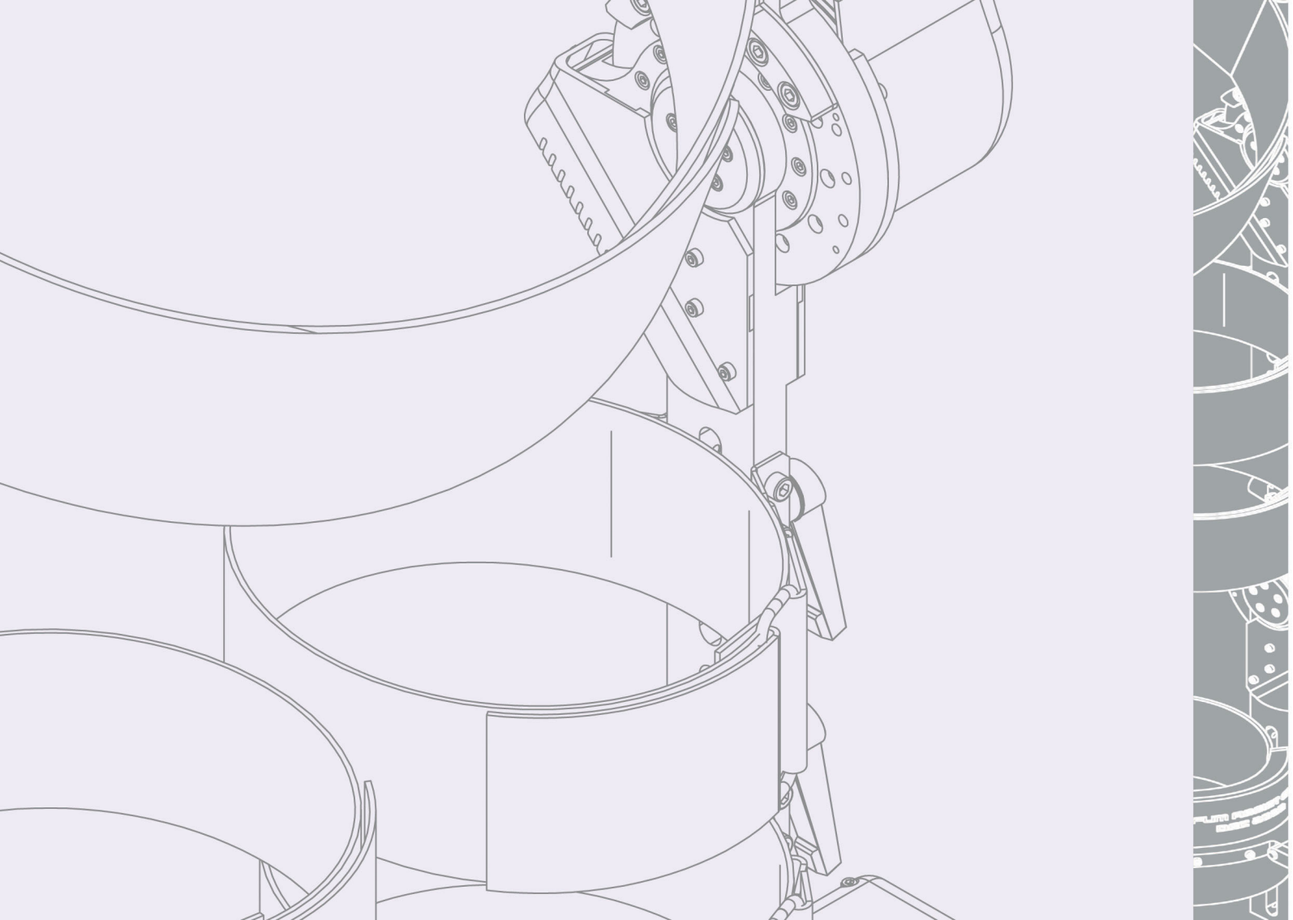


FUM-Exoskeleton

FÜM CARE

CENTER OF ADVANCED

REHABILITATION & ROBOTICS RESEARCH

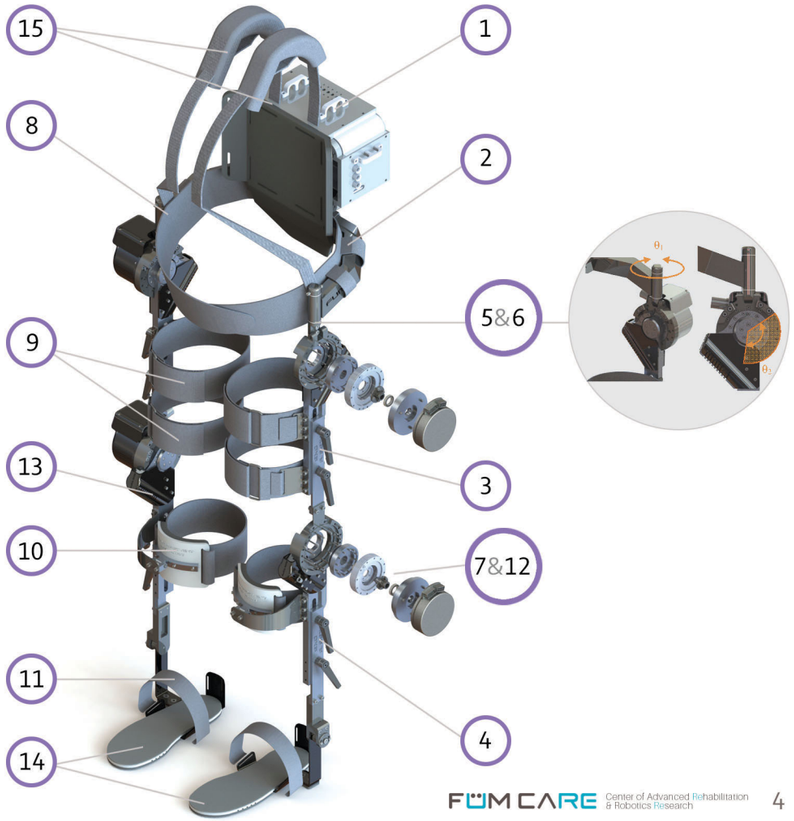
General Explanation

Rehabilitation is increasingly benefiting from developments in medical robotics and bio-mechatronics. The growing demand for rehabilitation, mostly due to the rising number of accident injuries and population ageing, also contributes to the need for more optimized treatment methods. To this end, exoskeletons, which are wearable robots, are designed to enable SCI patients to walk and to improve the treatment process. Robots can equip physiotherapists with detailed data regarding the rate of improvement, and this quantitative feedback will motivate the patient and help the physiotherapist to determine the most effective treatment.

FUM-Exoskeleton is a 12 degrees of freedom (DoF), 4 active and 8 passive, lower limb exoskeleton robot. The robot is designed with 8 passive DoF to resemble that of a human leg for convenience purposes. The 4 active DoF are manufactured with four 160 watt BLDC motors placed on hip and knee joints in sagittal plane, each driving a link which is placed parallel to the human leg and fastened with eight Velcro straps. **FUM-Exoskeleton** can provide a range of 0 to 100 percent of required movement force for patients.

FUM-Exoskeleton Components

1. Box
2. Adjustable torso
3. Adjustable thigh link
4. Adjustable shank link
5. Rotational passive DoF
6. Passive DoF in frontal plane
7. Active DoF in sagittal plane
8. Torso strap
9. Thigh strap
10. Shank strap
11. Foot strap
12. Actuator component
13. Force sensor
14. Foot force sensor
15. Suspend



How to Use FUM-Exoskeleton

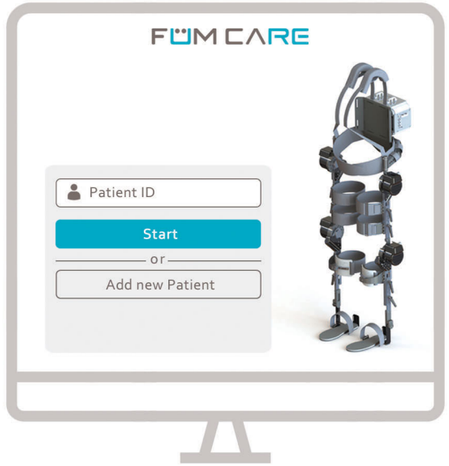
1) Wearing the robot and turning it on

A. The torso link should be adjusted to the waist width

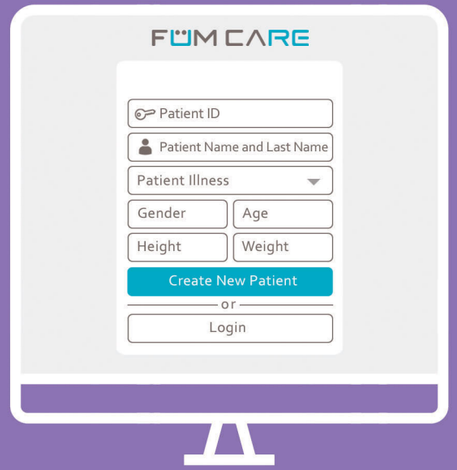
B. The thigh and shank links should be adjusted so that the actuators are placed on the hip and knee joints

2) Entering user ID:

A. Patient ID for registered users is entered and Start button should be pressed



B. For new users, patient ID is first completed and registered

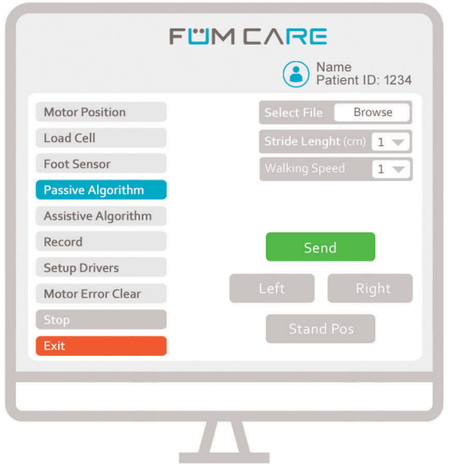


3) Choosing the control system

A. Passive Algorithms:

i. Sit to Stand

ii. Walking



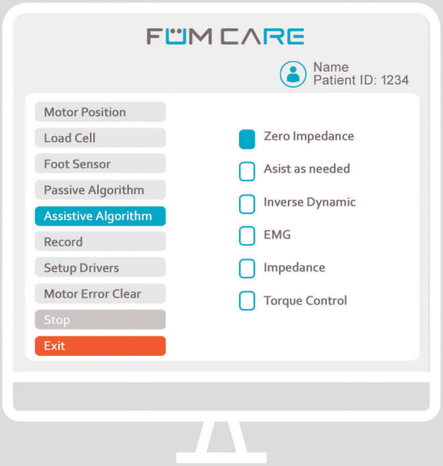
B. Assistive Algorithms

i. EMG based

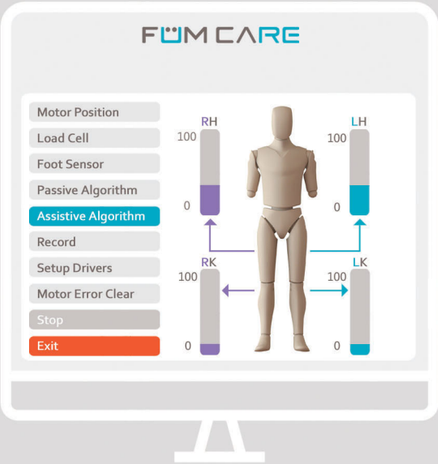
ii. Inverse Dynamic

iii. Assist as Needed

iv. Impedance and Admittance



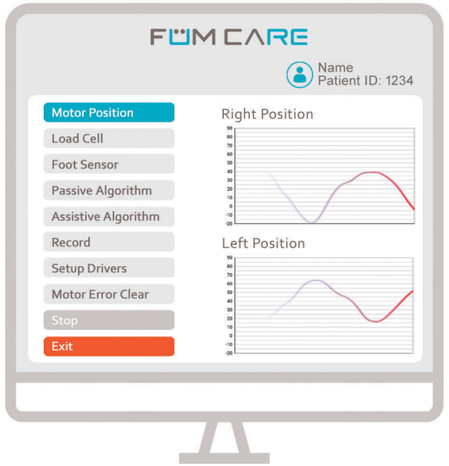
4) Entering and sending control parameters



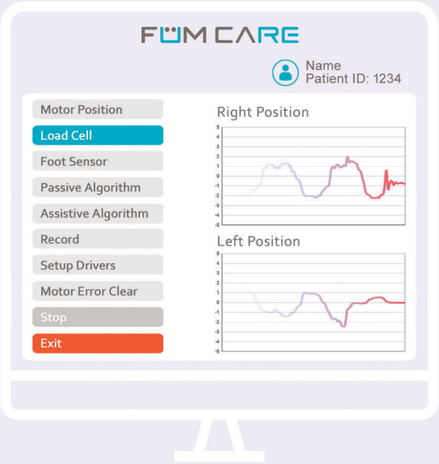
5) Starting the rehabilitation and training

6) Receiving visual feedback

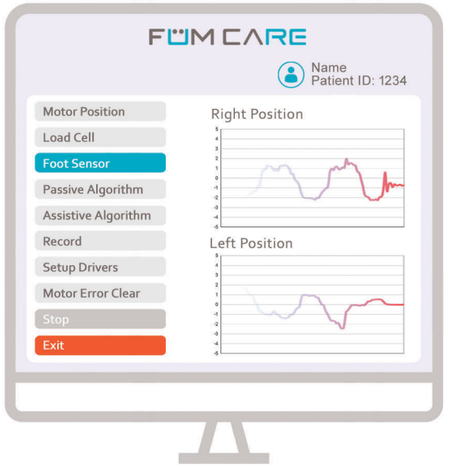
A. Motor Positions



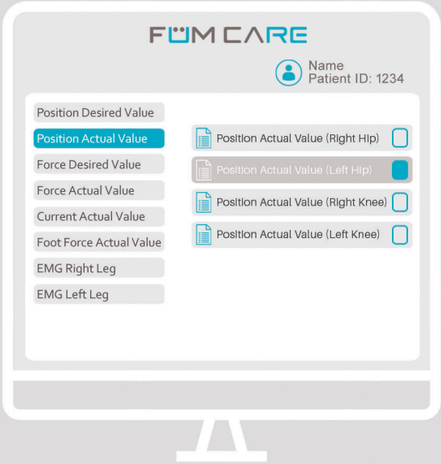
B. Load Cells



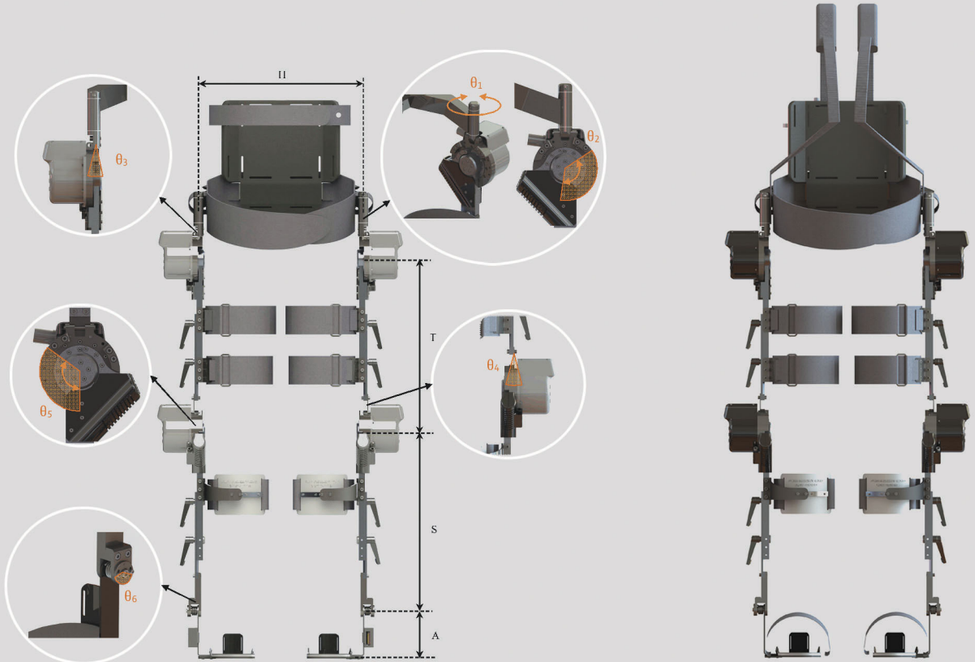
C. Foot Sensor



7) Receiving detailed performance report including stride, symmetric movement, and linear speed



FUM-Exoskeleton



Features

1. Wide range of motion

2. Table of Properties

Weight	28 kg
Assistive force	Hip: 20 Nm, Knee: 40 Nm
Function duration	Unlimited
User weight	Maximum 80 kg
Torso width	345 – 395 mm
Thigh length	395 - 455 mm
Shank length	405 - 465 mm
Patent number	