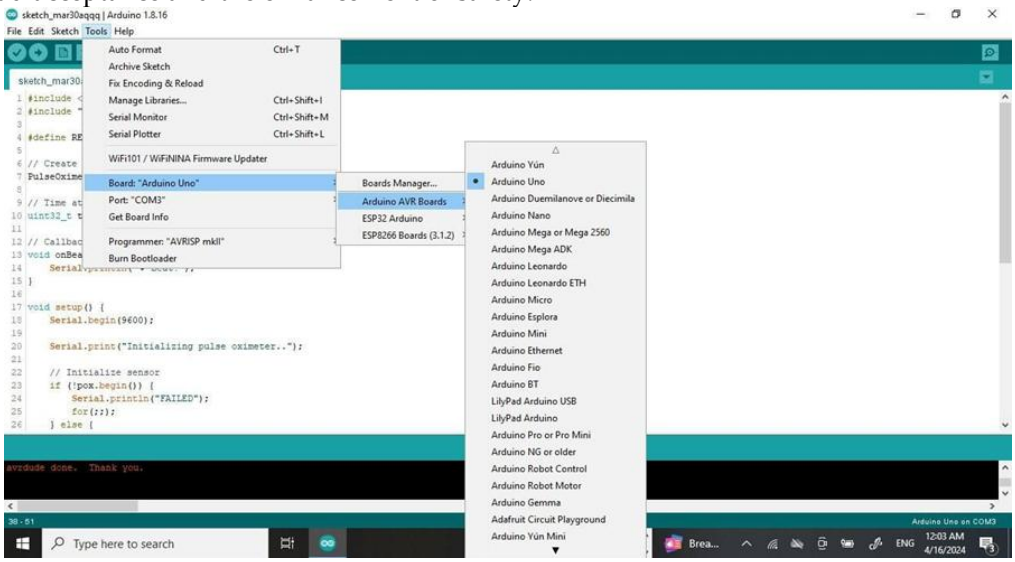

Figure 7. Selects of Arduino uno

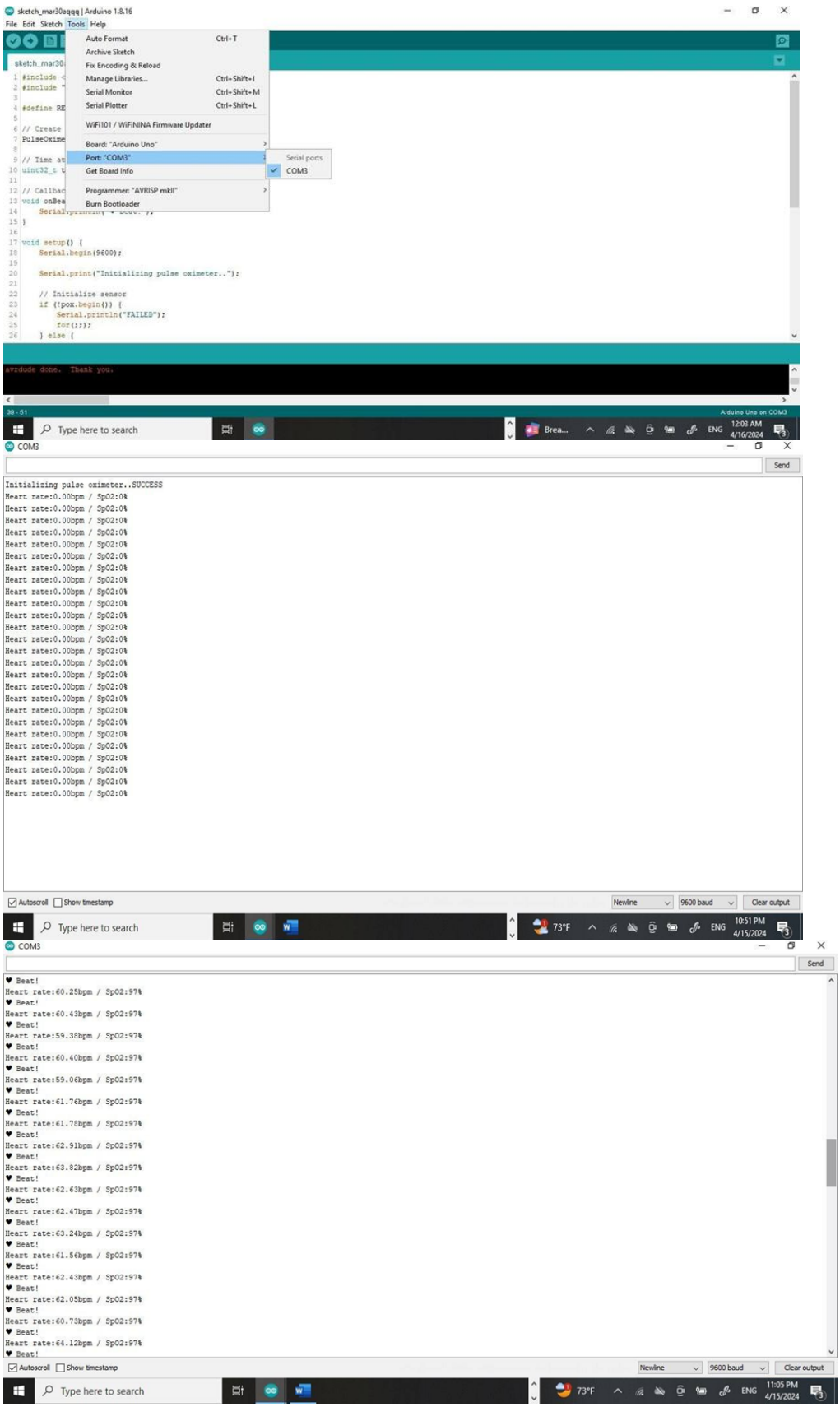

Figure 8. Result of heartbeat and level of oxygen in the body

4. Discussion

The development of a device capable of detecting heart attacks and driver drowsiness represents a significant advancement in addressing critical road safety challenges. By integrating sensors such as the MAX30100 for real-time heart rate and oxygen monitoring,

alongside GPS and GSM modules for immediate location tracking and emergency communication, the device provides a multi-layered safety net. The findings indicate that early detection of physiological abnormalities can lead to timely interventions, potentially reducing the incidence of accidents caused by health-related events. Moreover, the seamless integration of the system with vehicle operations ensures that alerts are communicated effectively without distracting the driver. Nevertheless, certain challenges remain, particularly regarding the accuracy of detection algorithms and minimizing false positives that could undermine driver trust in the device. Accessibility issues, including cost and user-friendliness, also need to be addressed to ensure broad adoption. Future research should focus on refining machine learning algorithms for better detection sensitivity, enhancing sensor performance under varied driving conditions, and conducting clinical trials to validate device effectiveness. Overall, the project demonstrates that combining biomedical monitoring with vehicular safety systems holds great promise for reducing fatalities and enhancing driver and public safety on the roads.

5. Conclusion

In the production of a device designed to alert drivers to heart attacks or drowsiness, conclusions generally encompass a summary of the device's effectiveness, reliability, and safety. These conclusions may also address any possible limitations or opportunities for enhancement, along with suggestions for additional research or development. Furthermore, factors such as user feedback, market acceptance, and adherence to regulatory standards would be essential in forming conclusions about the device's feasibility and its potential influence on road safety.

Recommendations For Future Work

a. Advanced Sensors: Utilize cutting-edge biosensors for real-time monitoring of vital signs like heart rate, blood pressure, and oxygen levels.
b. Machine Learning: Develop sophisticated algorithms to analyze sensor data and detect early signs of drowsiness or heart issues accurately.
c. Customized Alerts: Create alert systems tailored to individual drivers, considering factors such as age, health history, and driving behavior.
d. Integration with Vehicles: Integrate the device with existing vehicle systems for
e. seamless alerts and assistance.
f. User-friendly Design: Design an intuitive interface for clear and timely alerts without distracting the driver.
g. Data Security: Ensure compliance with privacy regulations and implement robust security measures to safeguard user data.
h. Clinical Validation: Conduct thorough testing in real-world driving conditions to validate the device's accuracy and effectiveness.
i. Healthcare Collaboration: Collaborate with healthcare experts to ensure the device meets medical standards and guidelines.
j. User Feedback: Gather feedback to improve usability and effectiveness continually.
k. Cost Optimization: Work on cost reduction strategies to make the device accessible to a broader user base while maintaining quality.

REFERENCES

[1] M. A. Grandner, "Epidemiology of insufficient sleep and poor sleep quality," in *Sleep and Health*, Elsevier, 2019, pp. 11–20. doi: 10.1016/b978-0-12-815373-4.00002-2.

[2] P. Philip, "Excessive daytime sleepiness versus sleepiness at the wheel, the need to differentiate global from situational sleepiness to better predict sleep-related accidents," *Sleep*, vol. 46, no. 11, Sep. 2023, doi: 10.1093/sleep/zsad231.

[3] R. Sijabat, "The Association between Foreign Investment and Gross Domestic Product in Ten ASEAN Countries," *Economies*, vol. 11, no. 7, p. 188, Jul. 2023, doi: 10.3390/economies11070188.

[4] A. O. Adeoti, O. O. Desalu, J. O. Fadare, and T. Elebiyo, "Obstructive Sleep Apnea, Excessive Daytime Sleepiness, and Its Association With Road Traffic Accidents Among Nigerian Truck Drivers," in *B55. EXPLORING LUNG HEALTH ACROSS POPULATIONS*, American Thoracic Society, Apr. 2024, pp. A3873–A3873. doi: 10.1164/ajrccm-conference.2024.209.1_meetingabstracts.a3873.

[5] K. Sadeghniiat-Haghighi, M. M. Nia, O. Aminian, and A. Esmaeeli, "Sleepiness, fatigue and road traffic accidents," *Sleep Med*, vol. 14, p. e253, Dec. 2013, doi: 10.1016/j.sleep.2013.11.613.

[6] F. H. Caryn and L. Rahadianti, "Driver Drowsiness Detection Based on Drivers' Physical Behaviours: A Systematic Literature Review," *Computer Engineering and Applications Journal*, vol. 10, no. 3, pp. 161–175, Oct. 2021, doi: 10.18495/comengapp.v10i3.381.

[7] G. Bouchouras and K. Kotis, "Integrating Artificial Intelligence, Internet of Things, and Sensor-Based Technologies: A Systematic Review of Methodologies in Autism Spectrum Disorder Detection," *Algorithms*, vol. 18, no. 1, p. 34, Jan. 2025, doi: 10.3390/a18010034.

[8] N. Guttman and T. Lotan, "Driver-Monitoring Technologies Measure," 2011, *American Psychological Association (APA)*. doi: 10.1037/t34317-000.

[9] E. Dolezalek, M. Farnan, and C.-H. Min, "Physiological Signal Monitoring System to Analyze Driver Attentiveness," in *2021 IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, IEEE, Aug. 2021, pp. 635–638. doi: 10.1109/mwscas47672.2021.9531871.

[10] L. Kalake, Y. Dong, W. Wan, and L. Hou, "Enhancing Detection Quality Rate with a Combined HOG and CNN for Real-Time Multiple Object Tracking across Non-Overlapping Multiple Cameras," *Sensors*, vol. 22, no. 6, p. 2123, Mar. 2022, doi: 10.3390/s22062123.

[11] M. Ong, "Emergency Medical Services in Singapore," in *Emergency Medical Service Systems: A Global Perspective*, Jaypee Brothers Medical Publishers (P) Ltd., 2014, p. 7. doi: 10.5005/jp/books/12298_2.

[12] S. Wang, "Factors related to user perceptions of artificial intelligence (AI)-based content moderation on social media," *Comput Human Behav*, vol. 149, p. 107971, Dec. 2023, doi: 10.1016/j.chb.2023.107971.

[13] C. Balasubrahmanyan, A. Akbar Badusha, and S. Viswanatham, "Quantification of Alertness and Evaluation Method for Vision Based Driver Drowsiness and Alertness Warning System," in *SAE Technical Paper Series*, in SIAT. SAE International, Jan. 2024. doi: 10.4271/2024-26-0021.

[14] I. R. Nair, "A Survey on Driver Fatigue-Drowsiness Detection System," *International Journal Of Engineering And Computer Science*, Nov. 2016, doi: 10.18535/ijecs/v5i11.92.

[15] S. R. Tunis and C. Turkelson, "Using Health Technology Assessment to Identify Gaps in Evidence and Inform Study Design for Comparative Effectiveness Research," *Journal of Clinical Oncology*, vol. 30, no. 34, pp. 4256–4261, Dec. 2012, doi: 10.1200/jco.2012.42.6338.