International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 14 (2015) pp 34951-34953

Continuous Mood Monitoring System (CMMS) for Vehicle Drivers

M. Harikrishnan[1)]
Department of Mechatronics Engineering
SRM University Chennai, India
anxioushari@gmail.com

S. Vasanth [2)]
Department of Mechatronics Engineering
SRM University Chennai, India
mails2gautham@gmail.com

B. Vikas Reddy [3)]
Department of ECE SRM University Chennai, India
vikasreddy1010@gmail.com

P. Sateesh Kumar Reddy [4)]
Department of ECE SRM University Chennai, India
satishreddy99899@gmail.com

Abstract
This Continuous Mood Monitoring System for Vehicle Drivers which is proposed in this paper is basically a system which analyses the driver's brain signals continuously using Electroencephalography (EEG). If any abnormal activities such as sudden increase in blood pressure, hypertension, drowsiness, or if the driver is drunk (alcoholic) is sensed by the system before the driver tries to start the vehicle, the system would respond by simply not letting the vehicle to start. Or, if these activities occur during the drive time, the system would immediately respond by turning on an emergency siren, thereby, alerting the nearby vehicles and the cops.

Keywords - vehicle safety, intelligent systems, brain computer interfacing, automotive intelligent systems, human machine interfacing, interactive control.

1) Introduction

Countless number of road accidents happen each and every day, which are in fact mostly caused by the vehicle drivers due to drink and drive cases and under other unforeseen circumstances like heart attack, drowsiness etc. So, in order to stop these some system is very essential which can take care of emergency situations like those mentioned above and in turn save lives of millions of human beings. This system which is proposed in the form of the Continuous Mood Monitoring System (CMMS) for vehicle drivers would be built on the basis of the Brain Computer Interfacing (BCI), where the system would be receiving brain signals of the drivers continuously and the system would analyse the signals received based on the frequency ranges, starting from safe to danger range. If in case any danger is sensed by the system, the system would immediately respond by just not let the vehicle to start by just turning off the power supply from the battery to the starter solenoid. Or, in the other case if the vehicle is already moving, the system would start the emergency siren on, so that all the other vehicles passing nearby and the cops would be alerted and the vehicle could be taken down immediately.

Some of the other systems which are already present in the market for preventing drink and drive cases are the odour detection systems. Even though these systems prove to be good in alcohol detection, they are not so accurate and they do not provide a wide range of solutions to other types of problems like drowsiness, heart attack which also are major causes for accidents. So this brain computer interfacing through CMMS could provide a wide range of platform as a solution to most of the reasons responsible for causing road accidents. This paper comprises of a detailed study of the possibilities of how well the brain signals can be interfaced with the machine to solve the above problem statement.

This paper is structured in the following way, section 2 would explain about the technology which is used in the project, section 3 about the actual working procedure of the technology used, section 4 is about the actual implementation pattern, section 5 would be the conclusion and future plans.

2) Technology Used: Brain Computer Interfacing

The Brain Computer Interfacing is a process by which an intelligent system or a computer is made to directly interact with the brain. This BCI is often been confused with prosthetics. Even though they achieve the similar tasks, which is to bring human and machine interface close to each other, they are often quite different from one another. The prosthetics are majorly concerned only about the peripheral nervous system whereas the brain computer interfacing is majorly concerned about the central nervous system of the human body which is the brain and the spinal cord. This type of interfacing would enable to take the human machine

relationship to the next level, where the machine would be able to understand the human beings completely. For a start the Electroencephalography (EEG) technique could satisfy the purpose. Using this technique the brain waves are continuously obtained from the brain of the driver and processed further. This BCI is chosen for accomplishing our real time problem because the brain waves obtained through the EEG is very accurate and has a very high precision which can rarely fail.

3) The Electroencephalography

Our brain emits signals constantly, even when we are at sleep. These signals are the major interest for us. Our human brain is actually a home to millions and millions of neurons interconnected with each other. Whenever, we think the brain actually communicates which each and every neuron by transmitting some chemicals called the neurotransmitters and small electrical signals. When these electrical signals are transferred from one neuron to the next they pass through a small gap called the synapse region which is protected by an insulating layer called the myelin sheath. In spite of the presence of this insulating layer, some amount of signals always tend to escape through the synaptic gap which is of major interest to us. Using Electroencephalography technique, these signals are captured using electrodes placed at various spots on the head. These electrodes measures the potential differences between them continuously and these data are further amplified and plotted in a graphic form with respect to time. Thus we obtain the various frequencies of signals waves at different conscious states of our brain.

The different conscious states of our brain according to the frequency of the brain waves obtained are as shown in the following Fig. 1 to Fig. 4.

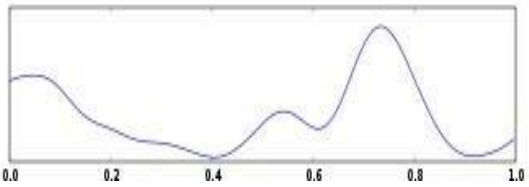

Fig.1. Delta Waves – Frequency less than 4 Hz – Usually obtained during sleep and in case of newly born babies

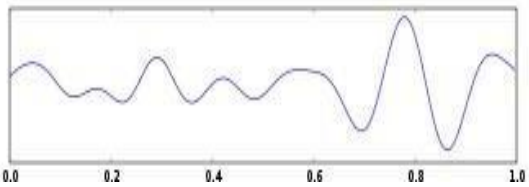

Fig.2. Theta Waves – 4-7 Hz – Usually obtained during state of drowsiness, alcoholic and light sleep

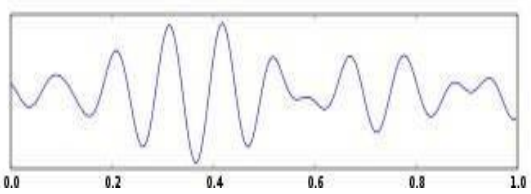

Fig.3. Alpha Waves - 7-14 Hz – Normal state, Relaxed, active and perfect for driving

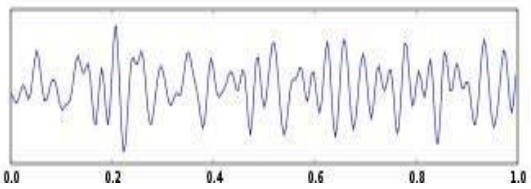

Fig.4. Beta Waves – 16-31 Hz – Hyper active, stressed, high blood pressure and under drug action

These are the four main ranges of interest for us out of which only alpha range of brain signals would be most suitable for driving conditions where an active and relaxed state of mind is required. So, since the system continuously monitors and identifies which range of waves are being emitted by the driver, if in case any other state apart from alpha waves is being recorded it would respond immediately and take the necessary actions.

4) Actual implementation

Since now the idea of the technology being used is made clear the actual implementation of these ideas in a vehicle is as follows. The receptors or the electrodes which will receive the brain signals will be placed on the head rest region of the driver seat and the CMMS turns on as soon as the driver is seated in the driver seat. These receptors would continuously send the received signals to an amplifying device which would be connected to the main processing unit which identifies the signal ranges and takes the necessary steps according the following cases.

Case 1 – When the vehicle is not running and the driver whose state is unstable tries to start the vehicle, the system would simply not let the starter solenoid to be powered which is responsible for starting the vehicle by interrupting the power from the battery to the starter solenoid.

Case 2 – However, when these abnormal brain wave activity is detected when the vehicle is already moving, the system would switch on the emergency siren, which would alert all the nearby vehicles and draw the cops attention.

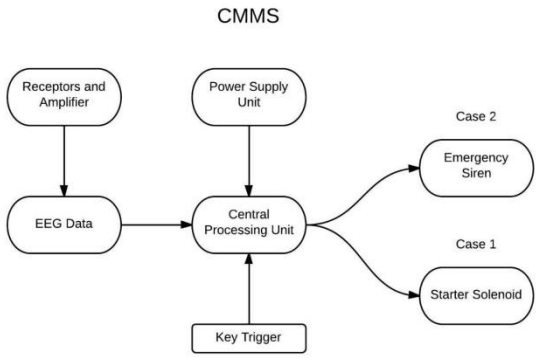

Fig. 5. The basic components structure and direction of control of CMMS is as shown in the diagram above.

5) Conclusion and Future Plans

On the basis of all that has been presented above it can be concluded that this system would be of great help to avoid road accidents by simply not letting them happen. This system would prove considerably better than the other systems available as it has direct contact with the brain and hence the response time would also be fast and accurate. This CMMS for vehicle drivers is just a small application. There are still so many other fascinating things that can be achieved in the future through this intelligent system, where the human errors can be completely avoided and the human machine interaction could be completely moved to the next higher level.

This proposal is just experimental and still has not been tested in the real world. Our further research on this topic would be is to test this idea in the real world and record the results to see how feasible and accurate this system would be in the real world and to propose few modifications to the system to enhance is operational capacity.

6) Reference

[1] B. Blankertz, K.-R. Mu□ller, G. Curio, T. Vaughan, G. Schalk, J. R. Wolpaw, A. Schlo□gl, C. Neuper, G. Pfurtscheller, T. Hinterberger, M. Schroder, and N. Birbaumer, "The BCI competition 2003: Progress and perspectives in detection and discrimination of EEG single trials," IEEE Transactions on Biomedical Engineering, vol. 51, no. 6, pp. 1044-1051, June 2004.

[2] P. R. Kennedy, R. Bakay, M. M. Moore, K. Adams, and J. Goldwaithe, "Direct control of a computer from the human central nervous system," IEEE Transactions on Rehabilitation Engineering, vol. 8, no. 2, pp. 198-202, June 2000.

[3] J. R. Wolpaw, N. Birbaumer, W. J. Heetderks, D. J. McFarland, P. H. Peckham, G. Schalk, E. Donchin, L. A. Quatrano, c. J. Robinson, and T. M. Vaughan, "Brain-computer interface technology: A review of the first international meeting," IEEE Transactions on Rehabilitation Engineering, vol. 8, no. 2, pp. 164-173, June 2000.

[4] J. R. Wolpaw and D. J. McFarland, "Multichannel EEG-based brain-computer communication," Electroencephalography and Clinical Neurophysiology, vol. 90, no. 6, pp. 444449, June 1994.

[5]. R. Wolpaw, N. Birbaumer, D. J. McFarland, G. Pfurtscheller, and T. M. Vaughan, "Braincomputer interfaces for communication and control," Clinical Neurophysiology, vol. 113, no. 6, pp. 767-791, June 2002.

[6] J. R. Wolpaw, D. J. McFarland, and G. W. Neat, "Development of an Electroencephalogrambased Brain-Computer Interface," Annals of Neurology, vol. 28, no. 2, pp. 250-251, August 1990.

[7] E. Donchin, K. M. Spencer, and R. Wijesinghe, "The mental prosthesis: Assessing the speed of a P300-based brain-computer interface," IEEE Transactions on Rehabilitation Engineering, vol. 8, no. 2, pp. 174-179, June 2000.

[8] J. R. Wolpaw, N. Birbaumer, D. J. McFarland, G. Pfurtscheller, and T. M. Vaughan, "Braincomputer interfaces for communication and control", Clin. Neurophysiol., vol. 113, pp.767 -791 2002

[9] T. M. Vaughan, L. A. Miner, D. J. McFarland, and J. R. Wolpaw, "EEG-based communication: Analysis of concurrent EMG activity", Electroencephalogr. Clin. Neurophysiol., vol. 107, pp.428 -433 1998

[10] B. Mensh, J. Werfel, and S. Seung, "BCI Competition 2003&mdash,Data set Ia: Combining gamma-band power with slow cortical potentials to improve single-trial classification of Electroencephalographic Signals", IEEE Trans. Biomed. Eng., vol. 51, pp.1052 -1056 2004