Home Automation using Brain Computer Interface for the Physically Challenged

Sarada Devi Yaddanapudi, K Sneha, S Sai Kamal Teja

Abstract: ***A Brain-Computer Interface (BCI)is labeledas Mind-Machine Interface (MMI) or a Brain-Machine Interface (BMI). It affords a non-muscular channel of messagein between the computer and a human brain. Using the enhancements in interface equipment to electronics,and the necessity to helpindividuals suffering from disabilities, a new area in this study has begun by acceptingtasks of brain. The Electro-Encephalogram (EEG) is an electrical activity created by brain structures and verified from the scalp using electrodes. The EEG signal is used in actualspell to accomplishperipheral devices using a broad BCI system. The post-processed output signals are converted to suitable instructions to regulate output devices. The main seek is to aidparalyzed and physically immobilizedpersons to govern the home appliances making use of Electro-Encephalogram (EEG) signals, such that they grow to beautonomous. According to the brain responsiveness the devices can be designated then usingrelays, the switching of the home-basedmachinescan be completedconsequently.***

Keywords* : *Physically Challenged, Home Automation, Brain Computer Interface, EEG.

I. INTRODUCTION

The BCI can help people with strict motor disability1, sustaining bio feedback working fromlong-suffering from the brain stroke,Epilepsy2 or Attentional Deficit Hyperactivity Disorder. Based on brain action, thesedevicestrace the variations in electrical potential, magnetic field and metabolic supply of ions causedfrom the excitation and inhabitation of neural networks

Shared devices that control features of the residence are included in CleverHouseholds.Competentintegration of this system can be achieved with available technologies. To meet the necessityof smart homes, this thought may be applied in various protocols. Tohelp the person to control the devices by using thoughts this Brain-Computer Interface technique is an innovative system. This methodworks taking into consideration EEG signals which are measured from the scalp. Various arrangements of neural interaction are the outcome of different brain states. These pattern lead to the signals and theses areregarded asnumerous amplitude and frequency principles. The most calculated non- invasive interface is EEG. Every assumption or impression, have their private pattern. These patterns are generated by muscle tighteningof eye blink and these can be noticed by brain wave sensor. By using the Bluetooth as a mediuma brain wave sensor then conveys the data. The data packets are received by Level Analyzer Unit and are processed using MATLAB.

II. BRAIN COMPUTER INTERFACE

BCI it gives acommunication between human neural system and machines. This helps people to get interconnected and to control devices by simple thoughts.

BLOCK DIAGRAM OF BCI:

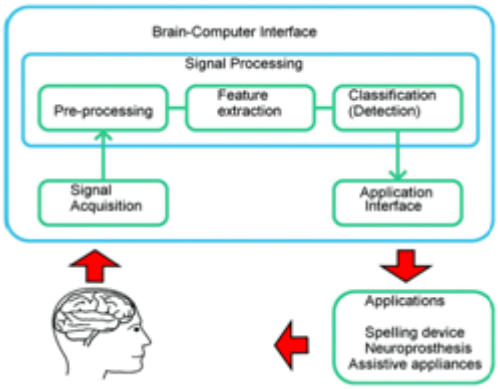

Fig 1: Block diagram of Brain Computer Interface (BCI)

Various stages ofBCI:

The major stages of BCIare:

1. DataAcquisition
2. Signal Processing &Classification
3. Computer Interface
4. Application

EEG and itscomponents:

An electroencephalogram is thegauge of a brain's voltage variations as obtained from electrodes placed on the scalp. It is an estimate of the cumulative electrical activity of neurons. Electro-Encephalographyis the most calculatedpossible non-invasive interface,because of its acceptabletime-baseddetermination, simplicity of usage, transportability and littlearrangementcharge. The acquired EEG signal consists of various components dependent on subject's state.

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A. *Delta:*

It has a range of 0.5-3.5 Hz. Ithas the highest amplitude and the slowest signals. It can beperceived in adults and babies.

B. *Theta:*

It has a range of 3.5 to 7.5 Hz. Theta is related to incompetence and inattentiveness.

C. *Alpha:*

It has a range of 7.5 to 12 Hz.It is brought out by rest by closing the eyes .

Beta: It has a range of 12 Hz to about 30 Hz.

D. *Gamma:*

It has a range of31 Hz andabove. It givesthe tool ofPerception.

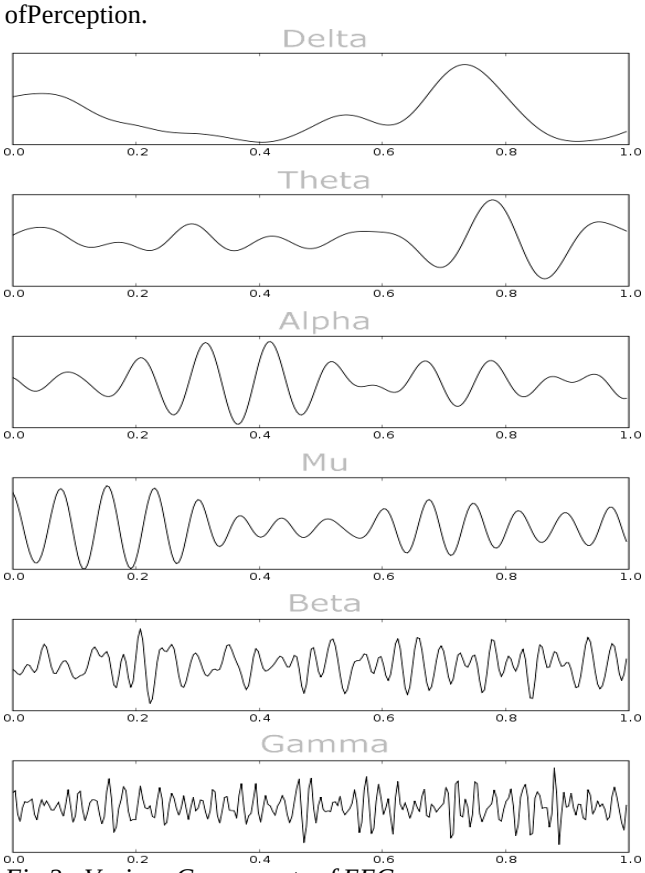

Fig 2 : Various Components of EEG

Working of BrainSensor:

Brain-sense deals with brainwaves and interprets it into evocative data to help to make the most of cognitive performance. The Brain-sense can measure, trail and helpto recover Attention, Focus, Meditation, Eye blink, and reduce Stress levels.

Fig 3 : Brain sense brainwave Sensor

ARDUINO CODE

Arduino code holds various sections like reading of data from established Bluetooth packet, examiningattention and meditation levels and if they are above certain intensities it generates a proper signal to switch home appliances.

- Defining various parameters and initializing them with appropriate values

```
#define BAUDRATE 57600

byte pld[32] = {0};
byte Meditate[5]={0};
byte cs=0;
byte gcs=0;
int  Pl,Temp;
int  Med_Avg=0,On_Flag=1,Off_Flag=0;
int  k=0,m=8,light=9,LED=13;
signed int  j=0;
```

- It's the main task which contains the code that is used to generate checksum and compare it with that of transferred sequence and accurate the errors that arose during transmission and also generate proper signals to control home appliances based on attention levels attained.

```
void loop()
{
//Serial.print(ReadOneByte(),HEX);
while (1)
{
   if(ReadOneByte() == 170)
  {
if(ReadOneByte() == 170)
{
Pl = ReadOneByte();
if(Pl == 32)   // Big Packet
{
  gcs = 0;
for(int i = 0; i < Pl; i++)
{
pld[i]     = ReadOneByte();
gcs  += pld[i] ;
}
  gcs = 255 - gcs;
cs  = ReadOneByte();

   if(cs == gcs)
  {
   if (pld[30]==5)
 {
  if (j<4)
    {
 Medite [k] = payloadData[31];
    Temp += Meditate[k];

    Serial.print("  Meditate: ");
Serial.println(Meditate[k], DEC);
  j++;
  }
else
{
```

```
 Med_Avg = Temp/4;
Serial.print("  Med Avg : ");
Serial.println(Med_Avg, DEC);
if (Med_Avg>50 && Med_Avg<80)
{
   digitalWrite(light,H);
  digitalWrite(m,L);
digitalWrite(LED,L);
}
   else if (Med_Avg>80)
   {
digitalWrite(light,H);
  digitalWrite(m,H);
  digitalWrite(LED,L);
}
else if (Med_Avg<50)
{
digitalWrite(light,L);
digitalWrite(m,L);
digitalWrite(LED,L);
}
else
{
digitalWrite(LED,H);
}
j=0;
Temp=0; }
```

III. IMPLEMENTATION & RESULTS

INTERFACTING:

Fig 4 : Interfacing Brain-sense with Arduino UNO

Results:

When the attention level is further than 30 and less than 80 light glows and fan is in off state.

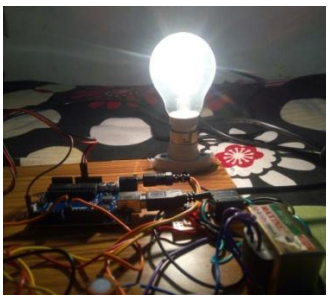

Fig 5 : Light glowing when the attention level is beyond 30

When the attention level crosses 80 both light and fan works that is they are in on condition.

Fig 6: Fan rotates when the attention level is beyond 80

IV. CONCLUSION

The brain-controlled home appliances have not yet been widely accepted. But there are greatexpectations for upcoming brain-controlled home utilizations. Immobilized people will be able to increase some individuality by using this device. Using the structureprojected in this paper, the Arduino receives the signals sent from head set,to examine commands to regulate the piece of equipment. This system is a footstepin the direction of brain-controlled actions. The regulation of home applications will be arranged to the signals produced by the attention thus opposing any bodilypower essential.

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