AI-driven collaborative robot for neuroinformational therapy of gait disorders based on brain signals

Development status

Phase 3

Technology validation and implementing it in real environment. Testing the technology outside of the laboratory and its adjustment to external conditions.

IP protection status

Industrial design EUIPO registration number 009203292-0001

Partnering strategy

Co-development, Collaboration, investment, licensing

Institution

University of West Bohemia

Vlastník

Západočeská univerzita v Plzni

Challenge

Gait disorders of central origin—caused by stroke, brain injury, or neurological diseases—significantly reduce patients' quality of life and pose a serious challenge to current rehabilitation medicine. Existing robotic systems fail to effectively link the patient's brain activity with physical movement, limiting their ability to activate the neuroplasticity needed for motor recovery. The aim of this project is to develop a new-generation neurorehabilitation robot that uses EEG signals and artificial intelligence to detect the patient's voluntary motor intention and actively assist in performing physiological gait. This innovative approach enables personalized therapy, accelerates motor re-education, and increases the chances of patients regaining independence.

Description

The proposed technology represents a comprehensive therapeutic system for the rehabilitation of gait disorders, integrating active robotic assistance with movement control based on the patient's EEG signals processed through machine learning methods. The key innovation lies in the fact that the robot does not operate solely based on mechanical programming or sensor-driven cycles, but actively responds to the user's voluntary motor intentions, detected in real time from their brain activity. The entire system supports neuroplasticity by connecting external (motor) and internal (cortical) responses, and further integrates mirror therapy, where the activity of the healthy limb helps to "awaken" brain responses on the affected side. Key innovative components include: - EEG + AI control unit: Enables analysis of voluntary brain activity (motor imagery of walking) and its transformation into robot control signals. - Robotic module with active drives: Enables a realistic gait cycle with force moment measurement of the lower limbs. - VR environment and mirror therapy: Visual presentation of motor tasks enhances user motivation and

therapeutic effect. - Modular design: The robot is designed as an easily relocatable and assembleable system suitable for a wide range of healthcare facilities.

Commercial opportunity

The technology has a wide range of potential applications in healthcare facilities (hospitals, rehabilitation clinics, long-term care facilities, and spas), outpatient neurorehabilitation centers, private practices, and home-based rehabilitation under professional supervision (a long-term goal enabled by the compact design and remote monitoring capabilities). It is also suitable for use in research and academic institutions (e.g., clinical neurophysiology, BCI research, physiotherapy).