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A Detection of Drowsiness using EEGBased Power Spectrum Analysis

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ABSTRACT

Drowsiness and lack of attention leads to accidents. These accidents can be avoided by monitoring the driver attention level and blinking status. So, in our proposed project work we are analysing the mental activities of the brain using EEG signals from the Brain- Computer Interface (BCI) technology. This methodology consists of BCI which is the interface between the human brain and the level analyser unit. EEG electrode converts the muscular action into electrical signals and which is sensed by a brainwave sensor and wireless device i.e., BLUETOOTH which transmits the raw data to the MATLAB for level analyser unit (LAU) which analyse the entire status of the driver.

Keywords: Brainwave Sensor, Level Analyser Unit, MATLAB, Communication module-Bluetooth, BCI.

I. INTRODUCTION

The accident occurs during the night time is mainly due the lack of attention i,e. drowsiness which reduce the vehicles control from the driver. Many techniques have been introduced to detect the driver drowsiness such as physiological measure, blinking detection from face, image capture from camera, etc., But these analyses has some disadvantage. For that sensor. The sensor generates the signal which is based on our muscle contraction. The muscle contraction has separate electrical signal. These signals are sensed by a brainwave sensor with the help of EEG(electroencephalogram) electrode. The level analyser unit received the data through bluetooth it processed the data through MATLAB.

The study of tracking the driver attention through focus of attention (FOA) during the dual-task condition based on neurophysiological data. They analysis the lane-keeping driving task and a mathematical problem solving task[1]. Nonintrusive drowsiness identification method using eye tracking and image processing through computer vision technology by changes occurs in eyelid closure, maximum closure duration, opening and opening velocity. It provides 86% of accuracy in drowsiness detection [2]. The analysis of eye state and head pose for alert the vechicle's driver, they consume 97.2% from adaboost and adaptive thresholding algorithm, and 96% from CDF(cumulative distributed function) [3]. The laboratory oriented biosensor technology is used predict the attention level of drivers in real time system, they used dry mobile wearable EEG system to monitor the brain activity of driver to alert the driver [4]. The drowsiness detection system of the brain and also the visual activity, blink detection are extracted from EOG(electroculographic) channel and brain activity is obtained from EEG(electroencephalographic) channel and it reaches 80.6% accuracy [5]. The automatic detection of low-vigilance states during a real flight based on automatic detection algorithm which compare epoch-by-epoch by pertinence and prognostic, and change in alpha, beta and theta, it can detect microsleep and involuntary sleep and alert the pilot [6]. The brain signal is used to help the disabled person based on the thought of the person who fixed electrodes and it has alert unit to indicate the obstacle detection [7]. Fundamentals of EEG consist of electrodes record electrical activity from the scalp surface after being collected by metal electrodes and conductive media [8]. The study of another type of brainwave sensor is neurosky brainwave sensor for mass market application which has TGAM module (think gear ASIC module) and its output as EEG frequency spectrums,EEG signal quality,raw EEG,and three sensor meter: attention, meditation, eyebink [9].

The main aim of this project is to reduce the accident due to lack of driver attention. The attention level of the driver can be analysed by brain signal obtained from human brain through brainwave sensor and analysed by level analyser unit.

II. METHODS AND MATERIAL

Design and Implementation

It consist of two main blocks i) transmitter block and ii) receiver block

Transmitter Block

In transmitter block the human brain is taken as an input source. The brain has multiple number of neurons, these neuron action can be expressed in terms of thought and action. Each expression and thought have different electrical signal in the human body. The brain generates biosignal. Biosignals is any signal from a human being that can be estimated and observed. These signals can be obtained with the help of Electroencephalogram. EEG measures the current flows within the neurons of the brain and records the electrical activity along the scalp.

These communications can be done by BCI(brain computer interface)

BCI MODULE:

The major communication module in this project is BCI (Brain computer interface).BCI is the direct communication between the brain and external using thought of the brain (EEG) without using any muscule control. It generally consists of three main element: i) A signal acquistion module (electrode) ii) A signal processing module iii) A control module (microcontroller & driver). It has two types of electrode i.e, invasive (directly connected to brain tissue) and non-invasive (placed on the scalp of the patient). In our work we used non-invasive electrode.

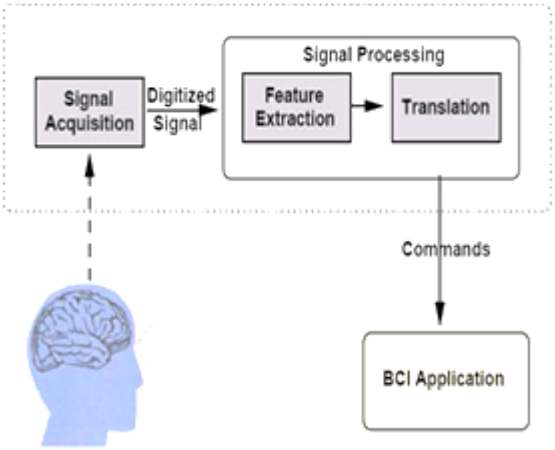

Figure 1: BCI Module

The brainwave has been categorized into four basic groups: Alpha (8-13Hz), Beta (>13 Hz), Theta (4-7Hz), Delta(0.5-4Hz), gamma (>30Hz)waves. Alpha waves are produced when the individual is in a relaxed state and decreasing in amplitude but increasing in frequency. Beta waves are generated when the driver is attentive or alert state, this also has low amplitude. Theta waves are generated when the driver is in sensitive troubles. Delta waves are generated when the individuals are in deep sleep with lesser frequency. Gamma waves are generated at the predominate during the period of times we are thinking.

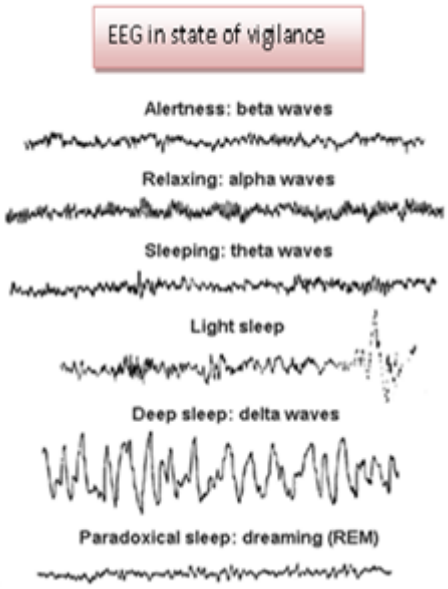

Figure 2: EEG State of Vigilance

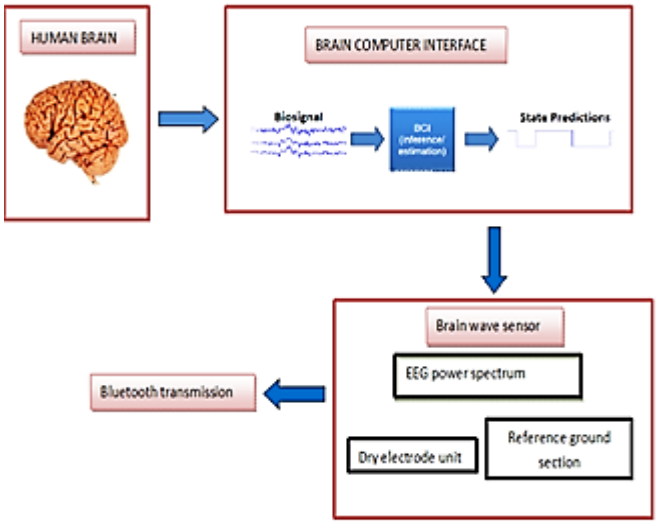

Figure 3 : Transmitter Block

RECEVIER BLOCK

The receiver block consists of Bluetooth reception and level analyser unit (LAU). The raw data should be processed and analysed by using MATLAB platform.

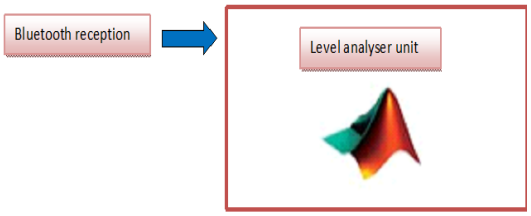

Figure 4 : Receiver Block

III. RESULTS AND DISCUSSION

MATLAB platform is to simulate the brainwave output and generate the output waveform. The coding is written in the program window and run the program,then the output waveform consist of two wave,i.e., one for attention level and another wave for blinking state.The attention level and blinking signal are ploted in the x-axis and time in y-axis. Based on signal strength the status of a driver can be determined. These can helps us to avoid the accident through alert the driver.

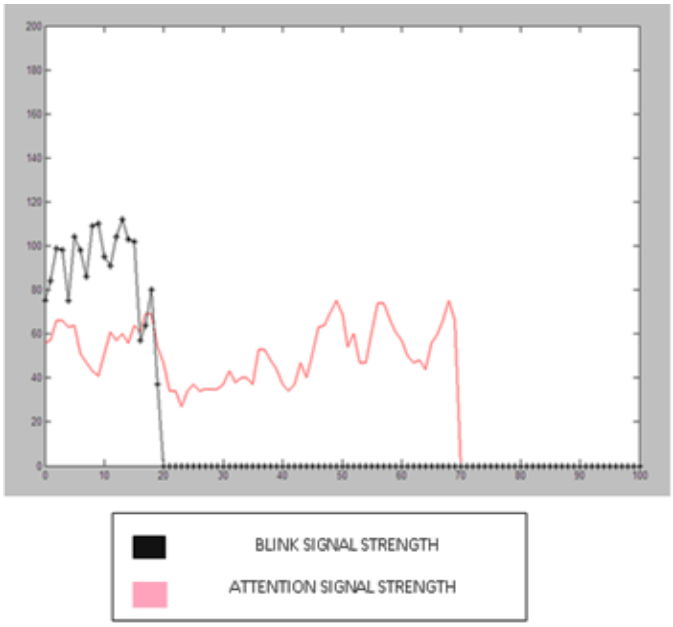

Figure 5: MATLAB Output

IV. CONCLUSION AND FUTURE SCOPE

From this project the attention level and blinking status can be detected, it can detect the driver status based on brain signal and it is mainly useful to avoid accident or to reduce the accident due to lack of attentiveness. In future these explorations can be used to alert the driver when the driver gets distracted and drowsy during its driving and also to control the speed of the car when they are in intense level of wakefulness.

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