Tracking of EEG-Based Attention during Distracted Driving

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Abstract— Driving may be a skill that needs drivers to direct their full attention to regulate the cars. Distracted driving might cause many catastrophic consequences. The operation of automotive electronic devices and mobile devices has been greatly augmented during driving. A number of these technological devices increase safety and reduce the drivers' attention load. However, operating the in-vehicle systems sometimes impairs driver's attention that's removed from the first driving tasks. Especially, conversing on the phone while driving is definitely distracting, even with hands-free systems. Also drowsiness is becoming a severe issue just in case of traffic accidents. Normally, Sleeping are often identified from several factors like eye blink level, yawning, gripping force on the wheel then on. But of these measuring techniques will check only the physical activities of the human. In some cases, people will mentally sleep with eyes open for a couple of seconds. This may make very big accidents in driving. In our proposed project work we are analyzing the mental activities of brain using EEG signals supported Brain- Computer Interface (BCI) technology. Brain-computer interface (BCI), an actively progressing field in brain engineering, refers to a platform that measures the precise intent of the user and issues commands to the computer by using EEG. This type of interface are often used on various applications.

Keywords: BCI, vehicle controlling, Brain Signals, EEG

I. INTRODUCTION

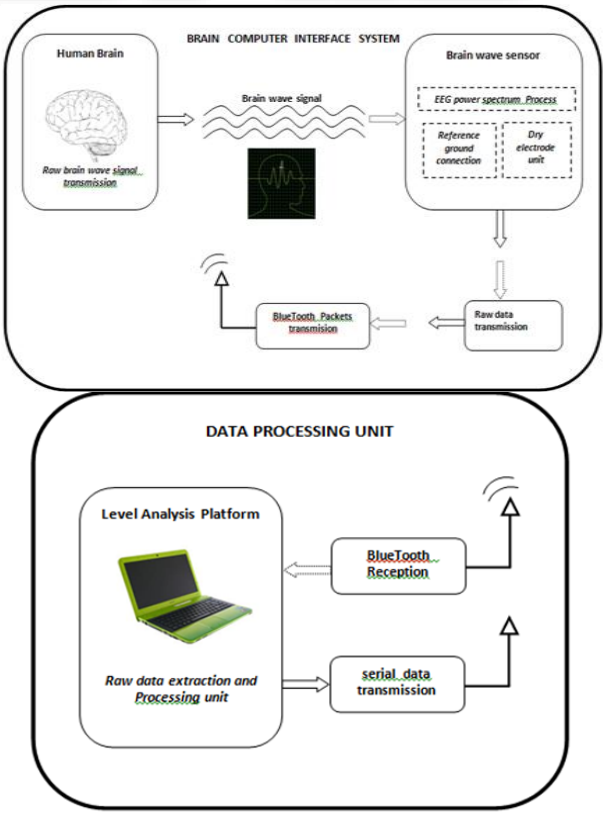
Recently, driving safely has received increasing attention of the publics due to the growing number of traffic accidents. Drivers' fatigue has been implicated as a causal factor in many accidents because of the marked decline in the drivers' abilities of perception, recognition and vehicle control abilities 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 motive drowsiness or fatigue in driving including lack of sleep, long riding hours, use of sedating medications, intake of alcohol, and a few riding patterns such as riding at midnight, early morning, midafternoon hours, and specially in a boring driving environment. Accurate and nonintrusive real-time monitoring of driver's drowsiness would be particularly desirable, especially if this measure should be in addition used to predict adjustments in driver's performance capacity.

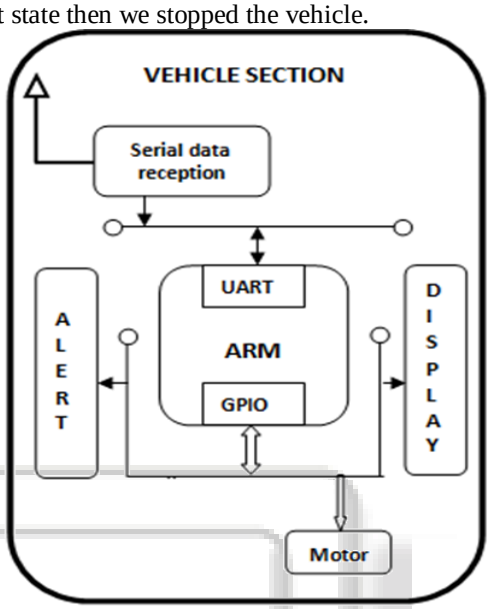
The principal purpose of this assignment is to control the tool based on electrical indicators of brain. The mind-laptop interface (BCI), also called the brain-gadget interface (BMI), permits us to interact with computers or machines through using electrical signals that occur inside the brain after estimate a person's intention. BCI may be a conversation system, which allows the person to control unique packages by using best his or her thoughts. Different research agencies have tested and used special techniques to realize this. Most of them are supported electroencephalography (EEG) recorded from the scalp. The EEG is measured and sampled at an equivalent time because the user imagines unique things (for example, shifting the left or the right hand). Depending at the BCI, specific preprocessing and performance extraction techniques are implemented to the EEG sample of sure length. It's then possible to find the task-particular EEG alerts or patterns from the EEG samples with a sure degree of accuracy.

Human brain consists of many interconnected neurons. This neuron pattern will change consistent with the human thoughts. At each pattern formation unique electric brain signal will form. If an individual is mentally sleeping with eyes open then the eye level brain signal will get changed than the traditional condition. This project work uses a brain wave sensor which may collect EEG based brain signals of various frequency and amplitude and it'll convert these signals into packets and transmit through Bluetooth medium into the extent splitter section to see the eye level. Level splitter section (LSS) analyses the extent and provides the drowsy driving alert and keeps the vehicle to be in self-controlled function until awakened state. This will save tons 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

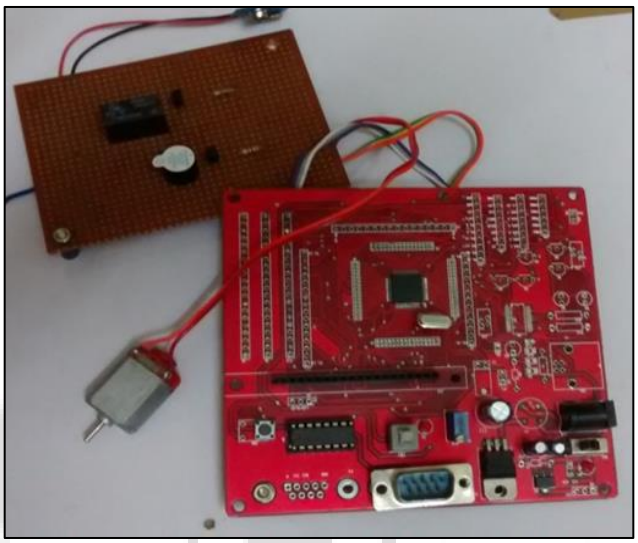
This project work consists of a Processor using ARM7, brain wave sensor and alert unit as hardware parts and an effective brain signal system using Matlab platform. In this project initially the person's attention level or else the driver's drowsy level should be found out by the brain wave sensor. Whenever 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 consist of:

1) Brain sensor
2) Arm7
3) Buzzer
4) 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 on-board chip that process all of the data

A. 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

B. 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

A. Coding Platform:

In this project a brain computer interface system is employed which can do the key role within the entire operation. For the BCI system, we are using the MATLAB for brain wave sensor is employed. The BCI will process within the following way. For calculating the meditation levels we'd like to use a brain wave sensor. Initially we've to require the info from the brain by using neurons position and will store within 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'd like to see that sensor is connected or not. The brain wave sensor software will provide the knowledge 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'll be send to MATLAB. Whenever MATLAB reads a meditation values it'll convert into digital values because for micro controller understanding purpose the values should be in digital format. After calculating the meditation values, we'd like to see whether it'll cross the point within the database. Then pre-processing are going to be done within the meditation levels and therefore 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 are going to be shown on the MATLAB.

B. 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 state. 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 are presented during this paper regarding the growing interest in BCI application fields like medical, organizational, transportation, games and entertainment, and security and authentication fields. It also demonstrates the varied devices used for capturing brain signals.

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