IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

A Real time EEG based Drowsiness Detection with Brain Computer Interface for Vehicular System

Ashwini Mane[1], Prof. Minakshi Pawar[2]

M.E Student, Electronics and Telecommunication, SVERI's College of Engineering, Pandharpur, India[1]
Associate Professor, Electronics and Telecommunication, SVERI's College of Engineering, Pandharpur, India[2]

Abstract: Drowsiness is becoming a severe issue in case of traffic accident. Normally, sleepy condition can be identified from several factors like eye blink level, yawning, gripping force on steering wheel and so on, but all these measuring techniques will check only the physical activities of the human. We proposed a real time EEG based drowsiness detection with brain computer interface system for drowsiness detection. The proposed BCI system consists of a wireless physiological signal acquisition module. Here, BCI system is used to collect brain signal and transmit them to the embedded signal processing module wirelessly. The embedded systems supports various peripheral interfaces, is used to real time detection of drowsiness and trigger a warning tone and stop the vehicle to prevent traffic accidents when drowsy state occurs.

Keywords: Drowsiness detection, Electroencephalogram (EEG), Brain Wave Sensor, Brain Computer Interface (BCI).

I. INTRODUCTION

Drowsiness is transition between awaken state and sleep during which one's abilities to analyse and observe is strongly reduced is termed as drowsiness. Most of the accidents are the direct result of drowsiness of the person driving the car. It would thus be beneficial to be able to warn the driver in time by finding a way to detect drowsiness before it occurs. That is why more and more researches are made in this area to build automatic detectors of this dangerous state. A number of methods have been proposed to detect drowsiness state, and are mainly classified into three approaches. The first approach is to monitor driver's behaviours related to drowsiness, such as the inclination of driver's head, sagging posture, decline in gripping force on steering wheel, and lane departure using a camera to track road markings. The second approach is measuring physiological signal analysis of drivers, such as electroencephalogram(EEG), electrocardiogram (ECG), electromyogram (EMG), electrooculogram (EOG), heart beat rate and skin electric potential. The third approach is to analysing facial image changes using image processing such as eye-blink frequency, yawning, eye closure duration. Each method has advantages and disadvantages. Because image processing techniques are non-contact, driver cannot be disturbed. Measuring the eye blinking frequency and eye closure duration is mostly used to determine the degree of drowsy driving. Although image processing techniques are practical method, accuracy and precision is lower than using physiological signal. Especially, because the image processing techniques focus on only eyes closed state, they cannot be applied for detecting drowsiness with eyes open. Therefore, among these approaches physiological signal analysis has known for identifying human's mental states accurately.

In this study, we proposed a real-time wireless EEG-based brain-computer interface (BCI) system for drowsiness detection. The proposed BCI system consists of a wireless physiological Signal-acquisition module and an embedded signal-processing module. Here, the wireless physiological signal-acquisition module is used to collect EEG signals and transmit them to the embedded signal-processing module wirelessly. This system used to real-time detects drowsiness and trigger a warning tone to prevent traffic accidents when drowsy state occurs.

II. BACKGROUND

A. Image PROCESSING-BASED PREVIOUS WORK

Eyes movements of the facial changes are particularly the important factors in the drowsiness detection. Previous Image processing technique studied drowsiness detection algorithm using eye blink pattern. That uses OpenCV's implementation of face recognition. After recognizing face recognize eye region located by using the feature of horizontal projection histogram. And then eye blink detected by taking vertical histogram. Drowsiness and sleep by checking the number of input symbols standing for closed eye only. The duration of eye close is more than 500ms subject state is drowsiness and more 800ms subject state is sleep.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

B. EEG

The electrical activity of the brain is commonly monitored to assess brain activity. Neural function depends on electrical events within the plasma membrane of neurons. The brain contains billion of neurons, and their activity generates an electrical field that can be measured by placing electrodes on the brain or on the outer surface of the skull. And those electrical patterns of activity are called as brain waves. The brain signal divided in to Delta, Alpha, Beta, Theta and Gamma as per the frequency range.

III. PROPOSED METHOD

The basic method of the proposed EEG-based wireless brain wave system is given as in figure 1. The hardware of the system divided mainly into two major parts: one is a wireless physiological signal acquisition module and another is an embedded signal processing module. So, in our proposed method analyzing the mental activities of brain using EEG signals based on Brain Computer Interface (BCI) technology.

Human brain consists of millions of interconnection between neurons. The electrical activity of neuron changes according to thoughts, work and mental stress etc. Each pattern formation of brain signal given the unique information. If a person is took alcohol, could not take rest properly from last two or more day, or in any other abnormal condition then the attention level of brain signal will get changed than the normal condition suddenly. This project work 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 formats to transmit through Bluetooth medium into processing unit to analyze the attention level of person. The processing unit analyze the threshold level of brain signal and gives the information that person is in drowsy state and not attention to control section. If the drowsy state is detected then vehicle get stop for few minutes and if not attention is detected then stop the vehicle and burg the alarm.

Proposed system consists of following unit:

- Brain Signal Analysis Unit.
- Data processing unit.
- Vehicle unit.
- Self-controlled function techniques.

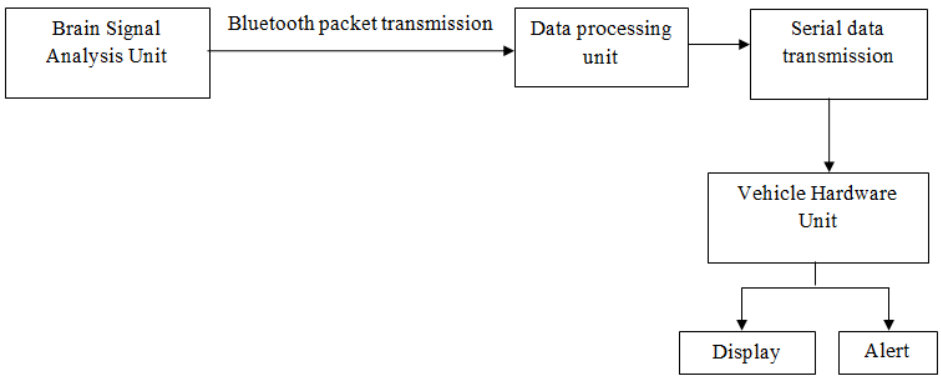

Fig. 1 System architecture.

A. Brain signal analysis:

Here we use brain computer interface technology to collect the brain signal. The brain signal divided as per the frequency range between alpha, beta, gamma and delta. If the drivers are at rest with their eyes closed, alpha waves highly occur on the occipital lobe. Delta waves are very large amplitude, low frequency waves. Frequency range up to 4Hz. They are normally seen during deep sleep in individuals of all ages. Delta waves are also seen in the brains of instants and in awake adults when a tumor, vascular blockages or inflammation has damaged portions of the brain. Alpha waves activity is usually best seen in the posterior regions of the head on both sides, being higher in amplitude on the occipital lobe. Alpha waves appear in the brains of healthy, awake adult who are resting with their eyes closed. Beta waves are the most evident frontally and typical of individuals who are either concentrating on a task, under stress, or in a state of psychological tension. Theta waves are higher in occipital and temporal lobe. These waves may appear

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

transiently during sleep in normal adult but are most often observed in children and in intensely frustrated adults. The presence of theta waves under other circumstances may indicate the presence of a brain disorder, such as a tumor.

Brain waves have been categorized into four basic groups as per frequency range:
-Delta(up to 4Hz),
-Theta(4-8Hz),
-Alpha(8-13Hz),
-Beta (>13Hz).

If subjects are at rest with their eyes closed, alpha waves highly occur on the occipital lobe. Alpha waves emerge with closing of the eyes and with relaxation and attenuate with eyes open or mental exertion. When drowsiness forces the eyes to close, alpha waves are strongest EEG brain signal. Transfer the brain signal in packet format wirelessly to Data Processing Unit.

B. Data processing unit:
In this circuit there are three electrodes are used to measure the EEG signals in which one electrode is fixed with middle of forehead another one electrode acts as reference ground electrode. Electrode 1 and Electrode 2 pick the EEG signal. These signal transfer to data processing unit wirelessly to analyze the eye blink count with threshold value. If eye blink count is greater than threshold then consider the driver is felling drowsy. According this controls the vehicle.

C. Vehicle Unit:
As per the result of data processing unit transfer the instruction for control vehicle by serial transmission. If the EEG signal above the reference signal the display the not attention of driver. And again the same mistake had taken then display the drowsiness detected and alarm is on and vehicle get stop for few second.
Hardware requirements-

- Brain wave sensor
- ARM LPC2148
- LCD Display
- Bluetooth Module
- DC motor

Software Requirements-

- Compiler(KEIL IDE)
- Proteus design
- Programmers (Flash magic)
- MATLAB

IV. RESULT

A. Once the drowsiness detected then this message is displayed on the LCD and trigger the alarm.

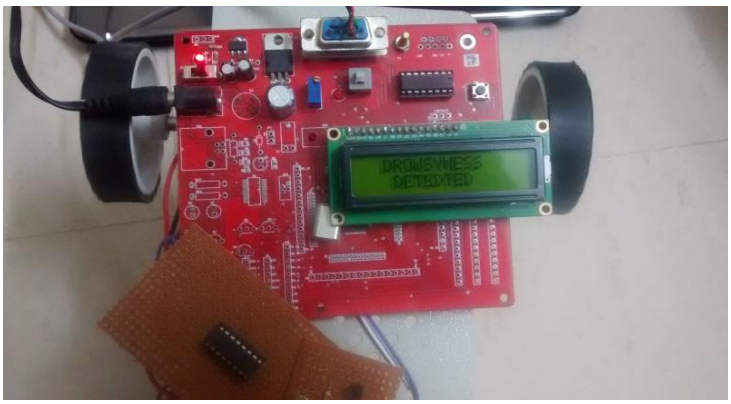

Fig. 2 Drowsiness Detected.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

B. When the again drowsy state detected then this message displayed on the LCD and stop the vehicle.

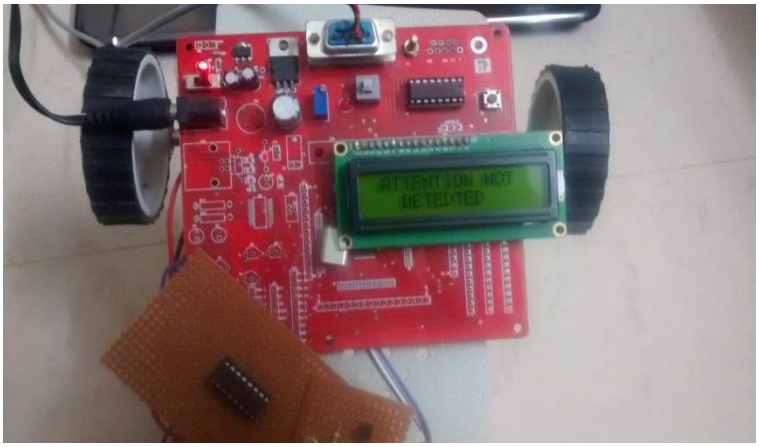

Fig. 3 Attention Not Detected.

V. CONCLUSION

The most practical method to drowsy driving detection is generally known as image processing techniques. Its accuracy and precision is lower than using physiological signal. Because image processing, techniques focus on only eyes movement. The proposed method can complement the vision based system. EEG sensor and wireless signal transmission method proceed with reliability for EEG. Typically, drowsiness is related to eye movement such as eyes open, eyes closed. In this experiment we can detect the drowsiness by eye blink on basis of EEG signal. As a result, the increase of eye blink count with change in alpha wave like normal drowsiness could be identified. If drowsiness detected firstly display the message on LCD to intimate the driver that there is "DROWSINESS DETECTED" and then alert the driver by alarm if again drowsiness detected then display "ATTENTION NOT DETECTED" and stop the vehicle immediately.

ACKNOWLEDGMENT

This work is just not an individual contribution till its completion. I take this opportunity to thank all for bringing it close to the conclusion. First of all, I thank my guide, **Prof. Mrs. M. M. Pawar**. I sincerely thank to Honourable **Dr. B. P. Ronge**, Principal, SVERI's COE, Pandharpur for the encouragement given by him to complete my work. I express my heartiest thanks to my friends and all those who directly or indirectly encouraged me throughout this work.

REFERENCES

[1] "Detection of Drowsiness with eyes open using EEG Based Power Spectrum Analysis", Dajeong Kim, Hyungseob Han, Sangjin Cho and Uipil Chong, 978-1-4673-1773-3/12/$31.00 ©2013 IEEE.
[2] "Design approach of real time drowsiness detection system in vehicular network model", Amruta P Kamdi, Ashish Sambare, V. N. Katkar, Proceedings of IRF International Conference, 13th April-2014, Pune, India, ISBN: 978-93-84209-04-9.
[3] "Brain computer interfacing: Applications and challenges", Sarah N. Abdulkader , Ayman Atia, Mostafa-Sami M. Mostafa, Production and hosting by Elsevier B.V. on behalf of Faculty of Computers and Information, Cairo University, 2015.
[4] "Classification of EEG Signals for Drowsiness Detection in Brain and Computer Interfaceg", Rajendra Kumar, Dr.Samuel Vara Prasada Raju, D. Santhosh Kumar, ISSN 1512-1232, gesj: computer science and telecommunications 2012.
[5] "Drowsiness Detection based on EEG Signal analysis using EMD and trained Neural Network", Rupinder Kaur, Karamjeet Singh, International Journal of Science and Research (IJSR), Volume 2 Issue 10, October 2013.
[6] "EEG Based Drowsiness Detection Using Mobile Device for Intelligent Vehicular System", Prof.Deepa.T.P, Prof.Vandana Reddy, International Journal of Engineering Trends and Technology (IJETT) – Volume 6 Number 1- Dec 2013.
[7] "Drivers Drowsiness Detection in Embedded System", Tianyi Hong, Huabiao Qin, 1-4244-1266-8/07/$25.00 ©2007 IEEE.
[8] "A Real-Time Wireless Brain–Computer Interface System for Drowsiness Detection", Chin-Teng Lin, Fellow, Che-Jui Chang, Bor-Shyh Lin, Shao-Hang Hung, Chih-Feng Chao, and I-Jan Wang, IEEE TRANSACTIONS ON BIOMEDICAL CIRCUITS AND SYSTEMS, VOL. 4, NO. 4, AUGUST 2010.