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EEG-Based Attention Tracking during Distracted Driving

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Abstract - Driving is a skill that requires drivers to direct their full attention to control the cars. Distracted driving might lead to many catastrophic consequences. The operation of automotive electronic devices and mobile devices has been greatly augmented during driving. Some of these technological devices increase safety and reduce the drivers' attention load. However, operating the in-vehicle systems sometimes impairs driver's attention that is taken away from the primary driving tasks. In particular, conversing on the phone while driving is easily distracting, even with hands-free systems. Also drowsiness is becoming a severe issue in case of traffic accidents. Normally, Sleeping can be identified from several factors like eye blink level, yawning, gripping force on the wheel and so on. But all these measuring techniques will check only the physical activities of the human. In some cases, people will mentally sleep with eyes open for a few seconds. This will make very big accidents in driving.

In our proposed project work we are analyzing the mental activities of brain using EEG signals based on Brain- Computer Interface (BCI) technology. Brain-computer interface (BCI), an actively progressing field in brain engineering, refers to a platform that measures the specific intent of the user and issues commands to the computer by using EEG. This kind of interface can be used on various applications.

Keywords-*BCI, vehicle controlling, Brain Signals, EEG.*

I. INTRODUCTION

Recently, driving safely has received increasing attention of the publics due to the growing number of traffic accidents. Drivers' fatigue has been implicated as a causal factor in many accidents because of the marked decline in the drivers' abilities of perception, recognition and vehicle control abilities while sleepy. Although many governments and vehicle manufacturers try to make policies to prevent such accidents including strategies to address rates of speed, alcohol consumption; promotion of using helmets and seat belts, enhancements of vehicle structures, etc. the knowledge and technologies available today are still not yet enough to prevent the catastrophic incidents resulted from loss of alertness and lack of attentions on drivers intrinsically.

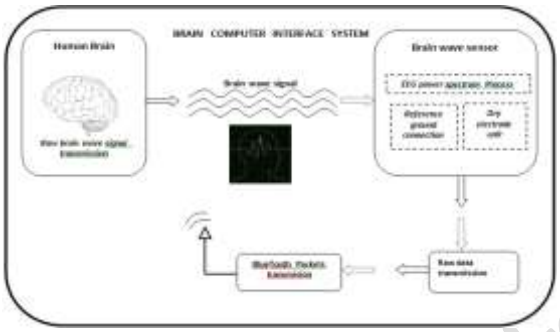
Many factors can cause drowsiness or fatigue in driving including lack of sleep, long driving hours, use of sedating medications, consumption of alcohol, and some driving patterns such as driving at midnight, early morning, midafternoon hours, and especially in a monotonous driving environment. Accurate and nonintrusive real-time monitoring of driver's drowsiness would be highly desirable, particularly if this measure could be further used to predict changes in driver's performance capacity.

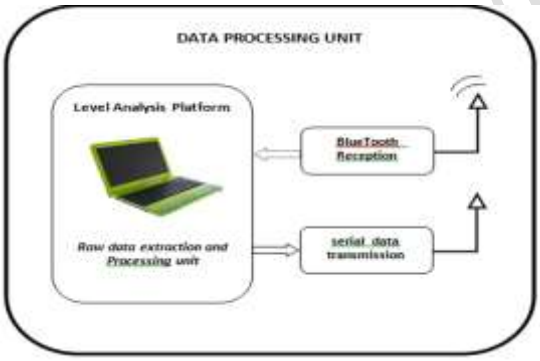
The main aim of this project is to control the device based on electrical signals of brain. The brain-computer interface (BCI), also known as the brain-machine interface (BMI), enables us to interact with computers or machines through the use of electrical signals that occur in the brain after estimate 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 electroencaphalography (EEG) precorded from the scalp. The EEG is measured and sampled while the user imagines different things (for example, moving the left or the right hand). Depending on the BCI, particular preprocessing and feature extraction methods are applied to the EEG sample of certain length. It is then possible to detect the task-specific EEG signals or patterns from the EEG samples with a certain level of accuracy.

Human brain consists of millions of interconnected neurons. This neuron pattern will change according to the human thoughts. At each

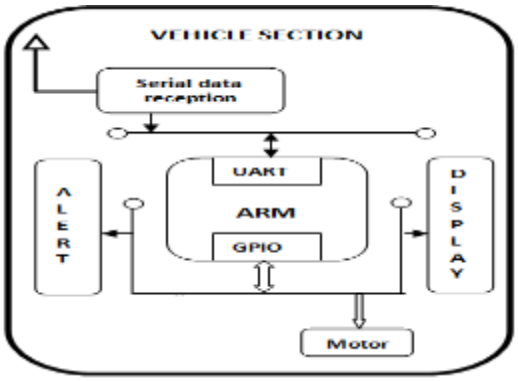
pattern formation unique electric brain signal will form. If a person is mentally sleeping with eyes open then the attention level brain signal will get changed than the normal condition. This project work uses a brain wave sensor which can collect EEG based brain signals of different frequency and amplitude and it will convert these signals into packets and transmit through Bluetooth medium into the level splitter section to check the attention level. Level splitter section (LSS) analyses the level and gives the drowsy driving alert and keeps the vehicle to be in self-controlled function until awakened state. This can save a lot of lives in road transportation.

II. BLOCK DIAGRAM





The Brain wave sensor receives the EEG signals from brain. This signal is given into Bluetooth and converts into Bluetooth packets and sends to the data processing system. The processor i.e. level splitter section analyses the signal. Then that raw data is converted into some meaning full data and transmitted serially to system. The data is received and given to ARM7. According to the signal the 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 state then we stopped the vehicle.



III. PROPOSED SYSTEM

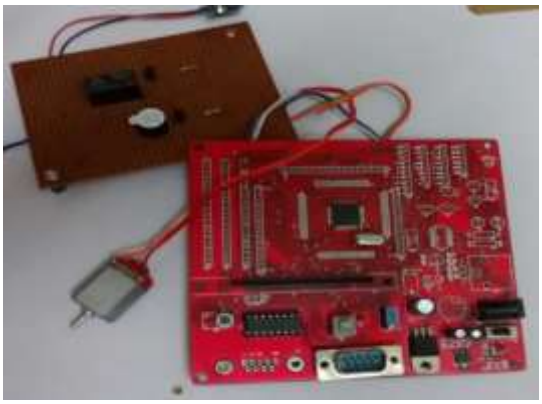
This project work consists of a Processor using ARM7, brain wave sensor and alert unit as hardware parts and an effective brain signal system using Matlab platform. In this project initially the person's attention level or else the driver's drowsy level should be found out by the brain wave sensor. Whenever a person is starting the car, the brain wave sensor unit will calculate the EEG signals and it will compare with EEG signals the levels of human whenever not sleeping. The EEG signals levels will equal the set point then automatically vehicle will move without any problem. In case if the EEG signals levels will cross the set point, then the vehicle will stop and vehicle driver will getting an alert. Most case, we can compare the owner's EEG signals levels with stored EEG signals levels. Now, the owner have to check whether he is drowsy mode or normal mode. If he is a drowsy mode then the vehicle will automatically stop. But if he is normal mode then the vehicle will running and there is no alert. Once the car received EEG signals command it will stop regardless the place. Further, if the owner wants to move the vehicle he has a need to come normal mode. This paper also proposes speed is adjusted according to the regions. This will helps to avoid accidents during in traffic from drowsy mode.

Some benefits are:

- Brain signal analysis
- Self-controlled function of the vehicle
- Drowsiness detection

IV HARDWARE

Brain sensor



Arm 7 Hardware circuit

Hardware section consists of:

i) Brain sensor
ii) Arm7
iii) Buzzer
iv) Motor with relay circuit

To interface brain sensor device with the wearers brain waves.

It includes

- The sensor that touches the forehead
- The contact and reference points located on the ear pad, and
- The onboard chip that process all of the data

Features:

- Uses the TGAM1 module
- Automatic wireless pairing
- Single AAA Battery
- 8-hours battery run time
- Bluetooth v2.1 Class 2 (10 meters range).
- Static Headset ID (headsets have a unique ID for pairing purposes)
- MATLAB, Android and iOS support
- UART Baudrate: 57,600 Baud

Output

- Raw-Brainwaves
- Processing and output of EEG power spectrums (Alpha, Beta, etc.)
- Processing and output of NeuroSky proprietary eSense meter for Attention, Meditation, and other future meters
- EEG/ECG signal quality analysis (can be used to detect poor contact and whether the device is off the head)

V DESIGN AND IMPLEMENTATION

This project uses two important platforms.1.Coding Platform and 2.Execution Platform. These platforms are discussed below

Coding Platform: In this project a brain computer interface system is used which will do the key role in the entire operation. For the BCI system, we are using the MATLAB for brain wave sensor is used. The BCI will process in the following way. For calculating the meditation levels we need to use a brain wave sensor. Initially we have to take the data from the brain by using neurons position and should store in the brain wave sensor. The supportable sensor in the MATLAB is given in the form of the following data function **connectionId1=calllib('Thinkgear','TG_GetNewConnectionId');**

Initially we need to check that sensor is connected or not. The brain wave sensor software will provide the information about the sensor connection. If the sensor is connected we are entering in to the MATLAB section for checking the meditation levels of person. Once the meditation levels will calculate it will be send to MATLAB. Whenever MATLAB reads an meditation values it will convert into digital values because for micro controller understanding purpose the values should be in digital format. After calculating the meditation values, we need to check whether it will cross the set point in the database. Then pre-processing will be done within the meditation levels and the database values which involve

Similarity checks and probability finding. Here similarity checking is nothing but the comparison between two meditation values by calculating the change between the input and data base values. Then the result will be shown on the MATLAB.

Execution Platform:

In this platform vehicle section has been done. When the drowsiness is detected the vehicle is stopped and buzzer is on for some time then back to normal stste. After some delay still drowsiness detected then stopped the vehicle.

VI CONCLUSION

Brain signals reflect the handled activities and controlling behavior of the brain or the influence of the received information from other body parts either sensing or internal organs. Brain Computer Interfacing provides a channeling facility between brain and external equipment. BCI applications have attracted the research community. Several studies have been presented in this paper regarding the growing interest in BCI application fields such as medical, organizational, transportation, games and entertainment, and security and authentication fields. It also demonstrates the various devices used for capturing brain signals.

VII. REFRENCES

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