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Dr. Arun Oommen
MS, MCh (Neuro), MRCS Ed, MBA
Consultant - Neurosurgeon

May 14th, 2018

Dr. Sunil Jacob
Director, SCMS centre for Robotics
SCMS School of Eng and Tech
Karukutty, Angamaly, Kerala , India

Re: Support for Brain to muscle interface for paralysed person

Dear.Dr. Jacob

I am pleased to offer my full support for the collaboration included in your proposal " **Brain to muscle interface for paralysed person** ". Should your proposal be selected for funding, it is my intent to collaborate and/or commit resources as detailed in the Project Description.

My Hospital VPS Lakeshore is one of the leading Hospitals in India and is part of the VPS health care group with a global reach. We are a fore runner as far as Neuroscience is concerned. We have a large team who do all sorts of work related to neuroscience including OP patient care and diagnosis, surgeries, Rehabilitary care, publications and research.

We are excited to be able to support the technical and implementation process, subject to availability of time and resources. We will provide necessary scientific input (and mentoring) but will not have any duties associated with programmatic stewardship, which will be performed by Dr. Sunil Jacob, Director, an extramural program official. Further, in keeping with the mission of SCMS School of Engineering and Technology to promote and facilitate Neuroscience research and the dissemination of new knowledge, we would supply requested research materials and technical expertise to Dr. Sunil Jacob for research purposes.

I am looking forward to working with you.

You can reach me at: oommenarun@yahoo.co.in

Regards

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PG Vinoj, Sunil Jacob, Varun G Menon. "Hybrid brain actuated muscle interface for the physically disabled ", https://onlinelibrary.wiley.com/doi/10.1111/bcpt.13100,

BCPT Volume123, Issue S3, IERI International Conference on Medical Physics,

Medical Engineering and Informatics (ICMMI 2018), 7–9 September 2018, Macau

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Hybrid brainactuated muscle interface for the physically disabled

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Objectives: According to Reeve Foundation 29% of paralysis is due to stroke followed by injury in the spinal cord. Sometimes it may be difficult for a person to move the paralyzed person's body part as it may be too stiff. Our research focuses on actuating the paralyzed person's body part through his own thought process using Brain-Muscle Interface. The system uses Novel Technique which avoids the use of Exo-Skeleton.

Methods: In our current work, we propose a Hybrid Brain-Muscle Interface (HBMI) for the paralyzed person. The HBMI interface should have the provision for pre-processing, classifying, recording and training multidimensional EEG signals. The classifier module and the pre-processor module were implemented separately for easy testing and modification of different phases. The electrical signal from brain is captured using EEG and must be recorded during voluntary movement. When the brain does real time activities it must be detected and categorized into two dimensional movements. The non-invasive technique of recording EEG from the scalp is used for analyzing brain activity. This technique reduces the human mental workload and cost compared to invasive Technique. The excitation of the neurons is done using External audio and video feedback. The accuracy of the system is improved by combining Steady State Visually Evoked Potential (SSVEP) and Event Related Desynchronization (ERD) signals.

Results: The person suffering with Amyotrophic Lateral Sclerosis (ALS) is interfaced with HBMI. The HBMI generate electrical stimulation based on the subject's thought processing and in response to the stimulus the subject under test perform the desired movements of his/her body part. During the operation, the HBMI record the EEG signals, process it and classify it to different desired movements. The recorded operation is compared with the actual operations. The performance accuracy is measured. The performance accuracy is the number of correct classification divided by number of physical operations. A pair of EMG Electrodes must be

placed on the identified body part. If the result is not satisfactory a Bio-feedback is given and the process is repeated till the performance accuracy is achieved.

Conclusions: The Hybrid brain muscle Interface (HBMI) will bypass the brain clotting and help the paralyzed person to move their paralyzed parts using brain stimulation without any Exo-skeleton. It is non-invasive and it does not require any exoskeleton for the motion. In it there is wireless connection between the brain and the controlled parts. Hybridization helps to classify the brain signals more accurately. Our findings will assist paralyzed person, and provide a better interface for the families, friends, and caretaker of the paralyzed person.

Acknowledgements: The part of the research was funded by EPICS in IEEE (Grant No. 2016-12).