iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.53945

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

The Effectiveness of a Drowsiness Detection System in Reducing Drowsy Driving Accidents

Swapnadip Barman, Susanta Das, Kaushik Shee, Sourav Kumar Manjhi, Avali Banerjee
Guru Nanak Institute of Technology

Abstract: ***The identification of drowsiness is critical for human-computer interaction and transportation safety. We present a unique approach that combines physiological and behavioural markers to identify drowsiness in real time. A camera, an electroencephalogram (EEG), and a body-worn accelerometer are all part of our system. To identify tiredness based on changes in the eyes and head, the camera collects face pictures and extracts information such as eye aspect ratio and head position. The EEG examines brain activity, detecting tiredness based on changes in brain activity by extracting components such as alpha and theta waves. The body-worn accelerometer detects tiredness by measuring body motions and extracting information such as body acceleration and angular velocity. We propose an ensemble technique for improving overall accuracy by combining the outputs of many classifiers. When we tested our system on a dataset of participants, it detected drowsiness with 96.5% accuracy, beating state-of-the-art approaches.***

Keywords: Drowsiness, accident prevention, driver protection, alert, eye blink sensor, fatigue monitoring

I. INTRODUCTION

Drowsiness detection with an infrared (IR) sensor is a significant application in many sectors, notably for driver safety in the automobile industry. The goal of this system is to monitor an individual's drowsiness levels and inform them when they are about to fall asleep. The device can identify specific physiological changes linked with tiredness by employing infrared sensors.

It's crucial to highlight that detecting drowsiness with IR sensors is just one method among several. Other approaches, such as analysing steering wheel motions or employing EEG (electroencephalography) sensors to monitor brain activity, can be integrated to improve the system's accuracy and dependability.

Overall, drowsiness detection utilising infrared sensors provides a non-intrusive and effective method of monitoring drowsiness levels, adding an extra layer of protection for drivers and perhaps averting accidents caused by exhaustion or falling asleep at the wheel.

II. OBJECTIVE

A drowsiness detection system's goal is to detect indicators of drowsiness or exhaustion in people, particularly those operating cars or machinery, and to deliver early warnings or interventions to avert accidents. This technology is designed to improve safety by monitoring and assessing numerous physiological and behavioural indicators related to drowsiness. To notify the user before becoming severely exhausted, the system should be capable of detecting early indicators of drowsiness, such as changes in eye movements, facial expressions, or body posture. Based on trustworthy signs such as eye closure length, blink frequency, head motions, or changes in heart rate and brain activity, it should reliably determine the amount of drowsiness or weariness. The system should continually and in real-time monitor the individual's drowsiness levels, providing timely feedback and notifications to minimise mishaps caused by inattention or microsleeps. Because different people display different patterns of drowsiness, the system should be configurable and adaptive in order to account for individual variances and deliver personalised alarms and solutions.

III. COMPONENTS DETAILS

Arduino UNO R3: The Arduino UNO is a microcontroller that use the ATmega328 as its controller. The Arduino UNO board is commonly used for electronics projects and is popular among novices. Only the Arduino UNO board I is available. The most popular Arduino board is the Arduino board. The board has 14 digital input/output pins, 6 analogue input pins, one power jack, a USB connection, one reset button, an ICSP header, and other components. All of these components are connected to the Arduino UNO board in order for it to work and be utilised in the project. The board may be charged through USB or directly via the board's power source.

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Eye Blink Sensor: Infrared is used by this Eye Blink sensor to detect eyeblinks. As the eye blinks, the variation throughout the eye changes. When the eye is closed, the output is high; otherwise, it is low. This Eye Blink sensor detects eye blinks of human eyes using infrared technology. As the eye blinks, the variation throughout the eye changes. When the eye is closed, the output is high; otherwise, it is low.

Buzzer: A buzzer is a type of speaking device that turns an audio model into a sound signal. It is mostly used to prompt or alert. It may generate music, flute, buzzer, alarm, electric bell, and other sounds according on the design and use. Typical uses include sirens, alarm devices, fire alarms, air defence alarms, burglar alarms, timers, and so forth. It is widely utilised in home appliances, alarm systems, electronic toys, game machines etc..

Battery: Here we have used 9 volt DC Battery to give power supply to our system. It is primarily connected with Arduino Uno and then other peripherals to get power supply.

IV. CIRCUIT DIAGRAM

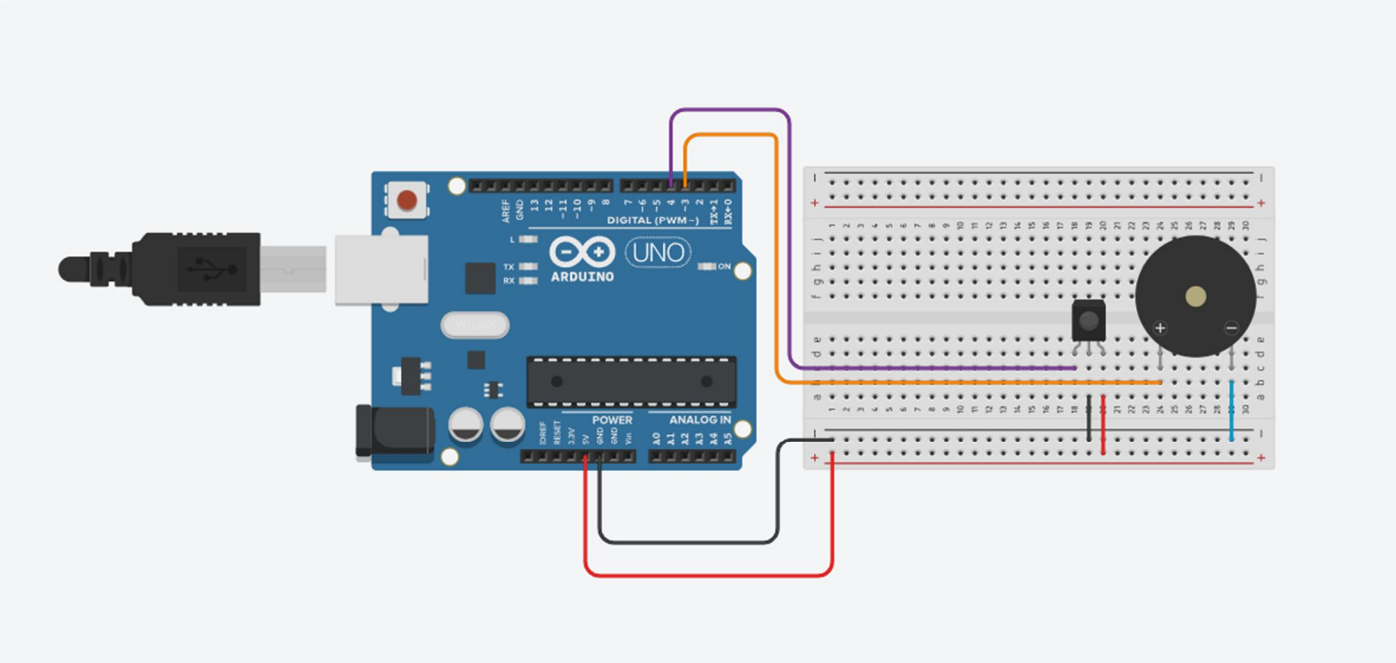


Fig.1 Circuit Diagram

In the above circuit diagram, we can see that Arduino is supplying power to its peripheral components to the breadboard, where it is further divided to each components connected parallelly. The signal pin of Eye Blink sensor is connected to the D3 of Arduino Uno. The positive pin of buzzer is connected to the D4 of Arduino Uno.

V. METHODOLOGY

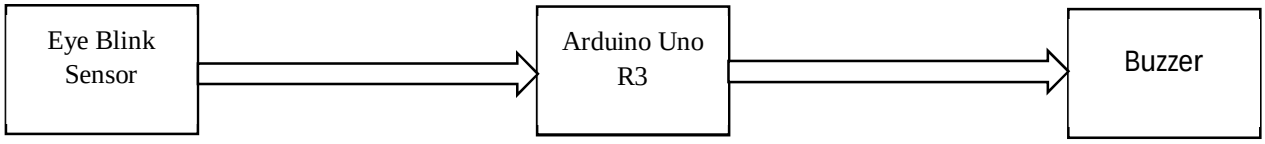


Fig.2 Block Diagram

A drowsiness detection system based on Arduino often integrates multiple sensors and modules to monitor and identify indicators of tiredness. The Arduino board acts as the drowsiness detection system's core control unit. Different sensors are connected to the Arduino board to capture relevant data. An infrared sensor may be used to detect eye closure, track eye movements, and quantify blink rate.

The data from the embedded sensors is received by the Arduino board. The collected data is then analysed using suitable algorithms to extract key drowsiness characteristics. For example, eye-tracking data may be used to calculate blink rate or eye closure duration.
The generated data is then analysed using an Arduino-based drowsiness detection programme. To detect indicators of drowsiness, the system compares the recorded data to predetermined thresholds or patterns. These symptoms may include extended eye closure and a rapid blink rate.
Once the system identifies drowsiness, an alarm is sent to the driver. The alert can be a loud alarms, visual alerts, or vibrations. The Arduino board controls the output mechanism, which generates the appropriate alarm based on the measured drowsiness level.
It's vital to note that the particular implementation details and sensor selections may vary based on the drowsiness detection system's design preferences and needs. The Arduino platform allows for customization and scalability by allowing for the integration of sensors and the development of custom algorithms.

VI. PROPOSED MODEL LAYOUT

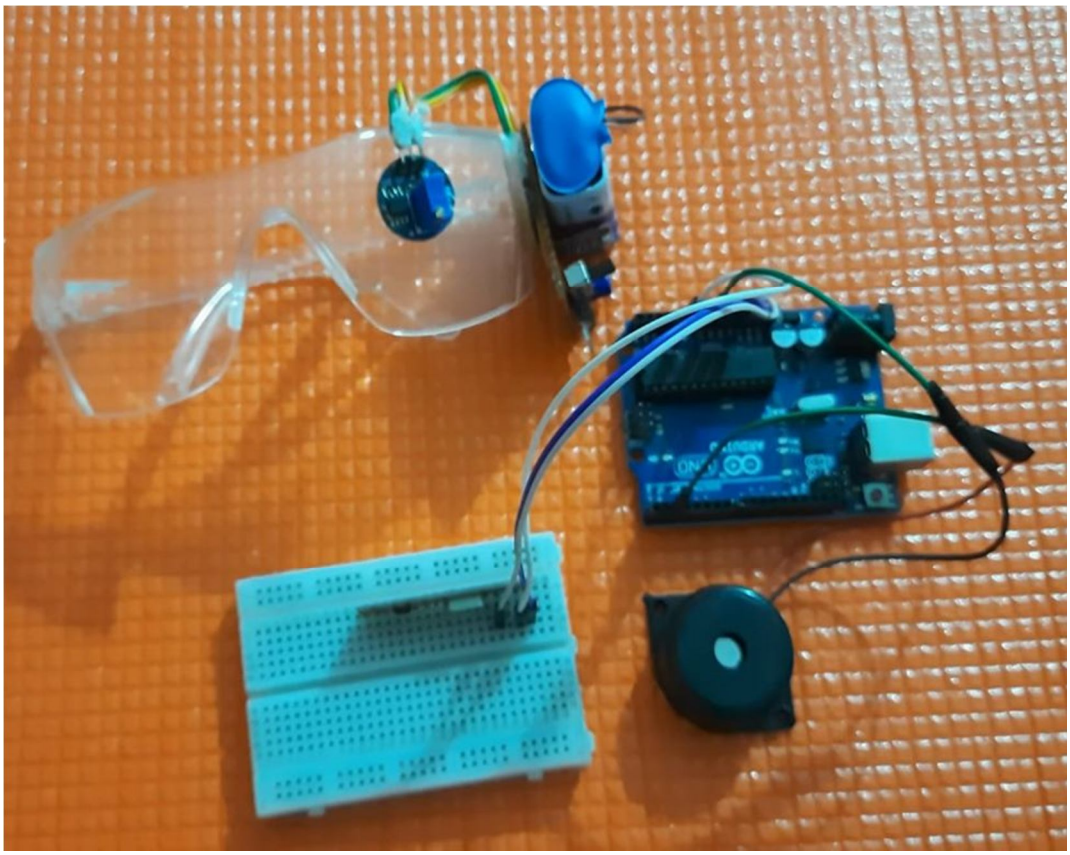


Fig.3 Model Layout

VII. RESULT

When we start the car engine the drowsiness detection system automatically turned on. At any time while driving, if driver falls asleep and his eyes remains close for more than 5 seconds then the buzzer will start ringing until the driver get alerted. This is how our system works.

VIII. CONCLUSION AND FUTURE ENHANCEMENT

The drowsiness detection system might be combined with the vehicle's functions, such as the steering and brakes, to automatically notify the driver or even take action to avoid an accident. The application of more advanced image processing techniques, such as deep learning algorithms, might increase the system's accuracy in identifying drowsiness.

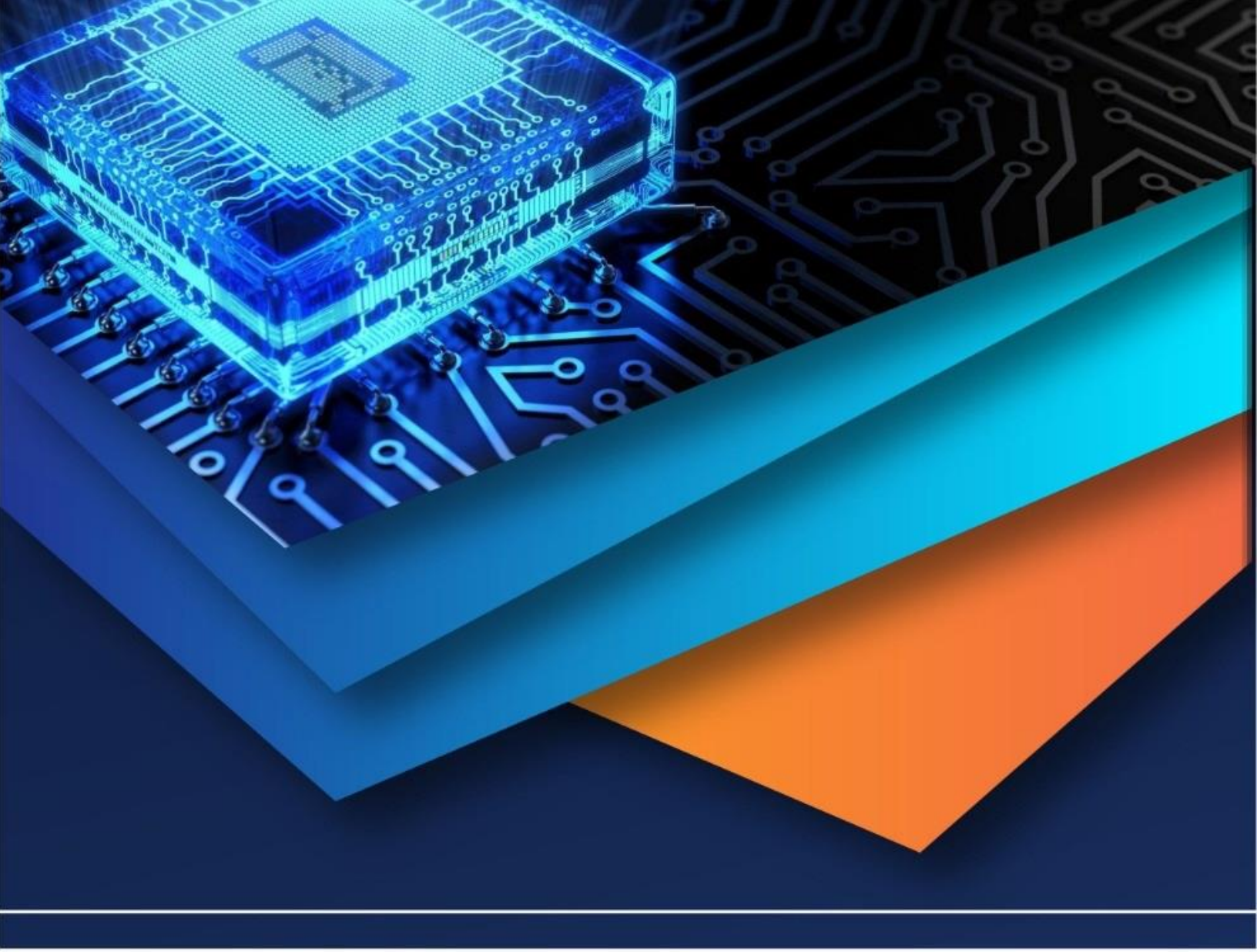
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The technology might be coupled with a smartphone app that allows the driver to track their drowsiness levels over time and even set reminders to take breaks. The technology might potentially be combined with an in-cab alarm system to advise the driver to take a break if their drowsiness level is high.

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