

A REAL TIME DROWSINESS DETECTION SYSTEM FOR SAFE DRIVING

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Abstract:

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. The embedded signal processing supports various peripheral interfaces, is used to real-time detect drowsiness and trigger a warning tone to prevent traffic accidents when drowsy state occurs.

KEY WORDS: Drowsiness detection, electroencephalogram (EEG), brain-computer interface (BCI).

I. INTRODUCTION

Drowsiness is transition state between awaking and sleep during which a decrease of vigilance is generally observed. Drowsy driver detection system is one of the potential applications of intelligent vehicle systems[1]. Previous approaches to drowsiness detection primarily make pre-assumptions about the relevant behavior, focusing on blink rate, eye closure, and yawning. The second approach focuses on measuring physiological changes of drivers, such as eye activity measures, heart beat rate, skin electric potential, and electroencephalographic (EEG) activities reported that the eye blink duration and blink rate typically are sensitive to fatigue effects. EEG-based methods for alertness estimates in a compensatory visual tracking task. It also indicated that the EEG-based method can use a shorter moving-averaged window to track second-to-second fluctuations in the subject performance in a visual compensatory task [2].

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window to track second-to-second fluctuations in the subject performance in a visual compensatory task. 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. The embedded signal processing supports various peripheral interfaces, is used to real-time detect drowsiness and trigger a warning tone to prevent traffic accidents when drowsy state occurs.

The EEG based scoring scale was considered a better reference measure and the presumption was that it would result in a well adjusted method. If it is found possible to detect early signs of drowsiness, the method may be transformed to a video based warning system able to detect changes in the eye parameters and warn the driver. In this study, a novel BCI system was developed to monitor the human cognitive state and provide biofeedback to the driver when drowsy state occurs.

II. REVIEW STAGE

An adaptive alertness estimation methodology based on electroencephalogram, power spectrum analysis, independent

component analysis (ICA), and fuzzy neural network (FNNs) models is proposed earlier for continuously monitoring driver's drowsiness level with concurrent changes in the alertness level.

Previous studies have proposed a number of methods to detect drowsiness. They can be categorized into two main approaches. The first approach focuses on physical changes during fatigue, such as the inclination of the driver's head, sagging posture, and decline in gripping force on the steering wheel. The second approach focuses on measuring physiological changes of drivers, such as eye activity measures, heart beat rate, skin electric potential, and electroencephalographic (EEG) activities reported that the eye blink duration and blink rate typically are sensitive to fatigue effects. Previous approaches to drowsiness detection primarily make pre-assumptions about the relevant behavior and drowsy driver detection through facial movement analysis. In other methods a drowsy driver detection system has been developed, using a non-intrusive machine vision based concepts. The system uses a small monochrome security camera that points directly towards the driver's face and monitors the driver's eyes in order to detect fatigue.

Here we use the 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.

III. SYSTEM ARCHITECTURE

The basic scheme of the proposed EEG-based wireless brain wave system is shown in Figure 1. The hardware of this system consists mainly of two major parts: a wireless physiological signal acquisition module and an embedded signal processing module. So, in our proposed project work we are analyzing the mental activities of brain using EEG signals based on Brain- Computer Interface (BCI) technology [4].

The key work of the project is analyzing the brain signals. Human brain consists of millions of interconnected neurons. This neuron pattern will change according to the human thoughts. At each pattern formation unique electric brain signal will form. If a person is took alcohol with abnormal condition then the attention level brain signal will get changed than the normal condition. 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 and transmit through Bluetooth medium in to the level splitter section to check the alcoholic level of the person. Level splitter section (LSS) analyze the level and gives the abnormal driving alert and keeps the vehicle to be in self controlled function until awaken state and sends the information to the control section through

mobile communication . This can save a lot of lives in road transportation.

Existing system:

Physical parameter measurement, Detection possible in eye close state, Image processing techniques, No self control.

Proposed System:

Brain signal analysis, Self controlled function of vehicle
Alcohol detection at eyes open or closed,

Level splitter section

A. Brain signal analysis:

Here we use brain wave stimulator which controls the car by detecting the brain wave signals like alpha waves are one type of brain waves predominantly originate from the occipital lobe during wakeful relaxation with closed eyes. Alpha waves are reduced with open eyes, drowsiness and sleep. Beta wave, or beta rhythm, is the term used to designate the frequency range of human brain activity between 12 and 30 Hz (12 to 30 transitions or cycles per second). Beta waves are split into three sections: High Beta Waves (19 Hz+); Beta Waves (15–18 Hz); and Low Beta Waves (12–15 Hz). Beta states are the states associated with normal waking consciousness. A gamma wave is a pattern of neural oscillation in humans with a frequency between 25 to 100 Hz though 40 Hz is prototypical and according to the drivers brain activity we can control the vehicle. This causes a remedial change in the accident prevention system.

Brain waves have been categorized into four basic groups:

- 1) - *beta* (>13 Hz),
- 2) - *alpha* (8-13 Hz),
- 3) - *theta* (4-8 Hz),
- 4) - *delta* (0.5-4 Hz).

An EEG signal between electrodes placed on the scalp consists of many waves with different characteristics. During normal state of wakefulness with open eyes beta waves are dominant. In relaxation or drowsiness alpha activity rises and if sleep appears power of lower frequency bands increase. The last two stages correspond to deeper sleep, where slow delta waves show higher proportions with slower dominant frequencies responsiveness to stimuli decreases.

Electroencephalography:

Electroencephalography is a medical imaging is the technique that reads scalp electrical activity generated by brain structures. The electroencephalogram (EEG) is defined as electrical activity of an alternating type recorded from the

scalp surface after being picked up by metal electrodes and conductive media.

Due to capability to reflect both the normal and abnormal electrical activity of the brain, EEG has been found to be a very powerful tool in the field of neurology and clinical neurophysiology [7].

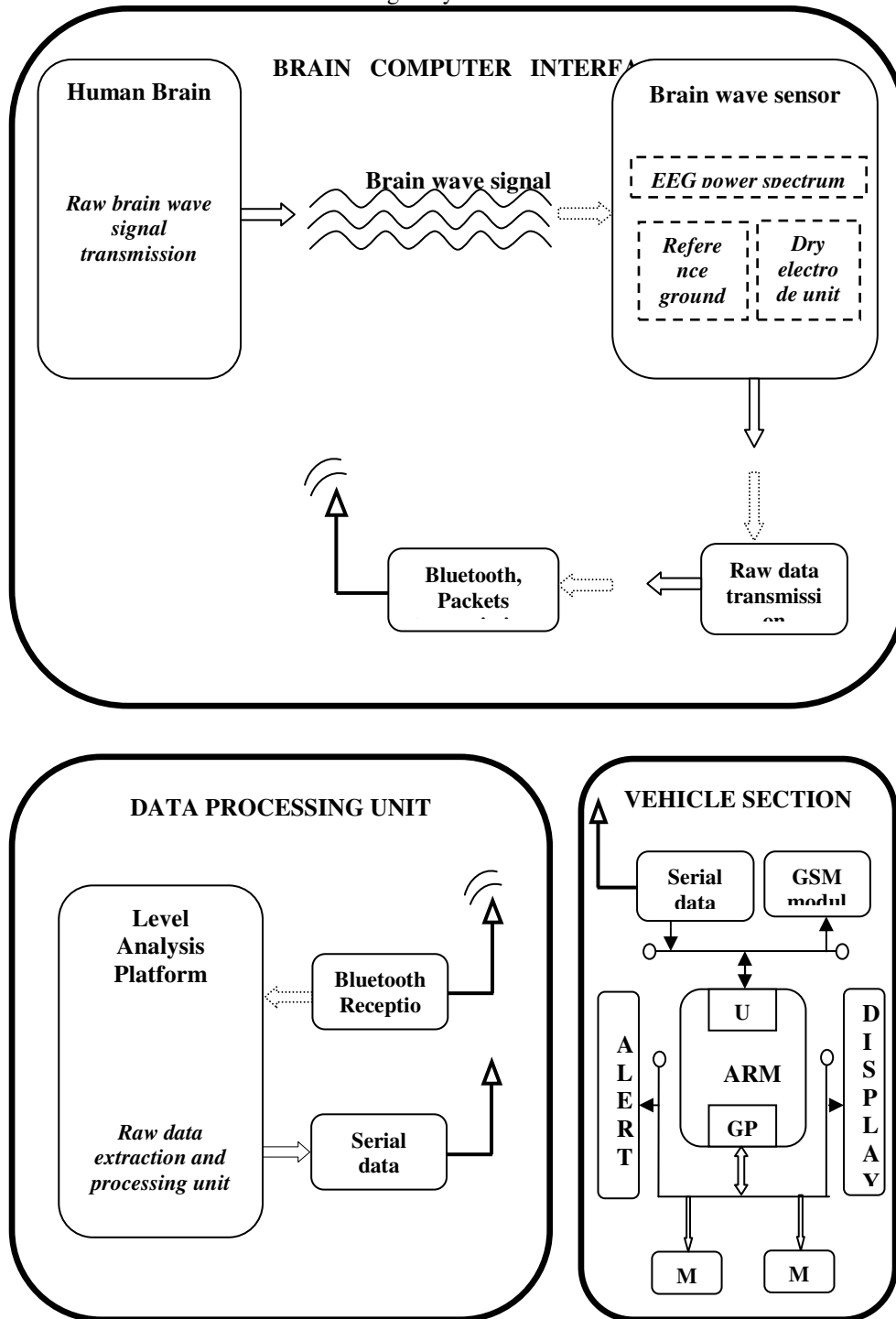
In the second state of model show that the EEG distinguishes three distinct mental states ranging from alert to fatigue.

State 1: Concentration: indicates heightened alertness and is frequently present during the first few minutes of time on task.

State 2: Meditation: indicates normal alertness, often following and lasting longer than State 1.

State 3: Eye Blink: indicates fatigue, usually following State 2, but sometimes alternating with State 1 and State 2.

Fig 1. System Architecture



B. DATA PROCESSING UNIT:

In this circuit there are three electrodes are used to measure the EEG waves in which two electrodes are fixed with left and right side of the head another one electrode acts as reference ground electrode. Electrode 1 and Electrode 2 pick up the EEG waves from the both hands. Then the EEG waves are given to instrumentation amplifier section.

This unit is used to processes EEG signal from EEG sensor. We know that signal from any sensor has low signal to noise ratio. This unit will help amplify and increases SNR.

Hardware requirements

- ❖ Brain wave sensor
- ❖ ARM lpc2148
- ❖ LCD display
- ❖ Zigbee module
- ❖ GSM modem
- ❖ DC motor

Software requirements:

- ❖ Compiler(KEIL IDE)
- ❖ Orcad design
- ❖ Programmers(Flash Magic)
- ❖ Languages: Embedded c

FLOW CHART:

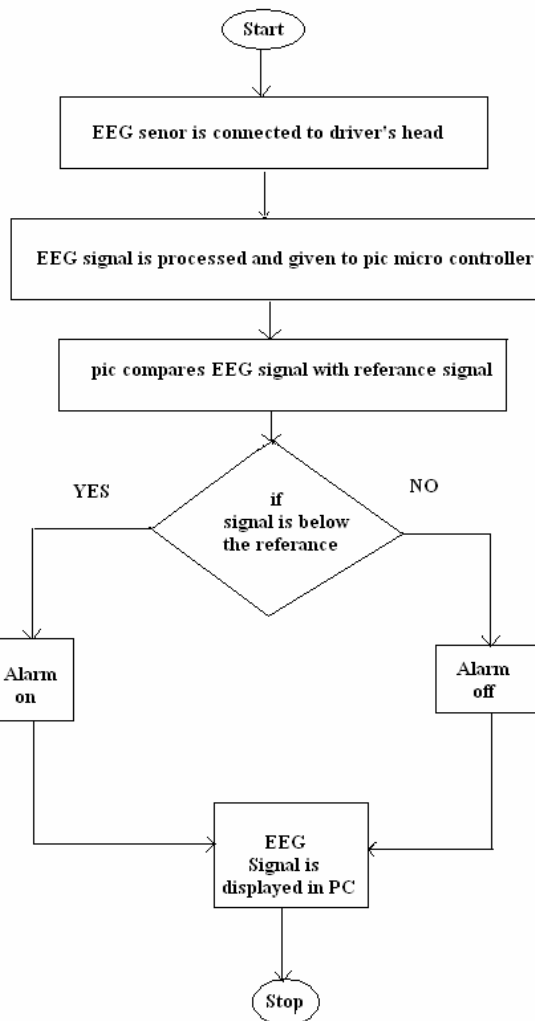


Fig.2: Flowchart

SOFTWARE IMPLEMENTATION:

ALGORITHM:

- Step1: start
- Step2: EEG sensor is connected to drivers head
- Step3: EEG signal is processed and given to PIC microcontroller
- Step4: PIC compares the EEG signal with the reference signal
- Step5: If the signal is below the reference signal ALARAM is ON otherwise it will be in OFF state
- Step6: EEG signal is displayed on the PC
- Step7: stop

CONCLUSION

The primary object of this project is to provide a drowsiness detection system and a method there of that detects the driver's fatigability in time by a processing circuit that processes an EEG (electroencephalogram) signal. In this study, a novel BCI system was developed to monitor the human cognitive state and provide biofeedback to the driver when drowsy state occurs.

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