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The Survival of Intellectual Disabled Subjects in Social Environment Using BCI

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***Abstract*—The BCI (Brain Computer Interface) systems are used for the damaged people (i.e., subject in our project) who were not able to interact with the computer according to their brain signals. The BCI can convert the brain signal into digital form. The BCI is widely used in various fields such as education, industries, video games and medical appliances, etc. In this paper, the EEG based brain controlled Robot and home appliances using IOT was developed using BCI. Here, the Neurosky technology is used in BCI. Here, the Neurosky technology is used in BCI. The e-sense algorithm is used to characterize the mental states. And also with the help of think gear technology which is used in our headset can be able to extract the subject's brain signal by eliminating the artifacts. The extracted brain signal is transmitted to the Arduino microcontroller using HC-05 Bluetooth module. Here the robotic module consists of Arduino microcontroller coupled with DC motor for controlling the entire system. The combination of BCI system in the brain controlled Robot by using the recommended technologies, the paralysed people can able to control their home appliances without any difficulties.**

Keywords—BCI – Brain Computer Interface, IOT – Internet of Things, EEG – Electroencephalogram

I. INTRODUCTION

Nowadays, the humans can able to interact with the computer according to their thoughts. Some of the sensors are used to obtain the brain signals. The researchers have been developed the BCI system for those people who were not able to do things by their own. This system has the direct communication between the computer and subject's brain waves. The BCI system can be helpful for the normal people and also for the subjects. The subjects can easily address their wheel chairs and can control robot for home appliances and incase of normal people, they can able to improve their efficiency and in high throughput tasks.

As there were various non- invasive techniques, the Electroencephalography (EEG) is considered as the best technique for measuring the electrophysiological signals of the brain. This can be used in BCI systems for the real time interactions of the brain and can get the exact results. The brain signals can be acquired with the help of some sensors and electrodes. The acquired signals can be varied according to the amplitude and frequency, it is monitored in the computer by the form of voltage or digital values. The EEG signals have been classified into alpha, beta, and theta, and delta, gamma as per their amplitude, frequency and shape of the brain waves. By the classified forms of the brain signals, it can be used to diagnose brain death, coma, sleep disorders, epilepsy, stroke, etc.

II. RELATED WORK

The Brain-Computer Interface (BCIs) provides good scope for the abnormal individuals. The different BCI framework and applications have been created with various time traverse manner is examined. The spatial samples are mostly used for calculating the EEG signal Classification by Stationary Matrix Logistic Regression. The Spatial samples will display the discriminative spatial projection with the belt control of signals. In this project, the calculation of LDA and the feature extraction and classifying of the various activities of brain signals will done. The dissimilarity based signal for basic spatial examples are calculated. The difference of the normal and abnormal signals helps to find the distinctive unchangeability and utilizing points of interest from different substances.

Bayesian learning for spatial sifting in Brain Computer Interface based electroencephalography (EEG). In any case, there is no settled speculation for spatial sifting that straightforwardly connects to Bayes classification. In order to intimate this issue for spatial sifting. The stationary standard spatial patters for brain PC interfacing. This strategy is suitable to Brain signals utilizing EEG as well as to display the inventive standard of BCI. In iterative spatio-unearthly examples learning (ISSPL), to accomplish proficient execution the channels and classifier are at the same time parameterized.

III. ADVANTAGES OF PROPOSED SYSTEM

Advantages of the EEG grouping in BCI frameworks are below:

- Sparing, Portable, low cost.
- Empower broken individuals to control prosthetic appendages with their brain.
- Allowing the deaf person to hear, by transmitting the required information to their psyche.
- Allow gamers (particularly broken individuals) to control computer games with their arms
- Empower harmed individuals to control a wheelchair
- Enables a man to screen the home apparatuses utilizing IOT
- Enables a stupid individual to have their line of intuition showed and talked by a PC.

IV. SYSTEM REQUIREMENTS

A. *Hardware requirements*

- Arduino Microcontroller
- EEG Sensor
- HC-05 Bluetooth Module
- USB Cable for Arduino
- Breadboard
- Jumper wires
- Monitor
- Robotic chassis

- Wheels
- Battery
- DC Motors
- Relay
- Light

B. Software requirements

- Embedded C
- Arduino 1.8.1
- Flash magic burner software

V. PROPOSED METHODOLOGY

The proposed Single-Trail EEG Classification in BCI consists of two modules:

A. *Signal Acquisition*

For the increase framework, the most important technique is measuring EEG. The EEG signals utilizes electrodes placed on the scalp to record the EEG signals. Advance techniques required for massive instrumentation are expensive and also intrusive.

The different phases of this module are:

1) Brain waves

In this framework, the Mindwave Mobile headset by NeuroSky is used to acquire EEG signals, shown in Fig. 1. The eSense technology can able to receive and transmit the acquired signals using Bluetooth i.e. HC 05 Bluetooth module at the rate of 1Hz.

Fig. 1. Brain Wave Head Set

The examples and frequencies of electrical signals can be measured by placing the electrodes on the scalp.

2) Think gear

ThinkGear is the technology inside the NeuroSky enables a gadget to coordinate with the subject's brainwaves. It comprises of the sensor which touches the eyebrow of the subject, the reference of the electrode placed on the ear.

3) eSense meter

For each unique sort of eSense, i.e., the Attention and Meditation meter are considered on eSense separate size of 1 to 100. An incentive crosswise over 40 to 60 at any given minute in time is viewed as "impartial" and is comparable in thought to "baselines. An incentive crosswise over 60 to 80 is considered "marginally lifted", and might be translated as levels of eSense esteems might be higher than typical for a given individual. Qualities crosswise over 80 to 100 are viewed as "lifted", meaning they are emphatically expressive of uplifted levels of that eSense. And also, on the flip side, an incentive crosswise over 20 to 40 specifies "decreased" levels of the eSense, while an incentive crosswise over 1 to 20 designates "unequivocally brought down" levels of the eSense.

4) Attention eSense

The eSense Attention meter determines the quality of a subject's level of mental "consideration" or "center", which happens mental movement. The attention meter ranges from 0 to 100. Absence of focus, Distractions, or uneasiness may diminish the Attention meter level.

5) Meditation eSense

The eSense Meditation meter indicates the subject's level of mental states. The estimate ranges from 0 to 100. The recording of Meditation eSense meter of a man's mental states, not physical states. Contemplation is related to diminish action by the dynamic mental procedures in the mind. It has been noticed that the eyes movements were expanding the Meditation meter level. Diversions, uneasiness may bring down the Meditation meter levels.

6) HC-05 Bluetooth

This Bluetooth module explains about the signal that consequently matches with the headset. It has a serial port profile, and it is a class-2 Bluetooth module, which can design either as a Master or slave. It is customized with the MAC address and password of the brainwave portable headset. The electrical signals got by the HC-05 module are then transmitted to an Arduino microcontroller.

7) Arduino

The Arduino is a microcontroller board with open-source. It is designed by composing programming to it, fusing an ARM processor. It has 14 computerized data sources, a 16 MHz quartz precious stone, a USB association, 6 simple information sources, a reset catch, an ICSP header and a power jack. It holds everything required supporting the microcontroller, and it also associates with a PC with a USB or battery to begin or controls with an AC to DC connector. Arduino sheets are permitted to peruse information sources, and it is additionally used to twitter message, enacting an engine, turning on a LED, and figure on a catch and light on a sensor. In this project, the Arduino microcontroller is used to gather and examine the electrical brain signals from the sensor to be used in actual-time or stored for future analysis. On the HC-05 Bluetooth module press and hold the push catch for few moments while fueling on the Arduino. Once both the gadgets are controlled on free the handle. On the HC-05 module, the LED should squint at low flip (flicker gradually) indicating that the instrument is in Data Mode in the event that it squints everywhere flip (streak quicker) at that point shut down the gadget and attempt once more.

B. BCI Application

The BCI Application which is used in the project is Robotic Chassis and for controlling the home appliances using IOT. The system consists of an Arduino microcontroller for controlling the movement and direction of the Robotic Chassis and for controlling the home appliances with respect to the command received from the signal processing unit. Brainwave mobile handset output i.e. attentions eSense meter values are given as input to robotic chassis module which consists of Dc Motors when attention value reaches above 70 then the robotic will moves in a Forward direction to ten feet and will come back to the

starting point. Likewise, if attention value reaches below 30, then the buzzer will turn on indicating that attention value is little. Meditations meter values are used to control the home appliances using IOT, if value reaches above 70 then automatically lights will turn off, and fan will turn on. Similarly, if value reaches below 30 then automatically lights will turn on, and fan will turn off. Using the URL which generated anyone can also see the status of the home appliances and they can also turn on/off the home appliances using the internet.

VI . SYSTEM BLOCK DIAGRAM

Brain Computer Interface (BCI) is to establish a control channel between subject's aims that is human cerebrum and PC. Two unique applications are utilized to exhibit the venture. One is Robotic Arm, and another is controlling the home apparatuses utilizing IOT. Such a framework can enable two sorts of individuals, first individuals who have to harm in their physical framework to recoup their exercises with a wheelchair, or control over a neuroprosthesis of a robot. Second, for solid individuals, it could be an extra man machine interface, which can expand the profitability and the effectiveness in high-throughput effects.

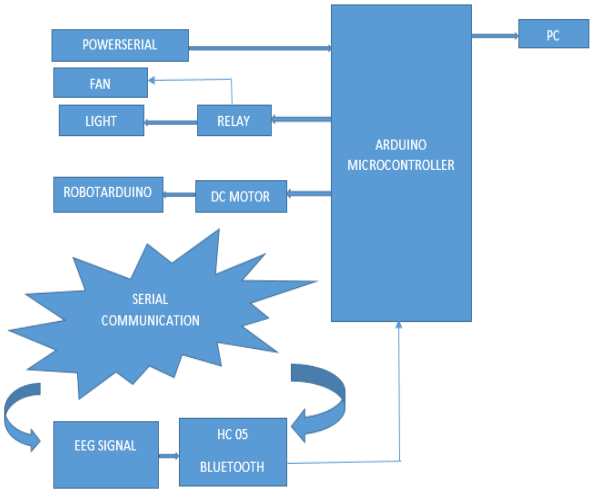

Fig. 2. System Block Diagram

The signals from the brain are acquired using headband computerized on the PC and afterward it is dumped into Arduino microcontroller. The microcontroller thusly associated with automated case and the home machines. Consideration esteems are utilized to work the mechanical edge, and contemplation esteems are utilized to control home machines.

VII . DESIGN FLOW

A flowchart is concerned with a graphic representation of a logic sequence, manufacturing process or work, similar formalized structure, or organization chart. The reason for using this flow chart is to furnish people with a common reference point or language when trading with a project.

The graph Fig.1 demonstrates the home machines is controlled over the web utilizing contemplation signals from the human cerebrum. The initial step is to introduce the Neurosky versatile handset and afterward acquire the EEG reflection signals. The flag esteems extend from 0 to 100. At first, the count will be kept up, if contemplation signals are more prominent than 70 then the number will be zero, if values are more than 70 at the same time for three times then the check will progress toward becoming 2, at that point the home apparatuses i.e. lights will turn off, and fan will turn on naturally. The methodology, catch the reflections flags all the while for three times. At first, the count will be kept up, if contemplation signals are below 30 then the number will wind up noticeably zero if values progress toward becoming underneath 30 at the same time for three times at that point tally will move toward becoming 2, at that point the home machines i.e. lights will turn on, and fan will be turned off naturally. The home apparatuses can likewise be controlled by anybody by opening a URL which is created while executing the program and the status of the machines can likewise be seen by anybody by opening the URL.

The below stream outline demonstrates how mechanical is controlled utilizing consideration signals from the human cerebrum. It fills in as take after; the initial step is to instate the Neurosky versatile handset and after that catch the EEG consideration signals. The flag esteems extend from 0 to 100. At first, atten count will be kept up, if consideration signals esteems are more noteworthy than 70 then the check will wind up noticeably zero if values end up noticeably more prominent than 70 at the same time for three times at that point tally will move toward becoming 2, at that point the automated will begins moving the forward way for ten feet's and will return to beginning stage.

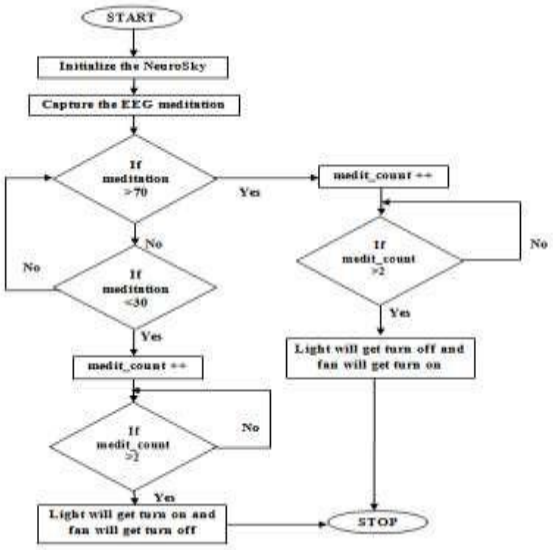

Fig.3. Flow Chart of the Project

If not rehash the system, catch the consideration flags all the while for three times. At first, atten_count will be kept up, if consideration signals are beneath 30 then the tally will end up plainly zero if values move toward becoming underneath 30 all the while for three times at that point check will move toward becoming 2, at that point the ringer will turn on.

VIII . IMPLEMENTATION

Algorithm for the implemented modules

A. Signal Acquisition Module

eSense algorithm eSense is a NeuroSky's quick fix algorithm for distinguishing mental states. To compute eSense, the NeuroSkyThinkGear technology fleshes out the

raw brainwave signal and removes the noise and muscle movement. The eSense algorithm is then applied to the remaining signal, result will be in the sense meter values.

Algorithm 1:

Input: Brain signals.

Output: eSense meter values.

Step1: Microprocessor Setup

Step2: Begin Serialization at Baudrate at 57600

Step3: print "BRAIN wave programming" while serial available do

Step4: Read serial data and echo the same byte out the USB serial.

Step5: Look for sync bytes:

If ReadOneByte () = 170 then payloadLength= ReadOneByte () if payloadLength> 169 then return for each i=0; i<payloadLength; do Read payload into memory: payloadData[i] = ReadOneByte () generated Checksum += payloadData [i] end

Step6: If user is not wearing the device do: Print poorQuality = 200; attention = 0; meditation = 0;

Step7: If user is wearing the device to parse the payload for poor-quality of attention and meditation.

Algorithm 2:

Step1:BTSerial RX pin is 0, TX pin is 1

Step2: pin Mode 9 as output pin

Step3: Begin Serialization at 57600

Step4: Keep reading from HC-05 and send to Arduino Serial Monitor

If Serialization is available do Serial. Write(BTSerial.read())

Step5: Keep reading from Arduino Serial Monitor and send to HC-05

If Serialization is available do BTSerial.write (Serial.read ())

B. BCI Application Robotic Chassis

A DC engine is a piece ofa class of rotational electrical machines that changes over electrical signals into mechanical signals. The every single normal signals created by attractive fields. A wide range of DC engines have some inside machine to consistently modify the course of current stream in the engine which is either electronic or electromechanical. A DC engine's speed can be overseen by utilizing either by changing the quality of the current in its field windings or a variable supply voltage or. DC engines are utilized as a part of different machines, toys.

Algorithm 3:

Input: eSense meter values

Output: Robotic chassis will start moving forward, reverse, and stop.

Step1: setup pinMode 8, 9, 10, 11 as output

Step2: To move robot in Forward motion: digital Write (8, HIGH); (9, LOW); (10, HIGH); (11, LOW);

Step3: To move robot in Reverse motion: digital Write (9, HIGH); (8, LOW); (11, HIGH); (10, LOW);

Step4: To stop the robot:

Digital Write (8, LOW); (9, LOW); (10, LOW) ;(11, LOW);

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