جامعة عين شمس
كلية الحاسبات والمعلومات

Project Allocation

Project Title :

NeuroPhone: Real-Time Brain-Mobile phone Interface

Department :Scientific Computing

Supervisors:

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Problem definition:

EEG signals are signals elicited by brain neurons. It carries and transmits information between neurons in the brain. Advancements in neuroscience and technology had enabled us to capture and detect these signals. This opened a novel and revolutionary way of thinking and has paved the way for new technologies to emerge such as BCI. Brain-computer interface (BCI) is an outstanding modern technology that is based on direct communication pathway between the brain's electrical activity and an external device. It is enabling the brain to directly reach and control the device.

The existence of such a technology in our world pushed us to think beyond limits and to solve problem with an unprecedented approach. Scientists began to think about people with disabilities especially motor disability and the ways this technology would help them. This innovation would not only help people with disabilities but would also serve all segments of people. Focusing on mobile phone applications -giving that smart phones are essential communication devices in our everyday life-, our project aims at applying BCI technology into a smart phone communication application. People with motor disabilities face a lot of obstacles to contact other people using smartphones, and it becomes more dangerous and life-threatening in emergency situations when they are not able to call for help, Therefore, using a BCI-based technology would provide them an easy way to communicate with other people. The wireless EEG headset would transmit EEG signals (p300 signal) to the mobile phone application and deep learning techniques deployed in that application would detect and capture those signals.

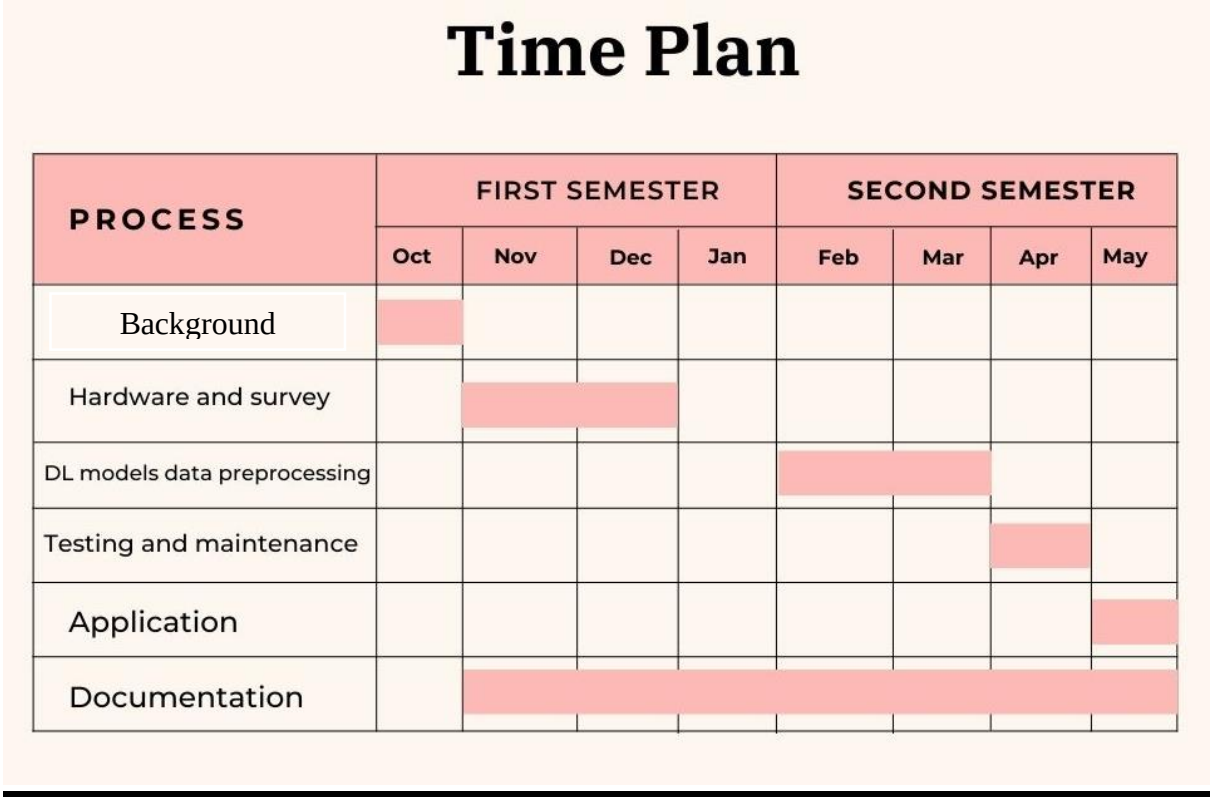
Motivation:

According to the World Health Organization (WHO), Over 1 billion people are estimated to experience disability. This corresponds to about 15% of the world's population, with up to 190 million (3.8%) people aged 15 years and older having significant difficulties in functioning, often requiring health care services. People with motor disabilities need constant help, and they would be in great danger if they are left alone. Even with the existence of smartphones, they are unable to call for help. So, we aim at providing an efficient communication application that is based on BCI technology to help them contact other people and call for help in emergency situations. The application would enable them to access the mobile phone application using only their visual attention. And by capturing the transmitted EEG signal that is elicited during attention using deep learning techniques they would be able to directly access the mobile phone and call for help.

Objectives :

Providing a BCI-based mobile phone communication application that would serve people with motor disability.

Time Plan:



Tools:

Hardware for building EEG headset:

- AD620ANZ amplifier.
- 2 X op-Amp TL084CN.
- Capacitor Kit
- Resistors Kit
- Breadboard with jumpers
- Male - Male jumpers
- Esp32
- Neuroline electrode cups
- Ten20 electrode gel
- arduino uno

References:

Papers:

[1] **Gutierrez-Martinez, Josefina and Mercado-Gutierrez, Jorge A and Carvajal-Gámez, Blanca E and Rosas-Trigueros, Jorge L and Contreras-Martinez, Adrian E ,**
Artificial Intelligence Algorithms in Visual Evoked Potential-Based Brain-Computer Interfaces for Motor Rehabilitation Applications: Systematic Review and Future Directions, NER. 2021

[2] **S. Kundu, S. Ari, A Deep Learning Architecture for P300 Detection with Brain-Computer Interface Application, NER. 2020**

[3] **Elsawy, Amr & Eldawlatly, Seif. P300-based applications for interacting with smart mobile devices, NER. 2015**

[4] **Campbell, Andrew & Choudhury, Tanzeem & Hu, Shaohan & lu, Hong & Mukerjee, Matthew & Rabbi, Mashfiqui & Raizada, Rajeev. NeuroPhone: Brain-Mobile Phone Interface using a Wireless EEG Headset, NER. 2010.**

[5] **Wang, Yu-Te et al. "A cell-phone-based brain–computer interface for communication in daily life." Journal of Neural Engineering 8, NER. 2010.**

Approvals :

Supervisor **(**……. **)**
Head of Department **(** …….**)**
Vice Dean of Education **(**Dr. Hala Mosheir)
Dean of FCIS **(**Prof. Dr. Nagwa Badr**)**