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Accident Avoidance using EEG Sensor

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Abstract-In today's world most of the accidents occurs due to drowsiness and alcohol consumption. Drowsiness is turning into a serious issue if there should be occurrence of auto collision. Sleeping can be distinguished from a few elements like yawning, grasping power on haggle on. We proposed under taking work and breaking down psychological exercises of cerebrum utilizing EEG signals depends on the Brain Computer Interface (BCI) innovation. The various cerebrum signs of various recurrence and transmit to the microcontroller and then for drowsiness detection we are using two different sensors. We are also sensing detection of alcohol by gas sensor. The microcontroller control dc motor using relay and keeps the vehicle self-controlled capacity until stir state. This is designed for deal of lives in street transportation.
Keywords-component; polysomnography; portable; psychological; cerebrum.

I. INTRODUCTION

In recent years there is increasing concern about quality of life during human's activities. Some people said that physical and psychical conditions are hidden in the body movements.

Fatigue, drowsiness and sleeping ness are often used synonymously in driving state description. Involving multiple human factors, it is multi-dimensional in nature that researchers have found difficult to define over past decades. Despite the ambiguity surrounding fatigue, it is a critical factor for driving safety. Studies have shown that fatigue is one of the leading contributing factors in traffic accidents worldwide. It is particularly critical for occupational drivers, such as divers of busses and heavy trucks, due to the fact that they may have to work over a long duration of the driving task, during the peak drowsiness periods.(i.e., 2:00 A.M. to 6:00 A.M. and 2:00 P.M. to 4:P.M.), and under boredom working conditions.

Drowsy driving is becoming one of the most important cause of road accidents. According to many surveys around 30% of road accidents is due to the driver fatigue and the percentage is increasing every year.

Drowsiness can be due to the adverse driving conditions, heavy traffic, workloads, late night long drive etc. Lack of sleep, absence of rest, taking medicines are also causes for drowsiness. When driver drives for more than the normal period fatigue is caused and the normal period fatigue is caused and the driver may feel tiredness which will cause driver to sleepy condition and loss of consciousness. This results road accidents and deaths of driver or serious injuries and also claims thousands of lives every year. Drowsiness is phenomenon which is the transition period from the awake state to the sleepy state and causes decrease in alerts and conscious levels of driver. It is difficult to measure the drowsiness level directly but there are many indirect methods to detects the fatigue. Driver drowsiness detection can be measured using physiological measures, vehicle-based measures, behavioural measures.

II. BACK DROPS

The most disadvantage of driving on roads is the driver's attention, and once this attention is lost, major accidents could happen. According to the National Highway Traffic Safety Administration (NHTSA), 1,53,297 car crashes happened due to drowsiness in the period from 2014 to 2019.

Another study by Kuwait times stated that for more than 80,000 accidents, 95% of them happened due to lack of attention. The attention of the driver can be diverted through many things, using mobile phones, changing radio stations, eating and drinking and day dreaming. In addition to that sleepiness due to stress or fatigue, when the driver is sleepy or tired, his reaction will be slower than the normal driver which leads to accidents.

The basic system consists of plenty of inputs and outputs such as sensors, wireless modules, buzzer, webcam and gsm to the microcontroller and this may increase the load on it. In order to decrease the load on the microcontroller and also to improve the performance of the system some advancements has made the existing system.

This can evaluate respiration rate, peripheral capillary oxygen saturation (spo2) is designed, the data taken from individuals are stored and analysed using a mobile application, this can be overcome in future.

III. PROPOSED DESIGN

This design is mainly deals with the measures that are been taken for the prevention of accidents that may occur due to drowsiness and consuming alcohol. Many systems used different kind of mechanisms to detect drowsiness like correlation methods, face tracking, eye detection, image processing, eye ball tracking, face expressions etc. The system which we designed is to monitor the driver behaviour and to control the accident that occurs due to the carelessness of the driver.

We using PIC micro controller and then for drowsiness and we use two different sensors. The input of the processor are EEG sensor, Gas sensor. The outputs are LCD, buzzer and Motor. The input power is balanced to get the specifications such as 5volts DC from 230volts AC power line from the power source unit. The main module of PIC microcontroller is, it has high performance efficiency which allows more work to be done without increase in frequency or power and low power will be consumed it helps to longer battery life.

The EEG sensor monitors the driver brain wave signal and displays the digital value in the LCD, consumption level of alcohol also monitors by Gas sensor these are the different sensor helps to monitor the driver, whether the driver is driving safely or not by monitoring the drowsiness. The micro controller controls dc motor using relay and keeps the vehicle to be self controlled capacity.
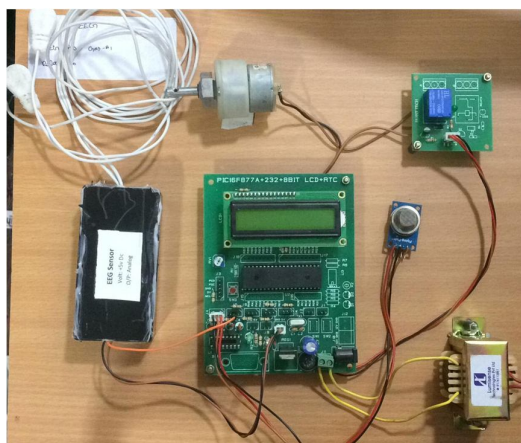

Figure 1. Snapshot of the hardware setup for proposed system

A. Hardware Description

1) PIC Microcontroller: The PIC microcontroller used here is 16F877A. It performs the key role of processing the received data from the sensors and transmitting them to the Li-Fi module. The advantage of microcontroller such as low power consumption and flexibility to connect other devices. PIC devices are popular with industrial developers due to their low cost, wide availability, large user base, serial programming, re-programming flash-memory capability.

2) LCD: This LCD display designed for E-blocks. It is a 16 character. This allows the device to be connected to most E-block Input and output ports. The LCD display present here requires data in a serial format. The display also requires a 5V power supply. The 5V is best generated output from the E-Blocks multi programmer or a 5V fixed regulated power supply. The 16 x 2 intelligent alpha numeric dot matrix displays is capable of displaying 224 different characters and symbols.

3) EEG Sensor: Electroencephalogram (EEG) sensor require conductive get to ensure low impendence electrical contact between the sensor and skin. We present a gel-free and a non-contact EEG sensor with on-board electrode those capacitive couples to the skin. Active shielding of high-impedance input significantly reduces noise, over 1-100 Hz frequency range. Experiments coupling the sensor on the human scalp through hair and to chest through clothing produce clear EEG recorded signals. This features are, it uses three electrodes, difference in voltage between two arms is taken and right leg electrode serves as the reference.

3) Alcohol Sensor: MQ-3 module is suitable for detecting alcohol, CH_4, Hexane, LPG, CO, Sensitive material of MQ-3 gas sensor is SnO_2, with lower conductivity in clean air. When the fixed point alcohol gas exist, the sensor's conductivity is more higher along with the gas concentration rising. MQ-3 gas sensor has high sensitivity to alcohol, and it has good resistance to disturb of gasoline, smoke and vapour. This given sensor provides an analog resistive output based on alcohol concentration. When the alcohol gas exist, the sensors conductivity gets higher along with the gas concentration rising. There is a resistance across an A and B inside the sensor which finds the detection of alcohol. The alcohol is measured by measuring this resistance.

4) Relay Board: A relay is the electromechanical switch which is activated by an electric current. A four relay board arrangement contains driver circuit and power supply circuit and isolation circuit. A relay is assembled with that circuit. The driver circuit contains transistors for switching operations. The transistor which is used for switching the relay. An isolation circuit prevents the reverse voltage from the relay which protects the controller and transistor from damage.

The input for switching the transistor is given from the microcontroller unit. It is used for switching of a four device. Some features of relay board is fast switching, motor forward and reverse operation.

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5) DC Motor: A DC motor which converts direct current electrical power into mechanical power. DC or direct current motor works on the principal of a current carrying conductor is placed in a magnetic field which experiences a torque. This is known as motoring action. When a magnetic field and electric field interact they produce a mechanical force. Thus, the DC motor can be used at a voltage lower than the fixed voltage. But, below 1000 rpm, the speed becomes unstable, and the motor will not be able to run smoothly. However, using the motor in outside at this range will result in high temperature rises and deterioration of motor parts.

B. Software Description

1) MP LAB-IDE: MPLAB is a proprietary freeware integrated development environment. It is software for the development of embedded applications on PIC and ds PIC microcontrollers, and is developed by Microchip Technology. MPLAB and MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit PIC and AVR microcontrollers, 16-bit PIC24 and ds PIC microcontrollers, as well as 32-bit SAM and PIC32 microcontrollers. The hardware capabilities of PIC devices range from 6-pin SMD, 8-pin DIP chips up to 144-pin SMD chips, with discrete Input and output pins, ADC and DAC modules, and communications ports such as Universal Asynchronous Receiver and Transmitter and even universal Serial Bus, Low-power and high-speed variations exist for many types.

PIC devices are popular with industrial developers due to their low cost and large user base. It is also popular with extensive collection of application notes, available at low cost and also in free development tools. The serial programming, re-programming, and re-programmable Flash-memory capability popular with PIC devices.

2) Embedded C: Embedded C is a language extensions for the C programming language by the C standards committee. Embedded C Programming requires non-standard extensions to the C language to support exoitc features such as fixed-pint arithmetic and basics Input and Output operations. Embedded C uses most of the syntax and semantics of standard C, example, main() function, variable definition, data type declaration. It also uses conditional statements(if, switch case), loops(while, for), functions, arrays and strings, structures and union, bit operations, macro.

IV. RESULT AND DISCUSSION

The designed system can avoid the accidents that occurring through vehicles, not all the accidents can be prevented only some of the accidents occurring due to alcohol consumption and through drowsiness can only be prevented. Two processing steps were applied in this system. Firstly, we detect the drowsiness using the EEG sensor which is placed in the drivers head. The EEG sensor monitors the brain waves whether the driver is feeling sleepy or in the normal way. Secondly, we detect the alcohol consumption using the MQ-3 Equivalent sensor weather the driver consumed alcohol or not as shown in Fig. 2.
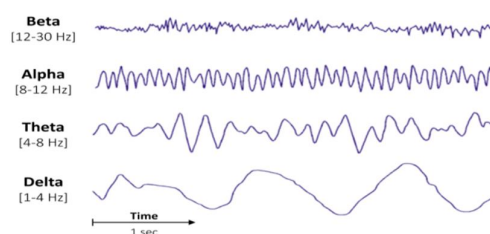

Figure 2. Different type of brain waves

Figure 2 shows the different types of waves that occur in the brain that can be calculated using EEG sensor. The Beta wave works when we are in consciousness and in awake, Alpha wave works when we are in relaxed and in creative visualisation, Theta wave works when we are in problem solving, Delta wave works when we are in dreamless sleep. All the output waves are shown in the digitaliized form.

Figure 3. Output of both EEG and Gas sensor

The above figure shows the output value of the EEG and the Gas sensor(MQ-3 Equivalent sensor) which is tested. G represents the gsa sensor and E represents the EEG sensor in Fig.2.

If the gas sensor reaches the value above 400 it shows the driver consumed the alcohol, similarly when the EEG sensor value reaches below 160-185 the driver is in sleepy stage so the vehichle won't start. These demonstrations confirm that device can be a potential technology for development of accident avoidance system.

V.   CONCLUSION AND FUTURE WORK

The accident occurence due to drowsiness and alcohol comsumption can be avoided successfully, that obtained in the proposed system. A hardware set up is sucessfully developed for detecting drowsiness and alcohol sensing. The advantage of proposed system is to reduce accident percentage by using this type of technologies. The main advantage of the system to give some alert before drive a vechile with dreaming or drowsiness. PIC microcontroller it has an advantage of low power consumption and low cost. In the future, we are intrested to develop the accident avoidance system to monitor heart rate, blood pressure and posture movement during driving.

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