Chapter 1
Overview

1.1 Introduction

Traditional music system lacks automation. Existing music system cause wastage of electrical power. If anyone fall asleep while listening to music, then it'll continue playing throughout the night which will cost a valuable amount of power wastage. If anyone fall asleep while listening music using their headphones or air pods, then there is a huge amount of risk as the device get hotter and sometimes get burst and cause death. These kinds of accidents are getting a regular headline in the newspaper.

Automation is an essential system for almost every sector of work. But still there is absence of automation for controlling all kinds of musical devices. Designing a musical device with automated function for people is our aim in this project.

1.2 Project Description

People often get hazy about using musical devices as there is lack of automation in this sector. They often feel the urgency for an automated musical device which will be more appropriate in the present context. Power wastage and accidents due to heat up of the device can result in tremendous loss of valuable assets and life. While the pecuniary misplacement can be retrievable, bruise impose on people may be prolonged. This bruise is not at all expected. That is the reason we have made the musical system to optimize the shoddy effect. Picking up an automated system for the musical device appeared to be the delicate segment of the entire project. As there is a huge variety of products in the market, choosing the appropriate one can be a bit hard. Besides, there are very few products in the market which has both low cost and exclusive features to deliver utmost satisfaction to the music lovers.

1.3 Purpose Of The Project

The most important part of the automated musical device is efficiency, less of cost, easily accessible, productive and also trendy. In this age of modern science and technology, people mostly prefer automation when using any device. At the same time, they prefer gadgets which is easily accessible and safe. They don't want to hook up with stereotype devices which are comparatively itchy to operate and also risky at times. For this vary reasons, people are getting more interested in automated musical devices.

Basically, most of the music devices are remote controlled. Few of these are gesture controlled and voice command activated but the demerits is that the devices can be more power consuming and can be dangerous in terms of getting over heated. This paper narrates the execution of various features in a single music device, which delivers efficiency in using an automated tool in every feasible path. From turning on the device and detection of the signal frequency of the user until the turning off period is fortified in this system.

1.4 Project Goal

Every listener wants to enjoy music without the disturbance of manual operating randomly. They also want to have the taste of music without any kind of harm that can be caused for traditional music devices. They want it comfortable and harmless all the way. Even if they fall asleep while listening music they want the system be automatically turned off to avoid unwanted accidents. Accidents happening due to the over heat of musical devices and deaths due to the bursts of headphones and air pods are getting a regular headline in the newspaper in the recent times.

Fig.1.1 Brain Wave controlled music system.

Hence, we have some goal placed at the beginning and at the edge of the project we have accomplished success. We have tried our level best to obtain the goals while customizing the project when required. We have advanced with fresh and more polished plans for the advancements of the system. Our goals are given below,

- Minimum cost based system to offer quality product.
- Automated service instead of manual interrupt.
- Helpful for the user especially for the physically challenged people to make their way a little bit easier.
- Reduce power wastage.
- Avoid unwanted risk of the traditional devices.
- Easily accessible

1.5 Summary

In this chapter, we discussed about the importance and the goals of our project. In this era of modern science and technology, peoples of all ages prefer automation in any kind of devices especially the one who loves music likes to enjoy it without any kind of disturbance and unwanted risk. By using automated devices, people can enjoy the music in a placid way. Implementation of EEG sensors to musical devices can solve the problem effortlessly. Especially in developing world, automated system is a crying need for the people in terms of listening to music in a placid mind and not worrying about the risk factors that can be occurred due to the traditional musical devices.

Chapter 2
Existing System

2.1 Introduction

In this chapter we discuss the types of music systems that currently exist in the market. We also focus on the loopholes that the current system entails and a proper justification will be provided as to why our system is the ideal one in the current circumstances.

2.2 Systems related to our project

Users are using a handful number of methods of system in order to accomplish their distinguish tasks. The list of systems has been discussed thoroughly including the drawbacks that they possess. The most common systems that are currently available in the market are as follows:

2.2.1 Manual System

In the manual system the entire function is conducted by users. They have to switch on/off their music system by hand using switch or touch. Whenever they need to switch off their music system then they have to switch off it by hand or by remote. It is harmful for their sleep as well as their body. Sometimes some benefit contains a lot of loss. Some manual systems are:

Fig.2.1. Manual System

2.2.2 Integrated Software System

This system provide a genuine solution to conduct almost all the mandatory tasks by inventing mobile phones. Today users use mobile phones or some mp3 players which has a comfortable music system. This system also give them a comfortable feelings to switch off and on music.

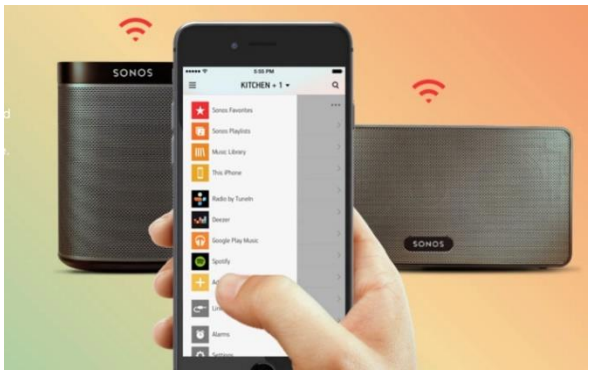


Fig2.2. Software System

2.2.3 Timer System

Another relevant alternative solution can be the use of mobile music system for maintaining the time. User can set their time in their music system to switch off their music. Music system then automatically switch off their music after the certain time period that the user set in the music system.

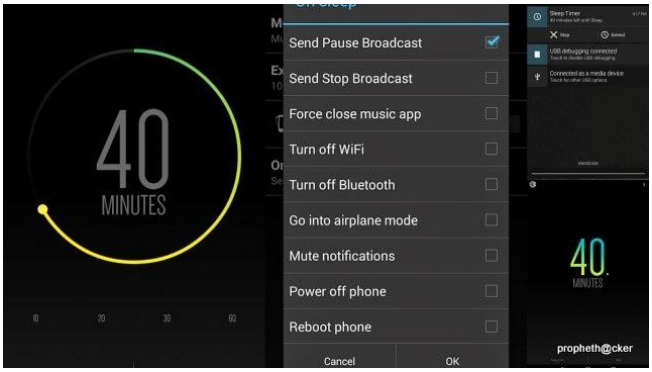


Fig.2.3. Timer System

2.3 Problems with the current systems

The manual system could never reach its principle in terms of its efficiency as the manual system requires a lot of space and it is so much disgusting to use. People want to use the simpliest option device to use. People do not use those device so more. They want a better device with simpliest option.

The issue of integrated software system which can be considered a better possible solution from the manual system but now a days it also seems some bust issues. Sometimes it happens that people are using headphones at night before their sleep. But they forget to switch of the system. As a result when they wake up in the morning they see that their mobile is busted by hitting a lot. Sometimes it happens that some people have to sacrifice their ear and sometimes some people have to die for serious accident.

The last one remains is the timer system which is considered as the best possible solution amongst the three of them. But sometimes it happens that music system switch off music automatically which is disturbing. Sometime it breaks our sleep and we have to start our music from the first. So every system has some problem in separated way. No one is giving us the perfect satisfaction to listen a music.

2.4 Proposed Solution

Our proposed solution is to use Brain Wave and Head Motion Controlled music system. This system provides an automatic music system which will switch off and on music automatically by detecting the brain wave. Our system read the brain wave from the users head and control the system without any touch. User can also change the music my shaking head. It will help

specially those users who are physically disable. They can also use this device easily without any touch nut only just use their brain and shake their head.

2.5 Related Work

As this project intends to build automated musical device using brainwave, multiple research paper regarding brain wave are studied. Authors proposed brainwave based authentication in addition with traditional password, PIN code and cards readers which added wide range in authentication system[1].Researcher developed a system to enhance both security and safety across a wide spectrum of applications using EEG-based biometry which is an emerging research topic that will fulfill the current need, which is focusing mainly on person identification and person authentication[2].In this paper the electrophysiological signals generated from the brain are used to command robot using a Brain Machine Interface (BMI)[3]. Considering brain and combining it with Neuro-Research researchers use the software MATLAB to extract brainwaves to make applications for different brain parameters like concentration and meditation which make life simpler and capable of showcasing creative aspects [4]. This paper presents a conceptual of EEG analysis and classification of brainwaves signal for alpha and beta signals during Functional Electrical Stimulation, FES-assisted exercise and a review on feature extraction for further classifying of brainwave signals stroke patients before and after performing FES-assisted exercised were also identified[5].

2.6 Summary

Considering all aspects, our proposed solution is an optimal one. The Brain Wave music system is an automatic music system which is controlled by head. It is reasonable because we are using numerous custom designed and self-programmed frameworks that are going to help

us to develop our project. The system interface is easy to operate and can be maintained by a non-IT professional as well. This system has been developed in such a way that it gives a feeling of user friendliness and there will not arise any issues with regards to complications. Therefore this chapter gives the idea about the current systems that are available in the market and about the motivation towards developing this dynamic system.

Chapter 3
System Design

3.1 Introduction

People like to listen music often. They use music as a therapy for a sound sleep nowadays. But still they are facing some problem with the traditional musical device. An automated mind controlled music system is going to be design through our project for people of all ages especially who have a deep affection with music are the targeted people of this project.

3.2 System description

The main equipment used for this prototype are OpenBCI Ganglion board, Gold cup electrode, Accelerometer MPU6050, Arduino UNO and SD card reader module. This system primarily has two function, by using EEG data retrieved from OpenBCI Ganglion board the system can be on/off based on Arduino's loaded code and the music track can be changed by detecting head motion using accelerometer which is also connected with Arduino.

Fig.3.1. Proposed System

3.3 Summary

We have our system design as we planned and hopefully whole system will work very well including the hardware and software portion.

Chapter 4
Technical Description

4.1 Introduction

The chapter gives us clear idea and view about the implementation and the steps we have taken for hardware and software implementation. The internal circuitry is built by hardware and developed by Arduino programming language and OpenBCI Processing GUI. It describes system block and flow chart, characteristics, working principle of OpenBCI ganglion board (EEG Sensor), Accelerometer, SD card reader module, Gold cup electrode and Arduino UNO. The OpenBCI Ganglion Board (EEG Sensor) is a high-quality, affordable bio-sensing device. Gold Cup electrodes are ribbon cable that can be used with an OpenBCI board to sample brain activity (EEG). An accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic - caused by moving or vibrating the accelerometer. SD card reader module supports Micro SD Card, Micro SDHC card (high-speed card) and reads data from SD card. Arduino UNO is an open-source PC equipment and programming organization, task and client group that outlines and produces units for building advanced gadgets and intuitive articles that can sense and control objects in the physical world. We have used the open-source Arduino Software and OpenBCI Processing GUI for the software part. The programming language used for Arduino is based on C language. The syntax is almost identical to that of C or C++. Arduino language is basically a set of C/C++ functions that can be called from the code.

4.2 Overview of the total system

The aim of this project is to controlling a music system using OpenBCI ganglion board (EEG sensor) and Accelerometer. OpenBCI ganglion board samples brain activity (EEG sensor) using Gold cup electrodes and the electrodes are placed according to 10-20 System on frontal lobe of

head at fp1 and fp2 position. The received data from the EEG sensor passed to computing device via Bluetooth where using OpenBCI processing GUI the raw data processed.OpenBCI processing GUI has its own widgets those have various feature. Focus widget is used to pass the focus state that is defined basis on the processed values from EEG sensor.The focus widget use Alpha and Beta value to define focus state.The focus state passes to Arduino UNO via serial port,when the state is 'FOCUSED' the widget passes '1' and '0' when it is 'NOT FOCUSED' and basis on these values the Arduino UNO turns ON-OFF the music system. By changing the focus state the music system can be easily turned ON- OFF. The accelerometer is used to change the music track which detect the head motion and a threshold value is set in Arduino UNO program, if the received value from accelerometer is more than the threshold value the current music track is changed.

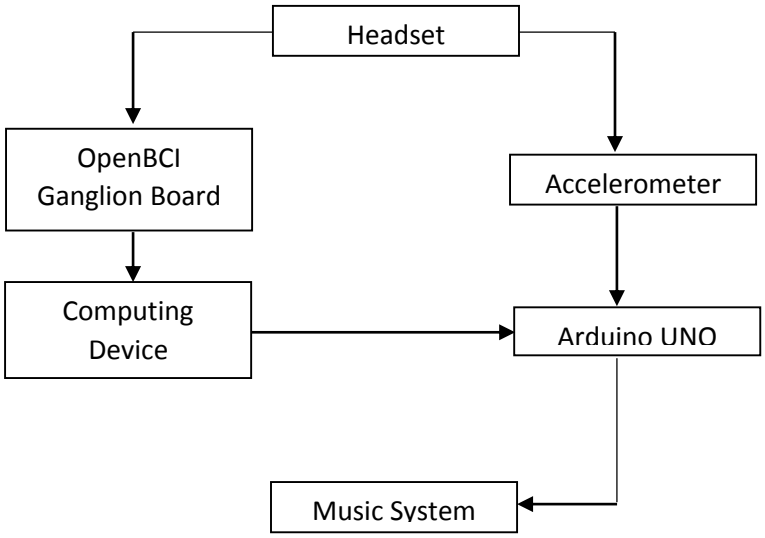


Fig.4.1. Simplified Block Diagram

4.3 System Flow Chart

In this section total flow chart of the system including all the subsystems will be shown.

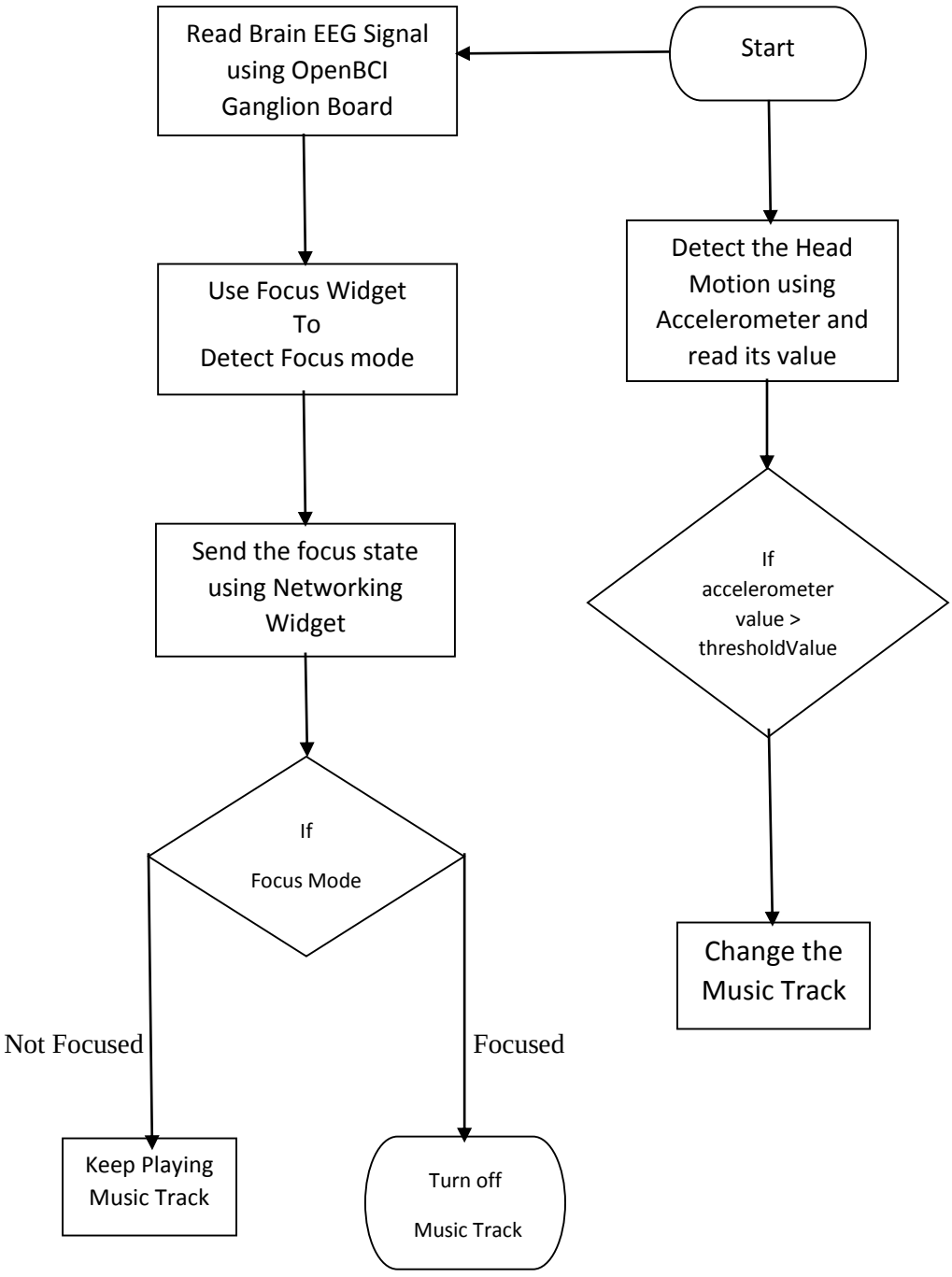


Fig.4.2. Flow chart of the system

Arduino UNO is an open source microcontroller based hardware platform which is used the system. It is very easy to work with various kinds of sensors to interact with the external physical world. Wikipedia states “Arduino UNO is a single-board microcontroller designed to make the process of using electronics in multidisciplinary projects more accessible.

4.4 Hardware Implementation

4.4.1 Description of all Subsystem

Because of the whole system being complicated, it will be very easy to understand the working principle of the whole system if it is divided into several small parts. We can treat each part as a subsystem. The subsystems are,

- Control system
- Sensor system

Now each of the subsystems will be described in details including the various possible ways to implement those.

4.4.1.1 Control System

Our designed system is a music player. It can be turned ON-OFF and music tracks can be changed. An EEG sensor used to turn ON-OFF system and an accelerometer is used to change the music tracks. The received data from the EEG sensor passed to computing device where using OpenBCI processing GUI the raw data processed.OpenBCI processing GUI has its own widgets those have various feature. Focus widget is used to pass the focus state that is defined basis on the processed values from EEG sensor. The focus widget use Alpha and Beta value to define focus state. The

focus state passes to Arduino UNO via serial port using Network widget where the data type set as Focus, baud rate set to 115200 and port figures out automatically according to Arduino UNO's connecting port, when the state is 'FOCUSED' the widget passes '1' and '0' when it is 'NOT FOCUSED' and basis on these values the Arduino UNO turns ON-OFF the music system. By changing the focus state the music system can be easily turned ON- OFF.

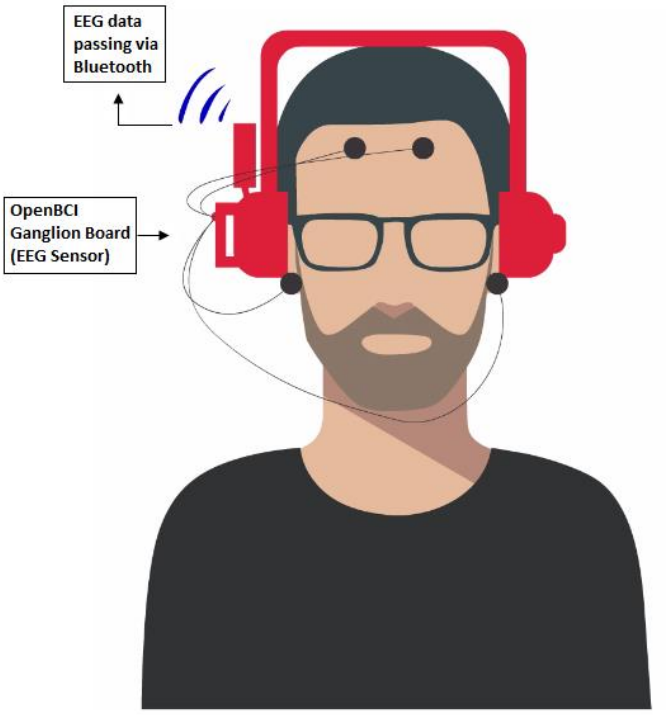


Fig.4.3. Passing EEG data

The system includes the accelerometer sensor which detects the movement of head and the controller will process the signal and will transmit to the music system. An accelerometer is a device that measures proper acceleration. The InvenSense MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip. It is very accurate, as it contains 16-bits analog to digital conversion hardware for each channel. Therefor it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino UNO.The accelerometer is

used to change the music track which detect the head motion and a threshold value is set in Arduino UNO program, if the received value from accelerometer is more than the threshold value the current music track is changed.

Fig.4.4. Accelerometer detecting Head motion

In Arduino UNO the received value compares with the predefined values for multiple function of music system, if the value matches or if the values cross the limit, it generates signals which execute the functions.

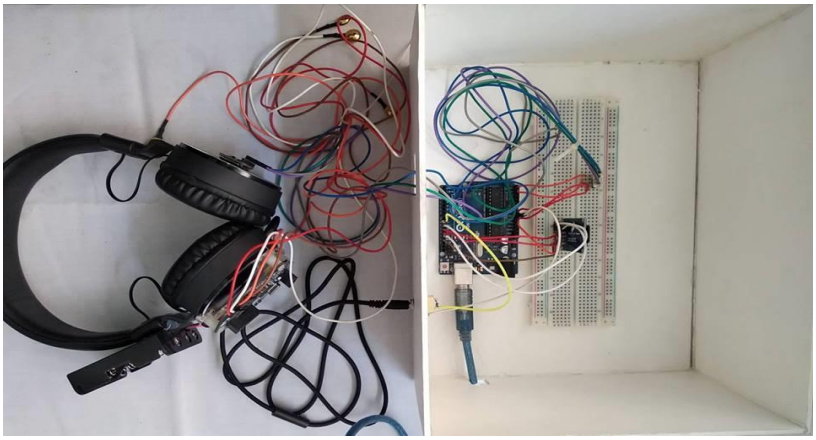


Fig.4.5. Designed System

4.4.1.1.1 Arduino UNO UNO

Arduino UNO Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the system; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and was chosen to mark the release of Arduino UNO Software (IDE) 1.0. The Uno board and version 1.0 of Arduino UNO Software (IDE) were the reference versions of Arduino UNO.

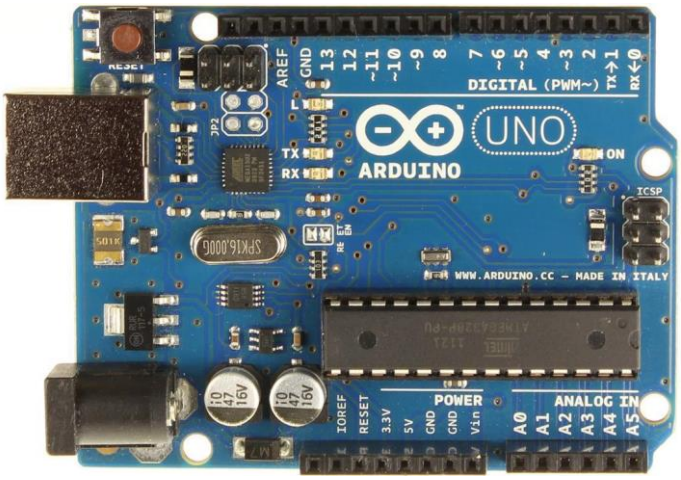


Fig.4.6. Arduino UNO

4.4.1.1.2 Gold Cup Electrode

The billions of nerve cells in your brain produce very small electrical signals that form patterns called brain waves. During an EEG, small electrodes and wires are attached to your head. The electrodes detect your brain waves and the EEG machine amplifies the signals and records them in a wave pattern on graph paper or a computer screen. It’s important to know the placement of

EEG electrodes on head, and thankfully there already is a map of electrode positions. It's called the 10-20 system), shown below:

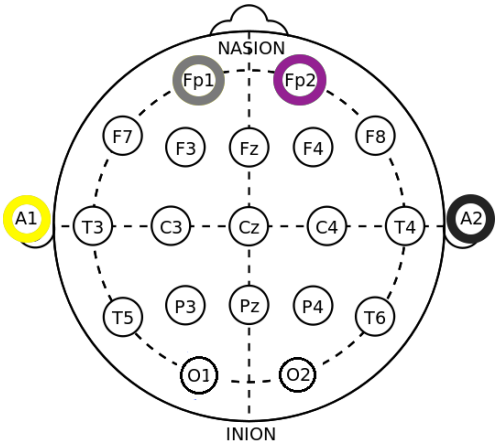


Fig.4.7. 10-20 Positions

Fig.4.8. Gold Cup Electrode

The Nasion is the ‘nose’ side of your head, and the Inion is the ‘back’ side of head. D_G and REF are connected at positions A2 and A1 respectively. The positions Fp1 and Fp2 are Frontal Parietal positions.Fp1 should connect to Channel 1, and Fp2 should connect to Channel 2.

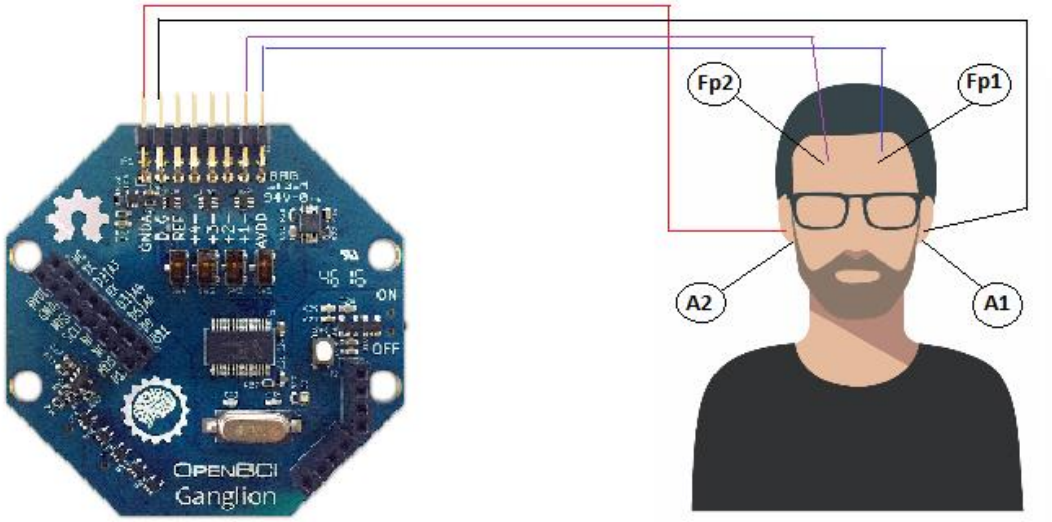


Fig.4.9. Ganglion Board Connection with Electrodes and Placement of Electrodes on Head

Scoop up a small amount of the electrode paste with the gold cup as shown below and it can help to use some medical tape or a band aid to help hold the electrode in place.

Fig.4.10. Electrode Paste

4.4.1.1.3 Micro SD card Adapter module

This module is used to make our music system which reads data from SD cards. It supports Micro SD Card, Micro SDHC card (high-speed card).The level conversion circuit board that can interface level is 5V or 3.3V.Power supply is 4.5V ~ 5.5V,3.3Vvoltage regulator circuit board. Communication interface is a standard SPI interface.4 M2 screw positioning holes for easy installation.

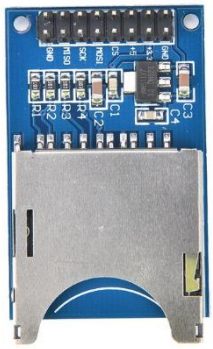
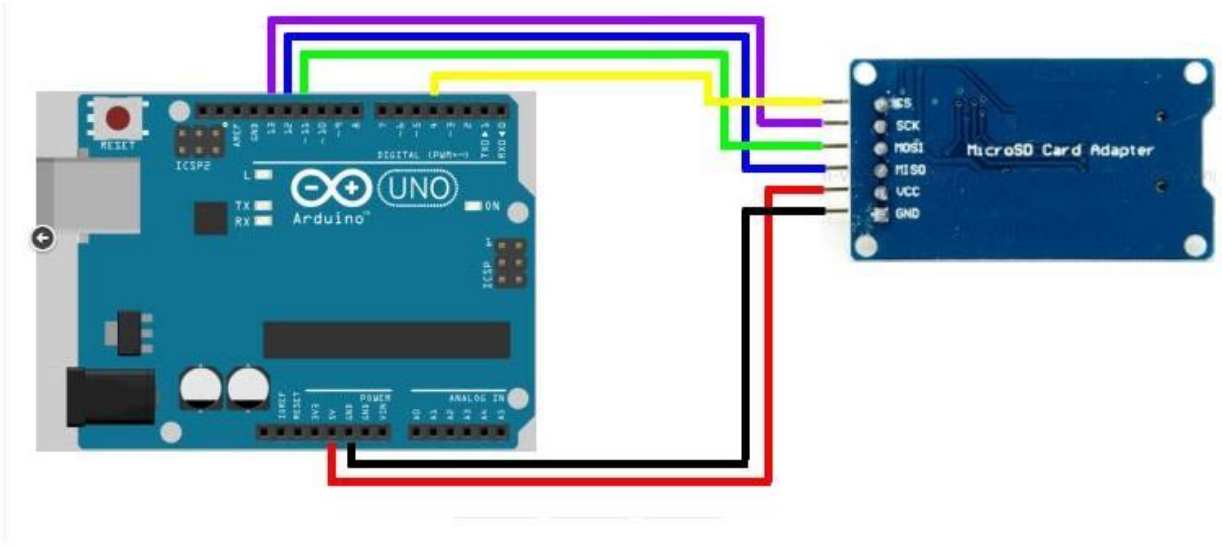


Fig.4.11. Micro SD card Module

A total of six pins (GND, VCC, MISO, MOSI, SCK, CS), GND to ground, VCC is the power supply, MISO, MOSI, SCK is the SPI bus, CS is the chip select signal pin.The connection with Arduino UNO is shown below,



CS ⟶ 10

SCK ⟶ 13

MOSI ⟶ 11

MISO ⟶ 12

VCC ⟶ +5v

GND ⟶ Arduino UNO's Ground

Fig.4.12. MicroSD Card Adapter with Arduino UNO

Fig.4.13. Audio Output Jack

One wire is in to 9 pin of Arduino UNO and other is GND of Arduino UNO and other side off these wires are connected to VCC and GND of audion output jack.

4.4.1.2 Sensor System

We use EEG sensor and Accelerometer to execute music system's features.

4.4.1.2.1 OpenBCI Ganglion Board (EEG Sensor)

The OpenBCI Ganglion is a high-quality, affordable bio-sensing device. It is not a medical device nor is it intended for medical diagnosis. On the input side, there are 4 high-impedance differential inputs, a driven ground (DRL), a positive voltage supply (Vdd), and a negative voltage supply (Vss). The inputs can be used as individual differential inputs for measuring EMG or ECG, or they can be individually connected to a reference electrode for measuring EEG. Data is sampled at 200Hz. There is a Simblee on this board microcontroller and wireless connection. Simblee is RF Digital's next generation Arduino UNO-compatible radio module.

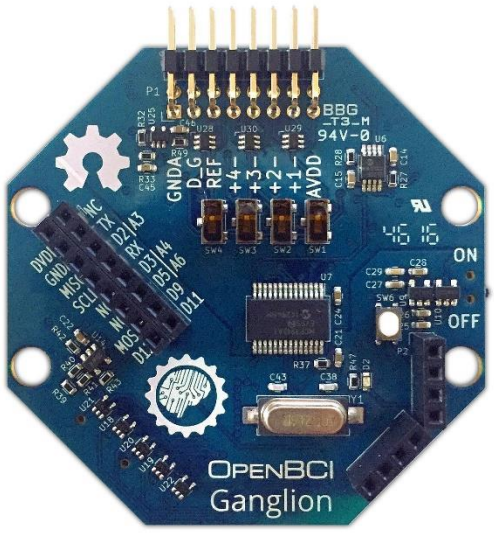


Fig.4.14. OpenBCI Ganglion Board (EEG Sensor)

Ganglion Technical Specifications

- Power with 3.3V to 6V DC battery ONLY
- Current Draw: 14mA when idle, 15mA connected and streaming data
- Simblee BLE Radio module (Arduino UNO Compatible)
- MCP3912 Analog Front End
- LIS2DH 3 axis Accelerometer
- Board Dimensions 2.41” x 2.41” (octagon has 1” edges)
- Mount holes are 3/16” ID, 0.8” x 2.166” on center
- Switches to manually connect/disconnect inputs to the REF pin

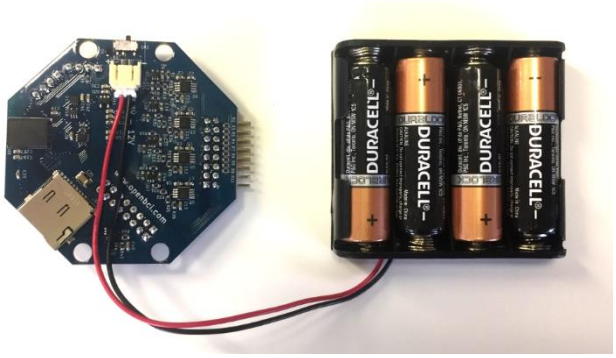


Fig.4.15. External Power to Ganglion Board

4.4.1.2.2 Accelerometer

The InvenSense MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip.It has total six pins (Vcc, Ground, SCL, SDA, XDA, XCL, AD0, INT). It is very accurate, as it contains 16-bits analog to digital conversion hardware for each channel. Therefor it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino

UNO.An accelerometer is a device that measures proper acceleration. Proper acceleration, being the acceleration (or rate of change of velocity) of a body in its own instantaneous rest frame, is not the same as coordinate acceleration, being the acceleration in a fixed coordinate system.

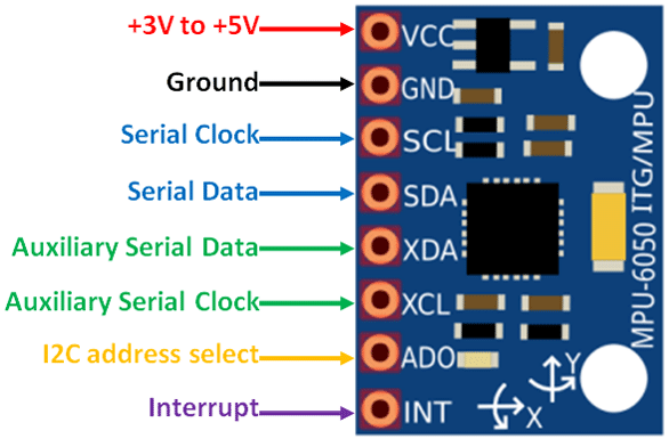


Fig.4.16. Accelerometer MPU-6050

For example, an accelerometer at rest on the surface of the Earth will measure acceleration due to Earth's gravity, straight upwards (by definition) of g ≈ 9.81 m/s2. By contrast, accelerometers in free fall (falling toward the center of the Earth at a rate of about 9.81 m/s2) will measure zero.

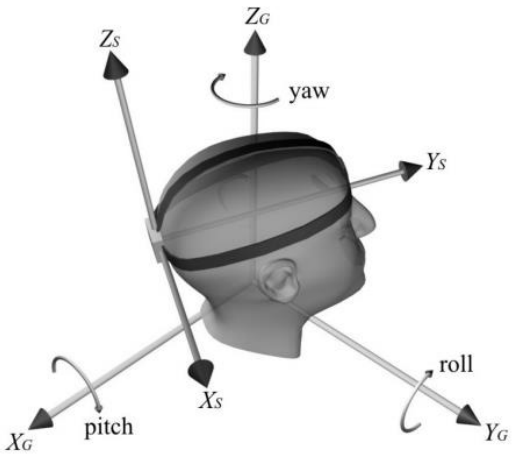
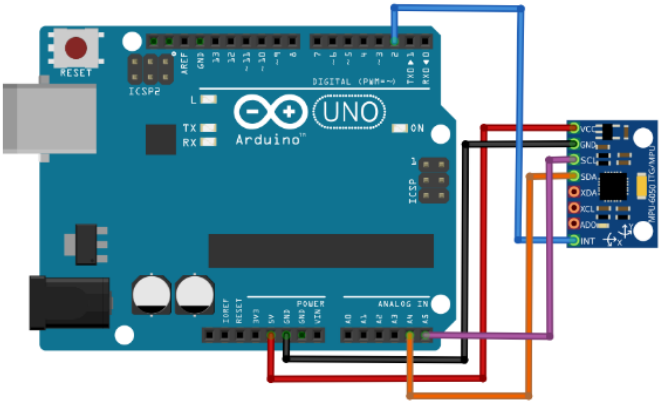


Fig.4.17. Motion control using accelerometer

It is very easy to interface the MPU6050 with Arudino, the connection between Arduino UNO and MPU6050 Accelerometer is given below



SCL ⟶ A5

SDA ⟶ A4

INT ⟶ 2

VCC ⟶ +5V

GND ⟶ Arduino UNO's Ground

Fig.4.18. MPU6050 with Arudino

4.5 Software Implementation

4.5.1 Arduino UNO IDE

Arduino programs may be written in any programming language with a compiler that produces binary machine code. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in Java. It originated from the IDE for the Processing programming language project and the Wiring project.It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism for compiling and loading programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch".

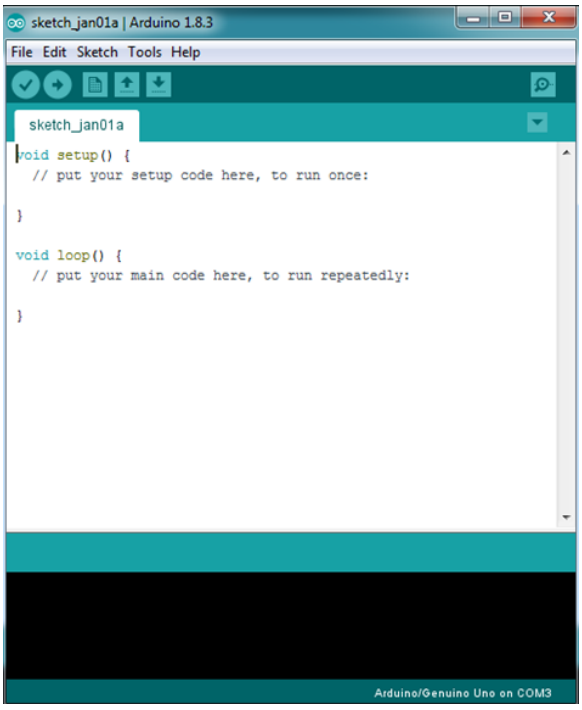


Fig.4.19. Arduino UNO IDE

To declare a pin of the Arduino as a input “pinMode(pin number, INPUT)” is used. An to declare as a output “pinMode(pin number, OUTPUT)” is used. If we want to read a value from a sensor which is connected to an analog pin we use “analogRead(pin number)”. If we have some conditional situation we can use “if” conditional statement. We have used all these things to write program for the Arduino. There are many libraries for the Arduino. The Arduino environment can be extended through the use of libraries, just like most programming platforms. Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data.We have used libraries for Accelerometer, SD card module.After writing the whole code on the Arduino IDE editor, we compiled it through the compiler. To do this we select “Sketch” file menu on the Arduino window. Then we select “Verify/compile”. This will compile the code. If there is any error, it will show that.

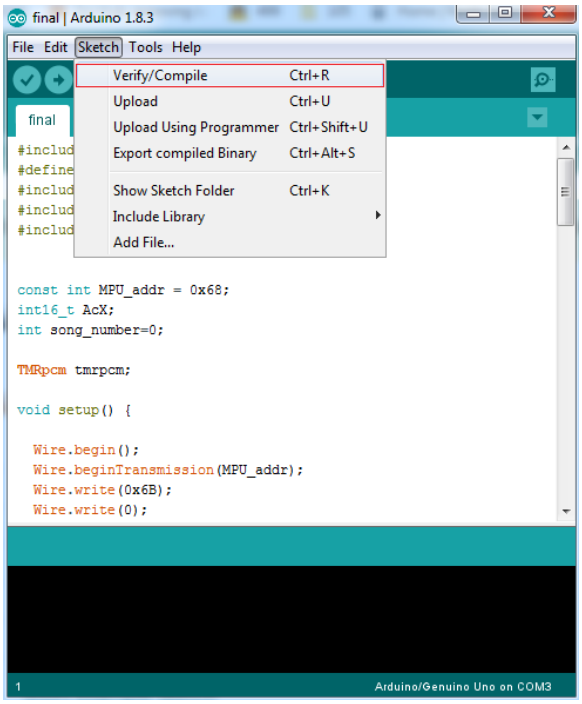


Fig.4.20. Compiling Arduino code

Another important thing should be remembered that for which board the codes will be compiled. For our case, it is Arduino Uno. So, we need to select the appropriate board. To do this we go to Tools > Board > Arduino/Genuino Uno.

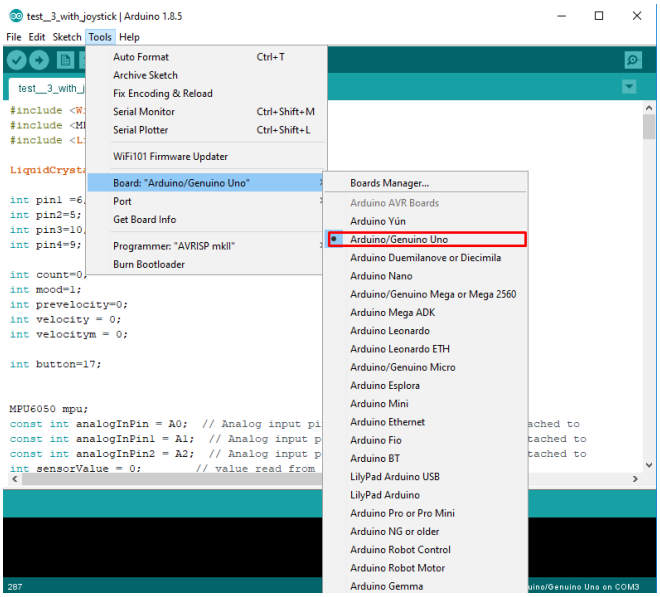


Fig.4.21. Board selection

After compiling it we have to upload the program to the Arduino. First we need to connect the Arduino board to the USB port through an USB cable provided with the Arduino. Then we need to select "Upload" at the top left corner on the Arduino IDE. If the program is uploaded successfully it will show it through a message.

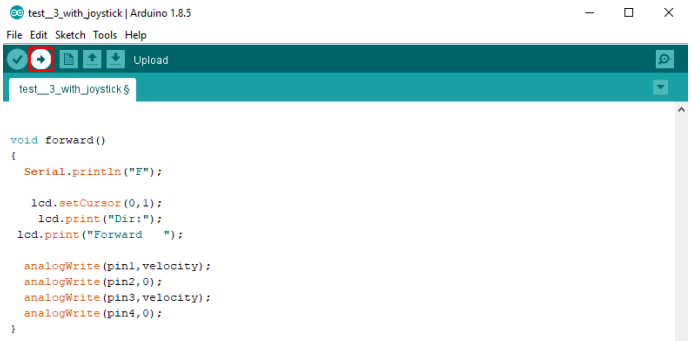


Fig.4.22. Uploading program to an Arduino

4.5.2 OpenBCI Processing GUI

The OpenBCI GUI is OpenBCI's default software tool for visualizing, recording, and streaming data from the OpenBCI Boards. It can be launched as a standalone application or launched from processing (a Java-based programming language). The OpenBCI Ganglion uses Bluetooth LE (aka Bluetooth Smart, Bluetooth 4.0) and in order to use the Ganglion a small USB CSR 4.0 Dongle is necessary.We have used GUI version 3.4.0.The GUI has multiple widgets with various functions,we have used Focus and Network widget to execute our system's functions.

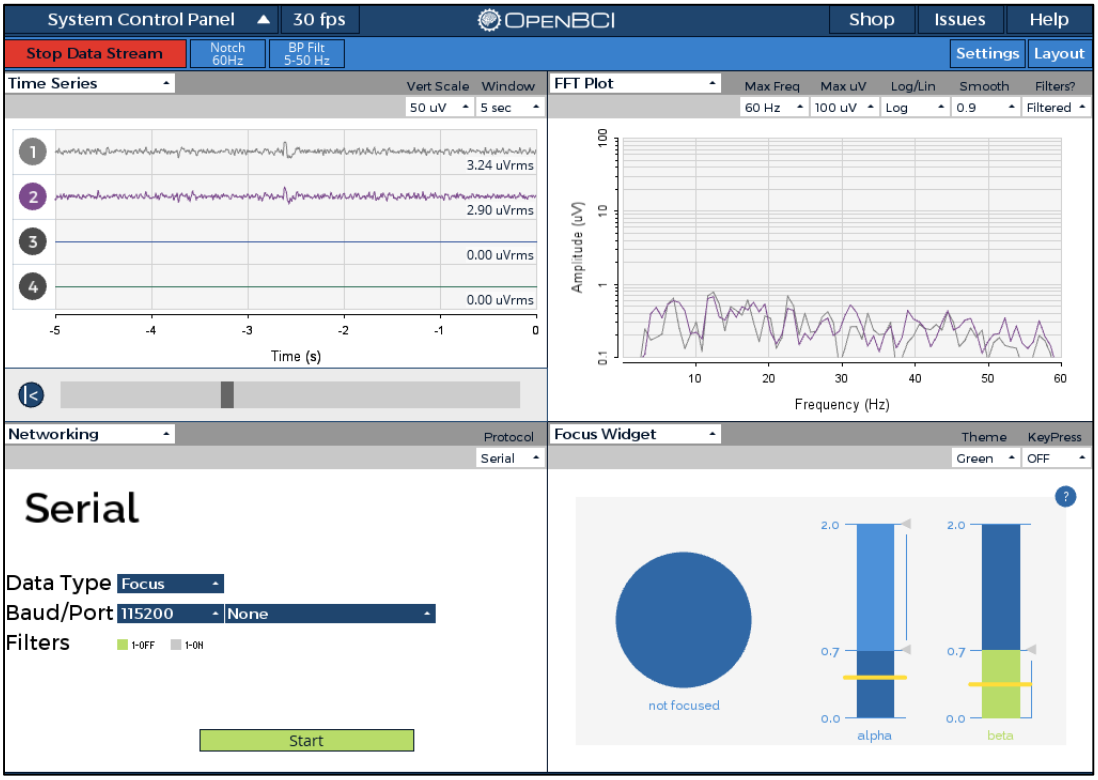


Fig.4.23. OpenBCI GUI

4.5.2.1 Focus Widget

EEG data was recorded with OpenBCI GUI. Focus is related to alpha and beta band, which are some frequency components of EEG.Fourier Transform is a mathematical method to decompose any periodic data into different "frequency components". Fast Fourier Transform is the fast and discrete version of Fourier Transform, so the resulting frequency components are segments of frequency bands named FFT bins. The FFT plot in OpenBCI GUI is the FFT amplitude map, of each data point the y value stands for the amplitude of this frequency bin, and the x value stands for the center frequency of this frequency bin.

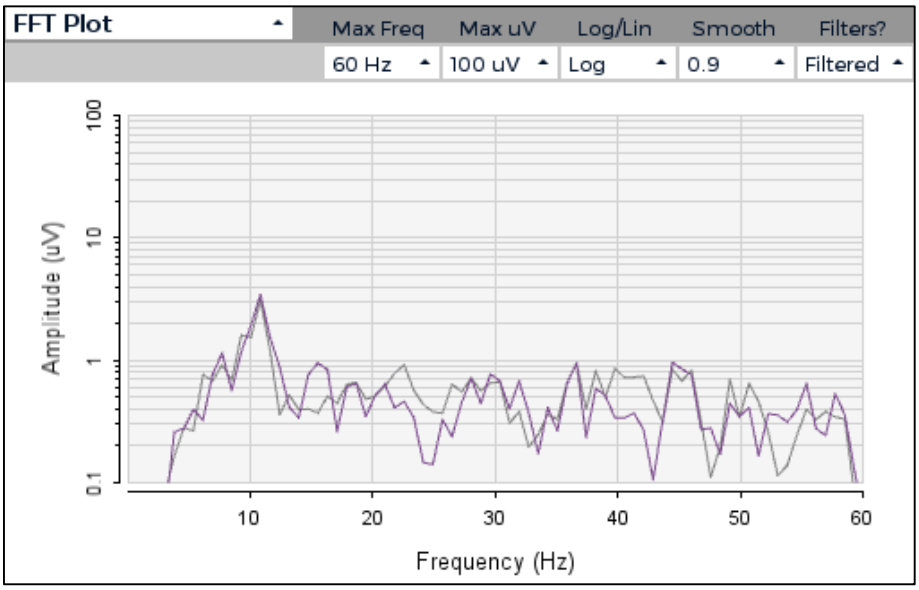


Fig.4.24. FFT Plot in Focused State

In a FFT plot, alpha band can be defined as frequency components between 7.5 – 12 Hz, and beta band defined as frequency components between 12.5 – 30 Hz. Following this definition, I observed this pattern of high alpha amplitudes and low beta amplitudes compared to an unfocused state.

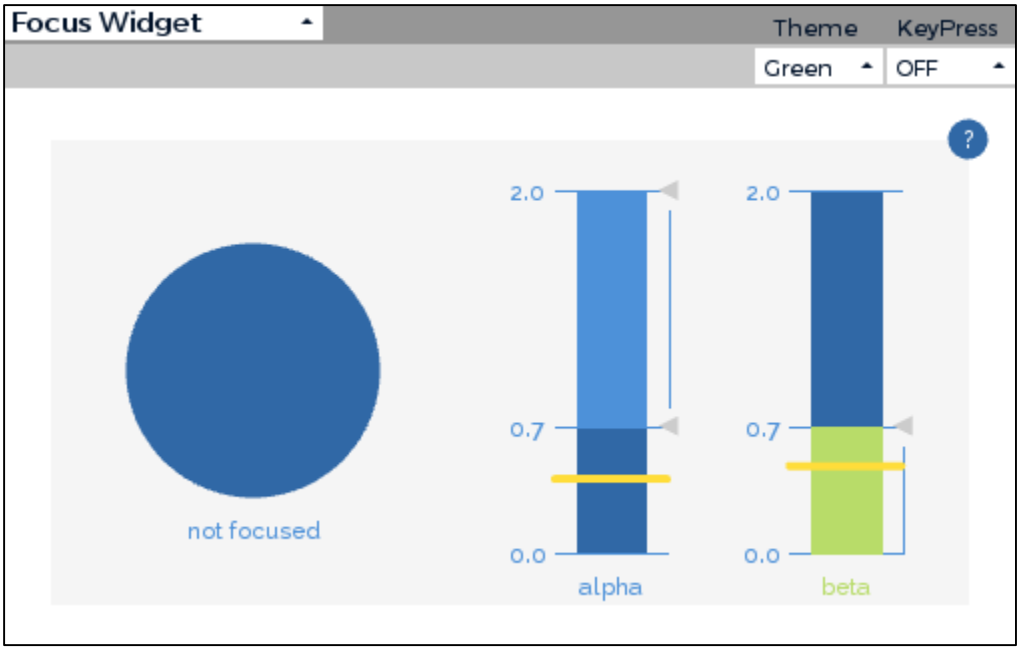


Fig.4.25. NOT FOCUSED State

4.5.2.2 Network Widget

This widget contains a collection of scripts for testing networking functionality for OSC, UDP, Serial and LSL. This is intended for use with OpenBCI networking functionality, but could work for other tasks as well. This kit is provided to help you localize and diagnose any issues while using the OpenBCI networking functionality. It is helpful to run scripts that allow you to send and receive data in order to determine if your issue is with the program sending data, the program

receiving data, or the network in-between.We have used Serial to communicate with Arduino UNO.The value from Focus widget passes via Network widget to Arduino.

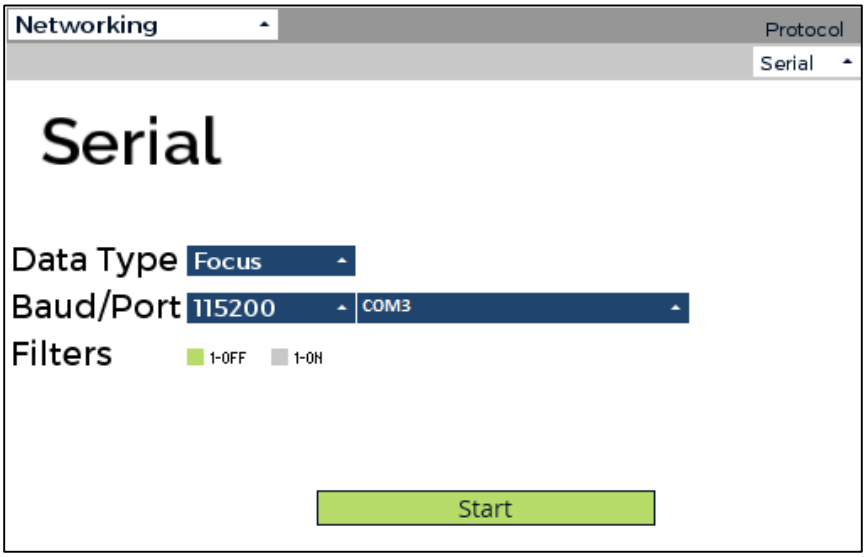


Fig.4.26. Network Widget

4.6 Summary

Here the hardware and software systems are described briefly with internal connection among hardware equipment.

Chapter 5
Design Implementation

5.1 Introduction

There are lots of invention regarding music devices. There is traditional music device and also a plenty of advanced musical and hearing devices with multiple functionality. Existing music system cause wastage of electrical power. If anyone fall asleep while listening to music then it'll continue playing throughout the night which will cost a valuable amount of power wastage. Automation is an essential system for almost every sector of work. But still there is absence of automation for controlling all kinds of musical device.

5.2 System Design

The system is developed as a common platform for the user who regularly listen music. Content is designed in such a way that it helps every type of listeners. It is a new invention in music system and also User will benefited by it. It is an automatic music system. Its design is divide into two portion: Head Set and Music System

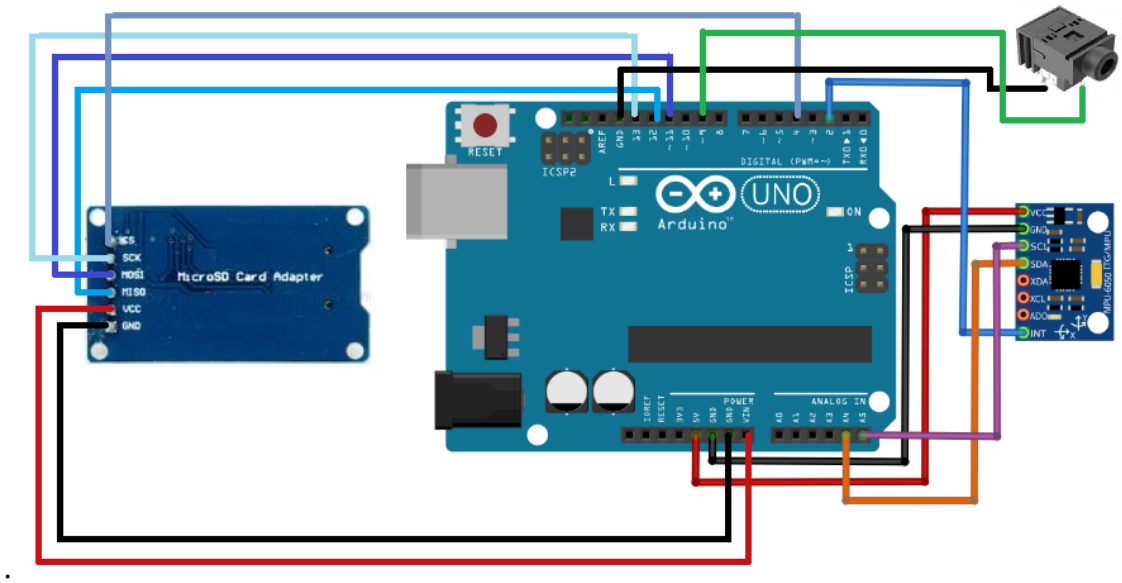


Fig.5.1. System Wiring

5.2.1 Head Set

Accelerometer and OpenBCI Ganglion Board are placed on Head Set. An accelerometer is a device that measures proper acceleration. Proper acceleration, being the acceleration (or rate of change of velocity) of a body in its own instantaneous rest frame, is not the same as coordinate acceleration, being the acceleration in a fixed coordinate system.The OpenBCI Ganglion is a high-quality, affordable bio-sensing device.

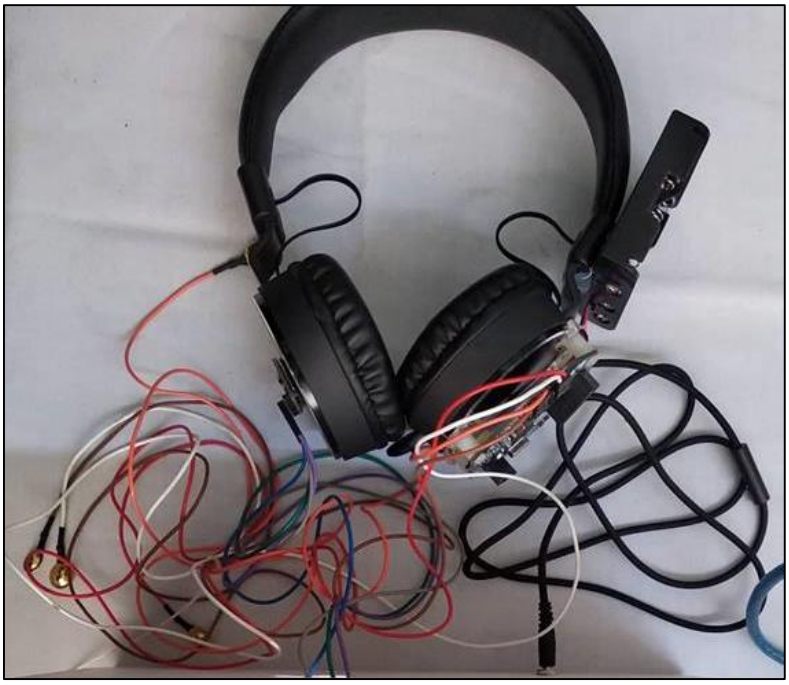


Fig.5.2. Head Set

5.2.2 Music System

The Music System has Arduino Uno and SD card reader module. Arduino UNO Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB

connection, a power jack, an ICSP header and a reset button.This module is used to make our music system which reads data from SD cards. It supports Micro SD Card, Micro SDHC card (high-speed card).

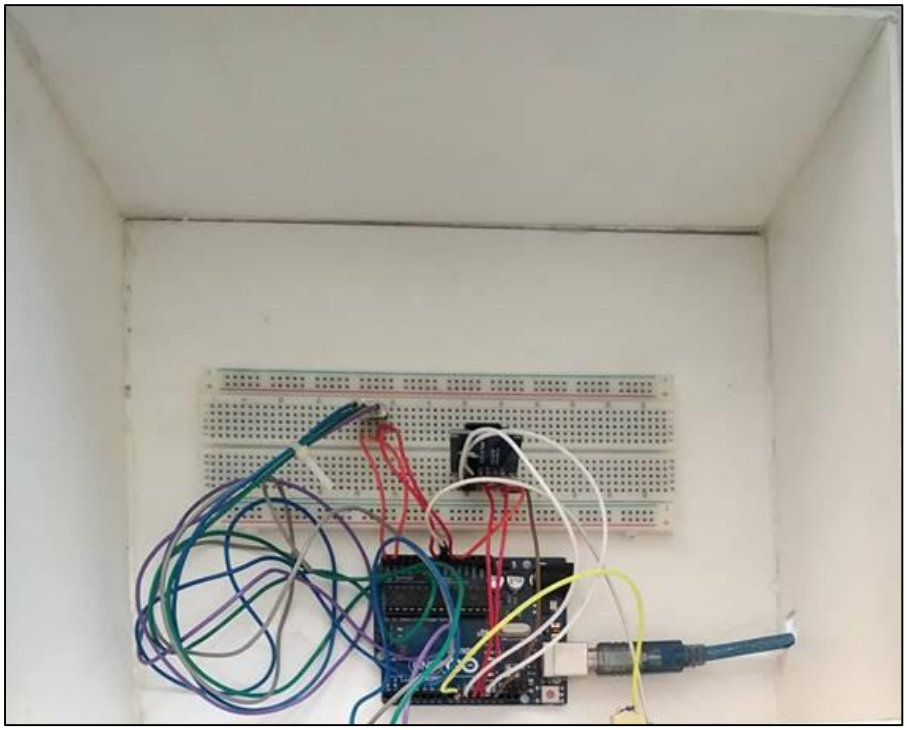


Fig.5.3. Music System

5.3 Summary

We successfully completed our design as we planned and whole system is working very well including the hardware and software portion.

Chapter 6
Cost
of Implementation

6.1 Introduction

The key factors in fabricating a project work is the equipment used, their costs and the procedures involved in making the system work. Initially when we designed our system, we listed down the components which were needed at the primary stage and as time progressed we added more components to it. Initially we made a costing list along with the components name but later on we could cut slit from our initial costing comparing with different shops where our components were available. We also got few components, which did not last long or were not appropriate for the project.

6.2 Cost of Implementation

The total cost that we have spent for the implementation of the project is given below. We tried our best to minimize the cost as much as possible. We achieved success to implement our planned system within a limited cost, which adds a significant value to the system. The table given below illustrates the name of the required components name, quantity and the price.

Materials	**Quantity**	**Price(taka)**
Arduino UNO	1	450
Gold Cup Electrode	1	200
Micro SD card Adapter module	1	124
OpenBCI Ganglion Board (EEG Sensor)	1	12000
Accelerometer MPU-6050	1	249
Battery	4	200
Memory card	1	549

Breadboard	2	140
LEDs,Resistors,Transistors	-	100
Jumper Wire	-	109
		Total: 14121

Table 6.1. Total Costing Breakdown

6.3 Summary

In this chapter we have discussed briefly about what was our costing regarding initial plan and the final plan, also how we could slit the costing after doing research in the local markets to keep a minimum costing for the whole system.

Chapter 7
Result Analysis

7.1 Introduction

In this section, we will talk about the results we obtained, and its analysis. This shows how we obtained our results and what was our findings regarding the project. We will also discuss how we analyzed our project for the betterment of it.

7.2 Results & Analysis

After the analysis of our system individually, we have seen the project works perfectly. Which means, we have effectively implemented the prototype of the entire system, which we planned initially. The whole system has two main parts and we combined them to make the system more efficient.We can successfully turn ON-OFF music system and change the music track.

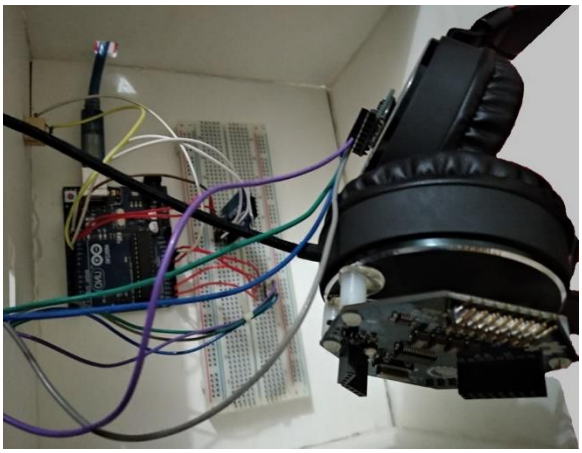


Fig.7.1. Designed Prototype

7.3 Summary

In this chapter, we have discussed the result and analysis of our system. The results obtained are discussed in this chapter and we sew that our method improved the entire system. We have also discussed how the internal part and the external part was working properly and gave perfect output better than we expected.

Chapter 8
Compliance with Standard

8.1 Introduction

In this chapter we will discuss the various comparisons of standards with our system, such as IEEE standard. In general, compliance means conforming to a rule, such as a specification, policy, standard or law. Regulatory compliance describes the goal that organizations aspire to achieve in their efforts to ensure that they are aware of and take steps to comply with relevant laws, polices, and regulations.

8.2 Compliance with IEEE standards

The establishment of electrical and hardware particular architects guidelines companionship (IEEE-SA) is an association inside IEEE that develops worldwide principles for claiming industries, including: control systems, renewable energy, biomedical health care, data engineering. Furthermore robotics, telecommunication and also home automation, transportation, nanotechnology. The IEEE standard IEEE 802.6 that is relevant to our project applies to Standards for information exchange between systems which was detecting through sensors and sending text to the owner using GSM Module.

IEEE 1451 is a set of smart transducer interface standards developed by the Institute of Electrical and Electronics Engineers (IEEE) Instrumentation and Measurement Society's Sensor Technology Technical Committee describing a set of open, common, network-independent communication interfaces for connecting transducers (sensors or actuators) to microprocessors, instrumentation systems, and control/field networks. This applies to all our sensor systems we have used in the project.

IEEE standard 802.15.4 intends to offer the fundamental lower network layers of a type of wireless personal area network (WPAN) which focuses on low-cost, low-speed ubiquitous communication

between devices.802.21 is an IEEE standard published in 2008. The standard supports algorithms enabling seamless handover between networks of the same type as well as handover between different network types also called Media independent handover (MIH) or vertical handover. Our system manages to maintain the mentioned standards and meet with IEEE code.

8.3 Summary

In this chapter, we examined the different standards of rules regulations for transportation, and how it compared to our own Music System. We have shown how our system follows the standards, IEEE.

Chapter 9
Design Impact

9.1 Introduction

In this chapter we will discuss about the impact of our design on economic, social, political, environmental feature and also health and safety issues that probably we could face. We will analyze the implications of our design on every feature separately. We will also focus on its consequences upon the economy and society and also the personal welfare. The effects of our system are: efficiency in terms of cost and accessibility, reduction in power consumption, vast opportunity of unconventional movement for the physically challenged ones in terms operation, depletion of risk factors. Crucial impacts are described below:

9.2 Economic Impact

Our brainwave controlled music system is produced low in cost. The device is built in such way that common people can afford it easily and take the opportunity of relishing the taste of music using automated device. Recompensing some money for the device can arise concern about financial sense, but discovering a facility that provides an individual the satisfaction of mind is priceless. The music device is powered by 5V battery which makes it cost efficient. By making market price low and with a bigger production, it can benefit and serve economical purposes as well.

9.3 Social Impact

Social impact is basically participating in social welfare and to improvement of society. The social impact that brainwave controlled music device may have on people's lives is highly based on existing social relations, tastes and cultural traditions. Our system is designed in such a way that people will be inspired to share their amusement that they get through using this device with

anyone of the society either the person is physically fit or challenged. They will always know that they can spread happiness or peace of mind just sharing the device if they want. Physically challenged people can lead an easier and stress free life which can be a good and better implementation for society.

9.4 Political Impact

If the leaders or politicians welcome the thoughts and design implementation of our system, they have enough authority to implement the digital thought for the betterment of the society. They can also create awareness that this automated system can carry us to the next level of digital revolution and have a good vibe in the nation.

9.5 Health and Safety Impact

The brainwave controlled music device can change many lives. Challenged people who are always dreamed to have the luxury of leading a better life can have a bit through using this brainwave controlled device. Our designed system has no negative impact on a person's health. It has a very positive impact on a person's mind. Our multi functioned system provides us the opportunity to have mental satisfaction without causing any risk. Our system provides a quality service either the user is awake or asleep. The procedure which were adopted while making the device makes it user friendly and unique than any other system available in the market.

Another best thing of our brainwave controlled music device is it can be used without taking any safety measures as it detects the user's brain frequency and works accordingly. The system is built in such way that there is no possibility of being injured. It doesn't overheat or malfunction.

9.6 Environmental Impact

The user of the system must pay attention to the environmental impacts of the devices or systems that is being used. Every user has their own tiny environment around them and retaining it with great attention is very much important for having the quality living experience. The system that we have constructed does not bring any kind of harm to the environment and proved to be effective in saving valuable energy from getting wasted.

9.7 Ethical Impact

In terms of the ethical issues, as our device or system is built absolutely on optimistic consequences, so this system does not violate any sort of ethical or moral codes. It does not influence the user's interpretation in any circumstances, rather help the society to have a next level musical device system.

9.8 Manufacturability

Manufacturing of the music device is easy and less complex. The parts of the brainwave controlled music device are easily available. If we manufacture our device in larger scale planning from the commercial point of view, we can minimize the cost per product if we get appropriate aid from the government and purchase the equipment in bulk.

9.9 Sustainability

Our music device has a high quality brain frequency detecting sensor, it is easy to operate, saving time and energy. This is a high time for automation based device businesses that are involved in

sustainability. The revenue earned from the project then can be invested to develop the device and cover other costs to keep the system running and up to date. We can implement more features and make it more user friendly. In such a way, the device can be made sustainable and a success. Taking quick initiative can enhance the opportunity to gain a profitable way to the sustainable future. We can illustrate the worth of ambition to the other companies regarding automated products in terms of sustainability. Our system can be used to enhance both the environment and the country.

9.10 Impact in Real Life

Easy accessibility and cost efficiency is the greatest potentiality of our system. As a reflection of a user friendly system, person with a minimum knowledge about technology can easily access the device. The building architecture of the system ensures the safety of the user. It can be operated by both an average person and a physically challenged person. There is a huge scope to get concerned when the topic is about automation and it reflects that how the automated devices could benefit an individual and his or her family. Very few aspects are given below about how our system makes it authentic:

9.10.1 Automation

There is no doubt that this benefit will come to every user's mind at the first place. Most of the music devices are remote controlled. Few of these are gesture controlled and voice command activated. But this is the first time we are introducing an automated music device to our users. People don't need to use the remote control to operate the music device anymore. A tiny but effective EEG sensor based music system will control the music system for the users just using the brain wave. All you have to do is just sit and focus.

9.10.2 Uses Brain Frequency to operate

Brain Wave controlled music device introduces us with EEG sensor which detects various waves of our brain. So all we have to do to control the device is just focus. No need to use our hands or use our voice commands to control the device.

9.10.3 Relief from risk factors

This is one of the vital aspect of brainwave controlled music device. Traditional music devices need to turn of manually. Sometimes we forget to turn of the device and it keeps playing the music unnecessarily. Again sometimes we fell asleep while listening to music using headphones or air pods. These results a great amount of power loss and often devices get over heated, sometimes it bursts and causes tragic accidents even deaths. Our constructed system has successfully reduced the power loss and also it turns off the device using the brain signal when user fall asleep which prevents the device of getting over heated and prevents the unwanted accidents.

9.10.4 A gift for the physically challenged people

The noble part of the project. In spite of having the same affection for music as a normal person, physically challenged people were deprived of the opportunity to enjoy the music. This device has brought the rays of happiness them among them. This automated music device enables the physically challenged people the independence of having the taste of music as they will be able to operate it all by themselves.

9.10.5 Offer the tranquility of mind

The feeling of reliability and tranquility one can achieve with an automated system probably one of the significant benefits. The conviction of feeling secure will boost up a person's productivity and will help him to be more focused. An automated music system will play a significant role in a person's life especially the one who are struggling with their physical inability and also to those music lovers who can't go a single moment without music. Neither the lone wolf who loves music nor the one who can't even do his/her basic daily life work due to inability will feel alone because the automated brain wave controlled music device will present them the tranquility of mind.

9.11 Summary

In this chapter we have described the design impacts a Brain Wave Controlled Music System on the economy, society, environment and also health. We described how this system won't pollute the environment, how will it provide security and how the conventional implementation of this system can achieve better days for the citizens of a country. We have described how our system will ensure a great impression in personal life. Addition of a brain wave controlled music device in an individual's life will present him an extra portion of reliability and happiness. Whether they awake or asleep, they can enjoy the advantage of the automated system.

Chapter 10
Conclusion

In this modern era of science and technology people are getting surrounded by devices. The prototype we designed might bring some change in traditional music player. Till now we able to use only focus state to turn off/on the system but as the prototype is in development state we will use eye blink and EMG signal to include other functions. Though accelerometer is used here but the OpenBCI Ganglion board has the same function which can be used to enable any feature.

Chapter 11
Future Work

11.1 Introduction

In this chapter, we will discuss about how we can include more features to our system to make it worth enough to use by the users commercially and sell for a vast amount of music lovers of the society who appreciate automation in this sector. Advancement in technology and emergence of smart device has led to the rise of automated musical system, which can be accessed easily by all types of users. This system will surely be able to improve the experience about listening music.

11.2 Future Planning

With a view to successfully do the industrial marketing of our project, we have polished our plan with great attention. The presence of an automated music system will allow lots of users with a peace of mind knowing that their hearing experience will grab a dramatic development without any kind of risk factors. Because of this, we believe that our idea of the system will be a booming one as it is multi layered and comes with multiple features. In order to make the idea a huge success, we have planned to do the industrial marketing if we get adequate support from the government and concerned community. We can ensure that our system will provide highly instinctive services for our customers or clients. Electroencephalography (*EEG*) which is one of our features has the largest market share in *Global* Brain Monitoring Devices *Market*, the largest markets being Asia, Europe and America.The features we are planning to add in future if properly nourished by our government and investors are:

- Our primary target was to turn ON/OFF the device using brain waves which we achieved successfully. As there is a wide open functional territory of EEG sensor so our next goal is

to add more features to our system such as change the current music track, volume control and so on just using the wave signals of our brain.

- There will be a Research and Development team, who will try to add more attractive features and a support team assured to respond to any problem regarding the device.

11.3 Method of Productization & Marketing

The entire method of productization and marketing process based on which we can implement the system in larger scale for marketing purpose is described below:

System Functionality

Automated music system is the blessing of modern science and technology. Regarding to the present context, whatever the user's needs, whether it is price or features that are most important to one, our system layers are state of the art and offer all the latest technical advancements.

The Automation

We have utilized the highest quality industry standard detection sensor, Arduino, SD card reader module etc. This components combining together to construct an automated platform for the music listeners which is totally a new concept in the huge market of musical devices. This automation process will keep our system one step ahead of every other competitor when we launch in the industry for selling purpose and earning revenue out of it. In future when we implement new features, it will ensure more efficiency in the event of operation and execution. By capitalizing on our distinctive capabilities, we will continue responding to the increasingly diverse needs of music lovers for flexibility and peace of mind.

The Peace of Mind

Our future work includes the feature that, different accessibility options will be available in one's musical device and all the operations will be handled by the wave signal of the user's brain. The users don't need to be worried about the wastage of power, the unwanted risk factors or manual operation because this automated system assured to take care of these situations using only their brain signal. So the customers have the flexibility and independence to enjoy music without getting worried about the system.

11.4 Situation of automated devices around the world

Automation has become vital part of our everyday lives and we can expect its vast need in upcoming days ahead us. Devices controlled by brain signal will be the phenomena of upcoming world. The rapid market growth of brain wave controlled devices give us the clear hint that the future world will be the place where people will prefer automated system rather than the manual interrupt. The pie chart below will show the Global EEG devices market share by region.

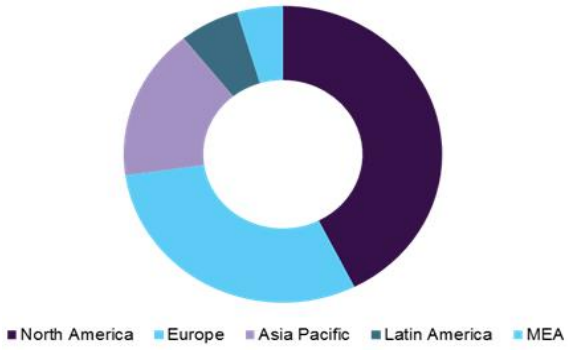


Fig.11.1. **Global EEG devices market share, by region**

As automation in musical device is a new concept so hopefully the most rapid market growth will occur among all classes of music lovers around the globe.