MINDWAVE AUTOMATION

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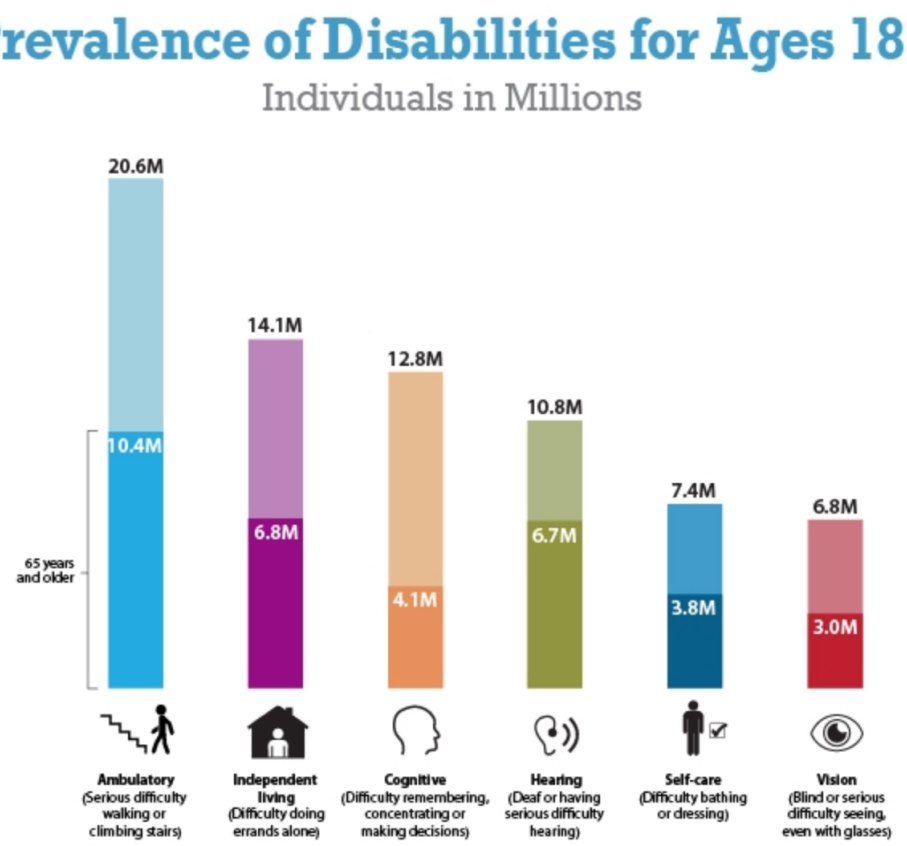
1 Introduction

People suffering from various motor disabilities like Spinal Cord injury, muscular dystrophy, multiple sclerosis, cerebral palsy, brainstem stroke and Amyotrophic Lateral Sclerosis(ALS) are not able to control different activities of their body. BCI gives direct collaboration among brain and other devices that enables signal from brain to control external activities, by converting various brainwaves to instructions. Dry electrodes are used for this purpose, which reside on the top of the heard of the user. The above procedure is known as electroencephalography. It can be categorised into two types, invasive and non-invasive. The former works by implanting the electrodes to the cortex. The actual EEG sensors are not cost efficient and are mostly preferred only in hospitals. They are also cumbersome to use since it involve a conductive gel to read all signals. A present device that has been developed and has been is the various applications record electrical impulses generated from brain. The Neurosky EEG sensor collects the electrical signals and amplifies it to the precise output values. Thus proving to be a cost-effective and user friendly device.

The control system design has made varied use of speech and gesture recognition, but the actual working is not displayed yet. The wheelchair which is being developed has a very wide horizon in its working domain. This would be controlled by Electrooculography. The motion of wheelchair is restricted to the eyes vertical and horizontal movement. The oblique movements of the iris would not be considered in this case. The above idea works with the brainwaves and motorised wheelchair using a cost-efficient EEG device. This would eliminate the idea of the traditional devices which were cumbersome to operate hereby making it convenient to use. This has also

reduced the cost by a huge amount. Here, we don't invent anything new but work on the previously available framework and bring the best out of it. Doing so would be a noble importance to paraplegic patients since they would have the freedom of mobility.

2 Market Research



The term spinal cord injury (SCI) is associated with a damaged spinal cord leading to temporary or permanent changes in the functioning of the spinal cord. The aforementioned injury can lead to loss of the sensation (partial or complete) at any level of the spinal cord. The long term disabilities

may lead to tetraplegia (also known as quadriplegia) or paraplegia.

Paraplegia is a disability where the lower half of the body becomes dysfunctional (including both legs). Tetraplegia, is more adverse than paraplegia as it causes all 4 limbs to stop functioning.

There are many rehabilitation centres which provide proper medications and help patients to lead a normal life. In the United States alone there are over 335,000 people suffering from spinal cord injuries with roughly 12,500 new cases arising each year.There are around 1million cases in India.

In an era where human and computer interaction has become the dream come true technology, there are many projects which aim at achieving the same and helping humanity. Most of them are focused on helping challenged people but fail when it comes to targeting the masses. Technologies need to be developed that target a bigger audience keeping in mind the cost efficiency and ease of use. An electroencephalographic device which reads brain impulses has given birth to such top-notch technological inventions. The strength of Brain impulses would not be the same for everyone, hence a common ground has to be developed, also making it compatible for each and everyone using it.

These brain impulses are interlinked and connected with each and every sensory organ of the body. Using all the five types of brain waves, that is Alpha, Beta, Gamma, Delta, and Theta, 100% brain control can be achieved. These technologies are impressive but are obviously still in very early stages of development.

Here we are aiming to make a cost-efficient and human-friendly brain signal operated wheelchair primarily focusing on paraplegic and tetraplegic patients. In addition we would have features like obstacle detection and avoidance, slope assist, emergency braking and other SOS assistances. Hence making the paralysed person independent to an extent.

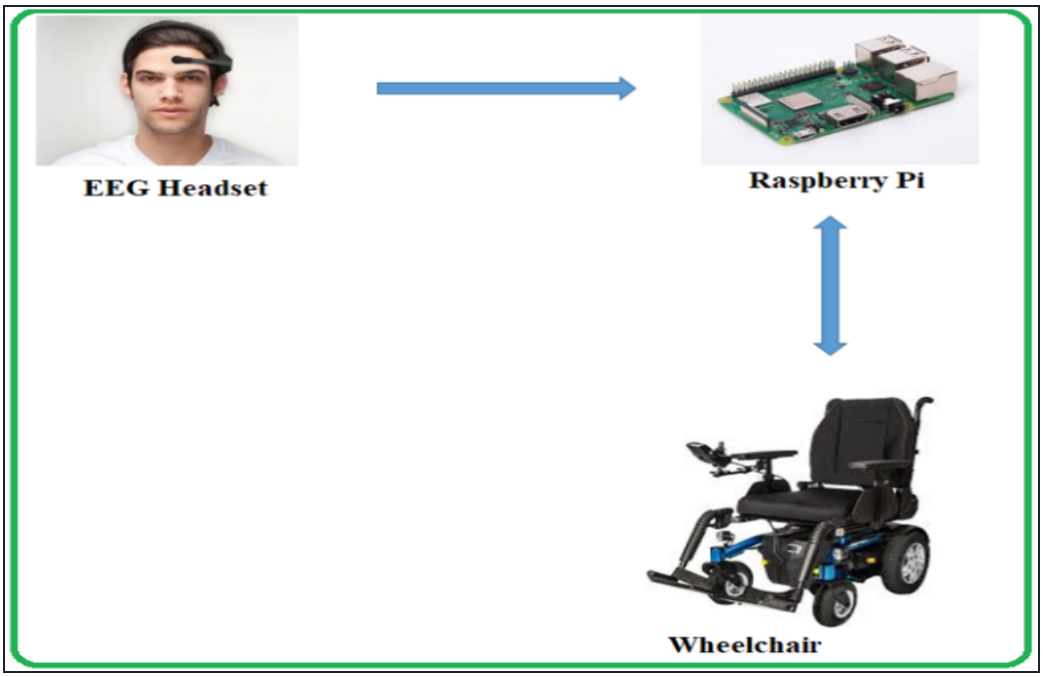
3 Hardware Requirements

- EEG Headset
- Raspberry pi 4
- Wheelchair framework
- Motors and Motor Driver
- Camera module
- Gyroscope sensor

4 Software Requirements

- EEG Analyser
- Bluetooth interface
- Python

5 Implementation



- The raw EEG signals are captured using the NeuroSky Mindwave EEG headset.
- The Level Analyser Technique is used to differentiate the attention level of the patient. External noise is removed using FT analysis.
- The EEG headset provides two types of signals i.e. the Attention level values and the Eye blink Intensity values which are transmitted to the Raspberry pi via the Bluetooth medium.
- Depending upon the algorithm designed for controlling action , the raspberry pi controls the movement of robotic wheelchair using the motor driver circuit.
- Received controlling parameters from headset assist in performing actions of moving forward, backward, right and left.

- Input received from the camera module and gyroscope sensor controls the speed of motor comparing it with the threshold value in order to bring about the concept of automation into it.
- Apart from movement control of the wheelchair, we have implemented Obstacle Avoidance System, Speed control and slope detection.

6 Feasibility

From the above figures we see that treatment for such injuries are heavy on one's pocket, and the majority of them are the employed population. Automated wheelchair can be used by such patients making them independent and comfortable at the workplace. It also holds a big market for the unemployed patient population. The USP of our product would be its efficiency, low cost and ease of use. We plan to market it by giving few products free of cost to famous hospitals, doctors and NGO's, online and offline marketing and branding activities. In future we aim to use EEG devices that sense all types of brain waves making it fully autonomous. This is still in the early stages of development and holds a big market with every considerable update.

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