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Mind Controlled Wheelchair for the Disabled.

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Abstract - *Designing a wheelchair for the patients with severe loco motor disorder such as poliomyelitis, motor neuron disease is a challenge because it should provide easy mobility without the involvement of limbs. Such patients are in a condition of being not able to move any limb below their neck. An attempt has been made to propose a brain controlled wheelchair, which extracts the brain signals and processes it to control the wheelchair.*

The method of extracting brain signals is known as Electroencephalography (EEG). Electrodes are placed on the user's head which extracts the brain signals and converts it into movement commands by the Arduino microcontroller which in turn moves the wheelchair.

Key Words: Electroencephalography, Neurosky headset, brain waves,

1. INTRODUCTION

According to the statistical data, the percentage of physically disabled persons among all the disabled person is 33%, which is the second majority of the disabled person. Since the physically disabled person is one of the major contributions to total number of disabled people, this indicates that the amount of disabled persons who lost their mobility are substantial. Wheelchair is the most common device that is used to provide mobility for the physically disabled and sometimes elderly people. Most of the wheelchairs today especially the affordable manual wheelchairs require human power to maneuver. Even for the electrical wheelchair, it still requires user's finger to move the joystick or press the button. Health conditions like Poliomyelitis, Motor neuron disease are incapable of moving any motor organs.

With the intension to resolve this issue, another constructive way is by using the brain to directly control the movement of the wheelchair. This method will allow most of the people to navigate the wheelchair by themselves. Therefore, this will bring an extremely high impact, especially for the disabled individuals who are not able to communicate physically .The activities of the brain are required to be analyzed for implementing the Brain-computer interface (BCI) for the wheelchair.

EEG is the most suitable method to be utilized for retrieving the signal of brain activity in order to implement the Brain-computer interface system. This is because the EEG device is portable and non invasive. EEG is a method that captures electrical waveform from the brain. These signals are captured and will be transmitted to the computer for further processing. The patterns of the electrical waves that produced by the brain is distinctive due to different kind of thoughts. There are two methods of obtaining brain waves, Invasive method and Non-invasive method. Invasive method means implanting the electrodes into the brain through surgical method and capturing the signals. It is very expensive and sometimes dangerous too. Non-invasive method involves capturing brain signals from outside the brain that is by placing electrodes on the scalp or on the forehead. This method is considered to be very safe and is also less expensive.

During the EEG signal processing the raw EEG signals are processed in a manner to differentiate the mental commands that are thinking by the user. After obtaining the mental command, it is used to produce the electrical control signals for controlling the movement of the wheelchair.

2. METHODOLOGY

The system mainly includes Mindwave Headset (signal acquisition), mobile app (Brain controlled wheelchair), Bluetooth module (HC-06), Arduino Uno microcontroller, motor driver and the Wheelchair. The headset is used to capture the brain signal.

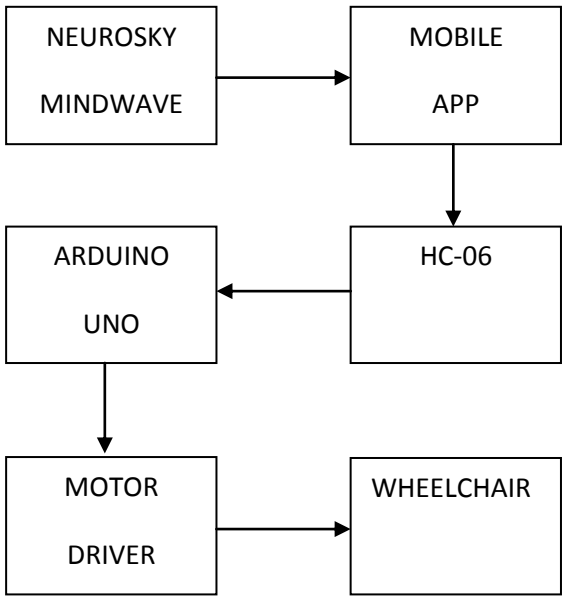

Fig -1: Block Diagram

The signal is sent to the mobile app which recognizes the commands sent by the user. The app sends this command to the arduino microcontroller via the Bluetooth module. The arduino sends command signals to the motors in the wheelchair according to the output of the headset. Now the disabled person on the wheelchair can move accordingly.

2.1 ANDROID APP

Android application GUI is shown below FIG.2. The application has two buttons: one to connect the app to the HC-06 Bluetooth module and the other to connect the app to the Mindwave Mobile. On startup, the connect button for the Mindwave Mobile is disabled - it will only be enabled once connection with the HC-06 Bluetooth module is established. The app displays six text values relevant to the operation of the wheelchair. Signal quality indicates whether the connection to the Mindwave Mobile is not detected, poor, medium, or good; attention level displays the users current attention level; state displays whether the wheelchair is currently in standby, command, focus or running mode; direction will only be activated when the current state is command and will cycle between the forward, backward, left, and right directions; normal blink strength will display blink strength values below the threshold value of 90; last, forced blink will display blink strength above the 90 threshold value.

Fig-2: Android App

2.2 FLOWCHART

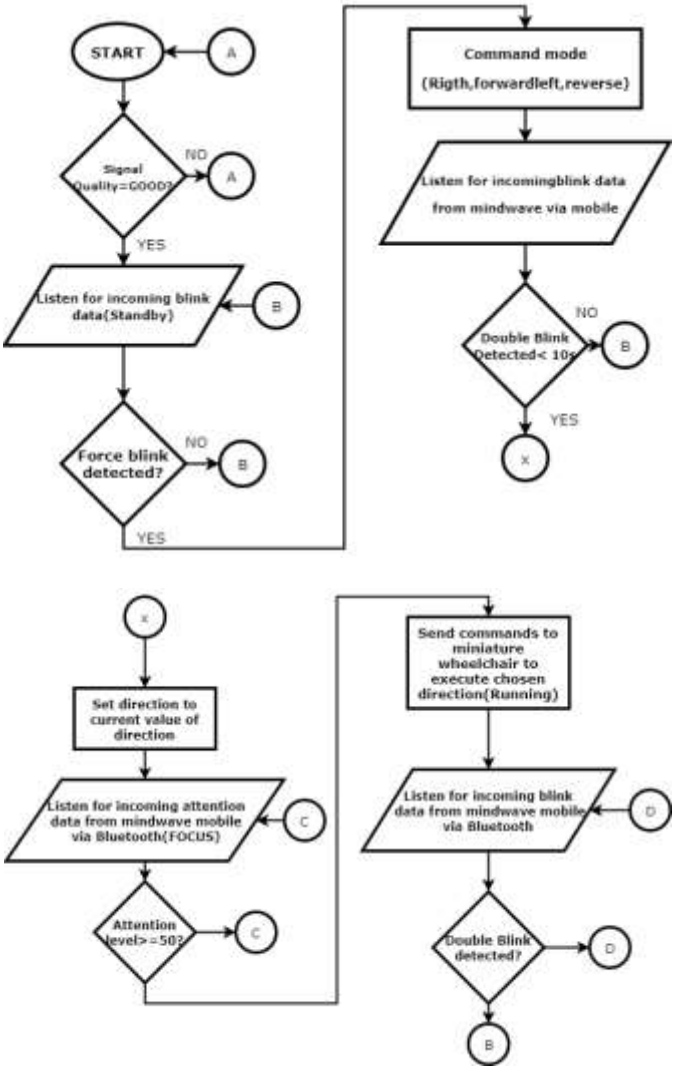

Chart 1: Android App

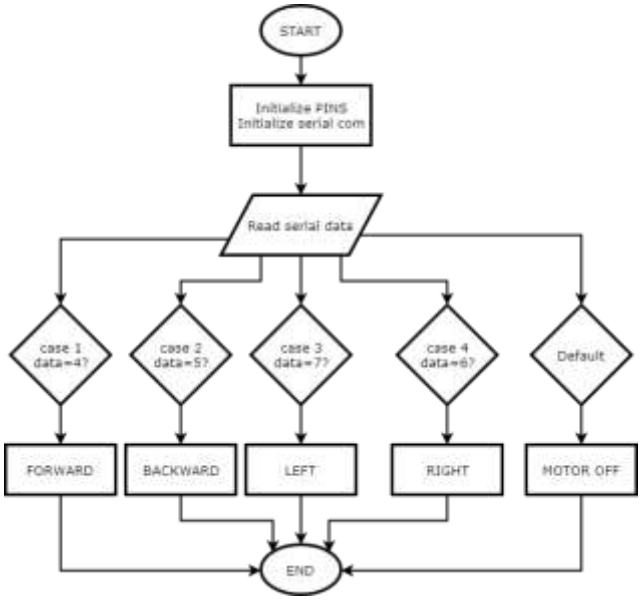

Chart 2: Arduino Control

3. CONCLUSIONS

As result, an electrical wheelchair which is able to function as a common electrical wheelchair is developed. Android based Application for this project is developed as shown in Fig.2. This program is able to read and process the EEG data from the NeuroSky mindwave headset into mental command. After processing, this program sends out the command signal to the connected HC-06 on the microcontroller board of the wheelchair. In the end, the electrical wheelchair is able to move according to the user's desire.

Fig -3: Wheelchair Implementation

By using this application, the electrical wheelchair can be directly controlled by human brain. The results show that the processed EEG data does not provide 100% accuracy according to the human mental command. However, it can achieve up to 75% of accuracy. The testing results for mental commands are,

Table -1: Result

Directions	No. of attempts	No of attempts successful	No of attempts failed
Forward	10	8	2
Reverse	10	7	3
left	10	7	3
Right	10	8	2

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