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BRAIN COMPUTER INTERFACE - AN EMERGING TECHNOLOGY TOWARDS FUTURE SPACEFLIGHT MISSIONS

Abstract

A Brain-Computer-Interface system (BCI) is a communication pathway between human brain and the external devices i.e. electroencephalogram (EEG) or related neurological sensors. Human brain is considered as a vital part for this research because it is the most complex part of human body that generates signals and noise. Several investigations have been carried out to understand the potential application of BCI into medical field i.e. finding solutions for those who are suffering from Amyotrophic Lateral Sclerosis (ALS). A similar experimental research (Elon Musk's Neuralink project) has been performed to understand how this technique could be utilized for future spaceflight missions. The purpose of this experiment is to design a system that can replace the mechanical or vocal inputs by detecting signals from various brain activities and act as an emergency response system during any critical situation. However, an experiment has been carried out to design a prototype version of an Emergency Response System that can transmit signal to the entire crew or mission support alerting them about the ongoing critical situation.The prototype is also equipped with a system that is capable of updating with astronaut's location and difficulties level during extravehicular (EVA). This is possible with the help of Meta-analysis of P300 waveform using the interface with the brain. The human brain signals are traced, analyzed and filtered according to the type of response. The expected outcome is; the signals generated during any critical situation can be triggered and transformed into an immediate response by detecting signals and transmitting an emergency alarm indicating its origin. Another potential application of BCI is, the psychological evaluation of astronauts during pre-assignment training for future spaceflight missions. A system is developed that can be integrated with the hybrid BCI (P300 and SSVEP) which can analyze the responsiveness to a particular task of astronauts onboard and during training. The expected outcomes of this research is to perform an in depth evaluation of the interaction between the human brain and machine then record the different signal patterns and response based on specific set of actions in contrast to the basic database of astronaut candidates.