International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Locomotion System for ALS Patients using Artificial Intelligence

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Abstract: ***This paper purposes the study of tools which aims to overcome the disability of handicapped people using their thinking capabilities.Many people around the world lack the credibility of vital movementsand rely upon powered wheelchairs to complete their daily activities. However, many of them are not prescribed to use powered wheelchairs, either because they are physically unable to control the chair using a conventional interface, or because they are not capable of driving wheelchair safely.Thus in such cases, this project can be helpful.***

Keywords: Neurosky waveform sensor (EEG), Arduino, motors, Wheelchair, MATLAB, Brain-Computer Interface(BCI), Amyotropic lateral sclerosis (ALS)

1. Introduction

Amyotropic lateral sclerosis (ALS)means amyotrophic lateral sclerosis. It is a neurodegenerative disease and it affects spinal cord and brain. It leads to no nourishment of muscles and when muscles have no nourishment it leads to its wastage. It's essential to locate the specific areas in person's spinal cord here a portion of nerve cells which control the muscles. Motor neurons transfer signal from the brain to spinal cord and from there to muscles throughout the body. The ability of the brain to control the Muscle movement comes to an end if the motor neurons die. People lose their ability to speak, eat, drink and even breathe if the muscle action is affected. ALS affects the motor neurons that provide muscle control and voluntary movements.

As Amyotropic lateral sclerosis (ALS) patients are not physically active but mentally they can perform all the operations which can be performed by a well matured and nourished man, their physical disability isolates them from the real world and hence a locomotion system is proposed to help them to certain extent. This project will allow them to travel anywhere through wheelchair just by using their thinking capability. This project will work on the idea that how a person can become mobile without even actually moving their body. Specifically, this project is about the people who cannot walk or even move. This could be useful for people who are paralyzed and are unable to control parts of their body. This project will comfort them allowing them to control their movements. This will highly help the Amyotropic lateral sclerosis (ALS)patients who have their whole body paralyzed and so it become very difficult to handle them over wheelchairs. But they do have the capability to think like a normal being and hence we can get control over their brain pulses and the brain pulse can be used to run the wheelchair. For example, the ALS patient will think of taking a right turn then the wheelchair will automatically turn to the right. Similarly, instruction for a left turn will move the wheelchair to left and so on for the rest of the directions. In section II goals are discussed. Furthermore in section III, IV,V, VI and VII Electroencephalography(EEG), proposed methodology, results and discussion , future scope and references are discussed.

2. Objective

According to the analysis of causes of paralysis and spinal cord injuries in Fig.1 and Fig.2 respectively, the importance of locomotion system for the people victimized due to such uncertain incidents is shown. The total causes of paralysis and spinal cord injuries are 5,596,000 and 1,275,000 respectively. Thus as a result of these injuries people suffer from severe loss of motor function and this force people to depend on the care of other individuals and feel very dependent on others. Therefore in these cases locomotion system is very beneficial to such people giving them a sense of independence of movement just by using their thinking capacity. The various reasons for the causes of paralysis and spinal cord injuries are shown in Fig.1 and Fig.2 respectively.

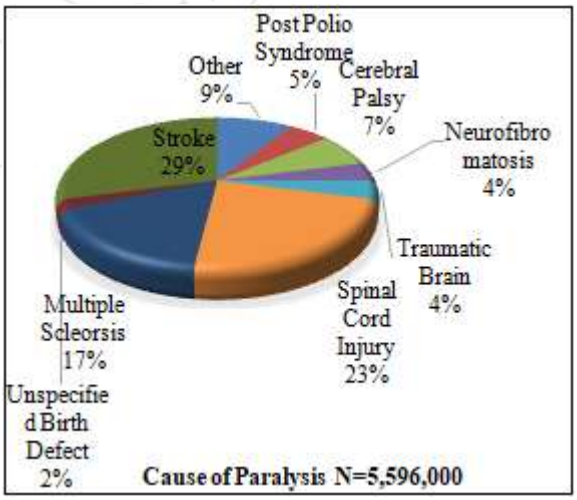

Figure 1: Analysis of causes of paralysis

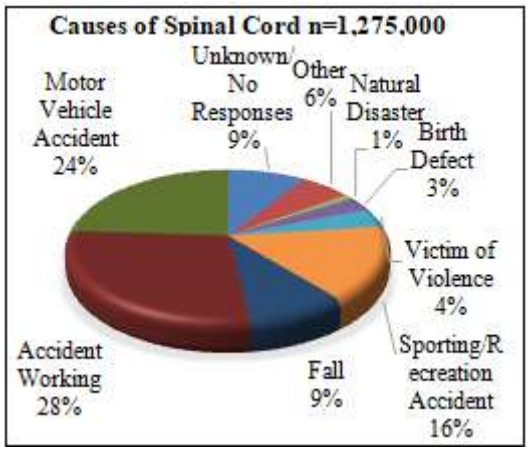

Figure 2: Analysis of spinal cord injuries

3. Electroencephalography (EEG)

3.1 EEG Sensors

Electroencephalography (EEG) sensors are designed with the motive to be used by the developers so that they can get to the market with complete EEG monitering products.This headset mainly measures brainwave signals and it also moniters the attention level of the the individuals.This headset can be used for the purpose of health, education as well as entertainment. Fig.3 shows the block diagram of Electroencephalography (EEG) sensor.[2]

3.2 Working Of EEG

Brain constantly produces electrical signals while it operates and EEG sensor picks up this electrical activity and divides the signal in various waves.EEG collects the electric patterns and digitize them for computer storage.Electrode conduct potential as microvolt level signals and carry signals to the amplifiers. Amplifiers are used to amplify the signals.Fig.5 shows the working waveform of EEG sensor.[2]

3.3Attention level indicator

The level of attention can be indicated by using EEG signals. After collecting the EEG data various features are collected from the raw data.SVM is used to calculate and analyze these features which indicates the attentiveness level.Fig.4 shows the block diagram of attention level indicator.

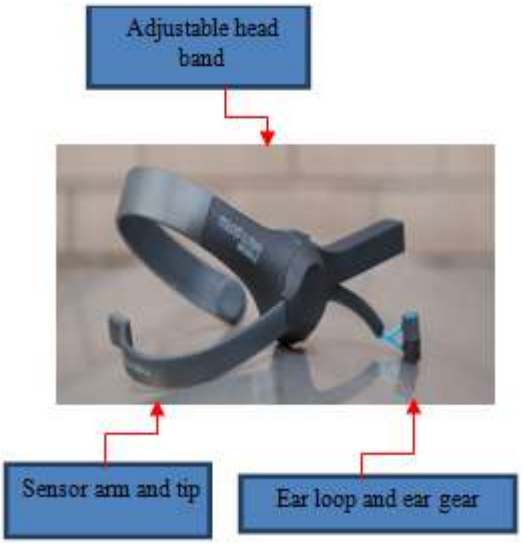

Figure 3: Electroencephalography (EEG)

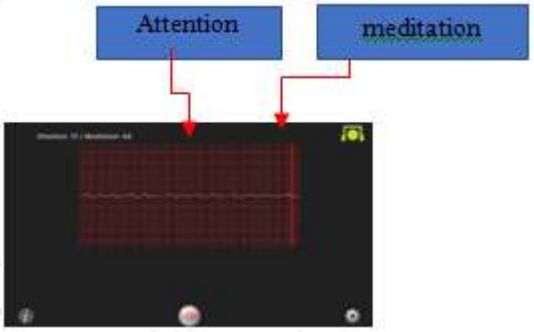

Figure 4: Attention Level Indicator

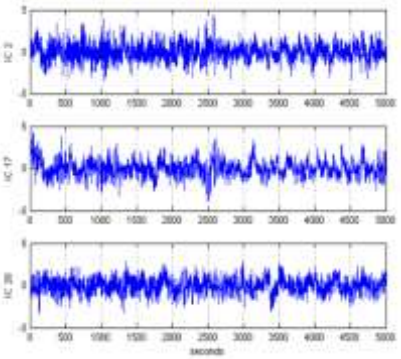

Figure 5: Example of EEG waveform

Figure 6: Locomotion system

4. Proposed Methodology

This project is based on the concept of artificial intelligence. This system will exhibit intelligent behavior and will act according to commands given using our thinking capacity.

For this purpose neurosky wave sensor is used which will collect electrical patterns.The connection between the neurosky mind wave and devices will be established using Bluetooth module. Furthermore, the information about how neurosky mind wave sensor reacts with the devices and how it determines the level of attention and meditation will be shared with the computer. The neurosky mind wave sensor will be connected to receivers and the processing with the MATLAB will be researched. Brain pulses will be converted in the form of frequency with the help of MATLAB. The sensor will be able to command the receiver side by the help of MATLAB processing. The project will be able to run the motors by using luminous battery over given command.The wheelchair will be able to move according to the given command.

4.1 Hardware

The hardware utilizations in this project are Neurosky Waveform Sensor, Arduino Board, Motors, Relay, Wheelchair, Power Supply (Battery 150ah),Bluetooth .

4.2 Software

The software utilizations in this project are MATLAB, arduino IDE.

4.3 Algorithm

The following steps discuss about the mentioned method's implementation.

1) Switch on the device
2) Connect the brain wave sensor to arduino.
3) Record the electrical pulses of the brain using brain wave sensor.
4) Brain pulses will be converted in the form of frequency using MATLAB.
5) Share the data with the help of computer to the receiving end.
6) The end device will work as per the received data.

5. Results and Discussions

5.1 Significance of Project

Wheelchair developed using the concept of artificial intelligence is easy to handle by ALS patients. No physical work is required to run the wheelchair.This wheelchair is easy and convenient. It is very useful and beneficial to not only ALS patients but every individual for locomotion purpose.The EEG acquisition can also detect any improvement in the condition of the body.

5.2Application

It provides a sense of independence and freedom to ALS patients allowing them to move freely just by using their thinking capability without the help of an attendant.It can lead to evolvement of day to day gadgets to work using mind waves.

5.3 Outcome

This project is aimed to provide ease of access to ALS patients so as to help them perform various tasks without any difficulty, as it uses just their thinking capability of the patient.The major motivation behind this project is to comfort ALS patients to a great extent.

5.4Output

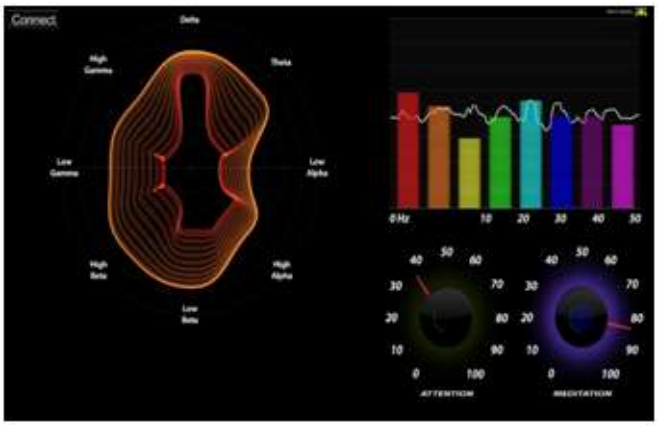

Figure 7: Mind Wave Analyzer

6. Future Scope

As the artificial intelligence has a vast scope, it can be used in various applications. For example, artificial intelligence can be used in gaming, medical diagnosis, electronic trading, robot control and remote sensing. These are the several applications of artificial intelligence. Specifically, the concept of artificial intelligence can be implemented to comfort ALS patients on larger level by allowing them to move just by using their thinking capability.This can be made cost efficient and more user friendly by replacing arduino with any other less expensive board.This can be used by any other patients as well who find it difficult to move with ease. It is not restricted to only ALS patients, even old people can use it to comfort themselves because with age they too face certain difficulties in walking or any other activities.

7. Conclusion

The final device is portable and it would be a great help for the ALS patients. This will allow them to move freely around just by using their thinking capability. This project will provide a sense of independence to ALS patients by allowing them to move without the need of an attendant. Since the accidents and injuries related to spinal cord have increased enormously in recent years , this project will be of even more importance to all the patients who are victimized with this severe injuries.

References

[1] J. Philips, J. d. R. Millán, G. Vanacker, E. Lew, F. Galán, P. W. Ferrez, H. Van Brussel, and M. Nuttin, "Adaptive shared control of a brain-actuated simulated wheelchair," in Proceedings of the 2007 IEEE 10th International Conference on Rehabilitation Robotics, June 12-15, Noordwijk, The Netherlands,pp. 408–414, 2007.

[2] Imran Ali Mirza, Amiya Tripathy, "Mind-Controlled Wheelchair using an EEG Headset and Arduino Microcontroller", 2015 International Conference on

Technologies for Sustainable Development (ICTSD-2015), Feb. 04 – 06, 2015, Mumbai, India, 2015

[3] Atanasios Vourvopoulos, Fotis Liarokapis, "Brain controlled NXT Robot: Teleoperating a robot through brain electrical activity", IEEE conference on Games and virtual worlds for serious applications, Athens, Greece, 2011.

[4] Electric Portable Ruby Plus wheelchair, viewed 1st February 2010 <http://www.mobsol.com.au/p/241352/wheelchair electric-portable-ruby-plus.html> from Sunrise Medical Australia http://www.sunrisemedical.com.au/.