IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 5, May 2023

Driver Drowsiness Detection using Brain Computer Interface

Tamilselvan Vijayakumar, Ayazpur Uday Kiran, Sriharikota Arun Kumar, Suriboyina Manoj
Department of Electronics and Communication Engineering,
Dhanalakshmi College of Engineering, Chennai

Abstract: In the event of a road collision, drowsiness is becoming a serious problem. Typically, eyeblink rate, yawning, grip force on the wheel, and other characteristics can be used to determine whether someone is sleeping. However, all of these measurement approaches will only examine a person's physical activities. Sometimes folks will mentally nod off for a short while while keeping their eyes open. Driving accidents will become quite severe as a result. Therefore, in our suggested project effort, we are using EEG signals based on Brain- Computer Interface (BCI) technology to analyse the mental activities of the brain.Analysing the brain signals is the project's main task. Numerous millions of linked neurons make up the human brain. The human mind will cause this neuron pattern to shift. Each time a pattern forms, a distinct electric brain signal will emerge. The brain signal for attention will shift from the typical state if a person is mentally asleep while keeping their eyes open. In order to assess the amount of attention, this research uses a brain wave sensor that can gather EEG-based brain signals of various frequencies and amplitudes, transform those signals into packets, and communicate those packets through Bluetooth. The Level Splitter Section (LSS) analyses the level, warns against drowsy driving, and retains the car under self-control until the driver is awake. When it comes to road transit, this can save many lives.

Keywords: drowsiness

I. INTRODUCTION

One of the largest issues on the planet is traffic accidents caused by sleepy drivers. According to Maclean et al., drowsy driving accounts for around 20% of traffic accidents. In addition, the research states that in 2010, accidents caused by such drivers resulted in 416,000 injuries and 3,092 fatalities. Therefore, it is imperative to create a method that can assess driver tiredness in order to reduce traffic accidents caused by inattentive drivers. Since a blink is a physiological signal that represents tiredness, it has been intensively explored how to detect blinks in order to understand this. EOG (Electro Oculogram), for instance, has been used to detect blinks. By monitoring the voltage difference between electrodes placed close to the subject's eyes, a blink can be identified.EOG is not practical, though, because placing electrodes on a subject's skin not only irritates that person's skin but also makes them uncomfortable for the duration of the measurement. A non-contact blink detection technique is therefore desired. The Doppler sensor and a camera can be used to realise the non-contact blink detection approaches. On the one hand, the camera-based blink detection method examines a collection of camera-captured frames to identify blinks. However, there are some problems with camera-based techniques, including privacy invasion and performance decrease in low-light conditions. On the other hand, a Doppler sensor is a device that sends microwaves in the direction of a moving target and receives microwaves that have been shifted due to dopplerAs a result, the Doppler sensor-based blink detection method is not affected by the problems with the camera-based one that were previously discussed. The majority of conventional techniques, however, have only emphasised blink detection. Although it is well known that blink duration is closely related to drowsiness and that estimation of blink duration is useful for preventing car accidents caused by drowsy drivers, none of the conventional methods can estimate the blink duration, which is the full duration of a blink. However, because the SNR of the signal reflected from the eyelids is low and it is challenging to catch the timings when the eyelids start to close and finish opening, measuring the blink length is often more challenging than detecting a blink. the signal being reflected. The duration, tblink, that is proportional to the real blink duration is estimated using a Doppler sensor in this paper's technique. Based on the difference between the times that eyelids close and open, tblink can be calculated. In our

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experiments, we discovered that when someone blinks, the behaviour of the eyelids shutting results in energy in either the positive or negative frequency domain on a spectrogram, whilst the behaviour of the eyelids opening results in the opposite one with a small time domain gap. The energies on a spectrogram are therefore integrated in each frequency domain in the suggested approach in order to capture the time fluctuation of these energies. The difference between the timings when eyelids close and open was estimated using such time-integrated energy.One way to calculate the difference is, for instance, to compare the times at which the peaks of two time-integrated energies occur. Due to the variability in how these peaks look from one blink to the next, this method's estimation accuracy is limited. The suggested approach calculates the interval between the centres-of-gravity of such time-integrated energy.

II. EXISTING SYSTEM

The most frequent cause of auto accidents is poor driving. These occur frequently when a driver is intoxicated or sleepy. Driver fatigue is acknowledged as a significant contributing factor in auto accidents. It has been shown that growing tiredness impairs driving performance, with crashes as a result accounting for more than 20% of all auto accidents. However, a life once lost cannot be recovered. There is some chance for avoiding this to some extent thanks to advanced technology.Utilising the CISC mechanism in this system.Detector that only detects alcohol.manual method

III. DISABILITIES OF THE CURRENT SYSTEM

The primary drawback of the current method is how sensitive it is to ambient noise. For instance, the environment must be entirely silent when the subject is conducting the EEG experiment. The other drawback of the system's primary use of two cameras—one to monitor head motions and the other to record facial expressions—is the ageing of the sensors, which are all linked to the driver's body and could have an adverse effect on the driver.

IV. PROPOSED SYSTEM

The development of a quick and dependable connection between a severely impaired person's brain and a personal computer is the aim of the brain-computer interface. Using a brain-computer interface, home appliances can also be controlled. The goal is to enable disabled people to use brain signals to communicate, operate prosthetics, and even move around in wheelchairs. study of brain signals autonomic capabilities of a vehicle Drowsiness detection when eyes are open

Block diagram:

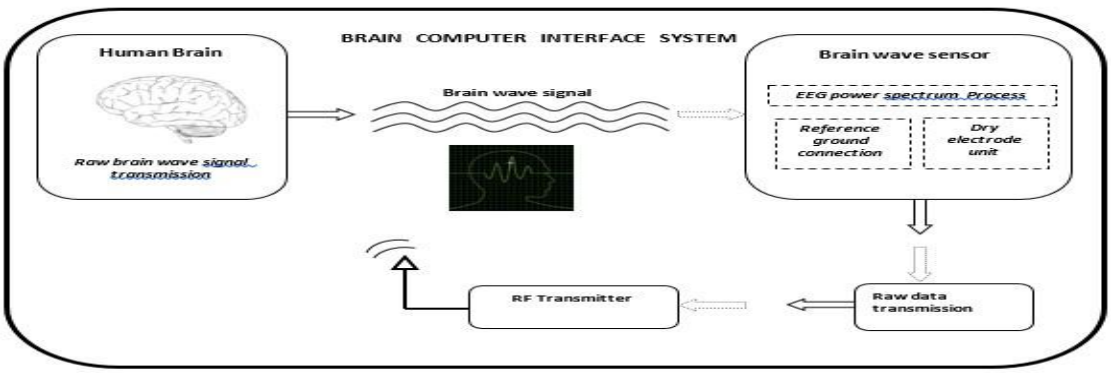

Fig.1. Block diagram of braincomputer interface system

V. HARDWARE DESCRIPTION

BRAIN WAVE SENSOR

The electrical signals that our brain's neurons create are known as brain waves. Electroencephalogram (EEG) is a technique that can be used to measure these signals by positioning sensors close to the scalp. Epilepsy, sleep problems, and other conditions involving the brain can be identified using EEG, which detects voltage variations in the electrical activity of the brain. Because it provides millisecond-range temporal resolution, which is not feasible with other techniques like CT, PET, or MRI, EEG is a useful tool for study and diagnosis. Each frequency of brain waves has a

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specific meaning and performs a specific function in the brain. The brain's ability to focus is strongly correlated with brain wave frequency, with Gamma waves having the highest frequency and Delta waves having the lowest during deep sleep.

BLUB

Compared to incandescent bulbs, LED light bulbs are more environmentally friendly. When electricity flows through a semiconductor device, they use it to generate visible light. The efficiency, price, and output of LED bulbs have increased, making them suitable for larger-scale lighting. In comparison to incandescent lights, they have a lifespan of up to 50,000 hours, consume less energy, and are up to 80% more efficient.

FAN

A DC fan is a cooling device that rotates its blades by kinetically converting electrical energy. Its four parts are the rotor, the stator, the motor, and the outside frame. The essential components of the fan are the stator and transfer, which use magnetic fields to create repulsion and rotate the fan blades. The Hall sensor part emits a synchronisation signal to make sure the fan blades continue to rotate in the right direction. Such is the operation of a DC fan.

POWER SUPPLY

(a)A step-down transformer

A step-down transformer uses an iron core, main and secondary windings, and these components to lower the voltage of an AC power source. The mutual induction principle, which underlies how the transformer functions, asserts that the magnitude of the voltage is proportionate to the rate at which the magnetic flux changes.

A bridge rectifier is a device that converts AC to DC and is frequently seen in electronic device power supplies. The proper rectifier is chosen based on criteria including load current requirements, component ratings, and mounting requirements. The rectifier can be manufactured with four or more diodes or other regulated solid-state switches.

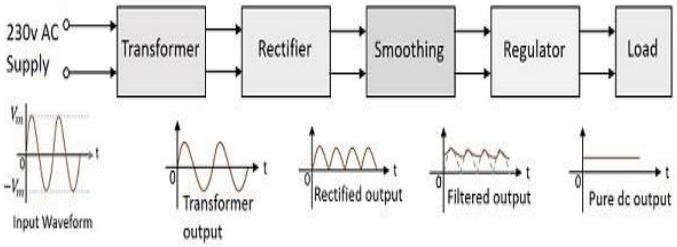

Fig.2.block diagram of power supply

(b) TRANSFORMER

We're using a transformer to change the voltage of the power supply from 230 volts AC to 12 volts AC for our electronic circuits. The transformer operates using mutual induction theory and can vary the current to change the voltage.

(c) Rectifer :

For the purpose of powering electronic devices, a bridge rectifier converts AC to DC. To enable one-way current flow, it makes use of four diodes

(d) Smoothing :

The resulting DC voltage is then filtered by a capacitor to remove any ripples, producing a constant DC voltage that can be used to power electronic components.

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(e) REGULATOR:

A voltage regulator is used to get a steady output voltage. A +5v output voltage is maintained by the LM7805 fixed voltage regulator, which is appropriate for microcontrollers. In spite of variations in input voltage, load, or temperature, it guarantees a constant output voltage..

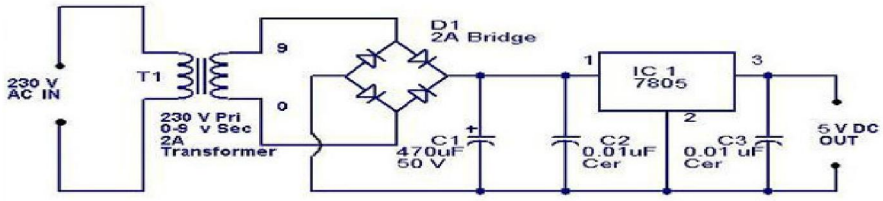

Fig.3.circuit diagram for power supply

DC MOTORS

A independently excited DC generator serves as the load for a DC motor, and the load on the motor can be changed by adjusting the generator field current. Plotting shaft speed versus armature current can be used to identify the torque-speed curves of DC motors. DC current excites the stator's poles, which create magnetic fields in the DC motor. To lessen commutator sparking, commutating poles are positioned in the centre of the poles. Coils with many turns are inserted into slots in the rotor's ring-shaped laminated iron core. Through the commutator segments, the coils are linked in series..Two brushes are placed against the commutator to allow current flow. The commutator is made up of insulated copper segments set on an insulated tube. When an inductive current is abruptly interrupted, the commutator shifts the current from one rotor coil to the neighbouring coil, however this can result in high voltages, flashover, and arcing between the commutator section and the brush. The commutator is made up of insulated copper segments that are stacked on an insulated tube.

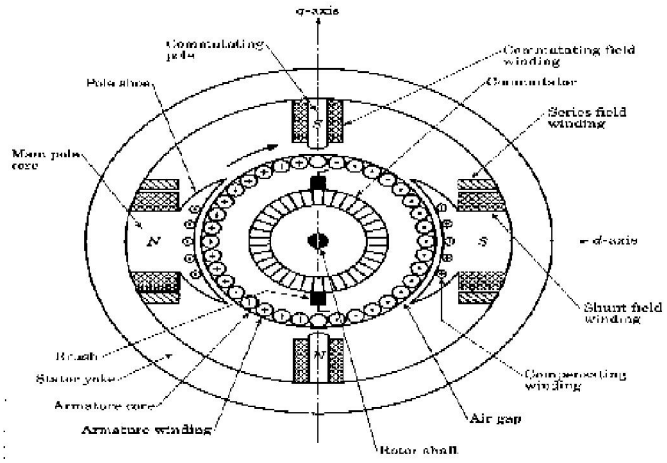

Fig.4.Construction of dc motor

ARDUINO:

With the help of the Arduino physical computing platform, you can build interactive things that can interact with and control the real environment. Programming is done using an open-source development environment and a microcontroller board. With its 16 MHz clock speed, 14 digital I/O connections, 6 analogue input pins, USB connection, power jack, andreset button, the Arduino Uno board is a popular option. A programme can be written in the board's programming language, which is a condensed version of C/C++, and downloaded to execute automatically. Both professionals and enthusiasts can benefit from this simple and inexpensive gadget

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Fig.5.Arduino uno R3 board

UART

A UART IS Computer Hardware for converting data between parallel and serial formats is known as a UART. It can be set up to support various data types and transmission rates. It often comes as a standalone integrated circuit or as a microcontroller component. A shift register is used by a UART to switch between serial and parallel forms. It requires interface devices to transfer signals to and from external signalling levels because it cannot directly generate or receive external signals. Simplex, full-duplex, or half-duplex communication are all possible.

VII. SOFTWARE REQURIMENTS

i. EMBEDDDED C

Even though assembly programming has disadvantages compared to high-level language programming, it is nevertheless employed for DSP-based systems because of the need for fast performance. A single cycle multiply-accumulate unit and a data channel with memory-access units that immediately feed into arithmetic units are two aspects of the specialised architecture that is used by DSPs for signal processing applications. In DSP designs, fixed-point arithmetic is frequently utilised since it can be implemented for not much more money than integer arithmetic. However, continuing to programme DSPs in assembly has become more expensive due to changes in technology and financial constraints. Despite the widespread use of C compilers in embedded processors today, signal processing components are still implemented using assembly programming because it is challenging to express some algorithms effectively in standard C.

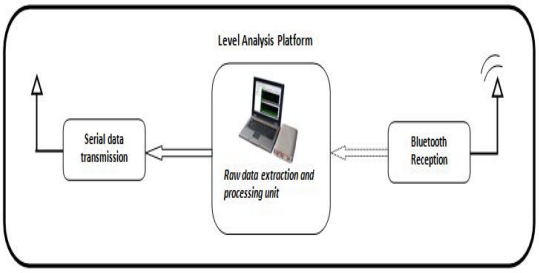

Fig.6.level analysis platform

ii. ARDUINO SOFTWARE (IDE)

(a)SOFTWARE DESCRIPTION

The Arduino software supports serial communication on digital pins, I2C, and SPI communication. It also has libraries that extend core programming functionality, allowing the reuse of code without having to copy and paste it. The standard Arduino installation comes with several libraries, and others can be downloaded from the support pages or third-party websites. The Servo library is an example of a library that allows control of servos connected to the Arduino's digital I/O pins. Arduino sketches have two main functions: setup() and loop(). Setup() sets up the hardware, and loop() is repeated endlessly. The Arduino IDE is used to writeprograms and upload them to the board.

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Fig. .7.Embedded System software

The language platform serves as the foundation for the embedded system, which uses devices for its operating system and is primarily used for real-time operations. Electronics like cars, phones, modems, appliances, etc. are made with embedded software by manufacturers. An 8-bit microcontroller running lighting controls is a simple example of an embedded system. Additionally, it might be challenging software for aircraft, process control systems, missiles, etc.

VIII. IMPLEMENTATION:

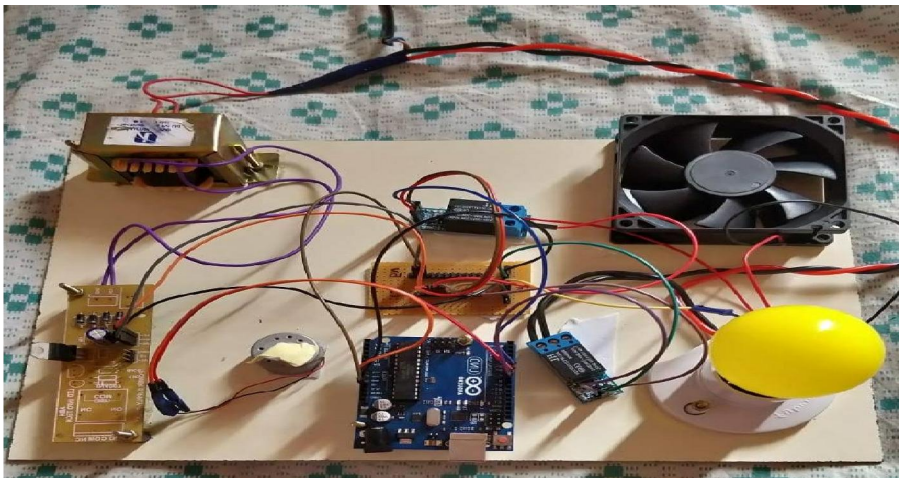
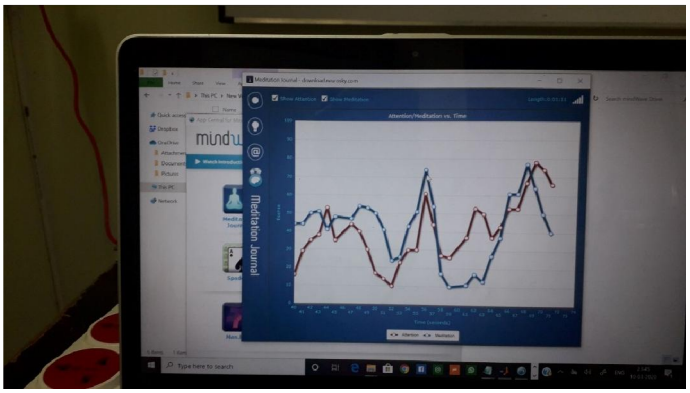


Fig.8. Implementation hardware used for driver drowsiness detection

IX. RESULT AND ANALYSIS



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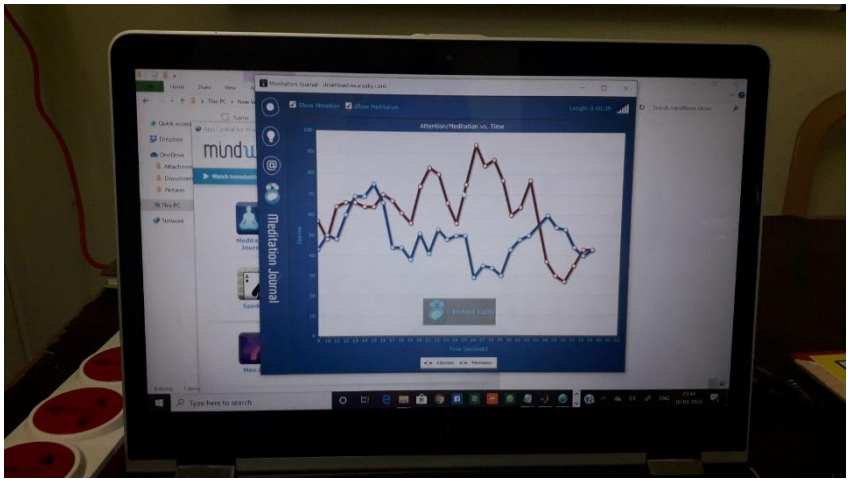

Fig.9. Graphical wayoutput for the project

X. ACKNOWLEDGMENT

It is to acknowledgment that this work is carried out by utilizing the resources that is funded by the Electronics and communication Engineering Department, Dhanalakshmi college of Engineering, Chennai.

XI. CONCLUSION

Driver drowsiness detection using EEG sensors is a promising area of research. EEG signals can provide valuable information to detect drowsiness in drivers. Various features and machine learning algorithms have been used to classify drowsiness based on EEG signals. Recent studies have focused on improving accuracy by combining multiple sensors

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