Progress Presentation-I

e-Yantra Summer Intership-2015

Controlling Firebird V using EEG sensor (Brainwave sensor)

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What is the project all about??...

- **Name of the project:**
  Controlling Firebird V using EEG sensor (Brainwave sensor)
- **Objective:**
  The main objective of this project is to control the bot using brainwave sensor. This brainwave sensor analyses attention, meditation and various brain activities except human thoughts.
- **Deliverables:**
  1. Tasks List
  2. Introduction to Brainwaves and sensor
  3. Various Task accomplished
  4. Challenges faced
  5. Future plans

Overview of Task

Tasks Accomplished:

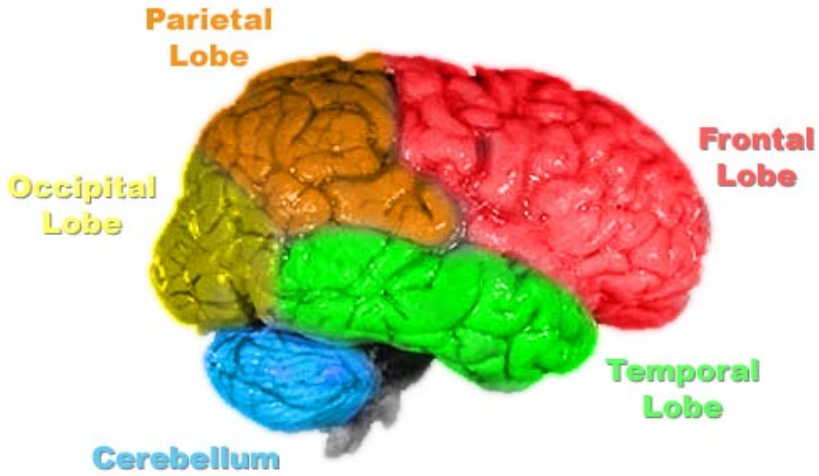
1. Understanding Brainwaves and about EEG sensor(Mindwave mobile headset)——(2 days)
2. Configuring Bluetooth module with sensor.——(2 days)
3. Analysing and Processing Brainwave values.——(2 days)
4. Interfacing Sensor to Firebird V via bluetooth.——(3 days)
5. LED Bargraph blinking based on Attention level——(4 days)

Task Remaining:

1. Controlling Firebird V motions using attention level and eye-blink.——(5 days)
2. Controlling wheel-chair using these techniques——(5 days)
3. Documentation——(5 days)

Introduction to Brainwaves

Figure: Five types of brainwaves measured from different sections of brain



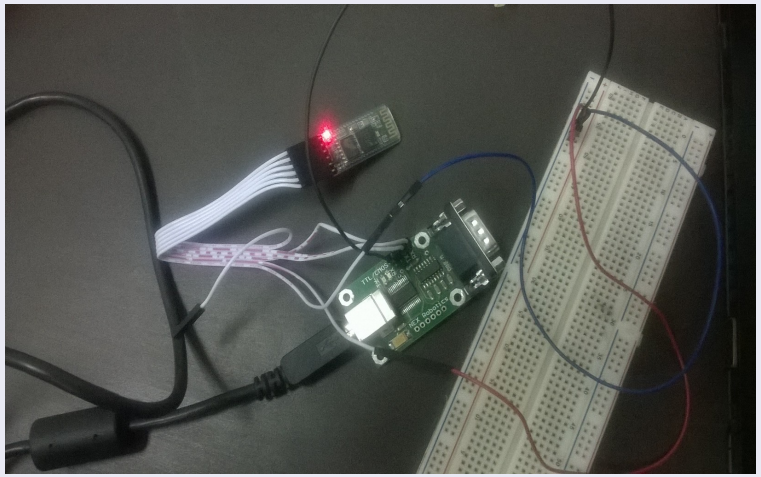
- Gamma waves (24Hz to 100Hz from Center part of brain)
- Beta waves (12-30 Hz from cerebral cortex)
- Alpha waves (8-12 Hz from Occipital lobe)
- Theta waves (4-7 Hz from Hippocampus while dreaming)
- Delta waves (0-3 Hz from thalamus and cortex)

What is EEG??...

- EEG stands for **Electroencephalography**.
- Electroencephalography is a non-invasive method to record electrical activity of the brain along the scalp.
- This measures voltage fluctuations resulting from ionic current within the neurons of the brain.

Configuring bluetooth module(JY-MCU) using AT commands

Connection of JY-MCU to USB to serial converter



Various AT commands for configuring module

Options

Output >>

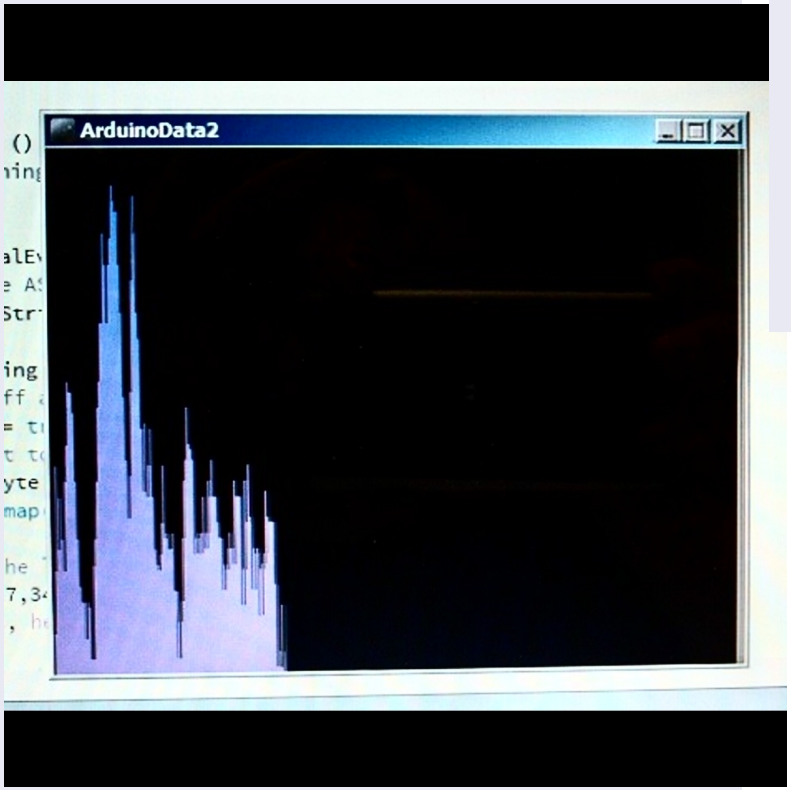
```
OK
+NAME:EEG
OK
+UART:9600,0,0
OK
+ROLE:1
OK
+PSWD:0000
OK
OK
ERROR:(0)
+CMOD:0
OK
OK
+BIND:2068:9d:88c1d7
OK
+IAC:9e8b33
OK
OK
+INQM:1,9,48
OK
```

Input >>

```
AT
AT+NAME
AT+UART
AT+ROLE
AT+PSWD
AT+CMODE=0
AT+C
aT+CMODE
AT+BIND=2068,9d,88c1d7
at+bind
AT+IAC
AT+CLASS=0
AT+INQM
```

Processing Brainwaves using Arduino and Realterm

Processing attention level data values using Arduino



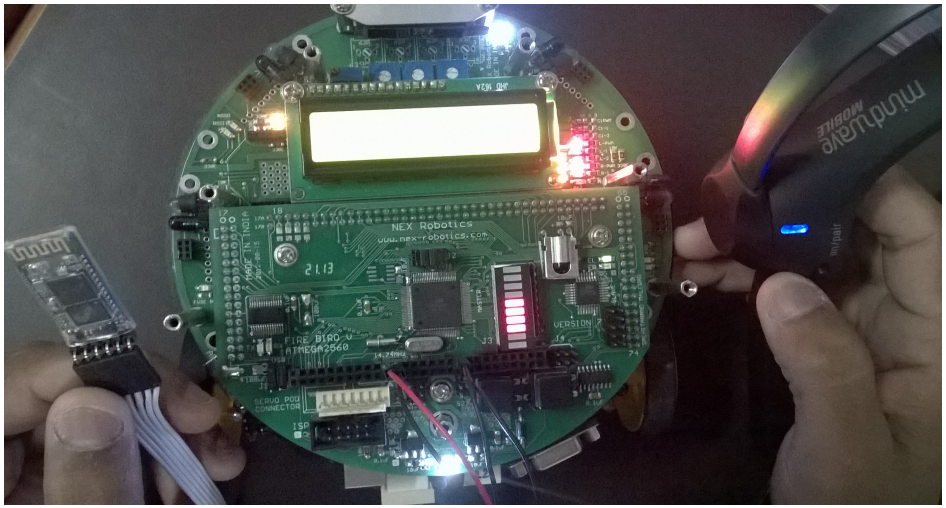
Analysing Data values using Realtern

```
AA 04 80 02 FF 77 07 AA AA 04 80 02 00 72 0B AA AA 04 80 02 FF EC 92 AA
AA 04 80 02 FF 8E F0 AA AA 04 80 02 00 C5 B8 AA AA 04 80 02 00 E8 95 AA
AA 04 80 02 FF 75 09 AA AA 04 80 02 FF F2 8C AA AA 04 80 02 01 38 44 AA
AA 04 80 02 00 53 2A AA AA 04 80 02 FF 28 56 AA AA 04 80 02 00 10 6D AA
AA 04 80 02 00 2A 53 AA AA 04 80 02 FF 7C 02 AA AA 04 80 02 00 83 FA AA
AA 04 80 02 01 5A 22 AA AA 04 80 02 00 06 77 AA AA 04 80 02 FF BC C2 AA
AA 04 80 02 01 20 5C AA AA 04 80 02 00 C9 B4 AA AA 04 80 02 FF 4D 31 AA
AA 04 80 02 FF AC D2 AA AA 04 80 02 00 29 54 AA AA 04 80 02 FF 25 59 AA
AA 04 80 02 FF A6 D8 AA AA 04 80 02 01 18 64 AA AA 04 80 02 00 5D 20 AA
AA 04 80 02 FF 5D 21 AA AA 04 80 02 00 A0 DD AA AA 04 80 02 01 23 59 AA
AA 04 80 02 FF D5 A9 AA AA 04 80 02 FF 9C E2 AA AA 04 80 02 00 7A 03 AA
AA 04 80 02 FF C9 B5 AA AA 04 80 02 FF B6 C8 AA AA 04 80 02 01 01 7B AA
AA 04 80 02 00 C0 BD AA AA 04 80 02 FF 52 2C AA AA 04 80 02 00 24 59 AA
AA 04 80 02 01 40 3C AA AA 04 80 02 00 10 6D AA AA 04 80 02 FF 15 69 AA
AA 04 80 02 00 39 44 AA AA 04 80 02 00 36 47 AA AA 04 80 02 FF 85 F9 AA
AA 04 80 02 00 79 04 AA AA 04 80
```

Interfacing Brainwave Sensor with Firebird V

- Mindwave mobile sends data via bluetooth to firebird V bot.
- Bluetooth module(JY-MCU) is bound with Mindwave mobile using Unique ID.
- Initially Programmed the bot to just receive data values form sensor.

Figure: LED Indication of receiving data values from sensor.



Attention Level Detection

- Attention level from 1-10 percent indicates mind-wandering event.
- Attention level from 10-30 percent indicates poor quality of attention achieved.
- Attention level from 40-60 percent indicates neutrality.
- Attention level of more than 70 to 80 percent cannot be achieved often.

Challenges faced during project

- Receiving data using bluetooth module.
- Receiving a proper data packet from the mindwave sensor.
- Processing delay of program compared to time taken to receive continuous data packets.
- Detection of random data values during connection of sensor with scalp and during disconnecting it.
- Analysing eye-blink data values.

Future Plans

- Analyzing eye-blink data values and increasing accuracy of it.
- Controlling Firebird V motions (Right, left, forward, stop) using attention level and eye-blink.
- Applying similar technique to control wheel-chair.

Questions are welcome

THANK YOU !!!