ELECTRONICS IN THE NERVOUS SYSTEM BRAIN COMPUTER APPLICATION

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ABSTRACT - ***Numerous efforts have been undertaken in recent years to link electrical circuits to the human nervous system. Diverse objectives guided this sort of study, ranging from a desire to comprehend the physiology of the nervous system to an effort to replace nervous tissue deficiencies with synthetic systems to the creation of an interface that enables computers to be directly controlled by thinking. The establishment of any version of such a combination would need a succession of following discoveries, allowing for a revolution in both theoretical and clinical neuroscience, regardless of the initial intent. This study reviews historical beliefs and modern concepts about such interactions in order to define the subject's primary medicinal and scientific value. Thus, the paper outlines the principal challenges surrounding the notion of merging the human nervous system with an electrical circuit.***

1. INTRODUCTION

The framework proposed by Vidal was refined and enlarged in the years that followed. New developments have emerged in the realm of BCI technology. Modern brain–computer interfaces are not limited to EEG-based equipment. The term BCI truly refers to any device capable of directly collecting, analysing, and interpreting brain signals. Recently, several BCI-related ideas, initiatives, and plans have been developed. Including them all in a single article seems impossible.

2. METHODOLOGY

The objective of a BCI is to identify and quantify characteristics of brain impulses that reflect the user's intents and to convert these characteristics into real-time device instructions that carry out the user's intention. In order to do this, a BCI system is composed of four successive components [1]

- **Signal Acquisition**
- **Feature Extraction**
- **Feature Translation**
- **Device Output**

These four components are governed by an operating protocol that specifies the initiation and duration of operation, the specifics of signal processing, the type of device instructions, and the monitoring of performance.

- **Signal Acquisition**

Using a specific sensor modality, signal acquisition is the measuring of brain signals. Signals are amplified to an appropriate level for electronic. The signals are then converted to digital format and sent to a computer.

- **Feature Extraction**

Feature extraction is the process of evaluating digital signals to separate relevant signal features from irrelevant information and expressing them in a compact format that is appropriate for translation into output instructions. These qualities should correlate strongly with the user's aim.

- **Feature Translation**

The resultant signal characteristics are then sent to the feature translation algorithm, which translates them into the appropriate instructions for the output device. The translation algorithm should be dynamic to accommodate and adapt to spontaneous or learnt changes in the signal's characteristics.

- **Device Output**

The external device is operated by the instructions from the feature translation algorithm, giving features such as word selection, pointer control, robotic arm operation, and so on. The functioning of the gadget gives the user with feedback, thereby closing the control loop.

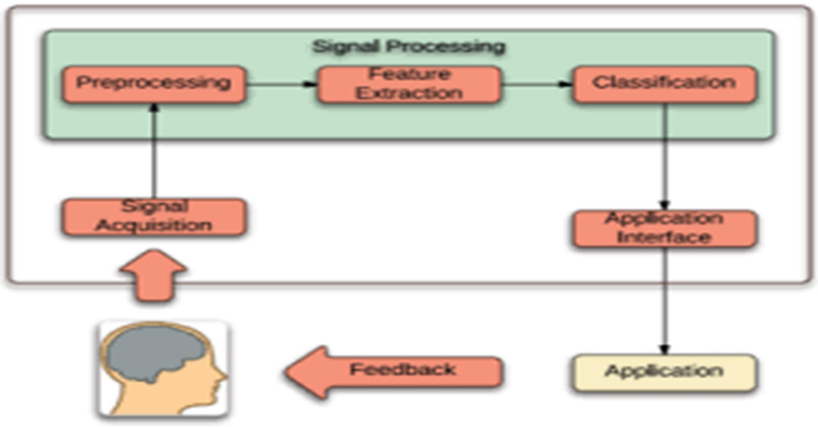

Fig 1: BCI SYSTEM

3. RESULTS

These systems use distinctive brain signals, recording techniques, and signal-processing algorithms. They can control a variety of equipment, including computer cursors, wheelchairs, and robotic arms .A small number of persons with severe impairments are already utilising a BCI for everyday communication and control. BCIs may become a significant new communication and control tool for persons with disabilities—and perhaps the entire population—with improved signal-acquisition hardware, demonstrable clinical validation, feasible distribution models, and enhanced dependability.

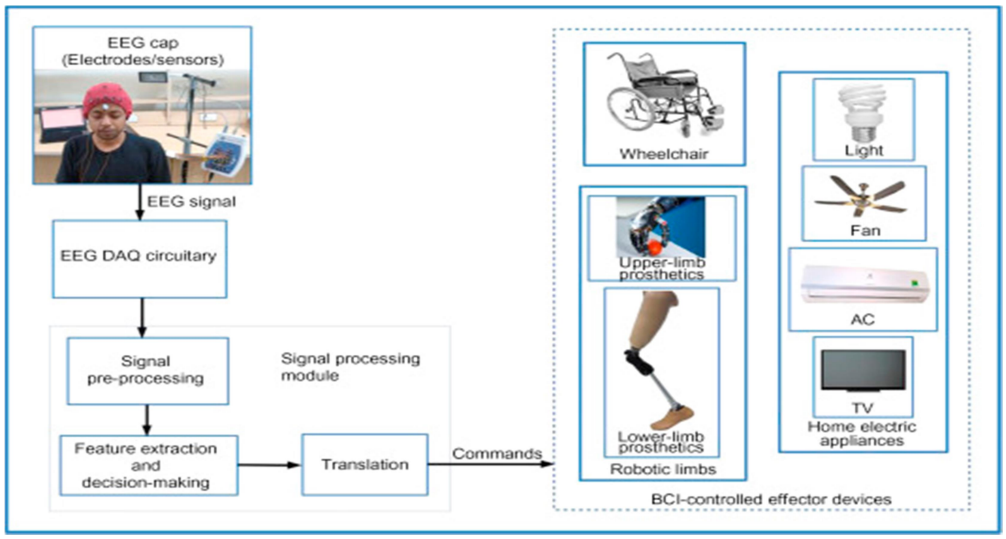

Fig 2: BCI APPLICATIONS [4]

4. CONCLUSION

- Currently, BCI research and development is virtually solely lab-based. Just starting are studies to prove BCI's feasibility and effectiveness for long-term home usage by disabled persons [5].
- Brain-computer interfaces may one day be utilised to replace or restore function for patients with neuromuscular illnesses and to complement pilots, surgeons, and other trained professions' natural motor outputs [6]. Brain-computer interfaces may potentially help stroke and head trauma recovery.

REFERENCE

[1] Shih JJ, Krusienski DJ, Wolpaw JR. Brain-computer interfaces in medicine. InMayo clinic proceedings 2012 Mar 1 (Vol. 87, No. 3, pp. 268-279). Elsevier.

[2] Shanmugapriya A, Selvarani AG. A Survey on Brain Computer Interface: A Computing Intelligence. Computational Vision and Bio-Inspired Computing. 2022:795-806.

[3] Van Erp J, Lotte F, Tangermann M. Brain-computer interfaces: beyond medical applications. Computer. 2012 Mar 6;45(4):26-34.

[4] Tarafdar KK, Pradhan BK, Nayak SK, Khasnobish A, Bhattacharyya S, Pal K. Electroencephalogram-based brain–computer interface systems for controlling rehabilitative devices. InBioelectronics and Medical Devices 2019 Jan 1 (pp. 857-890). Woodhead Publishing.

[5] Pal D, Palit S, Dey A. Brain Computer Interface: A Review. Computational Advancement in Communication, Circuits and Systems. 2022:25-35.

[6] Postelnicu CC, Talaba D, Toma MI. Brain computer interfaces for medical applications. Bulletin of the Transilvania University of Brasov. Engineering Sciences. Series I. 2010; 3:99.