A Machine Prototype to Assist Differently Abled People

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I'd like to present my prototype in detail for free use and further development by anyone. At the time of writing, I do not have the monetary resources to buy the parts for realizing my prototype, but I'm confident that this prototype can work practically, with minor modifications.

1) Description :
Minimum biological specifications for eligible users :
  a. Must have their limbs intact.
  b. Must have their head shaved.
This mechanism is intended for disabled users who have their limbs intact but cannot control their muscles.
To work around this problem, I studied the dynamics of human motion in sparse detail.
To move any muscle, your brain sends a signal to your muscles to contract or relax. This contraction and relaxation of different muscles in a timed fashion using information from your senses such as sight and the body's own balance correction mechanism, allows us to walk . All in all, this works almost perfectly in harmony.

The users are unable to move their limbs, probably because of the following reasons, but not limited to :

  a. Nerve injury at some point in their nervous system which blocks the signal from the brain to the muscle.
  b. Muscle degradation due to any reason or absence of muscles.

In all the relevant cases, I found that the disabled people had one or both of the conditions above. To walk, it is necessary that a person has their nerves functioning and their muscles intact.

2) Mechanism

The solution I found to the problem was applicable to both cases. I thought of an exoskeleton limb movement mechanism which could be controlled via brain signals. I knew about a Brain-Computer Interface available in the market for video game players, called Epoc, manufactured and designed by Emotiv Inc. It is a relatively cheap BCI at 300$ a unit. It has a USB interface and an API, both of which can be easily exploited to trigger servo movements.

We can easily bypass the body's nervous system and deliver signals directly to the needed muscle.
The second challenge of making limb motion and body posture correct is achieved by accurate and timed triggering of different servo motors. The servo motor layout has been revised 18 times considering efficiency, practicality, cost, power considerations, balance correction parameters, strength and durability. It is very likely to be revised many more times before a testable version is realised.

3) Construction
The entire frame can be made out of aluminum/titanium alloy or carbon fiber.
Both of these materials can be used as they are light,strong,durable,rigid. One may prefer a carbon fiber frame for flexibility and extra lightness, but it is costlier.

Parts :

a) BCI Interface (Emotiv Epoc) : It consists of 6 saline electrodes which are in direct contact with the scalp skin. When we think of something, chemo-electrical reactions produce electric signals in the brain which reach the scalp as well. Let's say our user thinks of lifting his foot from the knee up. An electrical signal is generated in his brain which travels to the scalp. The BCI interface intercepts this signal and this signal can then be used for any purpose, including triggering of servo mechanisms.

b)Arduino Servo Controller/Linux Box with Servo Interface.

c) Power Source.

d) Servo Mechanism installed on a frame, customised for each user's body frame.