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Mental Fatigue Identification and Prevention of Accidents in Driving via EEG

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Abstract: Monitoring driver attention has a direct effect on decreasing injury/fatality rates. Hence, detecting episodes of driver distraction is fundamental in reducing car crashes. Driverinattention is a major factor in most traffic accidents. Research and development have actively been carried out for decades, with the goal of precisely determining the driver's state of mind. In this project, we summarize these approaches. An accident, of which one important characteristic is suddenness, i.e., the occurrence is instantaneously, often cause casualties and variouslosses of society. Distracted driving might lead to many catastrophic consequences. Developing a countermeasure to track driver's focus ofattention and engagement of operators in dual multi-tasking conditions is thus imperative. Here we have use EEG sensor then it can able to monitor the driver situation. Driver situation means driver slept or not as well as driver concentration while driving. In this system we have to add an alcohol detection system. If driver is drunk then vehicle not starts.

Keywords: Gesture Recognition, Glove, Sign Language, Sensor, Man-Machine Interface, Pattern Recognition

I. INTRODUCTION

Recently, driving safety becomes more important and has receiving attention of the public's due to the increase in the number of accidents in road. Driving is a skill that drivers need their full attention to regulate the vehicles. Distraction in driving may causes catastrophic consequenses. Operating electronic devices of the driver during driving has been greatly augmented during driving which may cause accidents and also drowsiness becomes the major factor of causing traffic accidents. This may cause very big accidents during driving. This proposed

model is to overcome these issues by analyzing the mental activities of brain using an electroencephalogram (EEG) signals supported by Brain Computer Interface (BCI) technology whichmeasures the intent of the user and also delivers the command to the computer using EEG and they are used in various application.

1.1 EVALUATION OF DRIVER FATIGUE ON TWO CHANNELS OF EEG DATA

According to Li.W, Q.-C. He, X.-M. Fan, and Fei Z.M ,et al.[5] in 2012,driving fatigue is oneof the major cause of meeting accidents in highways. The process of fatigue during driving in highways is yet to be found. Experiments was conducted between 23 participants to collect the data on behaviour of drivers during driving using ECG. The behavior of fatigue was calculated by person coefficient and principal component analysis method.it is based on entropy weight which is employed in the process of fatigue. According to them driving fatigue occurs dueto the 13 feature indicators.it was no consistent and may vary with person to person. Based on this they were classified into three types namely mild, moderate and severe fatigue and their similarities were 0.87,0.61 and 0.50.and they conclude that driving fatigue occur at the time between 19minutes or 33minutes.

1.2 INCREASED EMOTIONAL INSTABILITY AFTER SLEEP DEPRIVATION

Liu.H says et al. [6] in 2014 human brain refers to small-world network as they are complex network connection. Brain region refers to the nodes and edges where there is correlation between twonodes. Sleep occurs when small-worldness uses the small-world property. This small world property is responsible for the sleep deprivation condition. According to him person with low level of neuroticism is more too resilient to sleep deprivation.

1.3 A REVIEW OF CHANNEL SELECTION ALGORITHMS FOR EEG SIGNAL PROCESSING

According to Alotaiby.T, F. E. A. El-Samie,S. A.Alshebeili, and Ahmad .I , et al.[7] in 2015,Didgital processing of EEG has been used in various applications such as sleep state classification, emotion classification, mental task classification, motor imagery classification and drug effect diagnosis. As they are used in wide variety of application, it requires large number of channels.it is important to choose the channel according to the application. The selection process of channel includesthreefold one is to reduce the complexity, second one is to reduce the amount of over fitting and the third one is to setup time in some applications. Signal processing tools are used in long range applications so, the selction of channels plays a major role in selection algorithm.

1.4 IMPROVING EEG-BASED DRIVER FATIGUE CLASSIFICATION USING SPARSE-DEEP BELIEF NETWORKS

Analysis of Chai.R et al. [9]at 2017, on 43 participants in which data has been collected between fatigue and alert states. The system employs autoregressive modeling and sparse deep belief networks. While comparing with other classifiers sparse-DBN is a semi supervised learning method semi supervised learning combines both the learning method of supervised learning and unsupervised learning.it is able to learn both the level of structures which are low level and high level structure. Forcomparison the artificial neural network (ANN), Bayesian Neural Networks (BNN)and original deep belief networks(DBN)classifiers are been used. The classification performances will improve the performances with a sensitivity of 90.8 percent, aspecify of 90.4 percent and an accuracy of 90.6 percent. Using the sparse DBN classifiers the performance can be improved.

II. WORKING PROCESS

The Brain wave sensor receives the EEG signals from brain. This signal is given into Bluetoothand converts into Bluetooth packets and sends to the data processing system. The processor i.e. Level splitter section analyses the signal. Then that raw datais converted into some meaning full data andtransmitted serially to system. The data is received and given to Microcontroller. According to the signalthe drowsy mode is detected. Then motor is deactivated and then alarm is buzzed. The vehicle is stopped for certain time and again start on. Now we again receive EEG signals and if it is in still that statethen we stopped the vehicle

The main aim of this project is to control the device based on electrical signals of brain. The brain computer interface, also known as the brain-machineinterface enables us to
interact with computers or machines through the use of electrical signals that occur in the brain after estimate a human intention. BCI is a communication system, which enables the user to control special applications by using only his or her thoughts. Different research groups have examined and used different methods to achieve this. Almost all of them are based on electroencephalography recorded from

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the scalp. Thismodel uses a brain wave sensor which can collect EEG based brain signals of different frequency and amplitude and it will convert these signals into packets and transmit through Bluetooth medium into the level splitter section to check the attention level. For many years, the evolution of safety improvements in driving was the result of a combination of science and perceived safe practices. Even though the accidents are occur due to driver tiredness and similarly drug usage. This model continuously monitors the driver's mental and physical state to avoid accidents. When a driver is very distracted and physically very abnormal, the sensor sense that and sends it to controller. Microcontroller sends the commands to slow stop the vehicle.

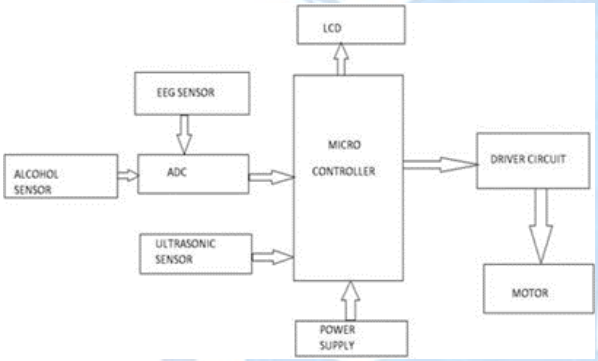

Fig. 1. Block diagram of proposed System

Fig.2. Prototype of proposed model

III. MATERIALS

A. LPC2148 Processor

The ARM7TDMI-S is a general purpose 32 bit microprocessor. The main advantage of this processor is it offers high performance and low power consumption. It is based on the principle of Reduced Instruction Set which much simpler than theusage of complex instruction set computers. Pipeline techniques are used in the all parts of processing of the system and rely on continuous operation on memory. If one instruction is been executed, the next instruction to be fetched from the memory, It also has a unique strategy known as Thumb, which is used in memory restrictions with high volume or where there is a issue in code density. The main process is that of a super-reduced instruction set.

B. Brain Wave sensor Electroencephalography

It is used to measure the activity of the brain electrically in the living brain. Proposed system uses the brainwave sensor MW001 to analyse the EEG signals. The design is made in a way that it process and record the raw EEG signal from the mind wave sensor. These mind wave sensor are not used clinically but can be used in the Brain Control Interface and neuro feedback which is one of thebiofeedback typic serves as a direct communication pathway between the brain and an external device. Improper fit detected through "Poor Signal Quality" warning from ASIC to reset if off the head for four consecutive seconds, or if it is receiving a poor signal for seven consecutive seconds. Advanced filtering technology with high noise immunity. Low power consumption suitable forportable battery-driven applications. Max power consumption 15mA 3.3 V. Raw EEG data output at 512 bits per second.

C. Electrodes

The EEG electrode can be located either the left orright eye on the forehead. The ground electrode is been located behind the ear or at the earlobe. Minimum pressure of 0.81 will have enough pressureto prevent movement.

Fig.3 EEG Electrode

D. Ultrasonic sensor

Ultrasonic sensor range finder is capable of finding the distance between the user and the object using ultrasonic waves. Considering the issues like safety, user interface and ease of use the ultrasonic rangefinder is been chosen. Rangefinder is used in various applications like measuring the device or an obstacle detection device.

Fig.4 Ultrasonic sensor

E. Alcohol sensor

It is technically referred as MQ3 sensor which is used to detect the ethanol in air. When a drunken person breathes near the alcohol sensor it detects the amount of ethanol present in his breathe and results the output based on the concentration of alcohol.

Fig.5 Alcohol sensor

F. Relay

It is an electrically operated switch. When a current flows through a coil it creates a magneticfield and attracts the lever which changes the switch contacts.it allows one circuit to switch a second circuit which can be completely separate from first.

Fig.6 Relay circuit

G. Motor

A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starter.

H. LCD

Liquid Crystal Display which is a screen display module and used in wide range of applications. It can display 16 characters on each line and it has two linesin it.The character in LCD is displayed in 5x7 pixel matrix.LCD has two registers use to display commands.

I. Software requirements

Proposed system employs two software requirements which are

1. EMBEDDED C
2. KEIL compiler

EMBEDDED C- It is a set of language extensions of the C programme. It requires nonstandard extensions in the C language to support the microprocessor features like fixed point, multiple distinct memory banks, and basic input and output operations.

KEIL compiler- it is used to supply one or more paths separated by semi-colon which is used to search header files. Firstly, it searches the current folder and then the source file folder.

RESULT AND DISCUSSION

Implementation of a vehicle driver drowsiness detection method using wearable EEG is proposed to alert and warn vehicle drivers under drowsiness

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conditions. To ensure the user safety, this method also detects the alcohol consumption and has feature controlling the speed of the vehicle which prevents accidents. Most of the times we may not be able to find the driver state of mind but in order to reduce the accident and fall, first we need to know the condition of each driver mental state are monitored. So this system placed a EEG sensor to know about the mental state of driver similarly alcohol sensor (both touch and air) additional drug also monitoring. If any one of the state cross the abnormal level then microcontroller controls the speed and stop the vehicle by cut off the petrol valve.

CONCLUSION

In recent days, the accidents occur due to the deviation of the drivers during driving which cause accidents. The major accidents are caused due to the mental fatigue or due to the drowsiness of the person.On developing this model it continuously monitors the mental activity of a person and sends those signals to the brain wave sensor. And transmits these signal packets to the level splitter section to monitor the condition of the driver. On proposing this model it prevents various accidents. We have been developing a system on the basis of the Smart safety serves in the purpose of the safety of driver, This project implements a design of the following featureslike detecting the driver's state and also the drugactivities.

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