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Preliminary Findings on EEG-Controlled Prosthetic Hand for Stroke Patients Based on Motor Control

Ab Wafi Ab Aziz, Jamaludin Jalani ✉, Sujana Mohd Rejab & Amirul Syafiq Sadun

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Abstract

This project established an electroencephalogram (EEG)-controlled prosthetic hand to help stroke patients with their rehabilitation exercises. The preliminary finding on the experiments to identify a suitable signal to control a servo motor using Minwave Mobile as the input signal is presented. Three methods are used to generate input signals; attention level (Experiment A), eye blink detection (Experiment B), and meditation level (Experiment C) using the EEG device based on four healthy human subjects. The generated input signal is then used to move the servo motor to a specific angle. All three

methods are found to be capable of generating the input signals to move the servo motor to a specific angle with some limitations. Therefore, the use of one or two input actions was recommended to vary the angle movement in the prosthetic hand of stroke patients for future development.

Keywords

Electroencephalography (EEG)

Prosthetic hand   **Stroke patient**

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References

1. Bruni, M.F., Melegari, C., De Cola, M.C., Bramanti, A., Bramanti, P., Calabrò, R.S.: What does best evidence tell us about robotic gait rehabilitation in stroke patients: a systematic review and meta-analysis. J. Clin. Neurosci. **48**, 11–17 (2018)

2. Khan, M.A., Das, R., Iversen, H.K., Puthusserypady, S.: Review on motor imagery based BCI systems for upper limb post-stroke neurorehabilitation: from designing to application. Comput. Biol. Med. **123**, 103843 (2020)

3. Jie, S., Haoyong, Y., Chaw, T.L., Chiang, C.C., Vijayavenkataraman, S.: An interactive upper limb rehab device for elderly stroke patients. Procedia CIRP **60**, 488–493 (2017)

4. Prakash, A., Sahi, A.K., Sharma, N., Sharma, S.:

Force myography controlled multifunctional hand prosthesis for upper-limb amputees. Biomed. Signal Process. Control **62**(July), 102122 (2020)

5. Graham, E.M., et al.: Restoring form and function to the partial hand amputee: prosthetic options from the fingertip to the palm. Hand Clin. **37**(1), 167–187 (2021)

6. Srimaneepong, V., Heboyan, A., Syed, A.U.Y., Trinh, H.A., Amornvit, P., Rokaya, D.: Recent advances in myoelectric control for finger prostheses for multiple finger loss. Appl. Sci. **11**(10), 4464 (2021). https://doi.org/10.3390/app11104464

7. Anam, K., Nuh, M., Al-Jumaily, A.: Comparison of EEG pattern recognition of motor imagery for finger movement classification. In: International Conference on Electrical Engineering, Computer Science and Informatics (EECSI), pp. 24–27 (2019)

8. Alazrai, R., Alwanni, H., Baslan, Y., Alnuman, N., Daoud, M.: EEG-based brain-computer interface for decoding motor imagery tasks within the same hand using Choi-Williams time-frequency distribution. Sensors **17**(9), 1937 (2017). https://doi.org/10.3390/s17091937

9. Alazrai, R., Abuhijleh, M., Alwanni, H., Daoud, M.I.: A deep learning framework for decoding motor imagery tasks of the same hand using EEG signals. IEEE Access **7**, 109612–109627 (2019)

10. Abiri, R., Borhani, S., Sellers, E.W., Jiang, Y., Zhao, X.: A comprehensive review of EEG-based brain-computer interface paradigms. J. Neural Eng. **16**(1), 11001 (Feb 2019)

11. Chinbat, O. Lin, J.S.: Prosthetic arm control by human brain. In: Proceedings – 2018 International Symposium on Computer, Consumer and Control, IS3C 2018, pp. 54–57 (2019)

12. Beyrouthy, T., Kork, S.A., Korbane, J.A., Abouelela, M.: EEG mind controlled smart prosthetic arm – a comprehensive study. Adv. Sci. Technol. Eng. Syst. J. **2**(3), 891–899 (2017). https://doi.org/10.25046/aj0203111

13. Mohan, M.C., Purushothaman, M.: Design and fabrication of prosthetic human hand using EEG and force sensor with arduino micro controller. In: ICONSTEM 2017 - Proceedings: 3rd IEEE International Conference on Science Technology, Engineering and Management, vol. 2018-Janua, pp. 1083–1086 (2017)

14. Bright, D., Nair, A., Salvekar, D., Bhisikar, S.: EEG-based brain controlled prosthetic arm. Conf. Adv. Sig. Process. CASP **2016**, 479–483 (2016)

15. Elstob, D., Secco, E.L.: A low cost eeg based bci prosthetic using motor imagery. Int. J. Inf. Technol. Converg. Serv. **6**(1), 23–36 (2016). https://doi.org/10.5121/ijitcs.2016.6103

16. Jiang, Y., Zhang, X., Chen, C., Lu, Z., Wang, Y.: Deep learning based recognition of hand movement intention EEG in patients with spinal cord injury. In: 10th IEEE International Conference on Cyber Technology in Automation, Control and Intelligent Systems, CYBER 2020, pp. 343–348 (2020)

17. Abiri, R., Borhani, S., Sellers, E.W., Jiang, Y., Zhao, X.: A comprehensive review of EEG-based brain–computer interface paradigms. J. Neural Eng. **16**(1), 011001 (2019). https://doi.org/10.1088/1741-2552/aaf12e

18. Jamil, N., Belkacem, A.N., Ouhbi, S., Lakas, A.: Noninvasive electroencephalography equipment for assistive, adaptive, and rehabilitative brain–computer interfaces: a systematic literature review. Sensors **21**(14), 4754 (2021). https://doi.org/10.3390/s21144754

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