Bioelectric Potential Telemetry: Detection, Measurement and Application

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Brain-computer interface (BCI) is an upcoming technological development that has shown a lot of potential in the field of medicine in restoring useful functions to people disabled by neuromuscular disorders such as cerebral palsy, stroke, and spinal cord injury. Although some success has been achieved in various clinical studies, additional research is still warranted to make BCI a cost-effective solution. The primary objective of this project was to develop a device that can detect and measure the Alpha and Beta waves from human brain. Once such a device was designed, the feasibility of this device to function as brain-computer interface (BCI) was explored. It was hypothesized that if the right circuit and software program is developed, it would be possible to measure, analyze, and translate bioelectric potential into desired actions. First an electroencephalography (EEG) system, suitable for detecting and measuring the Alpha and Beta wave frequencies, was designed using a combination of a circuit board, capacitors, resistors, an amplifier, an Arduino, etc. This battery-operated homemade device was used to measure the bioelectric potential by placing the electrodes on the cortical surface of frontal and occipital part of the brain. The device capabilities of measuring 7 Hz to 31 Hz (Alpha and Beta wave region) frequencies, while eliminating the interfering electric frequency was demonstrated using the National Instrument Portable Data Acquisition (NI DAQ) system. The device's LCD display and the state of the robotic hand model were successfully programmed to change, based on the frequency value recognized. This demonstrated that it is possible to translate the bioelectric potential into commands to perform the desired actions.

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