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Development of EEG Based System for identification of Drowsiness

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ABSTRACT

In this modern world, rapid technological development paves the way for human community to experience the comfort and advancement in life. Though the world of science brings up many innovations, humans can never been able to secure their life from death, as life is very uncertain. Around the world, millions of accidents are happening every year and for most of them, drowsiness of the driver is the major cause. Humans cannot control the nature but can be smart enough to handle the nature. Drowsy driving is a real threat for drivers. Drowsiness can be caused by many reasons. Consumption of some medicines, drugs, alcohol can also cause drowsiness. Thus, drowsiness is a serious threat for drivers. There are many devices existing in the present-day market but most of them costs high price and also they are not delivering accurate results. This prototype will serve as the best low-cost system which gives accurate results. Unlike other existing systems, this system is capable of delivering output in high accuracy rate which is necessary, as this a life-saving system.

Keywords : Brain waves, Electrodes, Arduino, Instant Alert.

Introduction

According to the National Sleep Foundation, about half of the U.S. adult drivers admit to consistently getting behind the wheel while feeling drowsy and about 20% admit to falling asleep behind the wheel at some point in the past year – with more than 40% admitting this has happened at least once in their driving careers. These startling figures show how prevalent drowsy driving is. What drivers may not realize is how much drowsy driving puts themselves – and others – at risk. In fact, an estimated 5,000 people died in 2015 in crashes involving drowsy driving, according to a Governors Highway Safety Association report.

Impact of Drowsiness on Driving

Driving while drowsy is similar to driving under influence of alcohol: Drivers' reaction times, awareness of hazards and ability to sustain attention all worsen the drowsier the driver. Driving after going more than 20 hours without sleep is the equivalent of driving with a blood-alcohol concentration of 0.08% – the U.S. legal limit. We are three times more likely to be in a car crash if you are fatigued.

Literature Survey

The author analyzed different stages of sleep is [1]. Monitoring system for eye ball has been developed for detecting the drowsiness of the drivers [2]. A system tracking the drowsiness of the driver was designed [3]. The author undergone a neurological study on sleep and its stages[4]. Tech problems and scopes were studies to detect fatigue and for the fatigue management [5]. Relaxation effects on response time was analyzed and studied [6]. A system was developed for monitoring the state of the driver for sleep detection [7]. Commercial transport safety and life-guarding importance was analyzed through this work [8]. A system

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monitoring the drowsiness of the driver was developed [9]. Electroencephalogram analysis for fatigue-driving detection was implemented [10].

Existing System

In the existing system, with the help of non instructive vision based concepts, drowsiness detection system is developed. Many systems which are available require a camera which is installed in front of the driver which point towards the driver's eye. In heavy vehicles this arrangements is not pertinent . It detects only 40% of the face. Similarly in steering movement monitoring system, when the sensor gets faulty or damaged the information it reads and sends to the board will be inaccurate and it is also be high cost.

PROPOSED SYSTEM

In the existing systems, there are many disadvantages to list-down though the main disadvantage in all the existing systems is the cost and the accuracy of the results. All the existing systems are costly that a low-end car driver can never afford. Only the top-notch brands and high-end models have the capability of delivering accurate results, such systems are generally priced high in the market. In countries like India, where most of the population is middle class, owning low-end cars, they cannot afford such costly systems eventhough they save the lives of the drivers, which is priceless.

In the proposed system, the system actually works with the data that is fetched from the brain through electrodes. Simply, Brainwaves are monitored and drowsiness is detected. So the accuracy will be one-hundred percent.

The Proposed system alerts instantly when the driver feels drowsy which is highly accurate . This system is portable and easy to deploy. This system is applicable to multiple devices. This system is cheaper when compared to other existing anti-drowsy alert system.

Block Diagram of the Proposed System

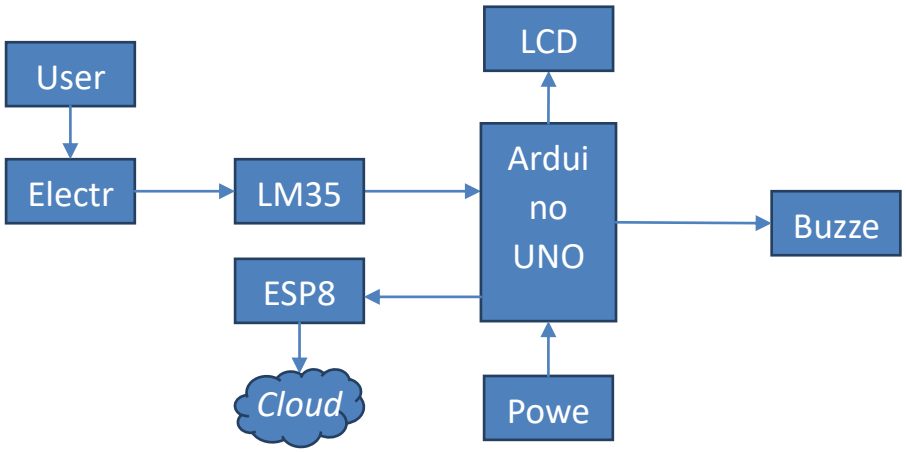

Figure 1. Block diagram of the proposed system

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The above figure shows the block diagram of the proposed system. Each block represents a function involved in delivering the result. Electrodes block represents the electrodes which are used to get the primary input from the brain. The acquired signals are then sent to LM358 ADC. In this block, the acquired analog signal is converted into digital signal and the signal is passed to the Arduino. Here, in the Arduino block, the signal is monitored and only if the drowsiness condition is satisfied, the signal is passed to the buzzer and the buzzer gives the alert to the user instantly.

Circuit Diagram of the Proposed System

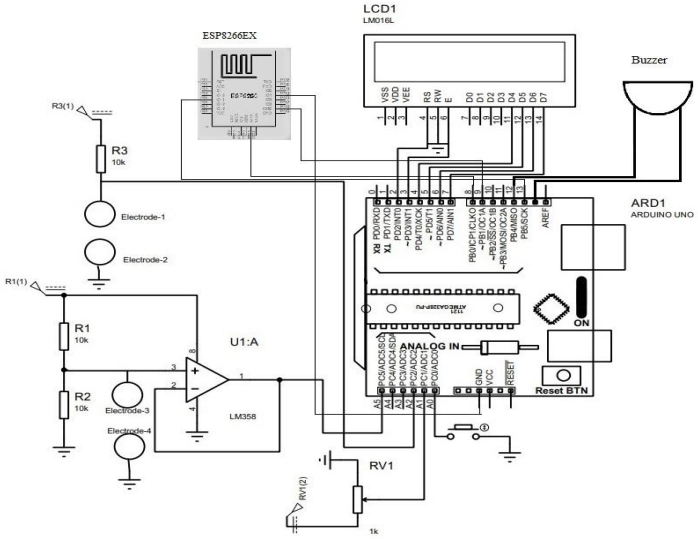

Figure 2. Circuit Diagram of the proposed system

The above figure shows the circuit diagram of the Anti-Drowsy Alert System. Electrodes are used here to capture the electrical signals and the electrodes are getting connected to the Arduino UNO ATmega328P microcontroller. In this microcontroller as per the requirements and if the condition satisfies, the signal is given to the buzzer and the control is given to the LCD screen and the alert message is displayed on the LCD screen along with alert sound. The electrodes 1 and 2 are connected to the overhead headset and fixed at the scalp of the user and electrodes 3 and 4 are reference electrodes where they are placed at the fingers. When the electrical signals of the user varies according to the movements of the body which then detects the range of the user attains the drowsy state,the signal is then transmitted to the microcontroller and the program gets executed and the buzzer alarms. The LM358L Integrated Circuit used here converts the signal from analog to digital according to the requirements for the microcontroller.ESP8266EX is a Wi-fi module which sends the data to the cloud for the analysis of the user and saved in the webpage.

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Table 1.Hardware Specification

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S.NO	Component	Specification
1	Electrode	Silver Chloride (AgCl)
2	Arduino UNO	Atmega 328, 14 digital pins, UART, Operating Voltage:5V
3	LM358L Dual OP-AMP	Supply range: 3V to 36V
4	Buzzer	Operating Voltage : 4V - 8V Minimum Sound Output-85dB
5	LCD display	16*2 display Operating Voltage : 4.7V -5.3V
6	ESP8266EX Wi-Fi module	32 bit microcontroller Maximum power supply : 3.3V I/O Voltage: 3.6 V(max) Source current:12Ma Frequency range :80-160mH
7	Overhead headset	-

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Hardware Setup

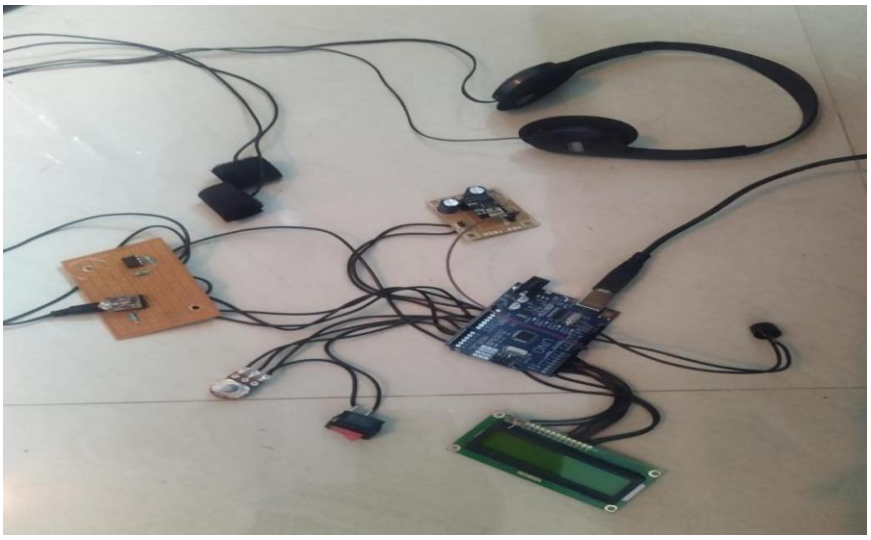

Figure 3. Hardware set up of the proposed system

The components were connected and hardware setup was done successfully for the verification of the output. Electrodes in the headphones observes the brainwaves from the brain and the obtained signal is passed to ADC convertor to convert the obtained analog signal to digital. Now the converted Digital signal is passed to the Arduino where the decision making is done and if the Arduino finds the signal to be in the drowsy range which is pre-programmed, then the signal is passed to the buzzer and through the buzzer, the alert is given to the user instantly. A LCD is also used for alert message display.

The hardware setup was done and the output results were verified successfully.

Conclusion and Future Scope

Drowsy driving is a serious threat to drivers and this system effectively helps the driver not to sleep by providing instant alert. This system could be developed into a product in less duration and everyone can afford this as it is of low cost. Thus, this low cost anti-drowsy alert system works efficiently thereby preventing the driver from accidents due to drowsiness.

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