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POTENTIAL FOR REMOTE AND DUAL-USE APPLICATION FOR NON-INVASIVE MOTOR REHABILITATION WITH BCI

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Abstract: *Non-invasive brain–computer interfaces (BCIs) are widely studied for motor rehabilitation and assistive control. The performances in laboratories are encouraging, even the translation into real-world conditions of use, remains limited. In parallel, the aviation, military, and space communities have proposed the use of BCIs for hands-free control, but the possibility of remote implementation and clinical relevance for motor rehabilitation still raises many questions. This paper aims to synthesize concepts using non-invasive BCIs, emphasizing the relevance for the medical rehabilitation field and the constraints of remote implementation, as well as an evaluation of studies published in scientific journals, from the perspective of "remote readiness", differentiating real remote implementations from those that would be feasible for remote use, in order to identify design patterns and elements that require more attention.*

Keywords: *rehabilitation, dual-use, military, aviation, spaceflight, brain-computer interface.*

1. INTRODUCTION

Non-invasive brain–computer interfaces (BCIs) translate neural activity, most commonly electroencephalography (EEG), and in some systems functional near-infrared spectroscopy (fNIRS)—into control signals for external devices. In medicine, BCIs are relevant to individuals with motor impairment (e.g., stroke, spinal cord injury, ALS), where they may support communication, environmental control, or facilitate neurorehabilitation through neurofeedback and intention-driven therapy. For motor rehabilitation specifically, BCIs are typically used to detect motor intention (e.g., motor imagery or attempted movement) and link it to feedback or actuation (robotic orthoses, exoskeletons, or functional electrical stimulation), aiming to enhance plasticity and motor recovery.

The paper has to offer the answers for the following questions: description of the problem, what is done by other people, what the authors did, what is new, what is my contribution? To address this issue, the present work adopts a two-part strategy: a narrative synthesis of non-invasive BCI work relevant to aviation, military, and space contexts, followed by a structured mapping of a large corpus of non-invasive BCI studies to assess remote readiness. By extracting standardized study descriptors and applying an engineering-focused remote readiness rubric, the review aims to distinguish systems that are truly remote or home-deployable from those that remain lab-bound, and to specify what technical and clinical elements are missing for robust remote deployment.

2. NON-INVASIVE BCI SYSTEMS FOR MOTOR REHABILITATION IN PROFESSIONAL ENVIRONMENTS

To structure this review of BCI systems, we propose a framework. To assess whether BCIs can be deployed in military, aerospace, or aviation settings, it is necessary to trace evidence across levels of maturity: from laboratory feasibility to controlled public demonstrations, and finally to professional environments, where remote operations must meet substantially higher standards of precision

and reliability. Because the literature is comparatively sparse in professional domains (aviation, military, spaceflight), this review is organized **from the outer ring toward the inner core** of the framework, starting with domain applications and progressively moving inward to the foundational enabling layer, namely **remote use** (Fig. 1).

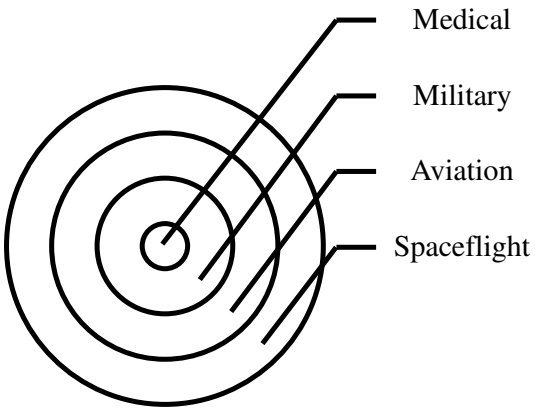


Fig.1. Review Framework: From Domain Applications to Remote BCI Deployment

2.1 BCI in Aerospace

The space environment imposes distinctive constraints while also offering specific opportunities for brain–computer interface applications. Astronauts operate under extreme conditions, including microgravity, communication latency, and prolonged isolation with associated psychological stress. BCIs have been proposed to allow mental control of spacecraft systems or robotic assistants without needing physical movement, which can be clumsy in microgravity.[1]

Space agencies have indeed started to investigate BCI potential. Researchers at NASA[2] and the European Space Agency (ESA) have considered BCI-driven surface rovers, free-flying camera drones, and even crew spacecraft controls. The envisioned benefits include enabling astronauts to send commands with minimal latency and high accuracy, allowing hands-free operation of instruments, and even letting multiple crew members collaboratively control a system using their brain signals.

A notable recent example is Project PhotonGrav , an experiment performed on the Axiom-4 private mission to the ISS (International Space Station), which was the first to test a BCI system in microgravity. In PhotonGrav, an astronaut wore a wireless functional near-infrared spectroscopy neurocap to measure brain activity (oxygenation changes) during various cognitive tasks in orbit. If astronauts can reliably use BCIs in space, they could leverage them for a range of applications: “hands-free control of spacecraft systems, real-time mental state monitoring, and cognitive support during extended missions.”

2.2 BCIs for performance support and rehabilitation (in-mission and post-mission)

Spaceflight is an extreme environment that poses unique challenges to human motor function. Astronauts in microgravity experience muscular atrophy, bone density loss, sensorimotor disturbances, and neuroplastic changes, all of which can degrade motor performance. Long missions result in pronounced deficits upon return to Earth, for example, a 6-month ISS mission often leaves astronauts with impaired balance and coordination, requiring weeks or months of rehabilitation to fully recover terrestrial motor function.

Space agencies have begun actively investigating BCIs for both performance support and rehabilitation. For instance, NASA’s Behavioral Health and Performance group[3] has solicited proposals for non-invasive neuromodulation technologies to enhance astronaut training, in-flight performance, and post-flight recovery.

On the rehabilitation front, space BCIs show promise for both in-mission and post-mission use. During missions, aside from MI(motor imagery) practice, BCIs could facilitate tele-rehabilitation: a crew member with a minor injury could perform guided therapy exercises with a BCI-augmented system that provides feedback and tracks their neural recovery, all remotely supervised by surgeons on Earth if needed.NASA’s [4] Johnson Space Center has explored augmented reality and sensorimotor adaptability training

on Earth to prepare astronauts for gravity transitions.

One can envision a dual-use scenario: the same BCI-based rehab protocols used for stroke or spinal injury patients on Earth (like BCI-controlled exoskeleton gait training) could be adapted to rehabilitate astronauts returning from Mars, who might have severe muscle weakness akin to spinal injury in some respects.

However, literature is still sparse, making this a suitable area for further research. We have yet to see peer-reviewed results on, say, an astronaut using a BCI to actually control a device on ISS, or a formal trial of BCI-aided rehab post-flight.

Space BCIs are still largely experimental, and significant limitations remain.

2.3 BCI in Aviation

In aviation, BCIs are being explored as novel control or monitoring interfaces. One line of research aims to offload some pilot tasks to the brain directly, reducing reliance on physical controls. As mentioned, a near-future scenario could be a pilot using a BCI to handle a secondary task (like communications or activating systems) without removing hands from the primary flight controls [5] In a recent example, volunteers successfully piloted a drone through an obstacle course using only their brain signals-effectively "flying with thoughts." Such advances address one of the longstanding bottlenecks of BCIs slow processing and adaptation and hint at practical deployment in the field. While this drone-piloting BCI was demonstrated in a lab setting, the authors noted it could be generalized to real-world applications ranging from clinical rehabilitation tools to defense systems.

One line of research has explored whether brain signals can directly control an aircraft or simulator, opening possibilities for hands-free operation in emergencies, which maybe could also be for disabled pilots, being one of the main goals of rehabilitation. In one of the early demonstrations of real-world applicability, researchers successfully integrated an EEG-based motor imagery brain–computer interface into a high-fidelity flight simulator. Licensed pilots were able to modulate the simulator's horizontal flight path using only their brain signals, while simultaneously managing conventional cockpit tasks, illustrating the potential of BCI systems in complex operational environments.

But what about rehabilitation? Was something done on aviators? We couldn't find more public reports of a disabled pilot returning to fly via BCI assistance or rehabilitation specifically for pilots, which may reflect how demanding aviation medical clearance requirements are.

In summary, non-invasive BCIs in aviation have demonstrated feasibility in both active (direct control) and passive (monitoring/training) roles.

2.4 BCI in military

Military interest in BCIs has grown rapidly, viewing technology as a potential enhancer for soldiers and commanders in various scenarios. The U.S. Department of Defense has invested in research on both invasive and non-invasive BCIs, with an eye toward multiple applications. A RAND [6] Corporation assessment in 2020 highlighted many of these possibilities though some ideas are still firmly in the realm of research and prototypes. Yet there have been proof-of-concept successes that capture the military imagination. For instance, researchers at University of Washington demonstrated [7] a brain-to-brain interface where one person's EEG-recorded intentions (move left/right in a simple game) were transmitted via internet to stimulate another person's motor cortex and execute the action.

A 2024 review in the context of U.S. Special Operations Forces (SOF) [8] argues that BCIs are a quintessential dual use neurotechnology, with potential both to rehabilitate combat injuries and to boost warfighter performance.

Military populations have been a major impetus for BCI advances, driven by the need to care for wounded warriors and to maintain operational readiness. Restoring function in injured soldiers is a critical use-case. BCI systems have allowed paralyzed individuals to control robotic arms or mobility devices by thought, which directly translates to helping

injured veterans (amputees or spinal injury patients) regain independence.

Non-invasive BCIs have also demonstrated the ability to assist paralyzed or amputee patients in regaining motor abilities, for example [8], enabling a tetraplegic man to stand and walk using a BCI-controlled exoskeleton, signals being recorded from a 96-channel microelectrode array implanted in the motor cortex.

In summary, non-invasive BCIs in the military domain are on the cusp of transitioning from research to applied use. The dual-use nature is clear: the same EEG system that helps a paralyzed veteran walk could, in a healthy soldier, enable novel control methods.

3. GAPS IN LITERATURE AND FUTURE RESEARCH OPPORTUNITIES

Despite the advances reviewed, significant gaps exist in literature at the intersection of BCI, motor rehabilitation, and extreme environments. There is a lack of studies involving active-duty military personnel, pilots in real flight, or astronauts in space using BCI in operational scenarios [6]. **Opportunity:** Conduct field studies and pilot programs, for example, a trial where soldiers undergoing rehabilitation use BCI exoskeletons during reintegration training, or an evaluation of an EEG-based assistive control on a parabolic flight with an astronaut crew.

Target Population Specificity: Many BCI rehab studies focus on clinical populations (stroke, SCI patients) which differ from, say, a combat-injured soldier who might have polytrauma or a pilot who needs fine motor precision. There is a gap in tailoring BCI methods to population-specific needs [8] [9] like prosthetic control for high-performance amputee athletes or veterans). **Opportunity:** Collaborate with military medicine programs and aerospace medicine to identify the unique requirements of these users. Special Operations Forces, with their openness to cutting-edge tech, could serve as early adopters in studies – leveraging their feedback to refine BCI devices.

Integration with Existing Systems: In both cockpits and space capsules, integration of a new control/input modality is challenging. Little literature [10] exists on how BCIs can be seamlessly integrated with current control interfaces and protocols. **Opportunity:** Human factors research on BCI integration, for example, designing cockpit interfaces that can accept both manual and BCI inputs fluidly. In rehab, integration means combining BCIs with traditional physiotherapy and prosthetic training.

Robustness and Ease of Use: Non-invasive BCIs still face issues with signal quality over long durations, user fatigue, and inter-subject variability (some users are "BCI hard-to-control"). **Opportunity:** Engineering research into next-generation sensors and adaptive algorithms. This includes dry or even non-contact electrodes that could be embedded in headgear (helmet, earpiece, flight cap) for quick setup, and multimodal sensor fusion (EEG+fNIRS+eye-tracking) to fill gaps in one modality with another.

Dual-Use and Remote Rehabilitation Paradigms: While we acknowledge dual-use potential [8] in concept, concrete programs that leverage it are sparse. **Opportunity:** Create pilot programs that explicitly link space research to Earth rehab. A hypothetical example: during a long space mission, have crew perform BCI-guided motor exercises and concurrently have a matched clinical group on Earth doing the same protocol (perhaps stroke patients), then compare outcomes. The 2023 wearable BCI [11] study already showed the viability of tele-rehab EEG systems; scaling that in a defense health context is an opportunity (with necessary cybersecurity considerations for transmitting brain data securely).

Ethical, Legal, and Security Issues: The literature [12] is thin on these, but there are critical gaps to address before deployment. Military ethicists have raised concerns about BCIs, issues of cognitive privacy for soldiers, the legality of brain-controlled weapon systems, or the ethics of experimenting on injured troops with new BCIs. In aviation and space, there are safety certification and liability questions, if a BCI malfunctions and causes an accident, who is responsible? **Opportunity:** Interdisciplinary research into neuroethics and policy for BCIs in these domains.

Close collaboration between engineers, ethicists, and regulatory bodies (FAA for aviation, FDA for medical, etc.) will be needed to shape policies that allow BCI innovation while protecting individuals.

4. REMOTE DIGITAL MEDICAL APPROACH

BCIs enable patients to communicate and interact with their environment by translating thought patterns (detected via EEG or implants) into commands. For example, studies have shown that people in a locked-in state can use a visual P300 BCI to spell out messages, enjoy entertainment, control home appliances, and even send emails or browse the web. By providing a direct communication channel from brain to external devices, BCIs offer a lifeline for independence and social connection to those who have lost voluntary muscle control.

Within CESTER [13] – Research Center for Robots Simulation and Testing within the Technical University of Cluj-Napoca direct activities are running for creating robotic assisted rehabilitation systems that can be directly used by medical staff in relation with patients. Several months were spent on the new developed system ASPIRE [13] testing the capabilities, the implementation of the safety measures, the operation capacity and the friendly interfaces for the medical staff in creating the rehabilitation programs, customized accordingly with the patients' impairments and the effective recovery of the selected patients. The clinical trials were developed at the Clujana – municipal hospital and the Neurology clinic of the county hospital in Cluj-Napoca, Romania.

Traditionally, most BCI systems, like ASPIRE, have been confined to research labs or clinical settings. Bringing BCIs into the home environment is a growing goal, aligning with telehealth trends that aim to reach patients where they live. Home-based BCIs would let motor-impaired patients benefit from assistive technology without frequent hospital visits, improving convenience and consistent use. However, BCIs are still mostly lab-bound, despite decades of research, they have been implemented. It remains challenging to deploy BCIs for independent use at scale, and only a handful of case studies have demonstrated successful long-term home use in patients (notably in advanced ALS cases). This gap underlines the need for robust remote BCI solutions that can be managed outside the lab.

BCI research on assistive technology has produced several key applications, usually tested under controlled conditions:

Communication (P300 Spellers)

BCIs can restore basic communication for those who cannot speak or gesture. A prominent example is the P300 speller, where the user focuses on highlighted letters and the BCI interprets their intended characters. Such BCI spellers have enabled completely paralyzed patients to communicate words and sentences using only their EEG signals.

Mobility and Environmental Control

BCIs have been used experimentally to give patients control over assistive devices. Research prototypes let users drive an electric wheelchair or a neuroprosthetic limb using their brain signals, granting mobility to those who cannot move on their own. Similarly, BCI interfaces have been proposed for smart home control – for instance, turning lights on/off or operating a TV via brain activity.

Neurorehabilitation

BCIs also serve as therapeutic tools. In rehabilitation, a patient can mentally practice movements or receive feedback through a BCI to help retrain the brain after stroke or injury. For example, motor-imagery BCIs (where users imagine limb movements) combined with feedback has been used to improve recovery of motor function. This "restore or improve" approach treats the BCI as a neurofeedback device to promote plasticity and rehabilitation. Although encouraging results exist, these too are usually conducted under supervision in clinics or labs, not yet as daily home therapy.

In this study, we independently analyzed 20 BCI systems using predefined criteria derived from recent studies. All data were collected, extracted, and analyzed by the authors to identify the most suitable options for brain–computer interface implementation in our robotic research. These studies represent a broad sample of non-invasive BCI research,

primarily in the context of motor impairment and healthy volunteer experiments (excluding implantable BCIs and purely invasive recordings). The aim was to determine which of these existing BCI systems have been, or could be, used remotely. Data were extracted from each study and evaluated for "remote-friendliness" according to predefined criteria (Table 1). A score was assigned to each item based on the scoring system described in Table 2. Descriptive statistical analysis and figure preparation were performed in Microsoft Excel.

Table 1

Data extraction

Rubric Item	What is scoring	0	1	2
Portable acquisition	EEG/fNIRS hardware practical outside lab	Lab-only rig (high-density wet + bulky)	Portable but awkward (wet cap, lots of channels, wired)	Wearable/portable (wireless, low channel count, home-capable)
Setup autonomy	Can patient/caregiver set it up?	Requires expert technician	Needs training + frequent help	Designed for self/caregiver setup (guided UI, simplified steps)
Signal quality control	Automatic QC + artifact robustness	No QC; fragile to artifacts	Some QC/manual checks	Automated QC + artifact handling; session gating if poor signal
Calibration burden & drift handling	Session-to-session stability	Long calibration, no adaptation	Some adaptation or short calibration	Minimal calibration + adaptation / transfer learning / re-calibration plan
Control mode suitability	Remote-safe control (false positives)	High false-positive risk; no suppression	Some suppression (thresholds/refractory)	Clear false-positive prevention + robust intention confirmation
Feedback/actuation feasibility	Rehab feedback can be deployed at home	Needs lab robot / fixed infrastructure	Portable but complex (robot/FES doable with effort)	Home-deployable feedback (orthosis/FES/VR) with practical workflow
Safety engineering	Especially if FES/robotics	Not described	Basic limits / supervision assumed	Explicit fail-safes (hard limits, emergency stop, no signal no actuation)
Remote architecture	Tele-supervision, logging, remote support	No remote features	Logs only / limited remote viewing	Remote monitoring/support built-in (telemetry, remote troubleshooting, session tracking)
Network tolerance	Works with real internet problems	Requires perfect connectivity	Some buffering / partial offline function	Clear resilience: local processing + graceful degradation if connection drops
Validation context	Evidence that it works outside ideal lab	Single-session lab demo only	Multi-session clinic or controlled environment	Home/real-world or explicitly remote/telerehab validation

Scoring scale: 0=not addressed, 1=partially addressed/plausible with major extra work, 2=addressed clearly/demonstrated or well-implemented; Total score 0–6 = Not remotely plausible (lab-only), 7–12 = Remote-adaptable but major engineering/clinical work needed, 13–16 = Near-term remote pilot feasible (with reasonable additions), 17–20 = Strong remote-ready prototype/ already telerehab-grade.

Table 2

Definition and rationale for inclusion

Dimension	Definition	Rationale for Inclusion
Portable Acquisition	Ability of the BCI system to acquire brain signals with lightweight, mobile hardware (e.g., wearable EEG) instead of tethered lab equipment.	Critical for remote/home use so patients can train outside the clinic; a portable, wireless EEG system allows BCI therapy to be deployed in everyday settings.

Setup Autonomy	The degree to which end-users can set up and operate the BCI on their own without expert assistance.	High setup autonomy is key for remote BCI adoption current EEG systems are often hard to configure, and a complex setup can be too difficult or time-consuming for untrained users at home.
Signal Quality Control	Mechanisms to ensure and maintain high-quality brain signal input (e.g. artifact detection, impedance monitoring) during remote use.	In a home environment, EEG signal integrity can degrade due to noise and artifacts; robust real-time filtering and quality checks are needed since EEG has low signal-to-noise ratio and is prone to interference.
Calibration Needs	The amount of user-specific calibration or training required before the BCI can be used effectively.	Minimizing calibration is important for remote systems lengthy recalibration (often up to ~20 minutes) before each session can frustrate users and hinder daily home use.
Control Safety	Safeguards in the BCI's control outputs that prevent unintended or unsafe device commands (especially when controlling robots, prosthetics, or stimulators).	Ensures the BCI-triggered actions will not harm the patient: for example, multi-layer safety controllers and fail-safes are integrated into BCI-driven robots to protect users during human–robot interaction.
Feedback Deployment	The provision of appropriate real-time feedback to the user (visual, auditory, haptic, etc.) to close the loop during BCI training.	Timely, multi-modal feedback is essential for motor learning and engagement – BCI studies show that giving immediate feedback on performance significantly boosts training efficacy and keeps patients motivated.
Safety Engineering	The overall design and engineering of the BCI system to meet health, electrical, and usability safety standards for unsupervised use.	Vital for patient well-being and device adoption: non-invasive BCI rehab systems must be proven safe (e.g., causing no serious adverse effects) and be engineered to avoid risks like skin irritation, fatigue, or other harm during independent use.
Remote Architecture	A system architecture that enables remote connectivity and supervision, typically featuring a local user interface and cloud or telehealth integration.	Required to support tele-rehabilitation: for instance, a design where patients use a home BCI setup while therapists can remotely monitor data and adjust therapy via the internet has been shown feasible.
Network Tolerance	The resilience of the BCI system to network latency or interruptions, ensuring stable operation under imperfect internet conditions.	In remote scenarios, wireless data links can suffer packet loss or delays; the BCI must tolerate such issues (e.g. via buffering or edge processing) so that short network glitches do not derail the real-time control.

Based on the data from the 20 studies, we extracted the remote status (Fig.2), the domain and disease (Fig.3), and the interface type (Fig.4).

Across 20 studies, only two BCIs were classified as "Home-use": one was explicitly designed for home deployment, and the other is *home-capable* but was tested in a medical center.

The home-capable study is relatively home usable for non-invasive rehab—wireless dry-electrode EEG plus a wearable orthosis used over 12 weeks with meaningful clinical outcomes—but it does not clearly demonstrate a true remote architecture (remote clinician oversight, cloud data transfer, or handling outages/latency).

The home-intended study is a stronger example of *actual remote home rehabilitation*, because the remote component is operationalized (remote desktop access, real-time support, and parameter adjustments during home sessions). Its main limitation for scale is reliance on expert oversight (wet electrodes, impedance management, occasional recalibration), and it does not thoroughly stress-test failure modes such as connectivity loss mid-session, degraded signal conditions, or cybersecurity of remote access.

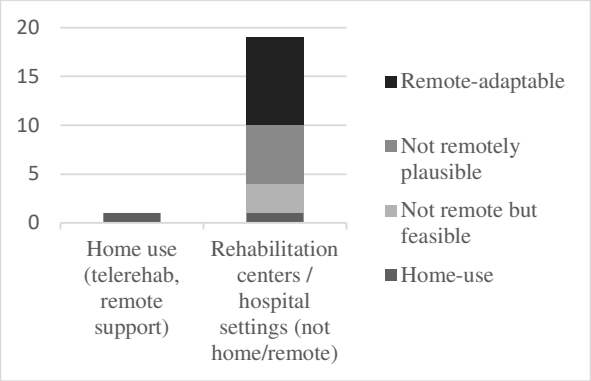


Fig. 2. Remote status

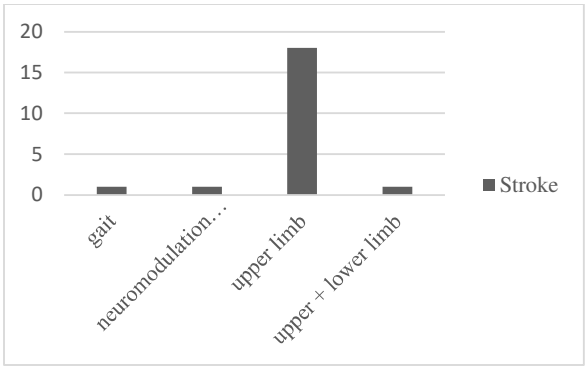


Fig. 3. Domain and disease

In this review, rehabilitation applications predominantly targeted the **upper limb**, and all included studies focused on **post-stroke** populations.Stroke rehabilitation, particularly upper-limb motor recovery, has become a central clinical use case for non-invasive BCI systems, given the high unmet need and the suitability of BCI-mediated feedback and assistive control paradigms for restoring functional movement.

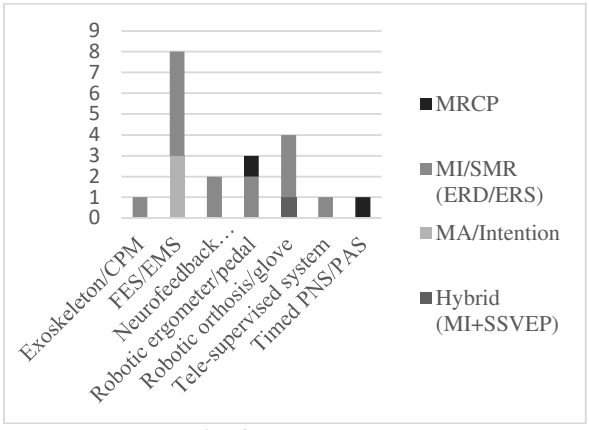


Fig. 4. Interface type

Across the included studies, FES/EMS (Functional/Muscular electrical stimulation) was the most common interface, predominantly paired with MI/SMR(sensorimotor rhythm) decoding and less frequently with movement-attempt/intention detection. Robotic orthoses/gloves were the next most common, almost exclusively using MI/SMR with one hybrid MI+SSVEP (Steady-State Visual Evoked Potential) implementation. MRCP-based control (Movement-Related Cortical Potential) was uncommon and mainly appeared in timed stimulation/PAS (Paired Associative Stimulation) and a single ergometer/pedal system.

5. DISCUSSION

From 20 studies, only 2 were as remote status home used and from this 2 only one was intended by the authors for home used. Together, these two studies illustrate complementary routes toward home-usable BCI rehabilitation. The telerehabilitation BCI-FES trial is explicitly engineered for at-home delivery: participants used a take-home kit (laptop + portable EEG + FES + control box) with caregiver-assisted setup supported by an electrode placement map, remote troubleshooting of signal quality, and the ability to recalibrate when needed; importantly, it also incorporates practical safety engineering (e.g., a physical emergency stop and mediated FES triggering) and a defined remote-support workflow using remote access tools (TeamViewer), and it is validated in the real home context through multiple home sessions. The IpsiHand therapy study emphasizes hardware and workflow simplification consistent with long-term home practicality: a wireless low-electrode EEG headset paired with a tablet-controlled robotic hand orthosis, session-by-session calibration as a quality gate, explicit impedance targets and standard artifact handling.

Taken together, the key “home-ready” lessons are to: reduce setup burden via portable/wireless acquisition and guided workflows, make signal quality control and calibration maintainable outside the clinic (ideally with remote support), and embed

device-level safety mechanisms for stimulation/actuation; a remaining gap for broader translation is robustly specified network tolerance (disconnect behavior, offline continuity, and fail-safe recovery), which is not deeply characterized in these reports. Future research on remote brain–computer interface (BCI) systems should initially focus on rigorous validation in healthy individuals, as such studies are already feasible and can establish baseline safety and performance metrics. Once efficacy and safety are demonstrated in this population, subsequent efforts should translate these systems to clinical use by applying remote BCI technology in patient rehabilitation and other therapeutic contexts. In parallel, it is essential to pursue interdisciplinary collaborations with experts in the aviation and aerospace sectors. Such partnerships can facilitate the integration of BCI technology into mission-critical operations and remote therapeutic programs (for example, rehabilitation sessions conducted during flight or space missions), thereby broadening the potential impact of remote BCI systems across both healthcare and aerospace domains.

6. ACKNOWLEDGEMENT

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Potențial de aplicare la distanță și cu dublă utilizare pentru reabilitarea motorie neinvazivă cu BCI

Rezumat: Interfețele neinvazive creier-computer (BCI) sunt studiate pe scară largă pentru reabilitarea motorie și controlul asistiv. Performanțele din laboratoare sunt încurajatoare, chiar dacă transpunerea în condiții reale de utilizare rămâne limitată. În paralel, comunitățile aeronautice, militare și spațiale au propus utilizarea BCI pentru controlul hands-free, dar posibilitatea implementării de la distanță și relevanța clinică pentru reabilitarea motorie ridică încă multe întrebări. Această lucrare își propune să sintetizeze concepte folosind BCI neinvazive, subliniind relevanța pentru domeniul reabilitării medicale și constrângerile implementărilor de teleoperare, precum și o evaluare a studiilor publicate în reviste de specialitate, din perspectiva „pregătirii pentru teleoperare ", diferențiind implementările reale la distanță de cele care ar fi fezabile pentru utilizare de la distanță, cu scopul de a identifica modele de proiectare și aspectele ce necesită mai multă atenție.

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