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MetaMotus™ Galileo

Biomechanics Analysis and Rehabilitation Platform

The MetaMotus™ Galileo system, developed by Fourier Intelligence, is an advanced research and training platform designed for biomechanics, rehabilitation exercises, and sports science. It integrates various cutting-edge technologies, such as a six-axis motion platform, force plate, LED curved screen, adaptive dual-belt treadmill, dynamic weight support, motion capture system, upper and lower limb rehabilitation robots, exercise equipment, and human-computer interaction software. This provides a versatile clinical assessment and rehabilitation training environment using virtual reality and robotics technology for both clinical and research purposes.

Application

The Galileo system is suitable for assessing and training a variety of functional impairments in adults and children, including neurological and musculoskeletal injuries, amputations, limb disabilities, cardiorespiratory dysfunction, and degenerative conditions. It is also applicable for enhancing the capabilities of athletes and warfighters, as well as creating a versatile research environment for the training, testing, and evaluation of various robots.

Environments

Neurorehabilitation

The Galileo system is designed to address neurological disorders such as stroke, spinal cord injuries, and traumatic brain injuries. Functioning as a tool, it facilitates interactive training to bolster rehabilitation efforts, fostering neuroplasticity and recovery. Its approach, more engaging than conventional methods, has the potential to elevate treatment outcomes and increase user confidence and interest in exercise.

ADL Training

The Galileo system is integrated with a 6-DOF motion platform, dual belt treadmill, and pressure sensors. This integration enables patients to train in a challenging yet safe environment by simulating walking and falling down scenario with the safety harness on.

Bilateral Upper Limb Training

The integration of Galileo with two ArmMotus™ EMU supports bilateral training and mirror therapy. The diverse training scenarios simulate the motion of rowing, swimming and ADL elements in a virtual reality environment to aid in improving user's upper limb strength, range of motion and motor coordinations.

Balance Training

The 6-DOF motion platform can simulate a stable or unstable surface to assess and train the user's static and dynamic balance ability in both standing and seated position. This enhances motor and vestibular functionality, improving adaptability to complex environments. The system also create multi-dimensional perturbations for vestibular rehabilitation and addressing the symptoms of dizziness.


Gait Training

The weight support system, force plate, and the option of integrating ExoMotus™ M4 can support the application of gait assessment and training. This setup facilitates early sit-to-stand and gait training in a safe environment, while also reducing the labor-intensive workload of a therapist. The force plate and pressure sensors can conduct a comprehensive assessment and data analysis of the user's gait pattern.

Motor Skill Development & Quantified Assessment and Training

The Galileo system integrates a 6-DOF motion platform, dual-belt treadmill, motion capture system, and wireless surface electromyography (sEMG) sensors. This comprehensive integration allows users to participate in performance enhancement training within a virtual reality environment. Simultaneously, the system facilitates detailed motion analysis, providing precise and quantifiable outcome measures.
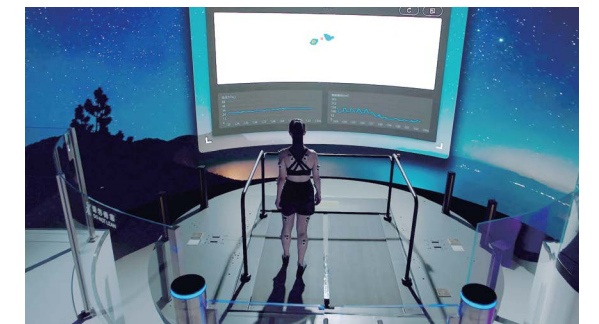
Psychological Rehabilitation

The Galileo system employs virtual reality technology to create a variety of immersive and lifelike virtual scenarios. This capability provides essential support for exposure therapy and systematic desensitisation. Recognized for its safety and efficacy in addressing psychological disorders, the system establishes a controlled environment. Within this environment, patients can systematically acclimate and overcome fears and anxieties, ultimately achieving therapeutic outcomes.

Pre-Event Intervention

Simulating battlefield environments for warfighters to facilitate faster adaptation. Through the simulation and adaptation of specific scenarios, children with special needs can better adjust to real social environments.

Post-Event Intervention

The Galileo system can be used in the post-intervention phase for psychological disorders such as PTSD, facilitating patients in overcoming fears and alleviating symptoms through immersive virtual reality environments. Additionally, it can support restoring psychological balance and promoting recovery for post-war psychological syndromes. The Galileo system stands as a secure and efficacious option for the treatment of psychological disorders.

Components

6-DOF Motion Platform

The Stewart platform with six degrees of freedom accurately simulates various real-life scenarios such as kayaking, walking on uneven surfaces, taking public transportation, engaging in sports activities, and experiencing unexpected falls. By incorporating upper limb tasks and external disturbances into balance maintenance tasks, it enhances the overall functional capabilities of patients. The design of multiple tasks gradually improves patients' abilities in a virtual environment that closely resembles real-life situations, enabling them to achieve rehabilitation goals.

Force and Pressure Distribution Platform

A dual-belt treadmill with a width of 1.5m and supports individual belt control. The treadmill is equipped with built-in force plates and pressure sensors, enabling the data collection related to dynamic balance and gait training. The collected data can be processed and visualised using software, facilitating assessment and training in areas such as balance, gait, and posture.

Force Plate

The force plate is capable of capturing force and torque values in three-dimensional space. Moreover, it is equipped with a high-density pressure-sensitive film on its surface, allowing for the collection of 9600 pressure points data at a rate of 100Hz. These data can be processed and visualised, enabling assessment in balance, plantar pressure distribution, and body posture.

Wireless sEMG

The wireless surface electromyography (sEMG) system captures real-time muscle electrical signals during movement. It operates in conjunction with other devices to provide comprehensive motion analysis, aiding users in understanding muscle activation and movement patterns to guide training and treatment. The wireless design not only offers convenience but also improves patient comfort and freedom of movement.

LED Curved Screen and Surround Sound System

Featuring a 180° flexible LED screen and a 7.1.2 channel surround sound system, the immersive setup delivers a comprehensive virtual interactive atmosphere. This multisensory environment, blending sound, light, and tactile feedback, allows patients to authentically engage in their training and therapy. The result is an optimal treatment experience with enhanced outcomes.

Motion Capture System

The high-definition motion capture system precisely records human movements in diverse sports and research settings. When combined with devices like surface electromyography (sEMG) and force plates, it enables comprehensive motion analysis and evaluation, yielding valuable biomechanical insights, enhances training techniques, and assesses performance.

Fall Prevention & Dynamic Weight Support

The dynamic unloading system that provides up to 80kg of weight support. It allows user to engage in walking and balance training on the treadmill. Additionally, the hoist can withstand a maximum pulling force of 200kg, providing fall prevention in the event of balance loss.

Centralised Control Workstation

Featuring a high-performance workstation and a high-definition, high-refresh-rate screen. It serves as a powerful central control hub for the entire system, capable of running multiple large-scale research or training software simultaneously while supporting data throughput and real-time analysis.

Research and Training Assessment - A Multifunctional Software System

The Galileo X software ecosystem for research and training assessment is an advanced and integrated platform. It enables the synchronisation of data from multiple sensors and components, allowing researchers and clinicians to analyse movement and rehabilitation data efficiently. This comprehensive software enhances the quality and efficiency of research and training by providing valuable insights into the assessment and progress of individuals.

Empowering You

Fourier Intelligence is a technology-driven company, infusing creativity into the development of exoskeleton and rehabilitation robotics since 2015. Together with researchers, therapists, and patients, we aim to excel in developing and redefining rehabilitation robotics solutions with interconnectable intelligent robotics technology by elevating user experience with an intuitive, easy-to-use system to empower the users and clinicians.

Fourier Global Research Joint Laboratories and Clinical Partners