Investigation of Electroencephalogram (EEG) Sensor Position for Brain-Controlled Home Automation

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Abstract Electroencephalogram (EEG) signals are widely employed in Brain-Computer Interface (BCI) or Human–Machine Interface (HMI) technique to provide assistive technology that can be used by paralyzed or disabled people. BCI or HMI technique will let paralyzed people to operate home automation such as lamp, fan, television and other home appliances by using their brainwaves. Since BCI or HMI is constructed from various sensors for various measurement position, it is vital to know which EEG sensors are really contributed to the control of the device. Thus, this study is conducted to investigate the EEG sensors position in controlling device by analyzing public EEG datasets. The scopes of the study include the construction of Graphical User Interface (GUI) in MATLAB for each selected sensor position and the classification of the selected EEG features from each sensor position. To implement the investigation process, first, the public EEG signals from the specified sensor location are filtered using preprocessing technique to remove the noise or artifacts such eyes movement and power line noise. Next, the filtered EEG signals are split to Alpha and Beta power spectrum using Fast Fourier Transform (FFT) technique. Next, the unique features from EEG Alpha and Beta Power are extracted for classification process in term of average (mean), standard deviation and spectral centroid. Finally, the prototype model using Arduino microcontroller is developed to implement home appliance. The results of the study show that the selected EEG features from the EEG signal produced by EEG position at Frontal side of brain lobes (F7 and F8) and Parietal side of brain lobes (P3 and P4) able to be classified with 83% classification accuracy. The selected EEG features from the selected sensors position can be converted to machine code to control the home appliance successfully.

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