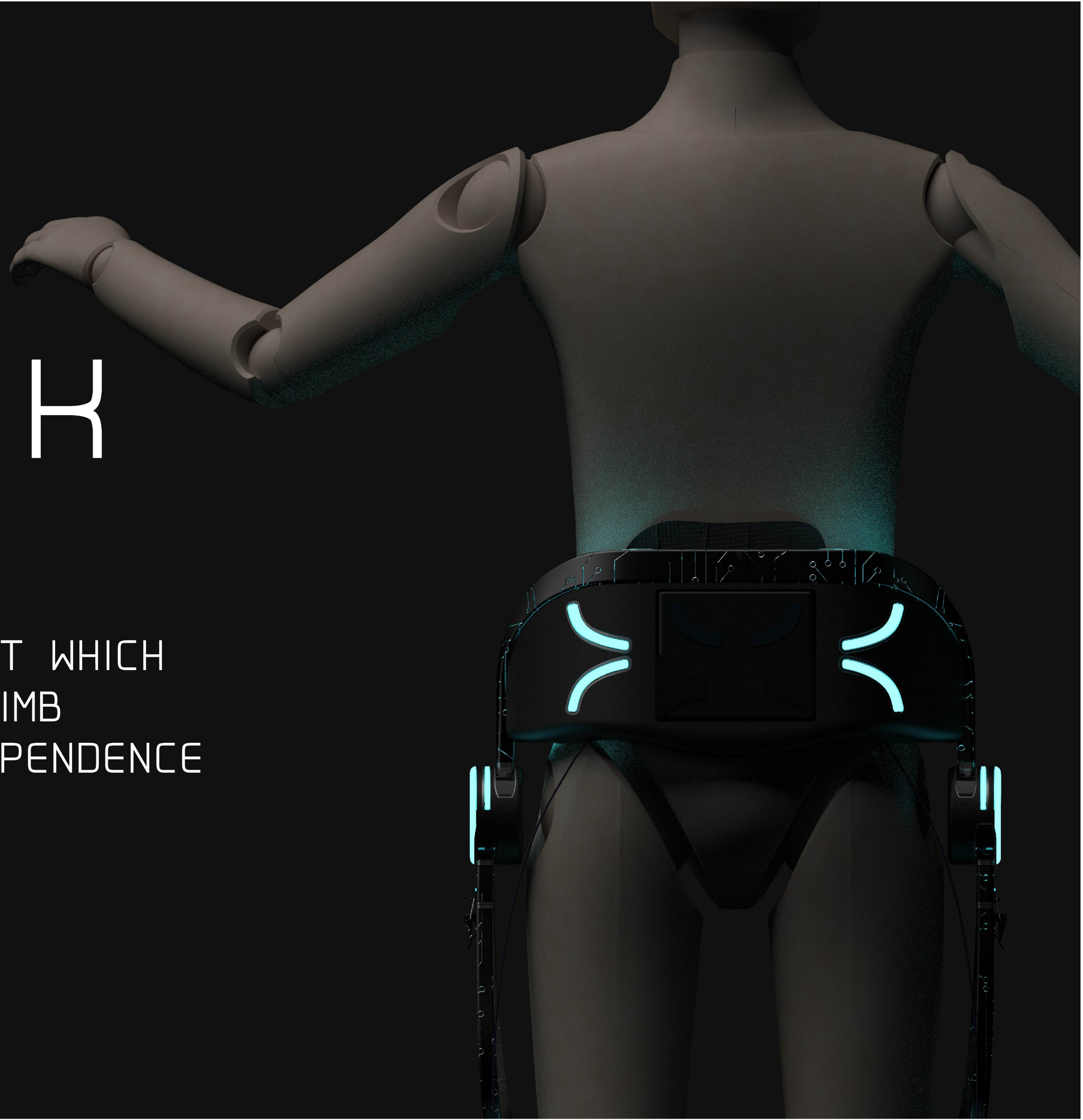


ADVISOR COMPANY: ASELSAN

DESTEK

ELECTRICAL WEARABLE BODY ASSISTANT WHICH
ENABLES THE USER WHO HAS LOWER LIMB
EXTREMITY PARALYSIS TO REGAIN INDEPENDENCE
IN ACTIVITIES OF THE DAILY LIVING.

MELİSA TUTKU SEKERCI





THE NATIONAL SPINAL CORD INJURY STATISTICAL CENTER AT THE UNIVERSITY OF ALABAMA AT BIRMINGHAM ESTIMATES THAT AS MANY AS 327,000 PEOPLE IN THE UNITED STATES ARE LIVING WITH SOME LEVEL OF PARAPLEGIA.

(SCHÖENBERGER, ROBERT.,2012)

LOCOMOTION TRAINING IS CONSIDERED AN EFFECTIVE APPROACH TO HELPING INCOMPLETE SPINAL CORD INJURED (SCI) SUBJECTS RECOVER THEIR WALKING CAPABILITIES.

(WERNIG AND MULLER 1992; WIRZ ET AL. 2001).

THE AUTOMATION OF LOCOMOTION TRAINING BY MEANS OF A POWERED EXOSKELETON POTENTIALLY IMPROVES TRAINING EFFICACY AND REHABILITATION OUTCOME.

(HREBS ET AL. 2000; COLOMBO ET AL. 2001).

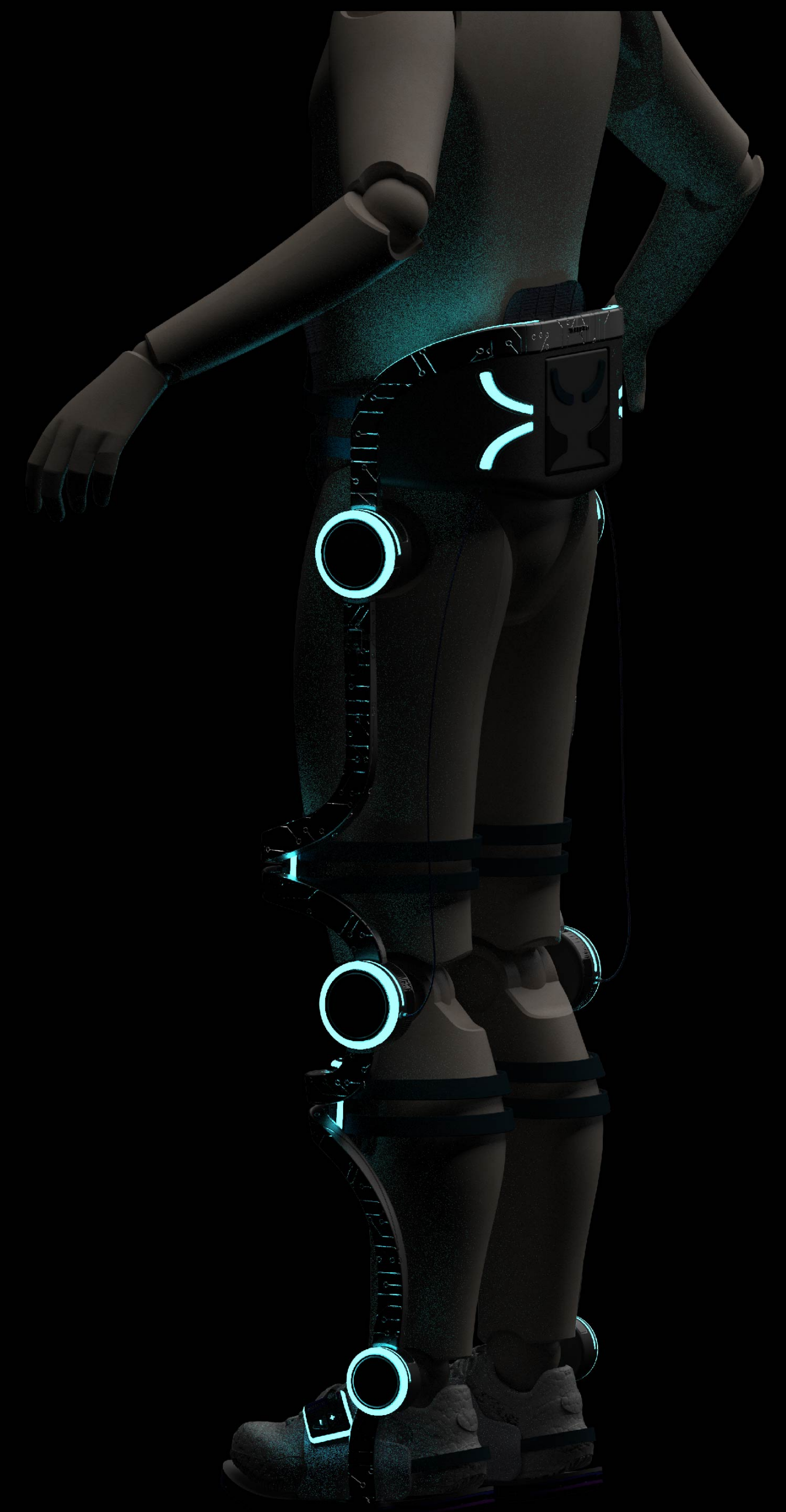
NEEDS OF SOMEONE ELSE'S HELP

SECONDARY MEDICAL CONSEQUENCES

EYE CONTACT LEVEL

INDEPENDENCY

SOCIALIZING



SPINAL CORD INJURY

DESTEK; In spinal injury, from level T7 (seventh thoracic vertebra) to L5 (fifth lumbar vertebra), as well as herniated vertebrae in domestic usage, people can benefit from T4 (fourth thoracic vertebra) where T6 (sixth thoracic vertebra) devices are limited to use in rehabilitation institutions.

Loss of mobility and independence are part of the main consequences of paraplegia.

Other health-related consequences include:

Pressure sores

Deficient bowel function

Blood circulation

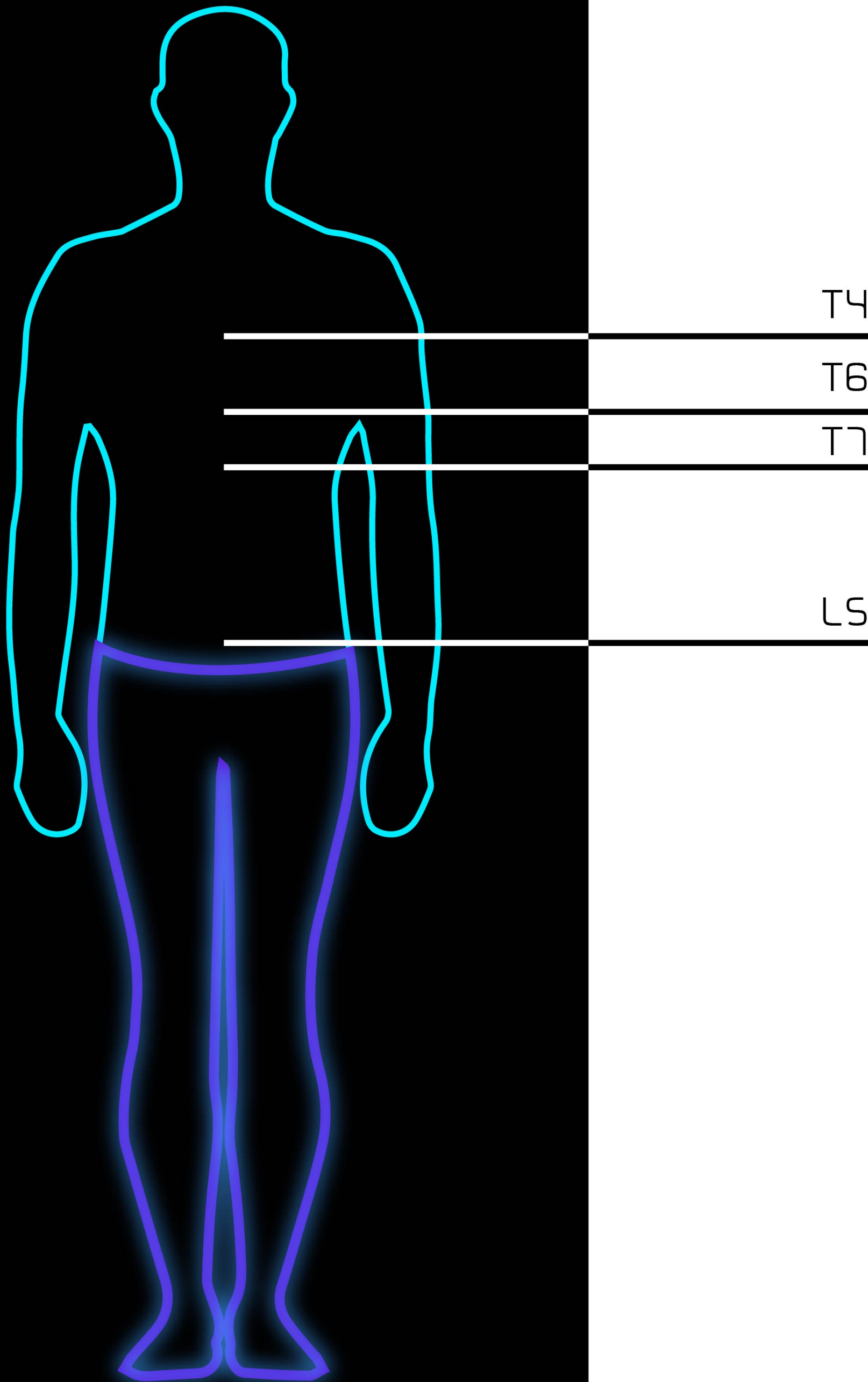
Loss of bone density

Training plays a very important role to prevent secondary diseases.

"hands-on" training which is labor intensive and strenuous.

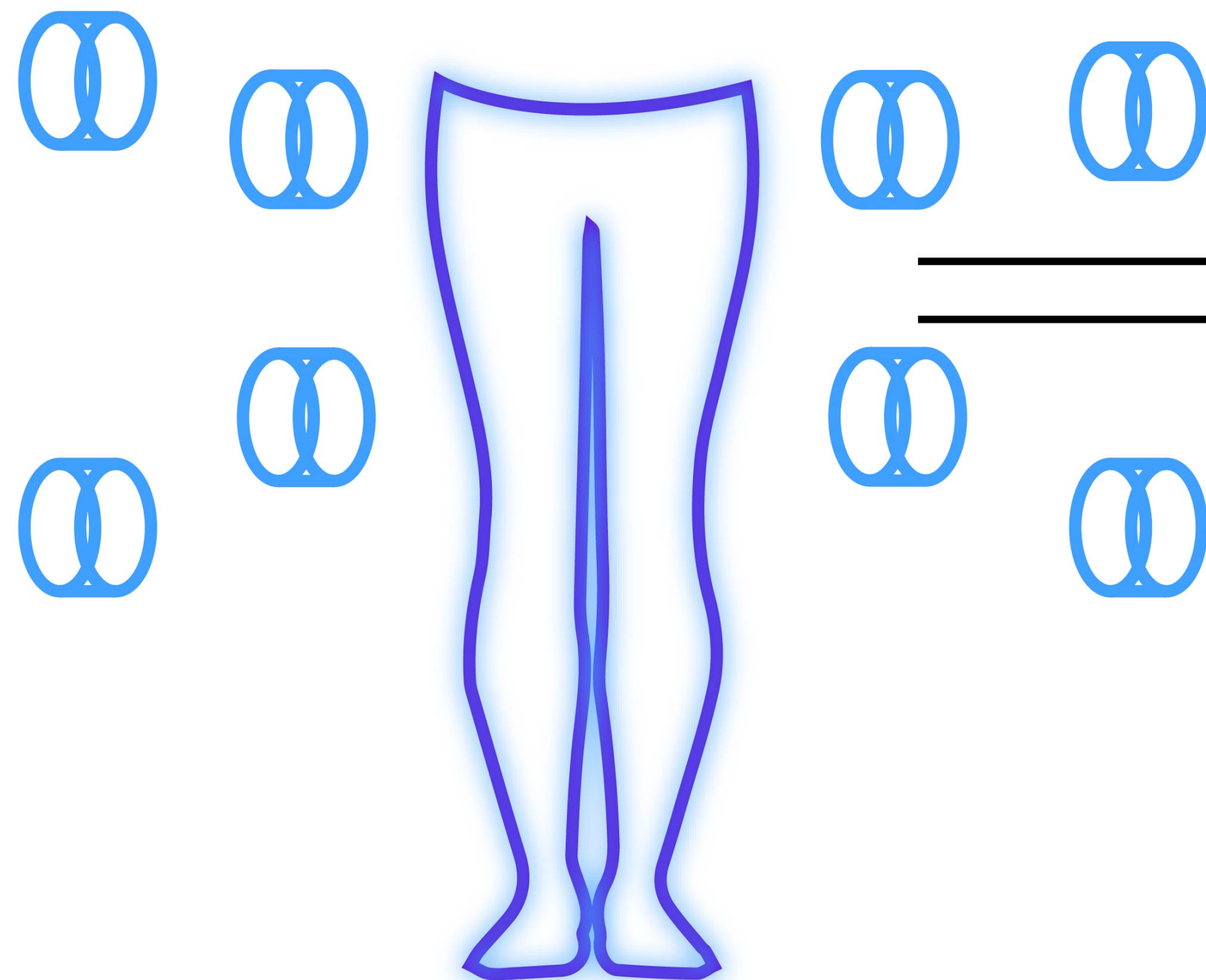
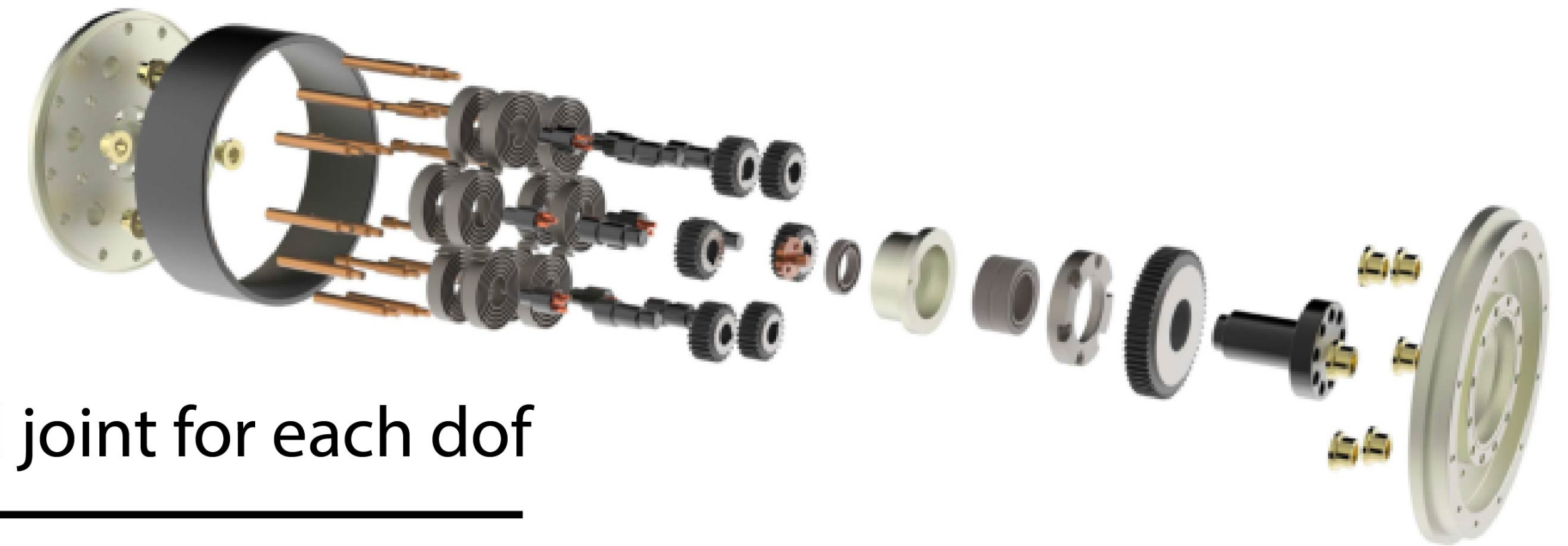
Because of the increase of such population

DESTEK is needed to fulfill these training tasks which is accomplished by user and improve the training effect



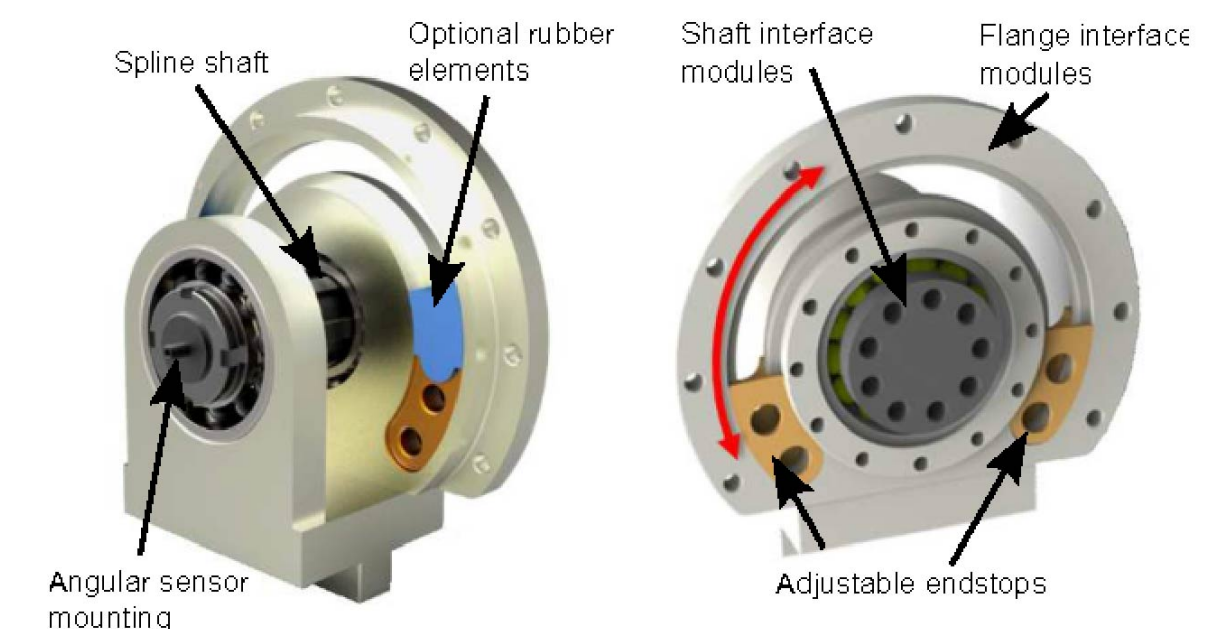
D E S T E R have been developed to provide functional mobility to paraplegic patients, enables people suffering from complete paraplegia to stand up and walk again, provides complete mobilization of the lower-limbs, which is a first step toward enabling the user to regain independence in activities of the daily living. The tasks it can perform include level and inclined walking, stairs ascent and descent, sitting on a seat, and standing up.

MECHANICAL PARTS

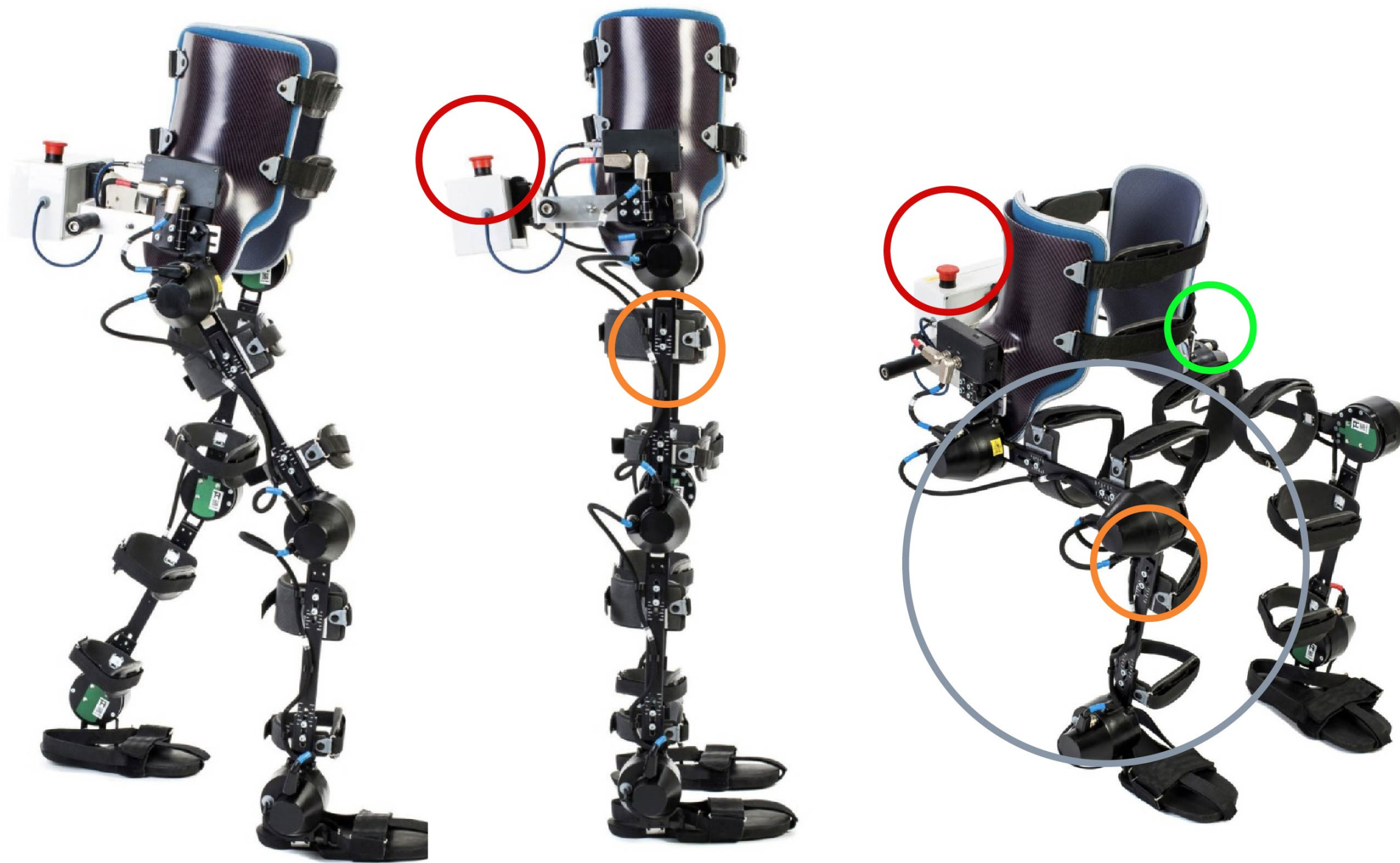


Identical joint for each dof

Hub motor's relatively compact size means more room for other components such as drivers.



COMPARISON & RESULTS



The EXO-H3 is the third version of Technaid's lower limbs robotic exoskeleton.

INTERACTION AREAS

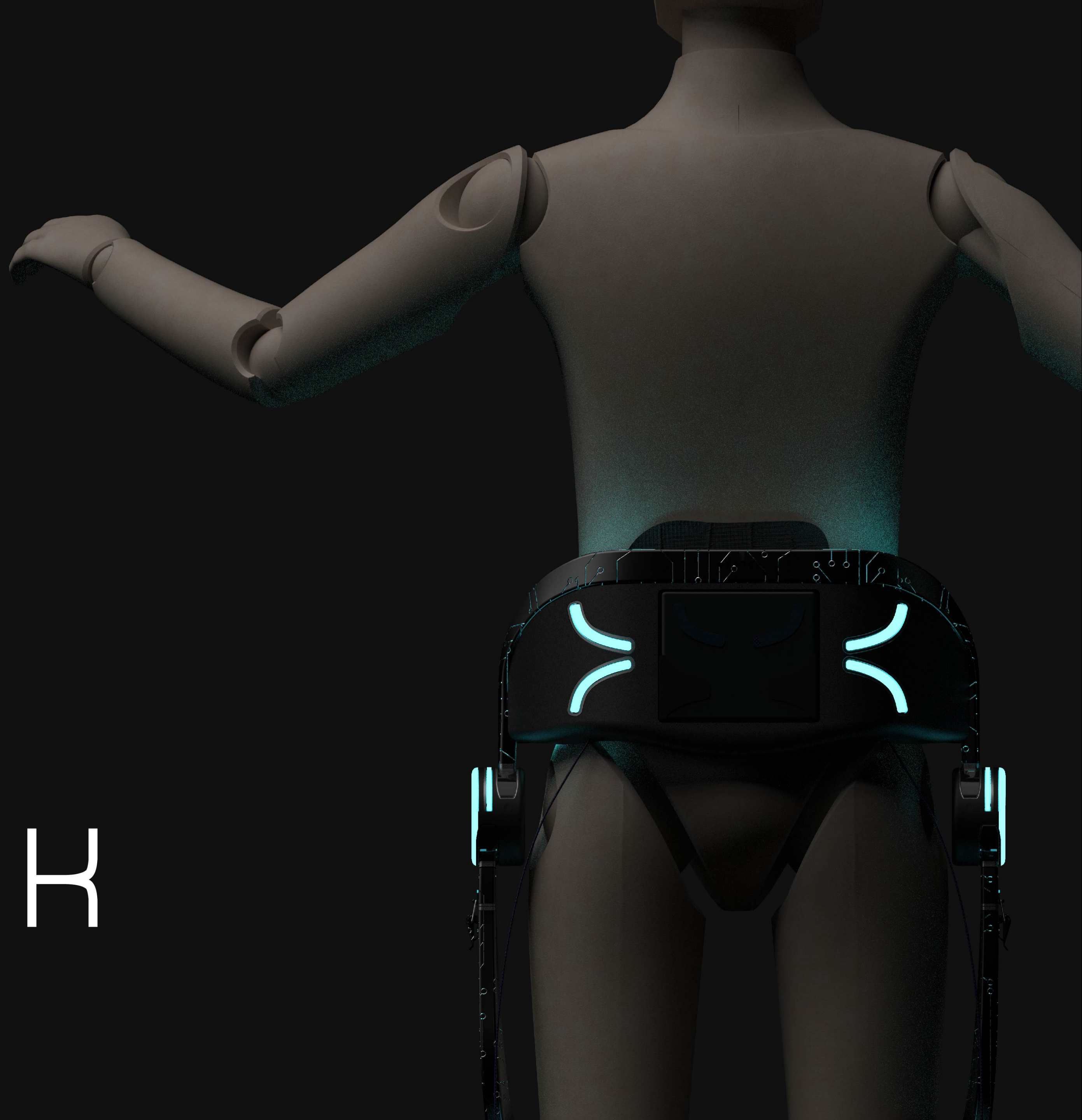
- In a falling situation, user cannot press the emergency button easily and suddenly because of the position of emergency button. So that motors keep working and doesn't allow user to fall safely in a normal position. Generally emergency button is located for the physiotherapist, but this restricts the user to use wearable body assistant fully independent.
- On/Off button is the main switch of the wearable body assistant which controls the electricity and drivers. When pressed a countdown from a few seconds starts so that user is informed about wearable body assistant will start working. In society, If someone or the user presses on/off button accidentally while body assistant is working, it may put user to in a dangerous position. So that On/Off button's position is very important.
- The user cannot wear the body assistant without help due to the binding method used for connecting the body assistant to the legs. In the used binding method strings need to be pulled and squeezed by a few people. So that user loses individuality.
- While user is wearing the body assistant, he/she needs some help from another person because the frame of body assistant is not suitable for wearing it alone.
- There are two different engine types currently used in the market. Ayna Mahruti and Hub motor are two effective motors. They differ from each other on shape, while Ayna Mahruti is relatively longer and thinner, Hub motor is relatively shorter and thicker.



COFFEE	SMOOTHIES	SNACKS
ESPRESSO 1.80	ON OF TEAS	HALE KALE 4.95
FLAT WHITE 2.50		BERRY BLITZ 4.95
AMERICANO 2.20	HONEY	NUT BUSTER 4.95
CAPPUCCINO 2.50	CHAI 3.00	CACAO POWER 4.95
LATTE 2.50	MATCHA 3.00	VANILLA ICE 4.95
MOCHA 3.00	HOT CHOC	LEMONADE 2.50
MACCHIATO 2.20	COLD P	RASPBERRY
PICCOLO 2.20	CO	FARMERS
BATCH BREW 1.80	CRA	KOMBUCHA 3.75
ICED COFFEE 2.60		GINGER PINE APPLE JUICE
COCONUT WHEY HEMP REUSABLE	OFF	CITRUS TURMERIC
EXTRA SHOT DECAF 2.50	AL	GREEN CUCUMBER

USAGE SCENARIO

DESTEEK



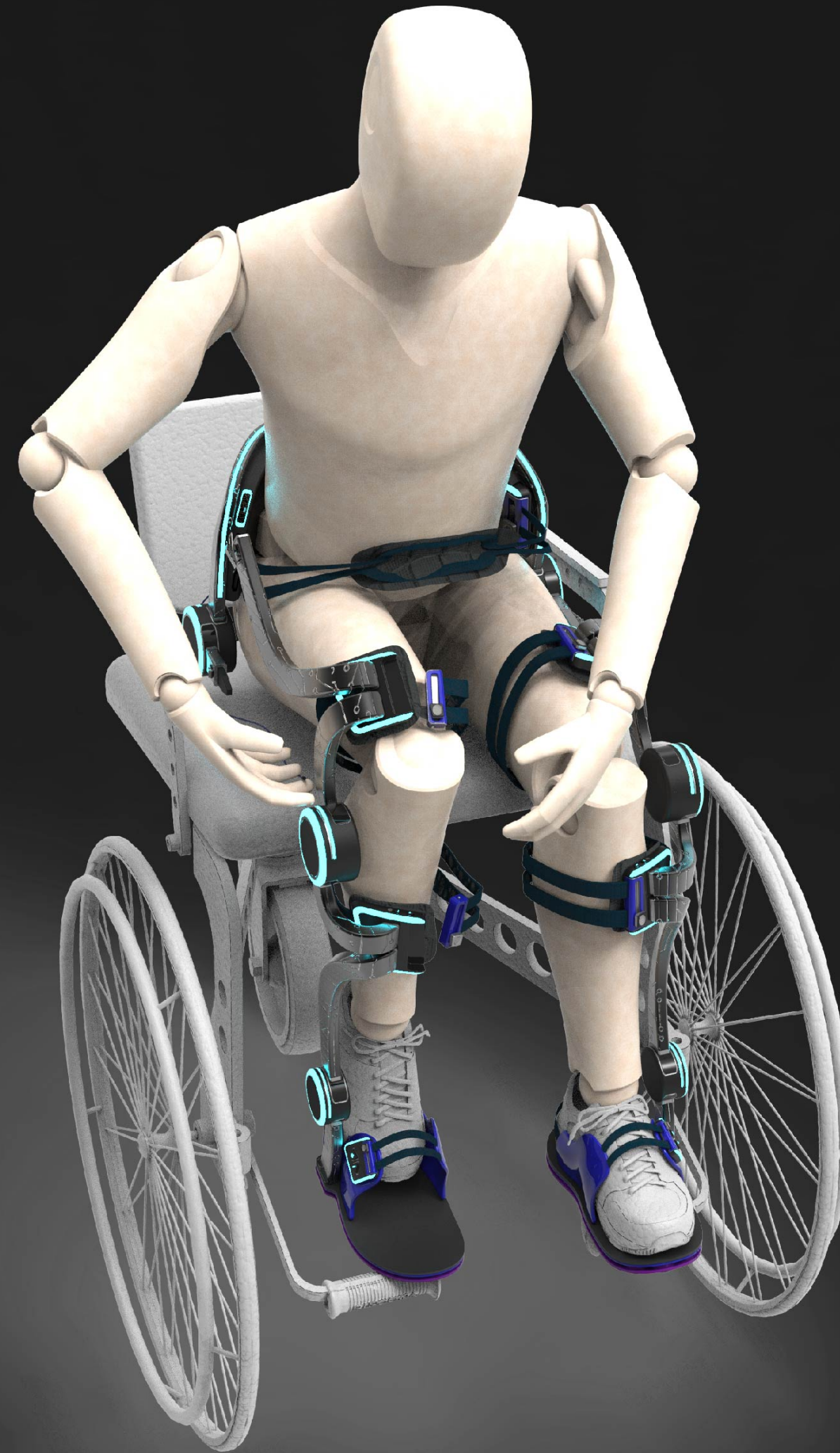
USAGE SCENARIO

THE COMPACT ACTUATORS.

THE LOCATION OF ELECTRICAL PARTS.

THE MODULAR PARTS WHICH ARE COMBINED ON USER.
ELECTRICAL SELF FITTING INTERFACES

PROVIDES THE EASY AND INDEPENDENT ACT OF WEARING FOR ONLY USES AS WEARING ON WHEEL CHAIR OR VEHICLE.



MOBILITY EXAMPLES



Swivel Car Seats for Van for The Disabled Turning Seat

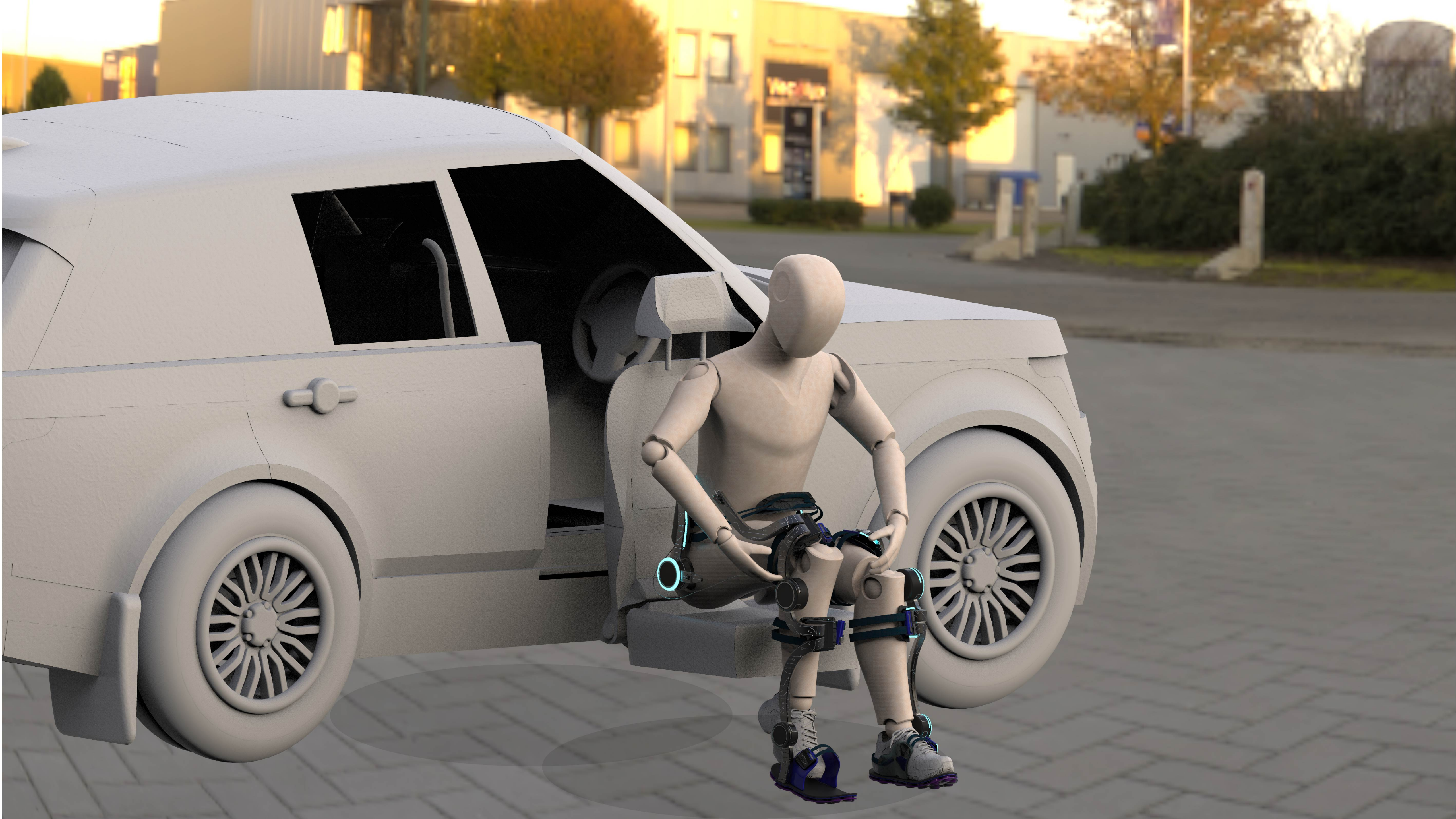


TRAINING IN REHABILITATION CENTER WITH PROFESSIONALS

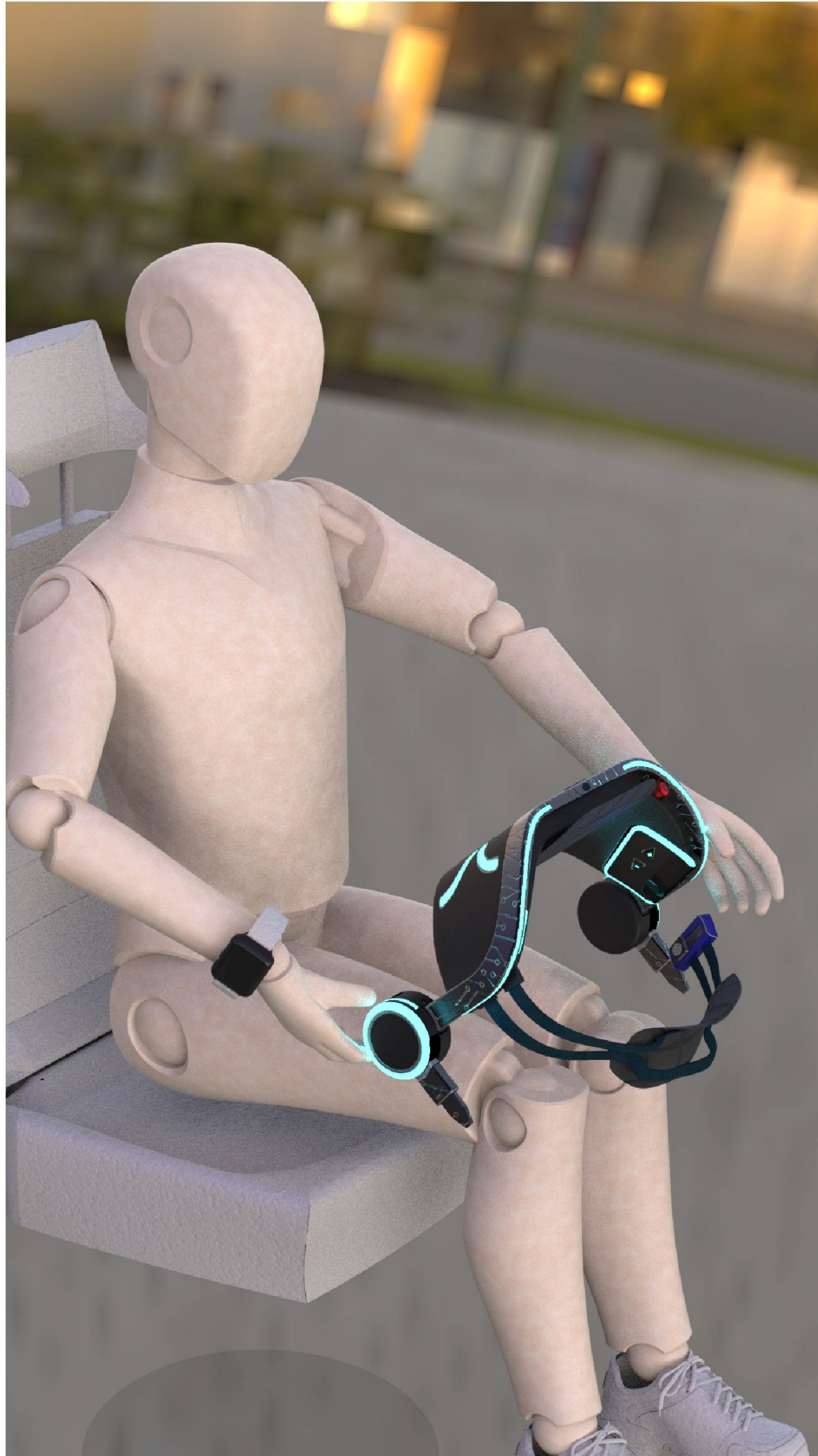
The user is given a minimum of two weeks of training explaining how to use the wearable body assistant and the user support. Training time varies depending on the user. During this training, experts taught and practiced users how to use the body balance sensors and control mechanism. The user can use the D E S T E H independently, without crutches and without help from people, at the end of the training.

2 WEEKS MINIMUM

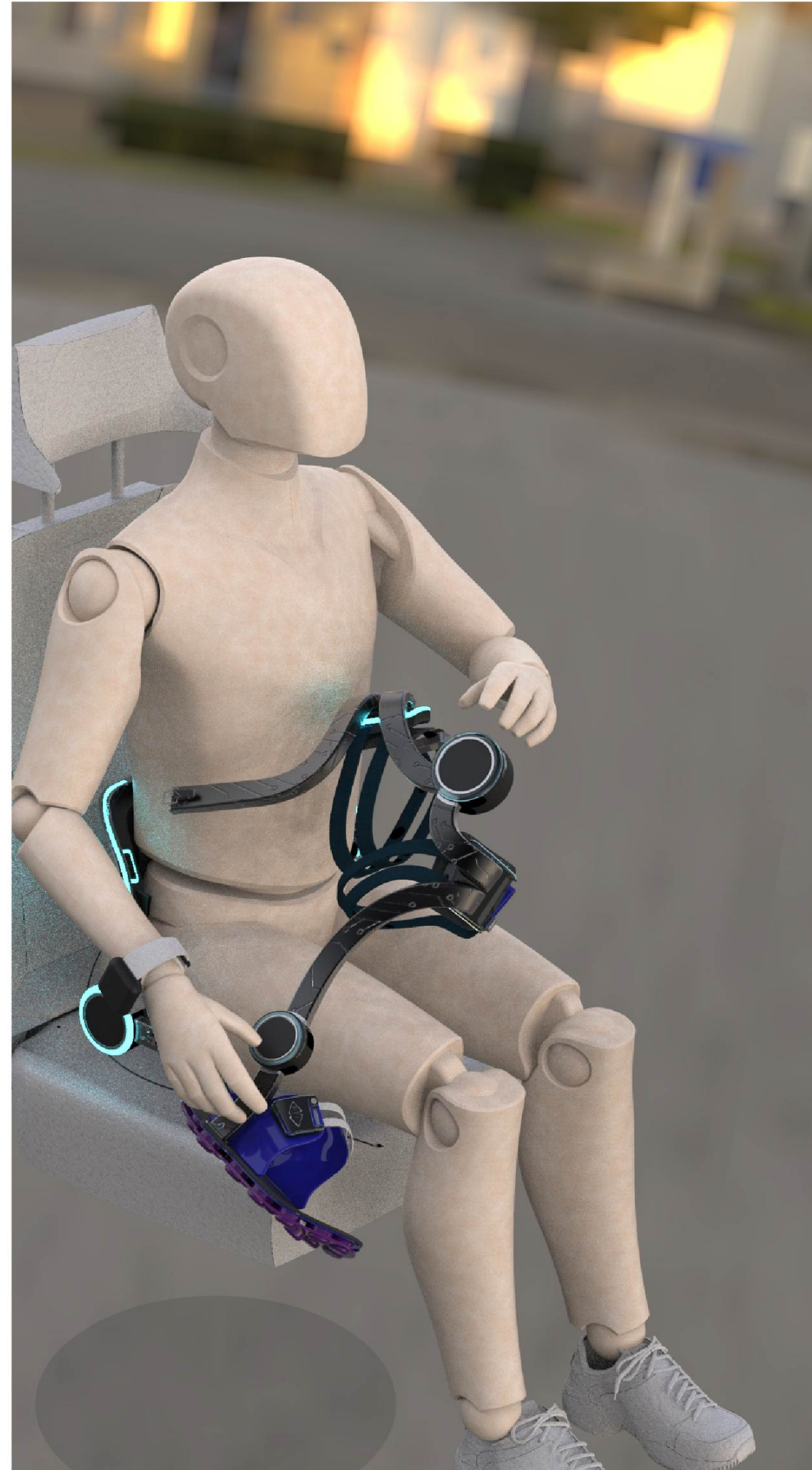




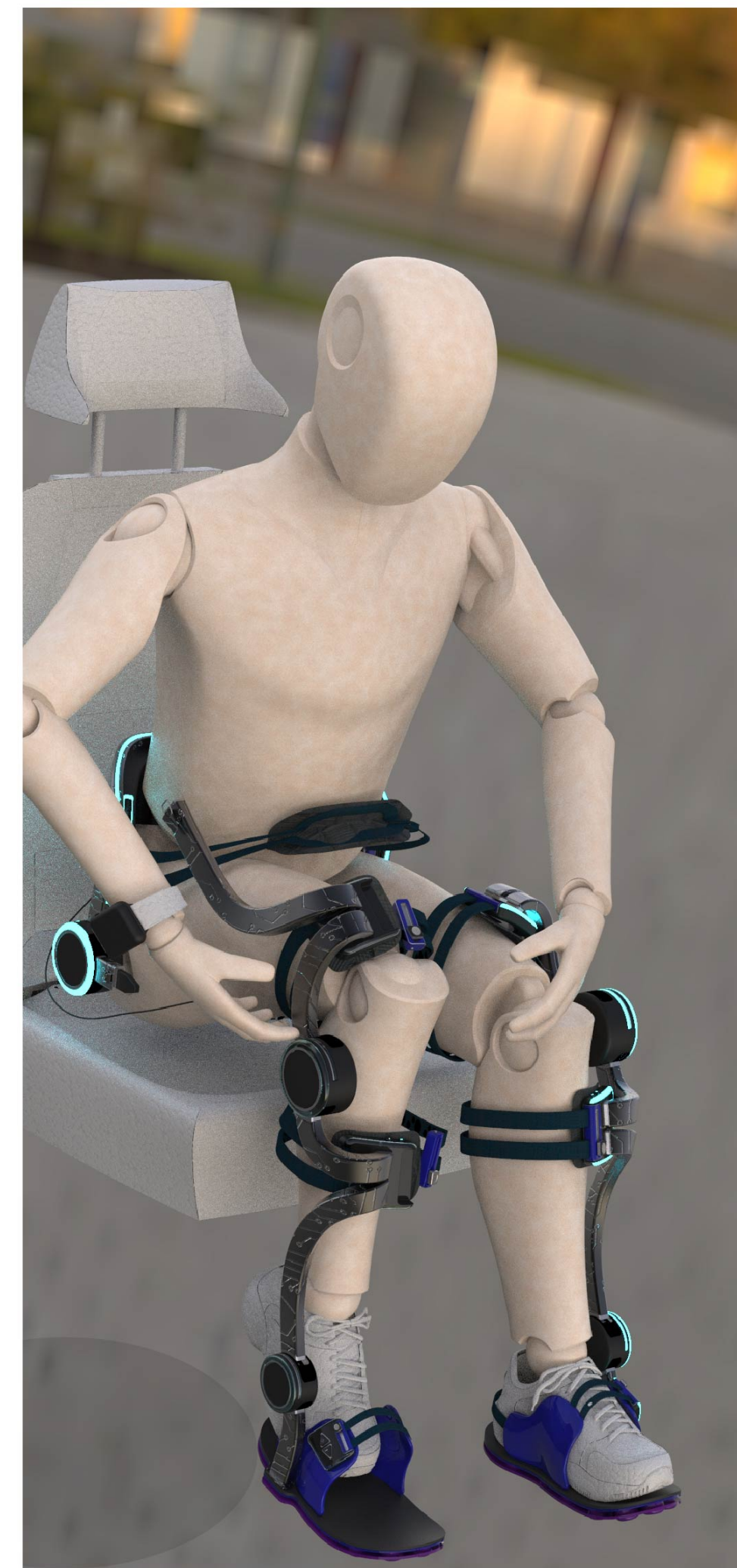
THE ACT OF WEARING



Wears waist pack.



Wears left or right leg module.

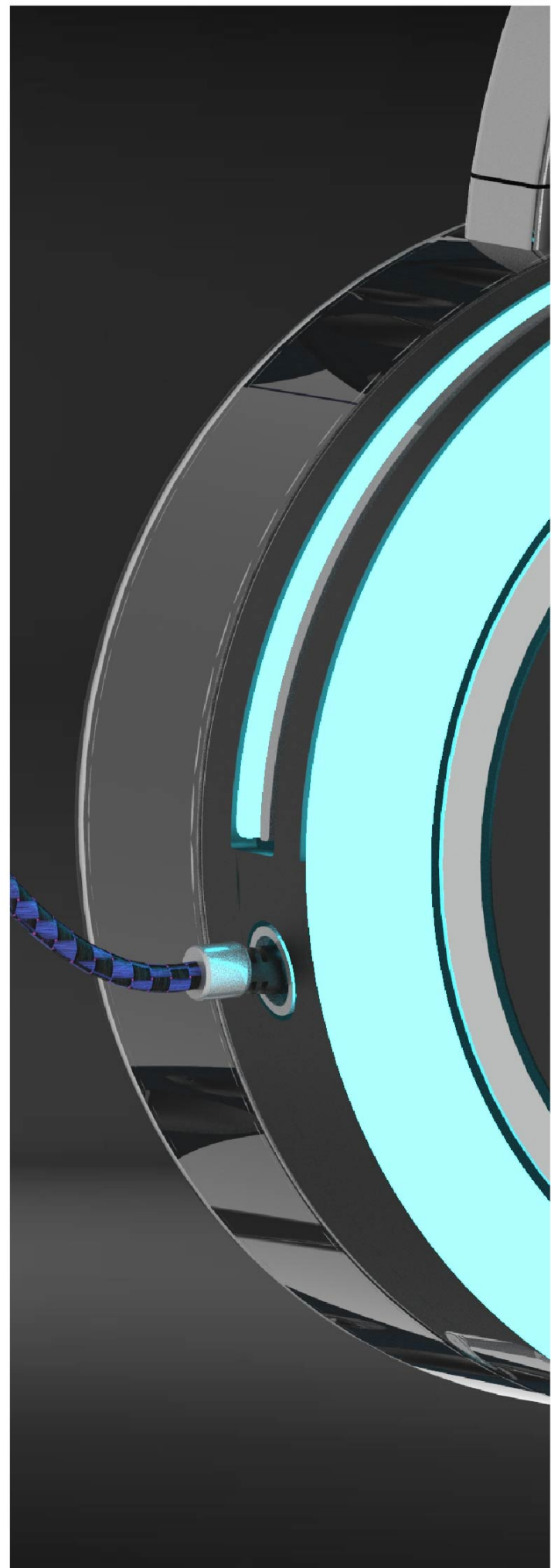


Puts the feet into
foot coupling module.
Closes interface.

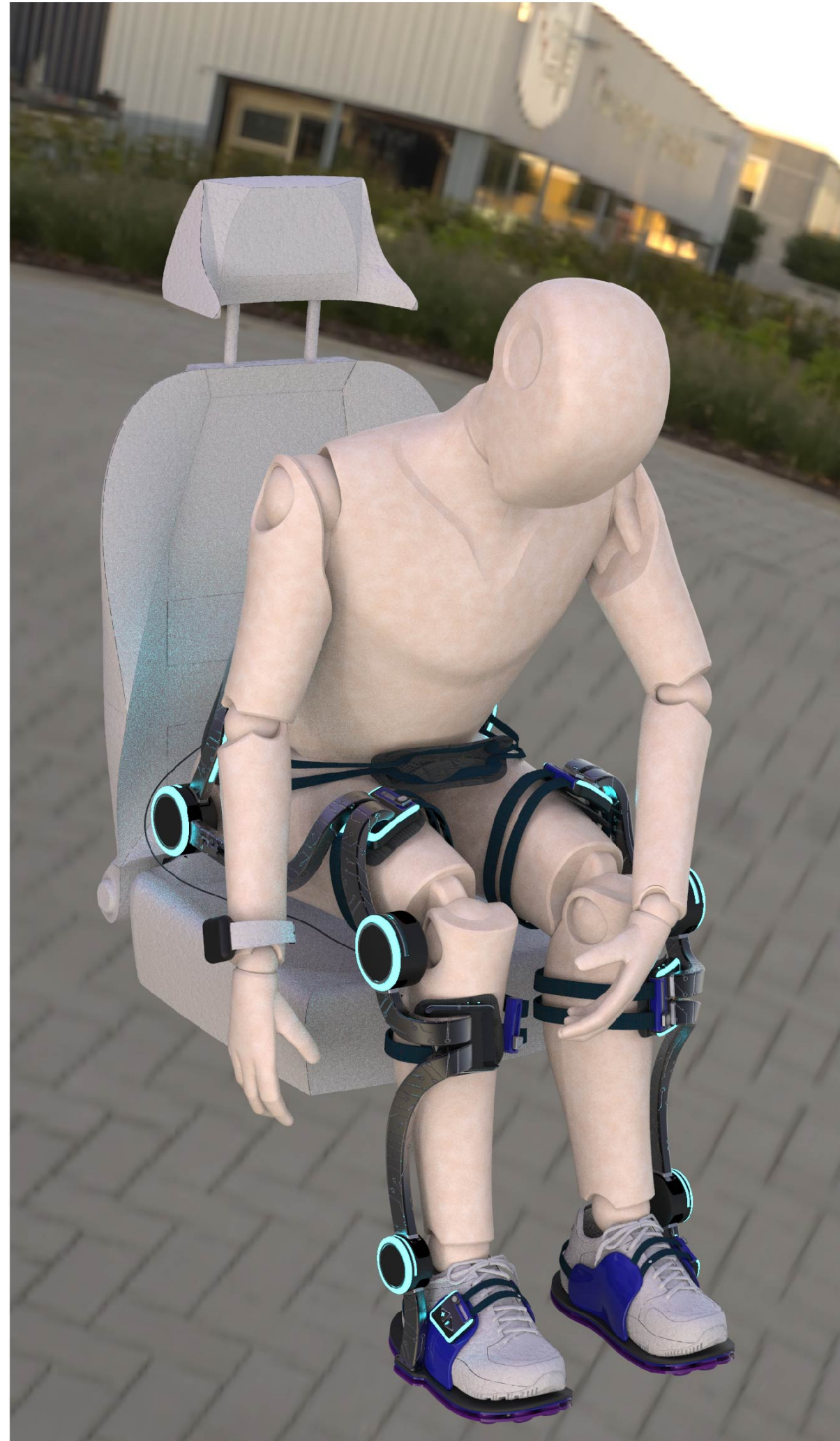


Checks safety from
visual and audicators

THE ACT OF WEARING



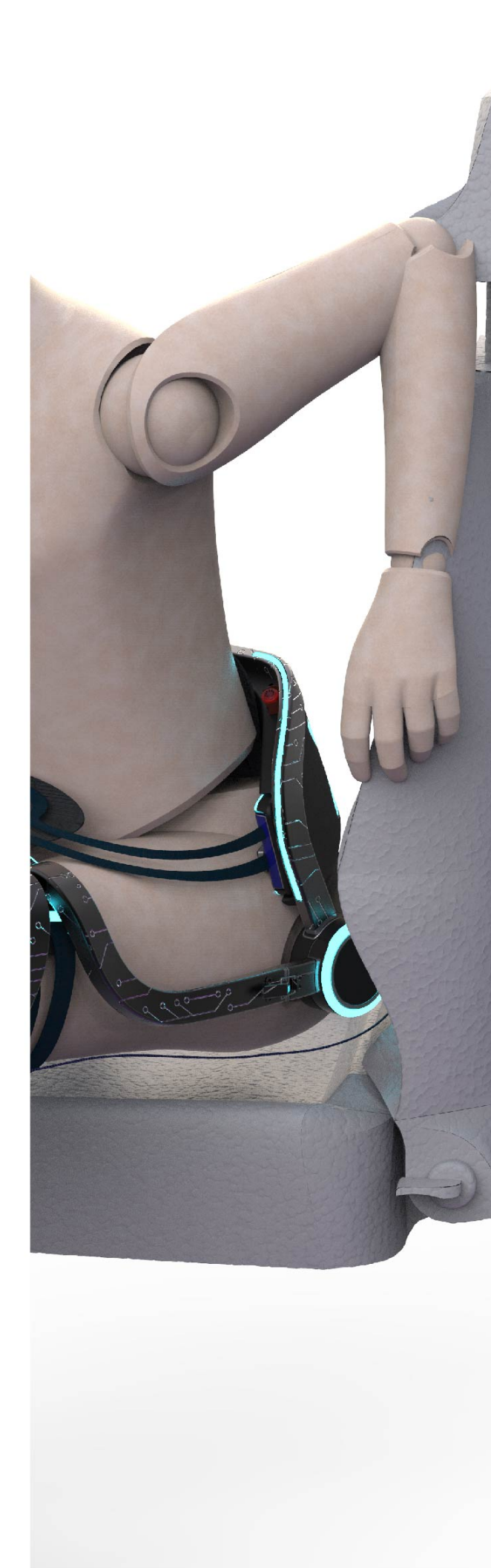
Plugs the power cord up into the actuators socket.



Closes interfaces.
User can control the pressure of laces from plus minus buttons on control box.



Press on on off button.
Waits 5 seconds for getting action.

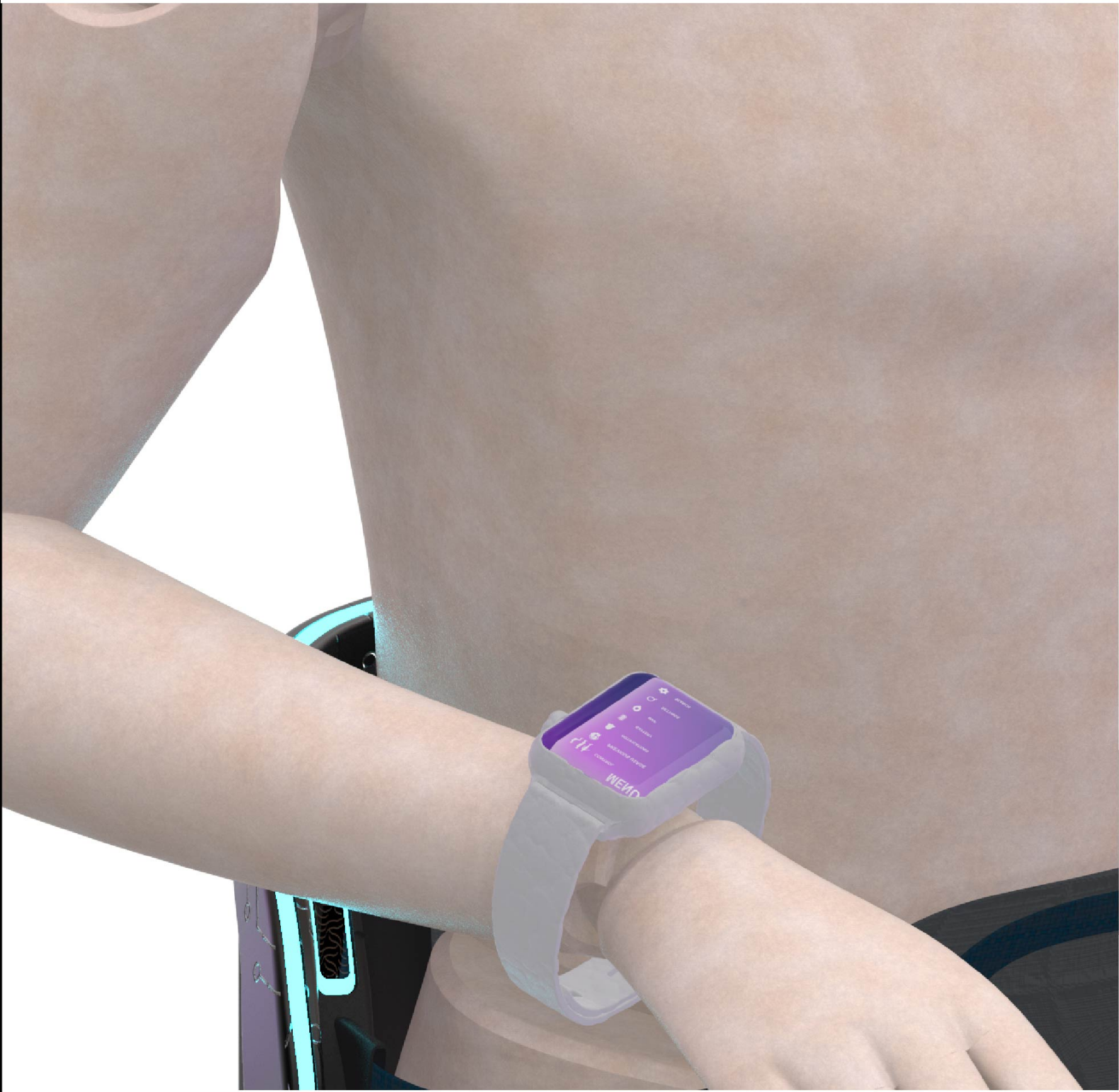


The electronic actuators and sensors estimates the position and support userto get action. User can take support while standing up if wants.

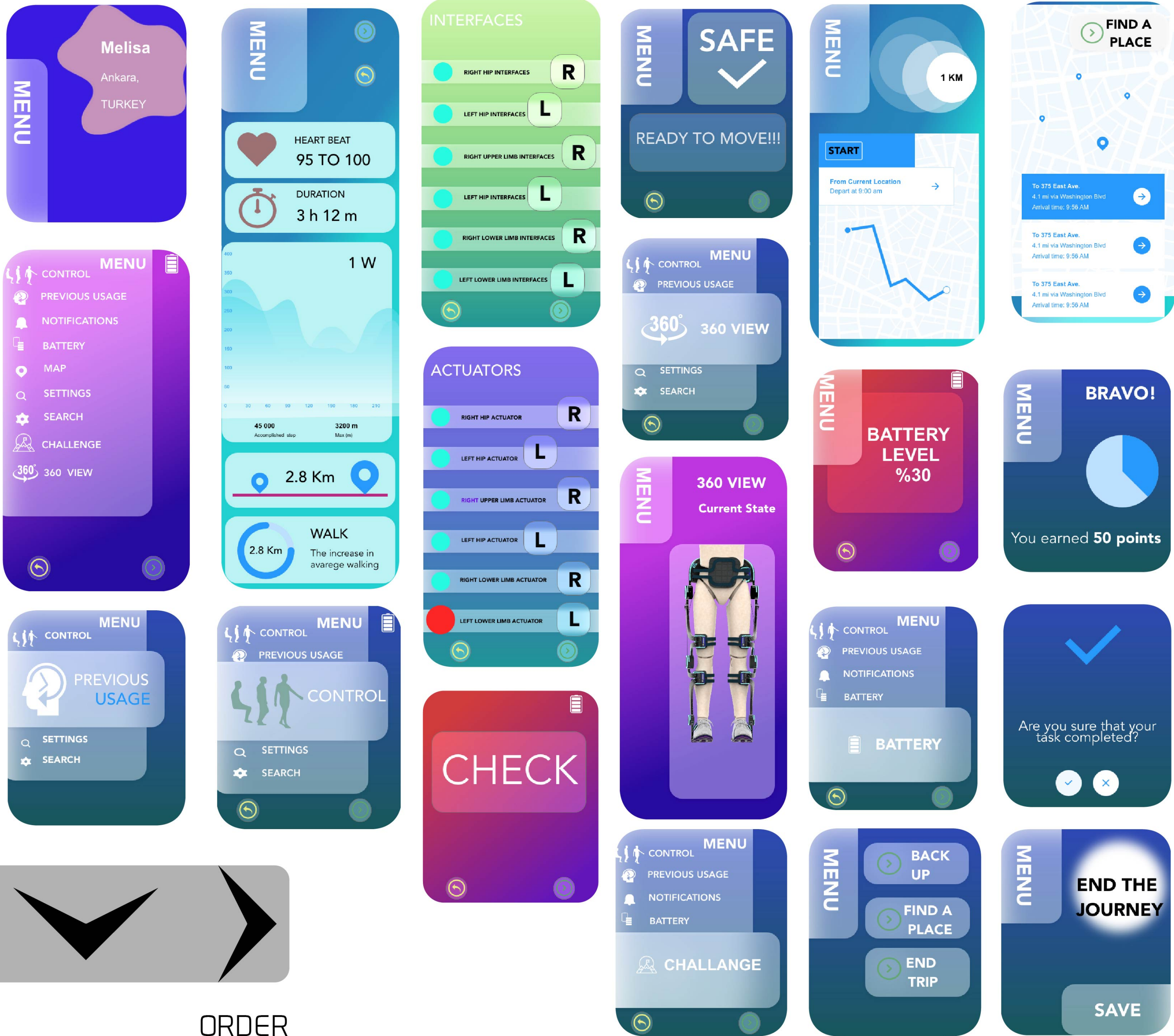


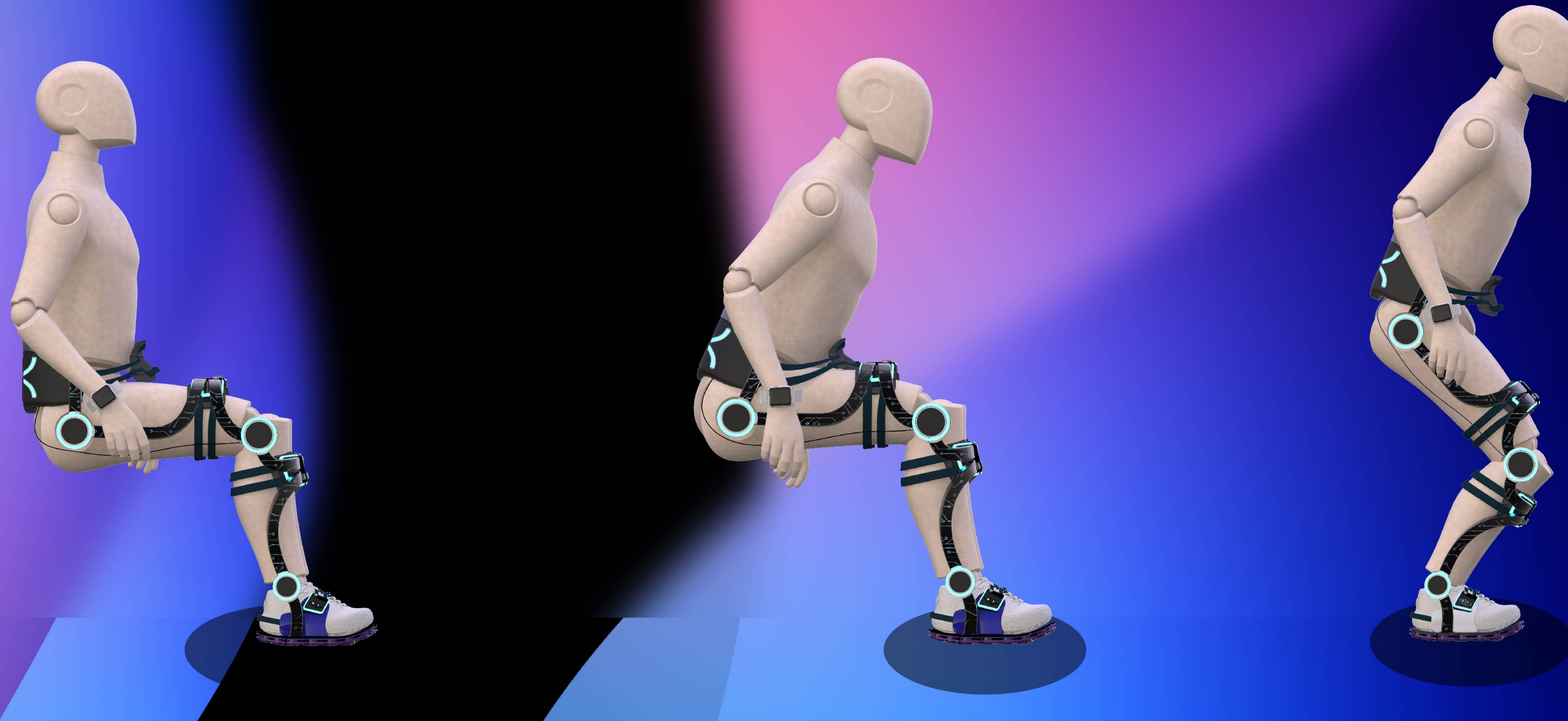
APP

App improves the intraction between user and D E S T E K. User can see the previous experiences' data. With the visual infographics user can compare the datas. App provides safety, places for battery and challanges to encourage user mobility.



ORDER





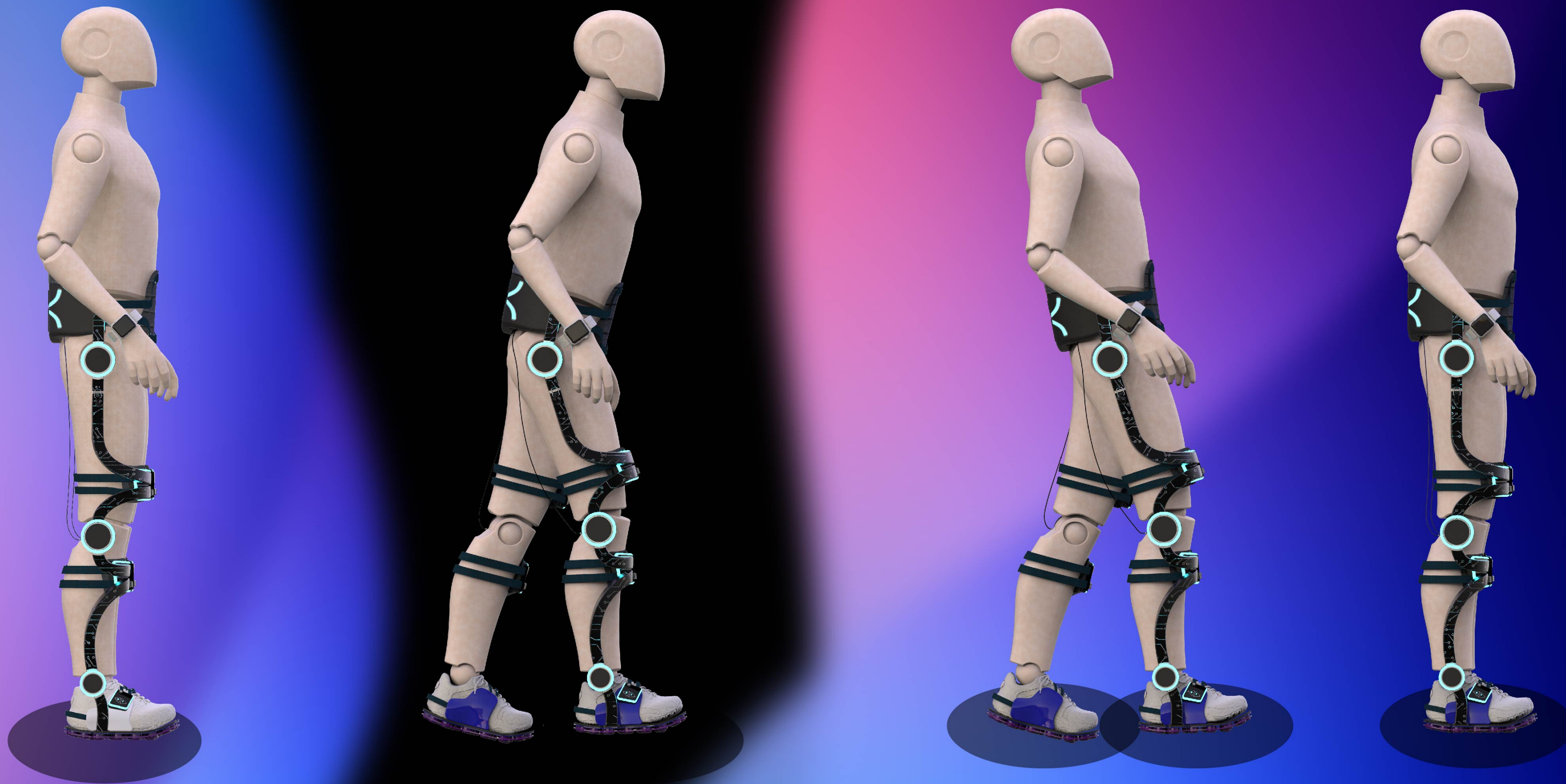
CONTROL MECHANISM

- 1 D E S T E K provides actuated hip flexion/extension support and allows passive and unconstrained abduction/adduction movement. For Gait Assistant Support of a paraplegic patient during gait, sit to stand transfer and stair climbing.

When the user leans own's upper body forward, the motion alerts the sensor's in the waist pack.

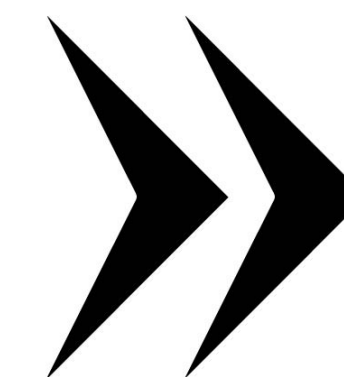
The unit responds by flexing its joints to stand the user up.

The unit's motors then begin their walk cycle.



CONTROL MECHANISIM

- 2 When the user leans own's upper body backward, the motion alerts the sensor's in the waist pack.
The unit responds by flexing its joints to stop the user up.



OBSTACLE

IMU SENSORS

There are two types of biomechanical data generally associated with human motion:

kinematic data such as body posture and joint angles

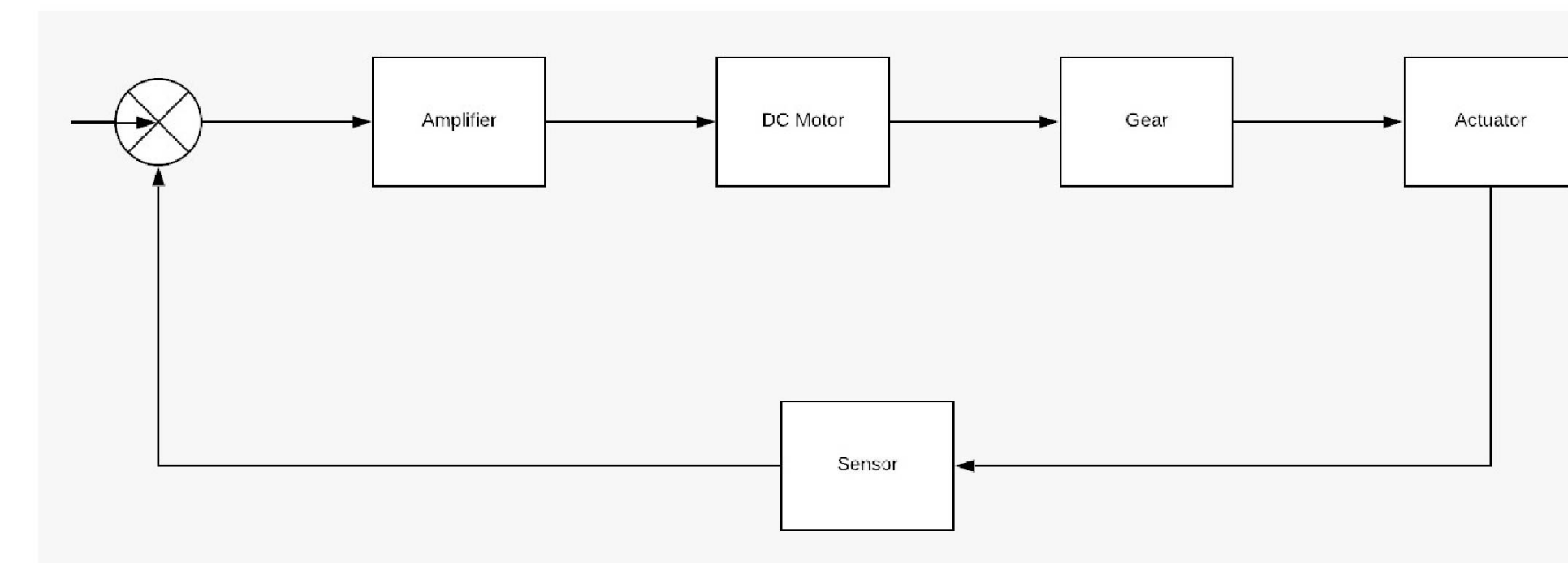
“Encoders, potentiometers, and an inertia measurement unit (IMU) are usually used to measure kinematic data.” kinetic data such as human joint torque, “Force/torque sensors are used for kinetic data acquisition.”

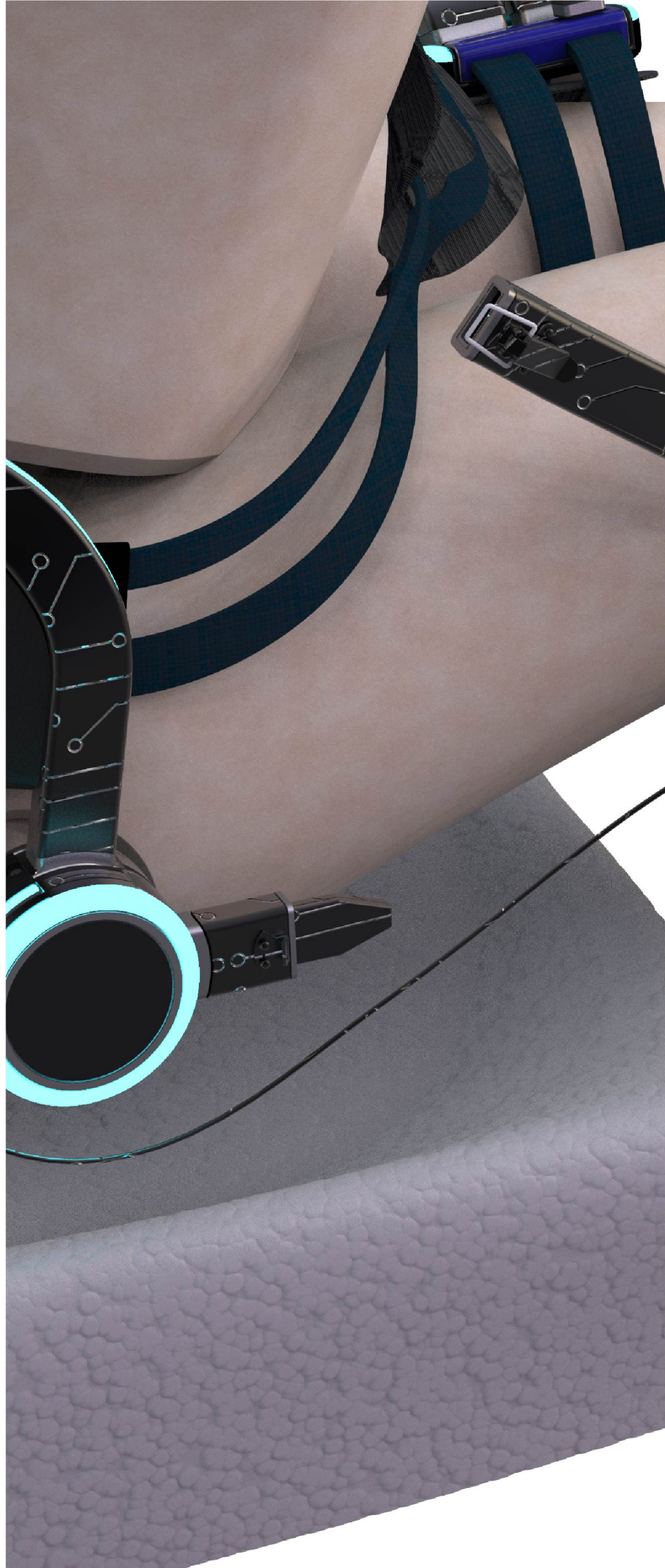
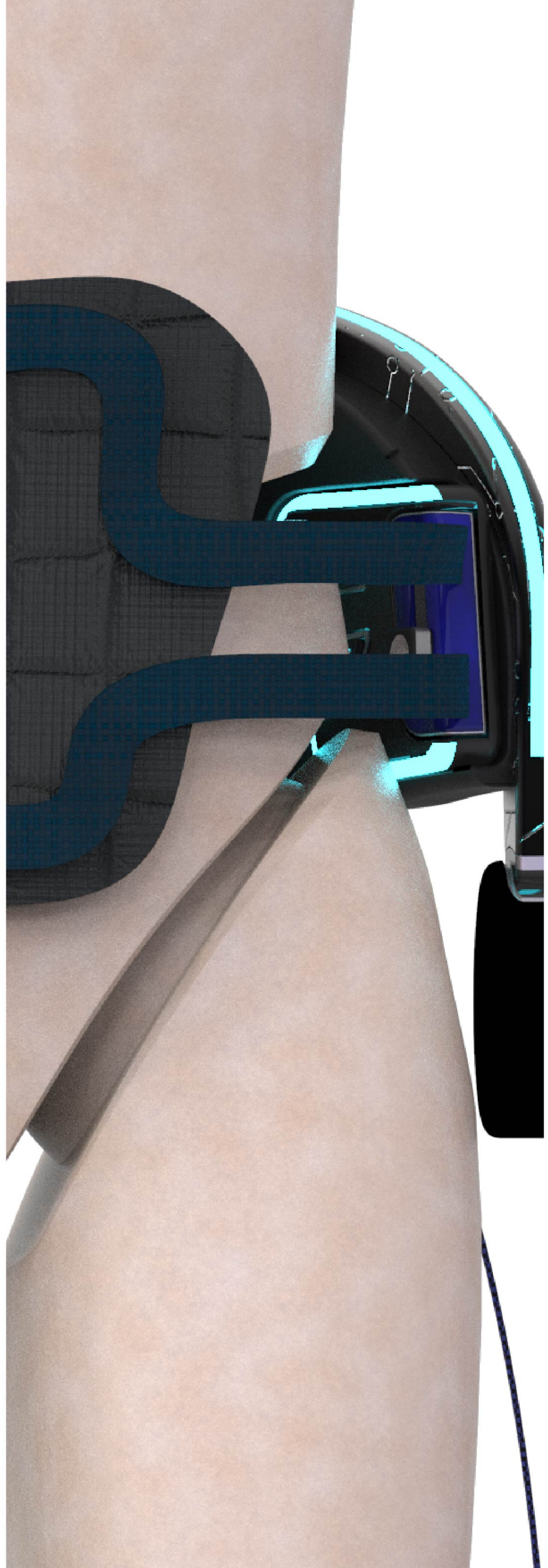
ground reaction forces interaction force between wearer and exoskeleton

The wearable sensing system employs 7 force sensors as a sensing matrix to achieve high accuracy of ground reaction force detection. There is one more IMU sensor that is integrated into the structure to detect the angular velocity. By fusing force and angular velocity data, four typical terrain features can be recognized successfully, and the recognition rate can reach up to 93%.

With this information, the wearer's centre of gravity can be calculated in real-time and the wearer's motion intention can be estimated by detecting the change in motion data.

IMUs are mounted on the hip support to obtain the wearer's trunk posture.

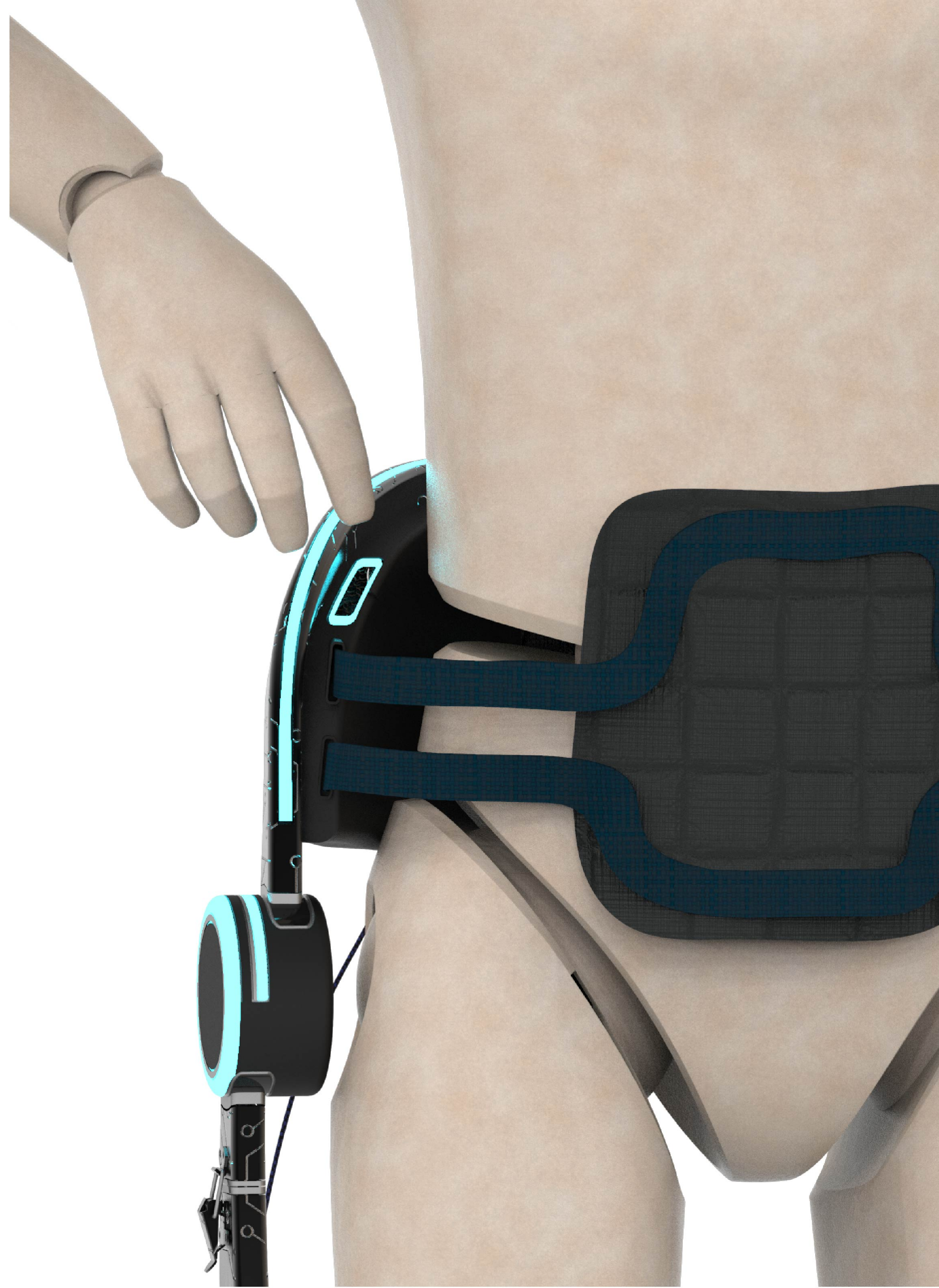




ON OFF BUTTON

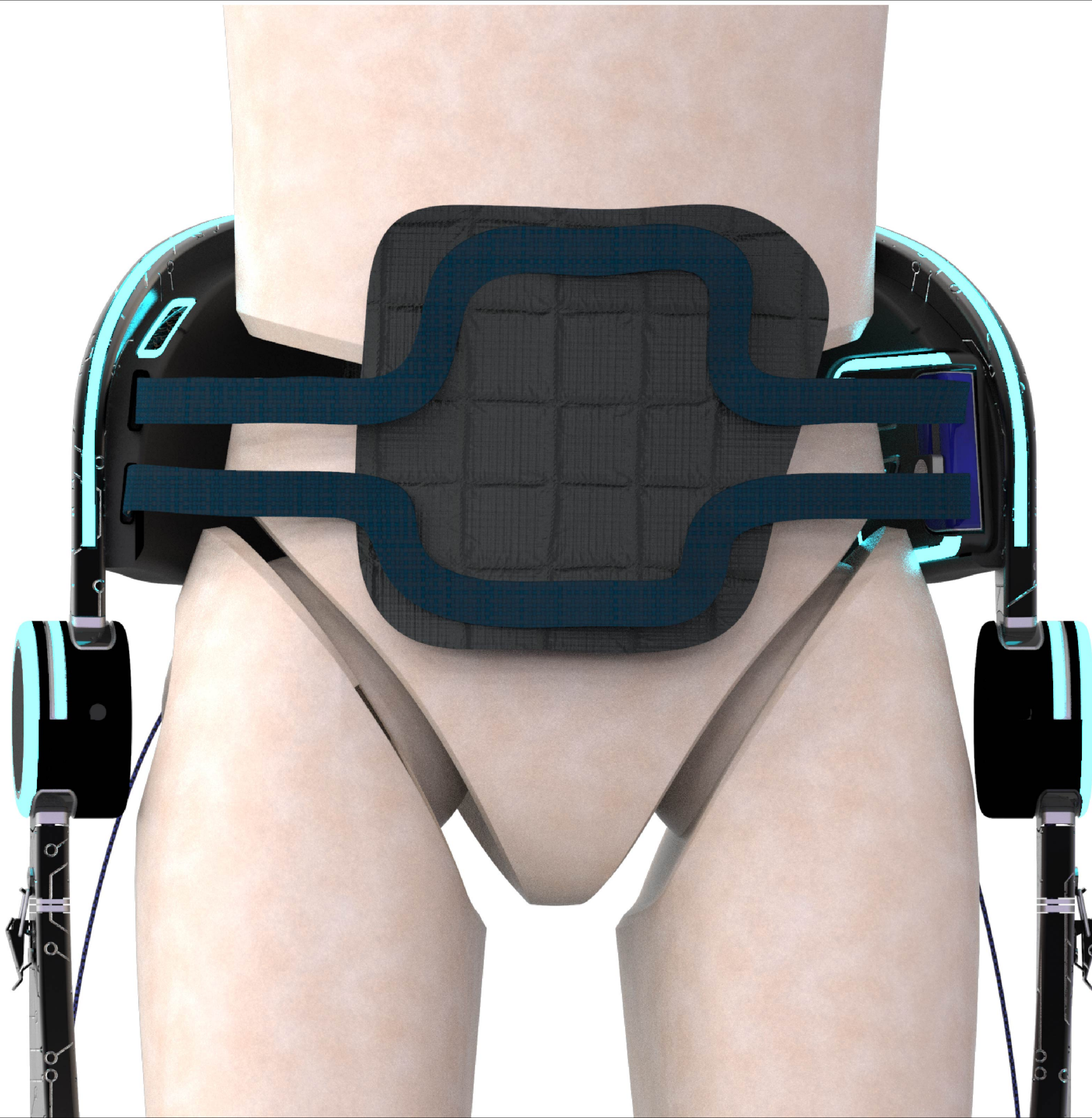
activates the
actuators
and distributes the
electricity from the
battery to the
actuators on the
support.

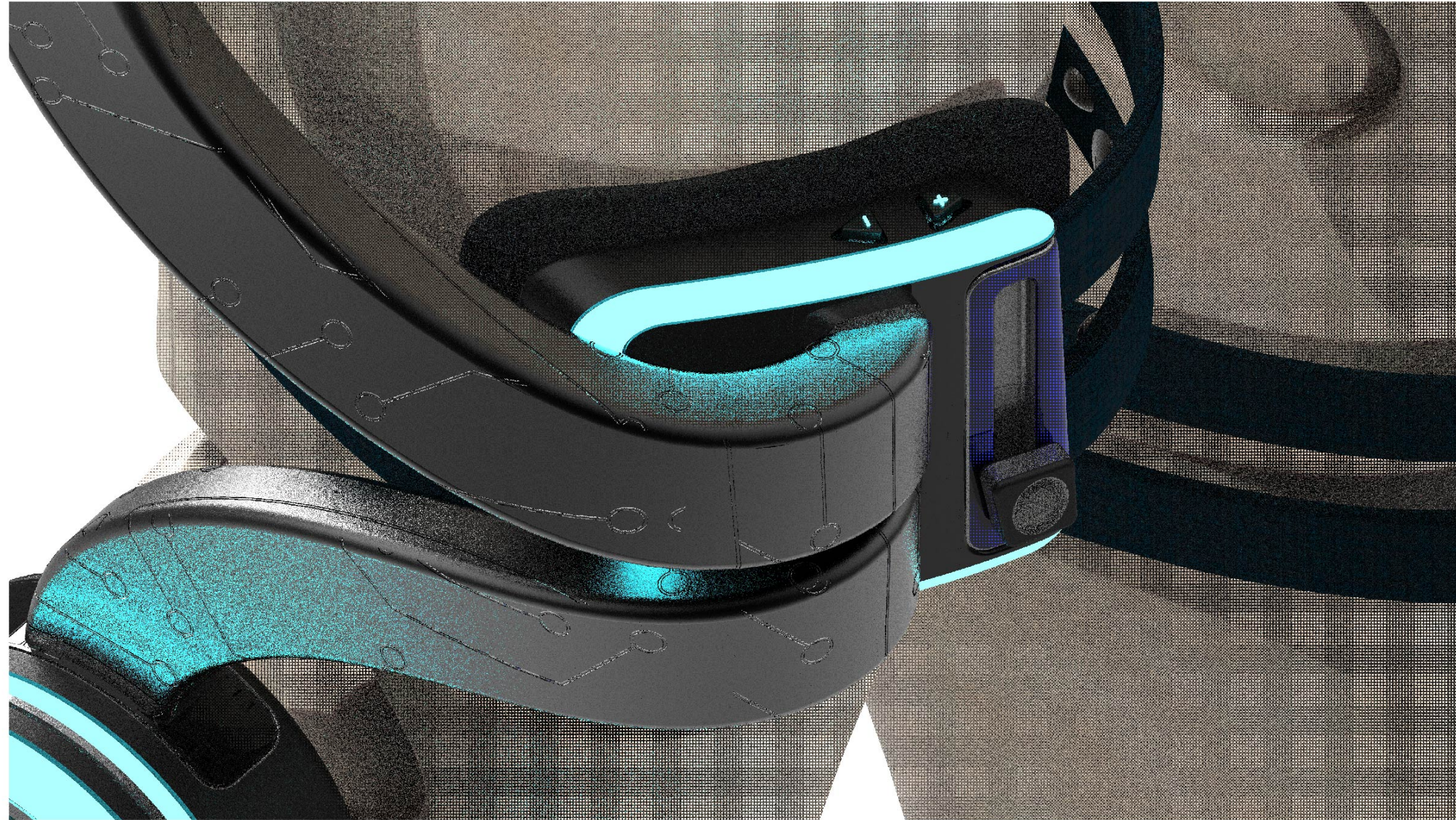
It takes 7 seconds to
open in order to give
time to user, and
every second the
user hears the
audible warning.
In addition to the
audible warning,
the user can also
receive feedback
visually with the
light color change
from yellow to
green to blue.



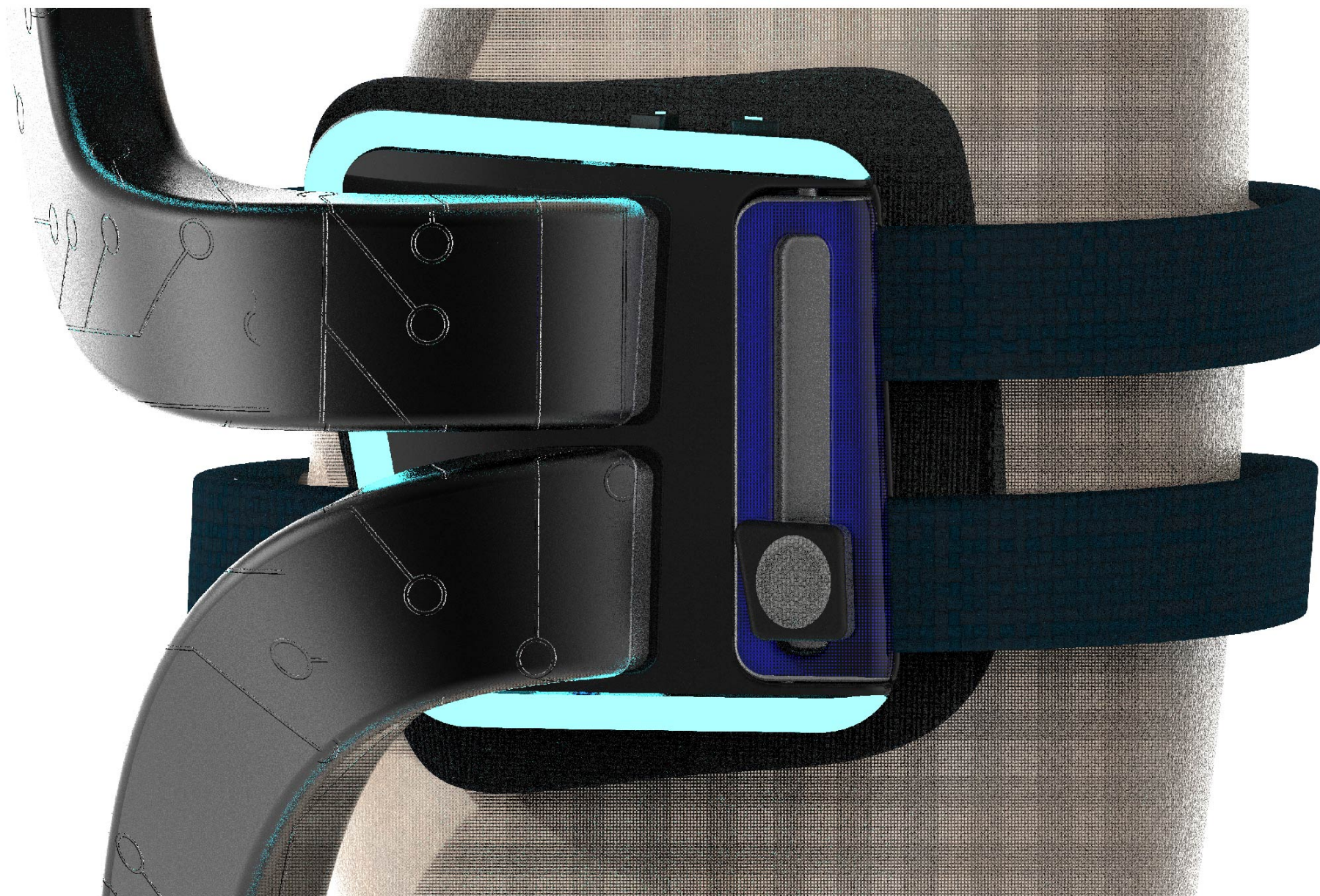
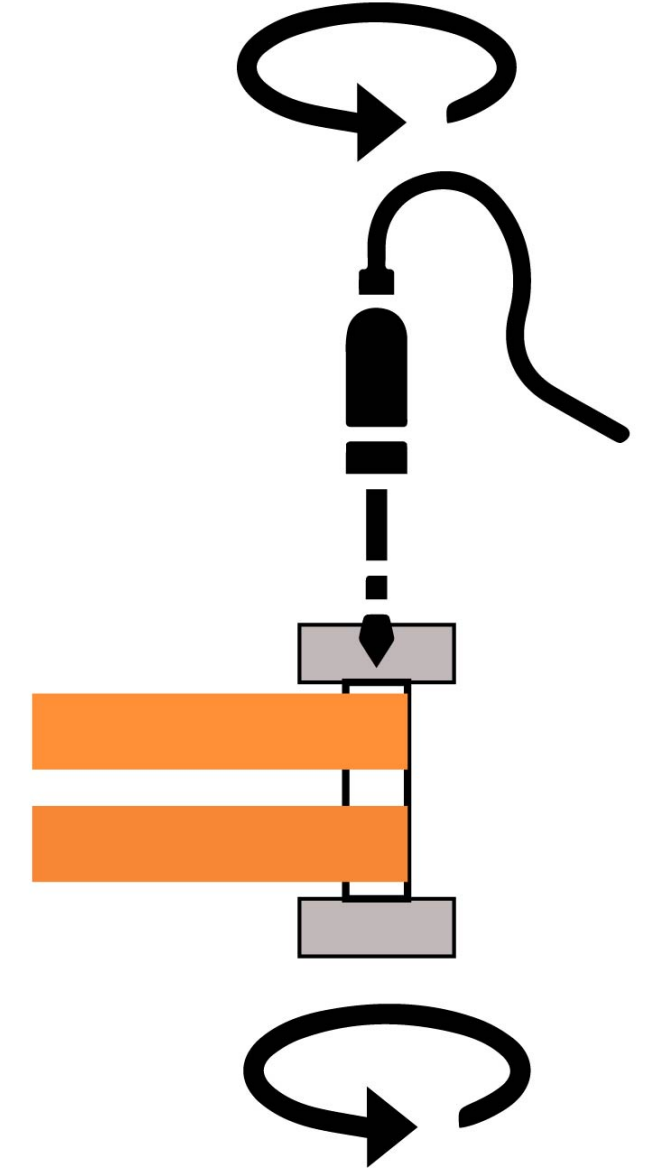
SUPPORTIVE PADS

There are pads in the front of the support, between the laces and the body, that filled with air and have IMU sensors. At the back, they are located between the waist pack and the body.





When a user wears the body assistant, a custom motor and gear train senses the tension needed by the leg and adjusts accordingly to keep the leg snug. The tensile strength of lacing is enough to secure the leg throughout a range of movement.



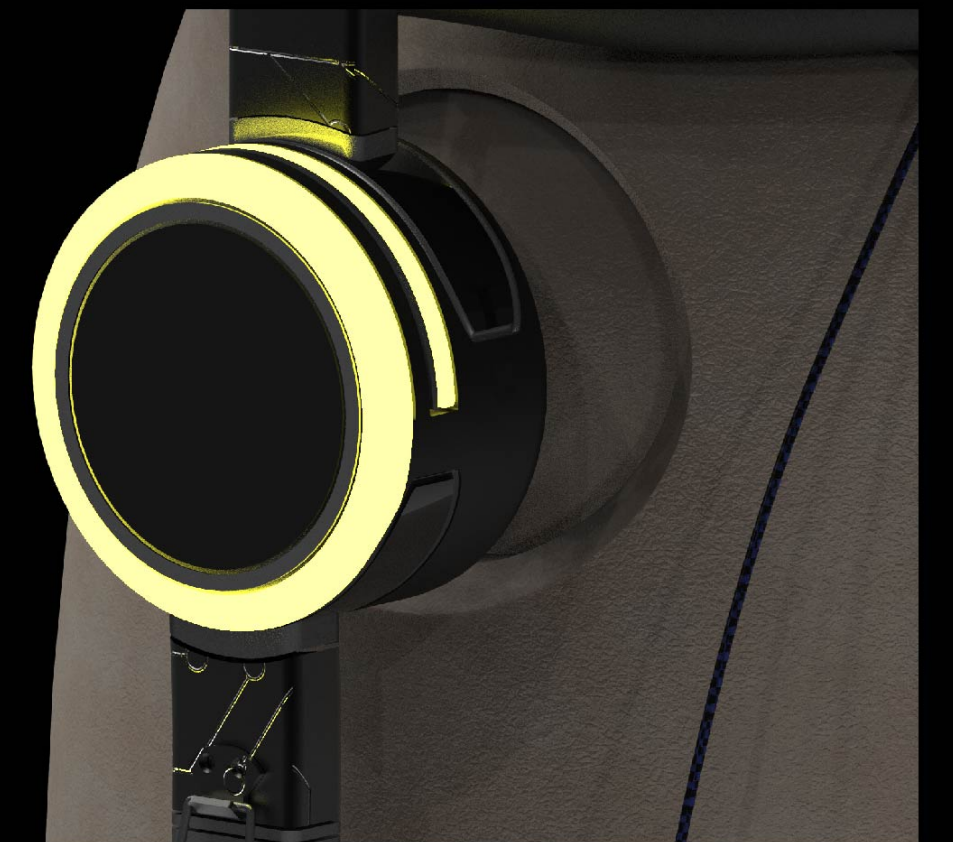
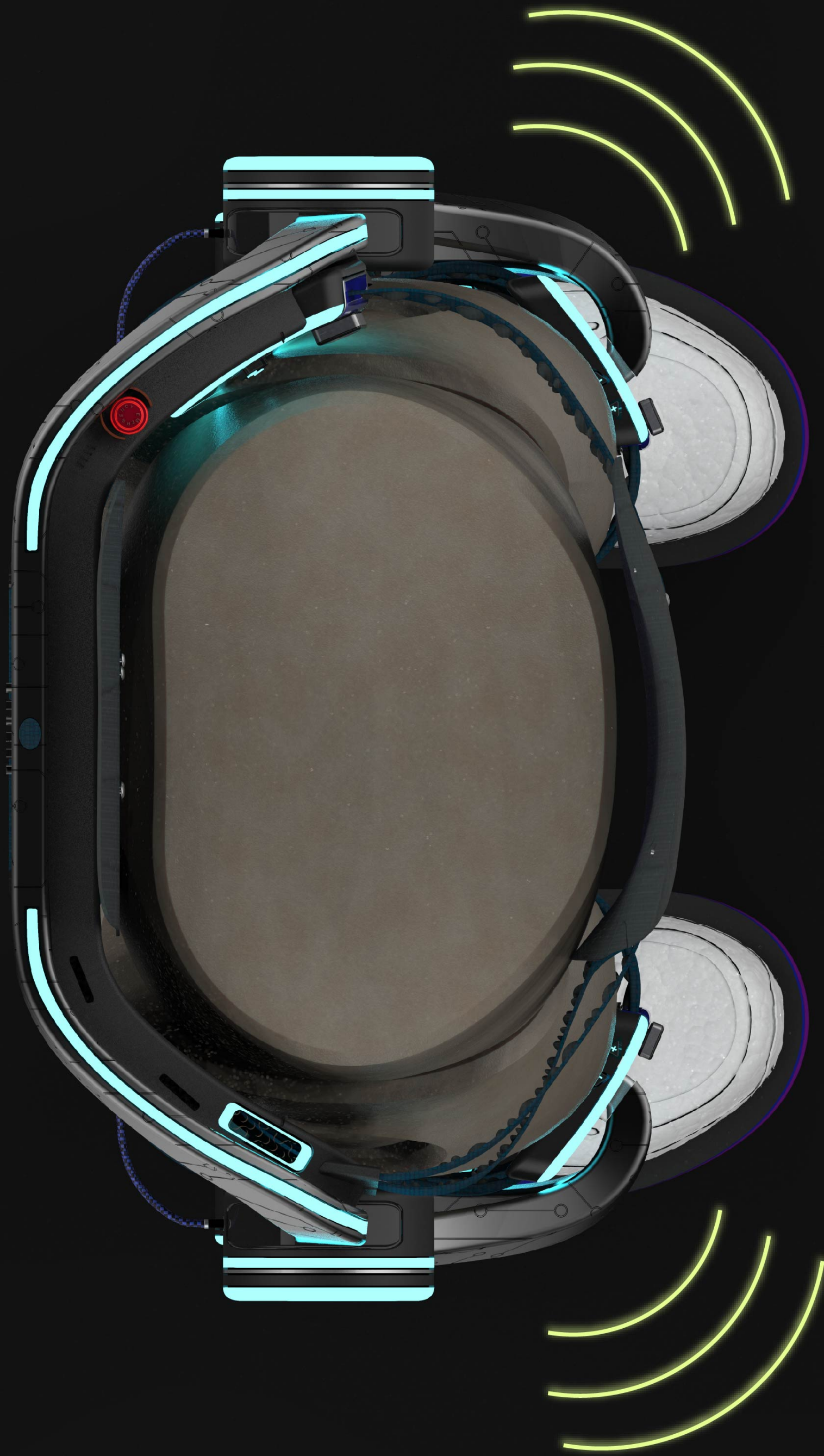
+/- buttons are for user to adjust the tightness of the lacings. After adjustment desired tightness is stored in the sensors memory and for the next times this tightnessvalue is used. Structure which the button onit supports the body at the same time.

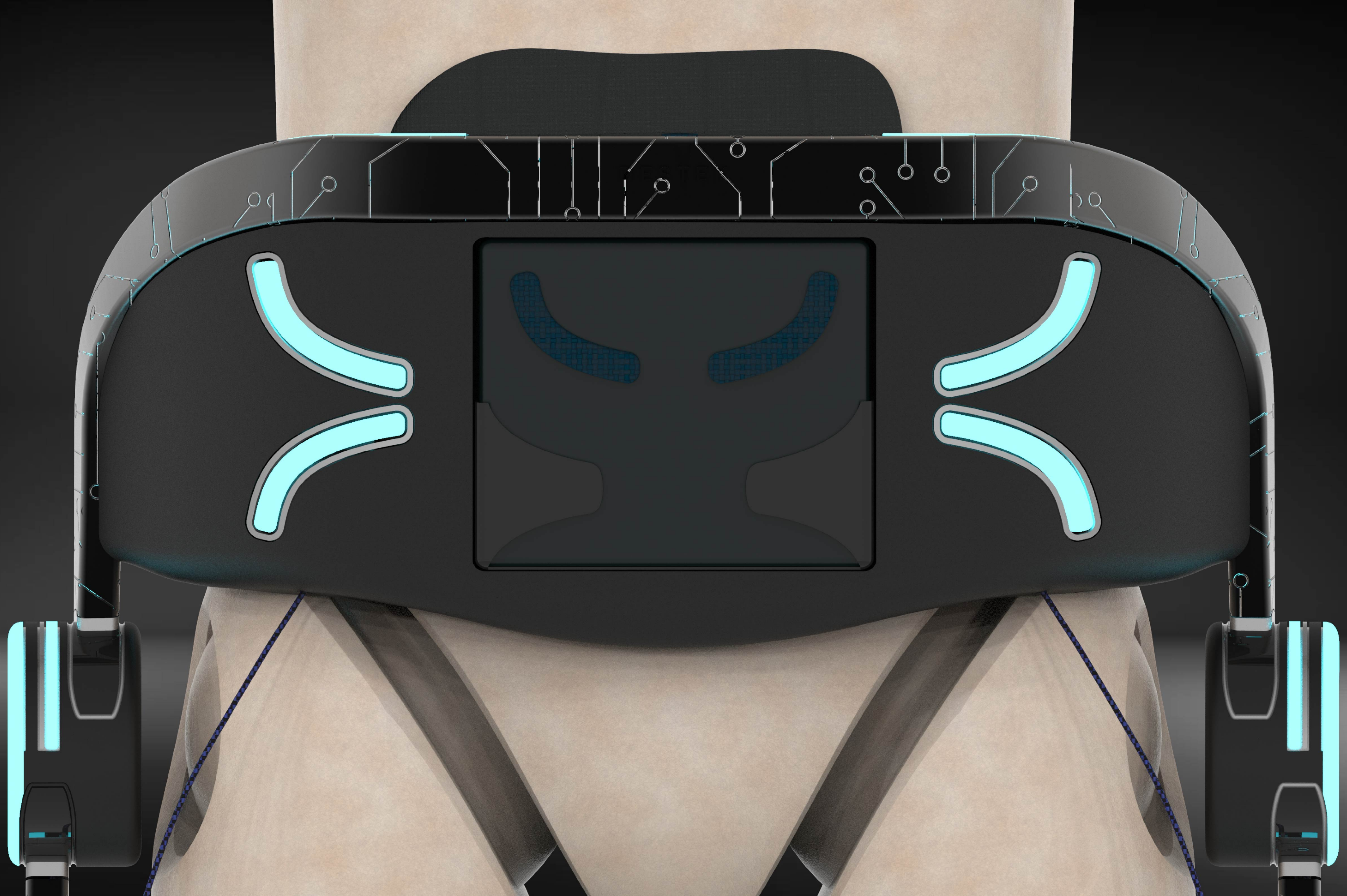
When a user wears the body assistant, a custom motor and gear train senses the tension needed by the leg and adjusts accordingly to keep the leg snug. The tensile strength of lacing is enough to secure the leg throughout a range of movement.

INDICATORS

Visual and Audial indicators are used to warn user about interfaces or actuators current situation. 5 seconds bip noise is used count down.

Light color is changing from yellow to blue to give user information about the state of actuator and interfaces.

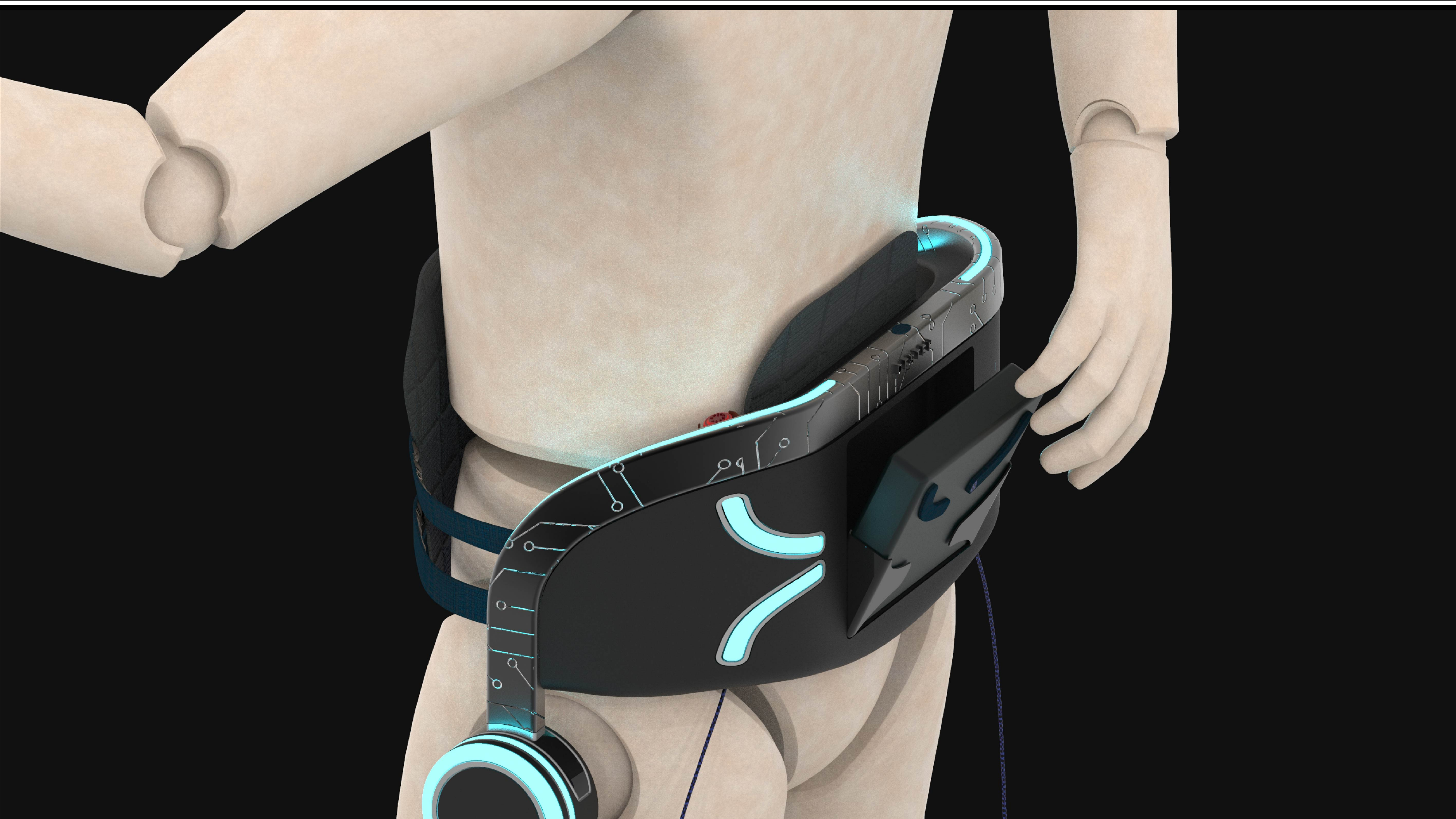




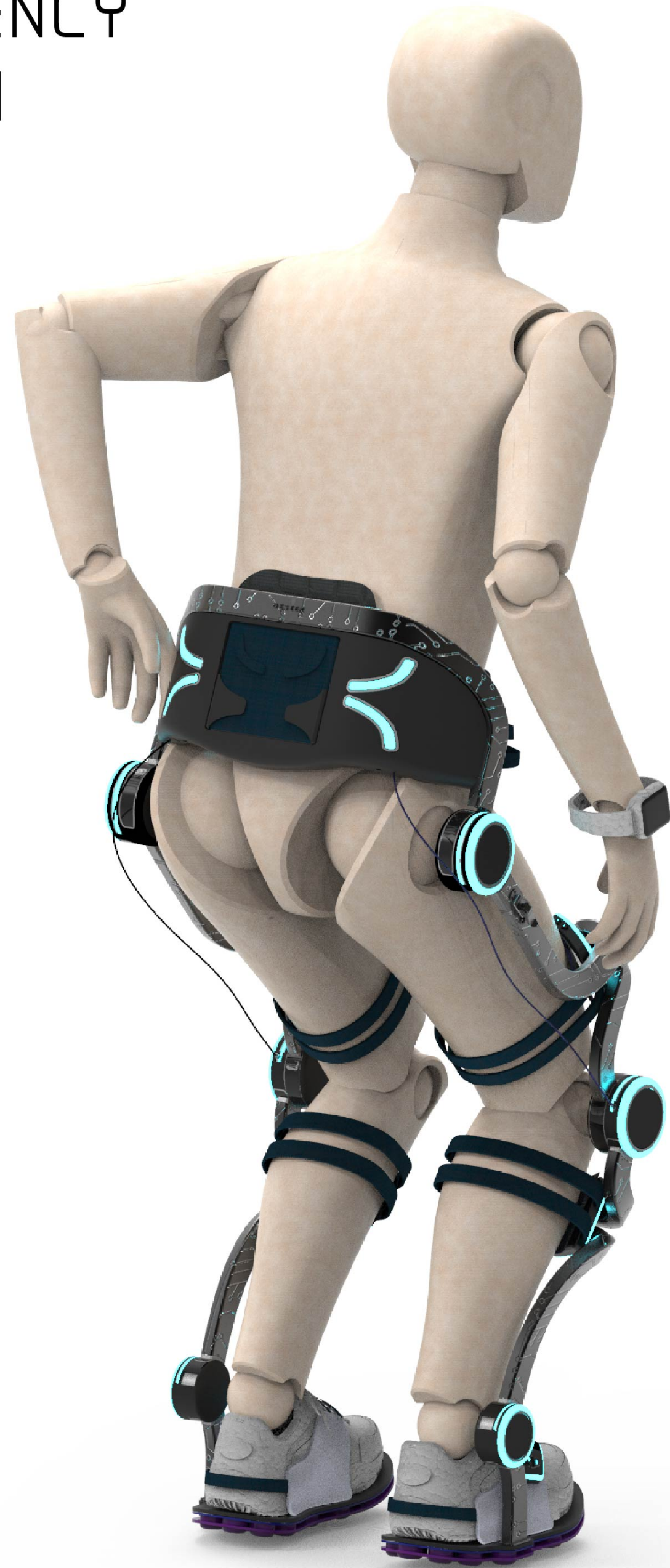


BATTERY

the battery compartment is designed to be opened easily at any moment and it makes an angle of 20 degrees, it opens with slot sliders, the user can easily remove the battery and put it back.

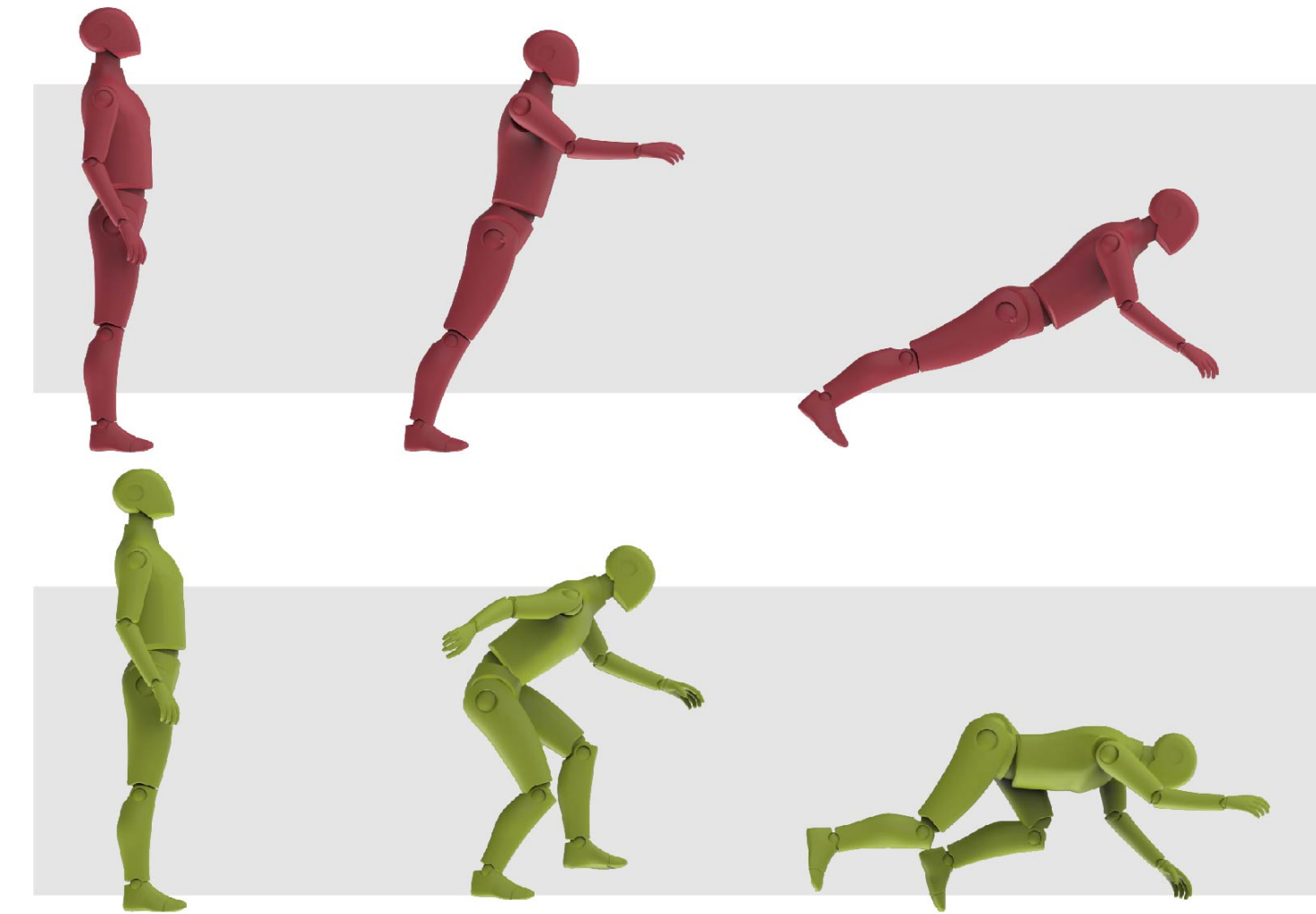


EMERGENCY BUTTON



The emergency button allows the joints and actuators to support the falling position, allowing the user to fall more smoothly on the ground.

Otherwise, while user is falling motors and joints being in a walking or sitting position cause the user not to fall to the ground in a normal position, which is very dangerous.



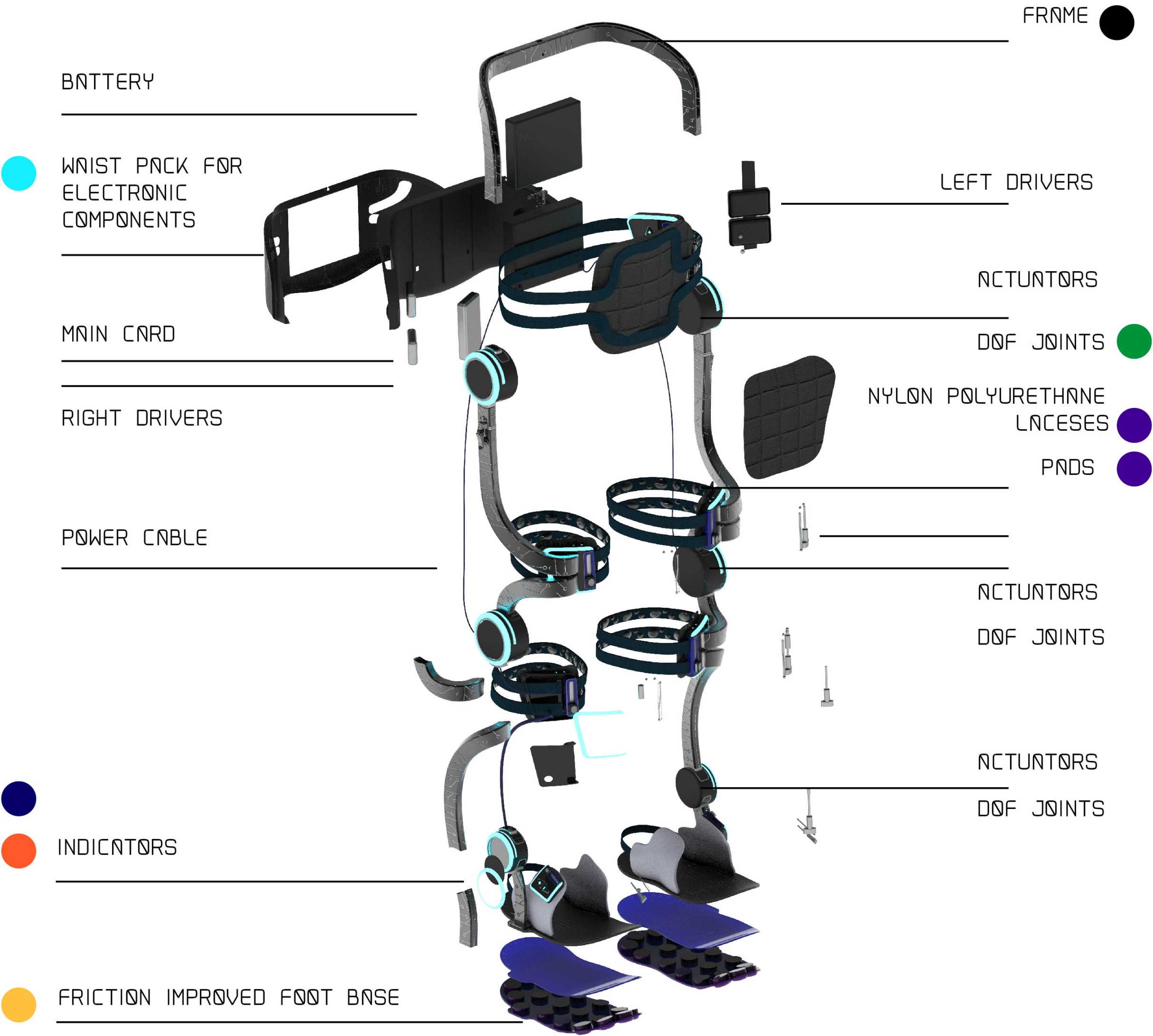
FOOT COUPLING

The ankle joint has one DOF (plantar flexion/dorsiflexion). Due to the hip angle adjuster, the ankle angle adjuster is also designed to make the foot parallel with the ground. The foot is composed of the foot plate and non-skid rubber. The foot plate is connected to the ankle joint rigidly, and the non-skid rubber is placed on the sole to increase the frictional force between the foot and ground. In addition, four force-sensing resistor (FSR) sensors are placed at specific points between the foot plate and non-skid rubber to measure the ground reaction force (GRF) applied to the foot.





EXPLODED



Fibre Reinforced Plastic:
Fibre-reinforced plastic is a composite material made of a polymer matrix reinforced with fibres. The fibres are usually glass, carbon, aramid, or basalt. Rarely, other fibres such as paper, wood, or asbestos have been used. The polymer is usually an epoxy, vinyl ester, or polyester thermosetting plastic, though phenol formaldehyde resins are still in use.

Aircraft Grade Aluminum (Al-6082T6)
Chemical Composition:
The alloy composition of 6082t6 aluminium is: Aluminium: 95.2 to 98.3%
Chromium: 0.25% max
Copper: 0.1% max

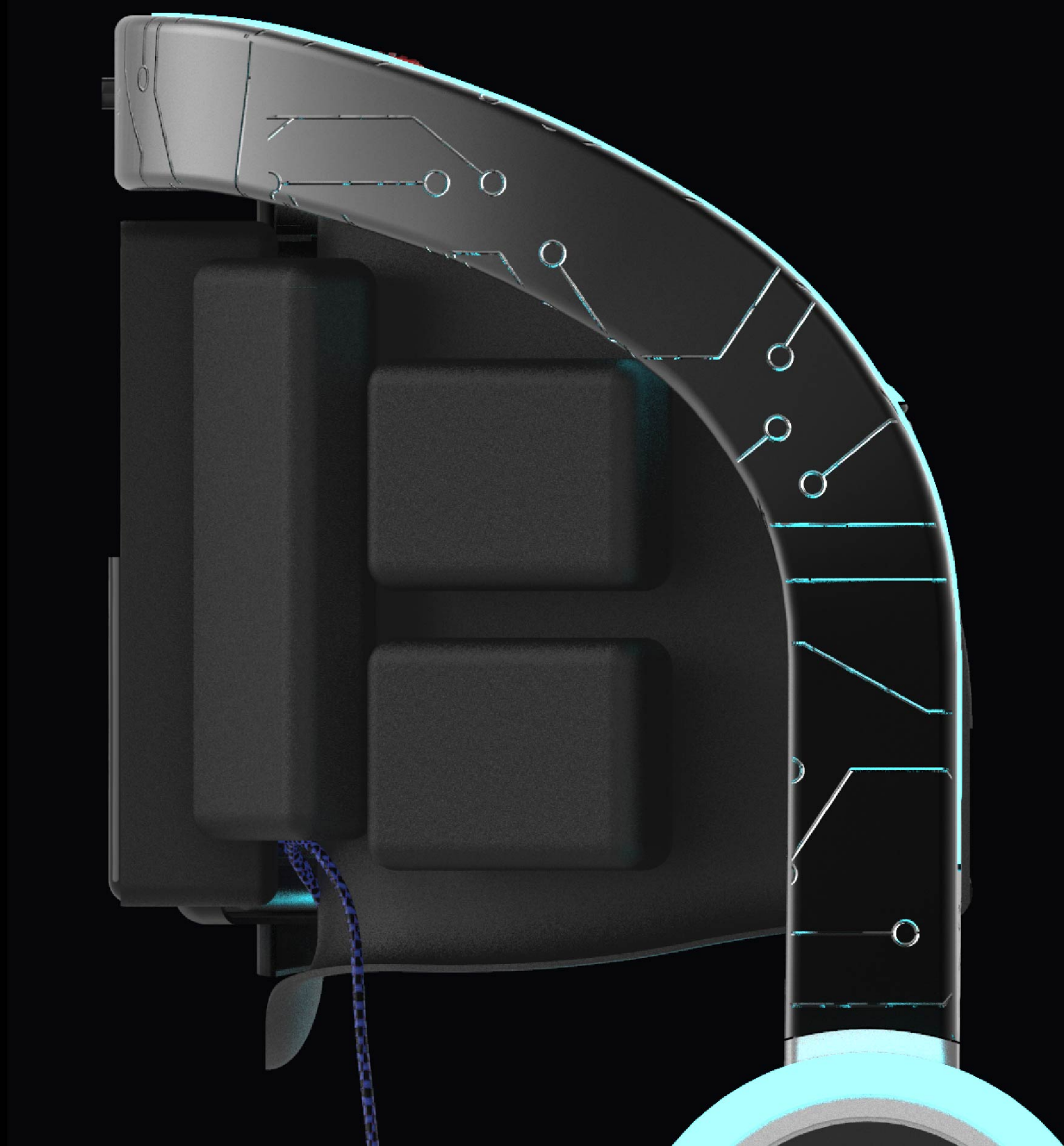
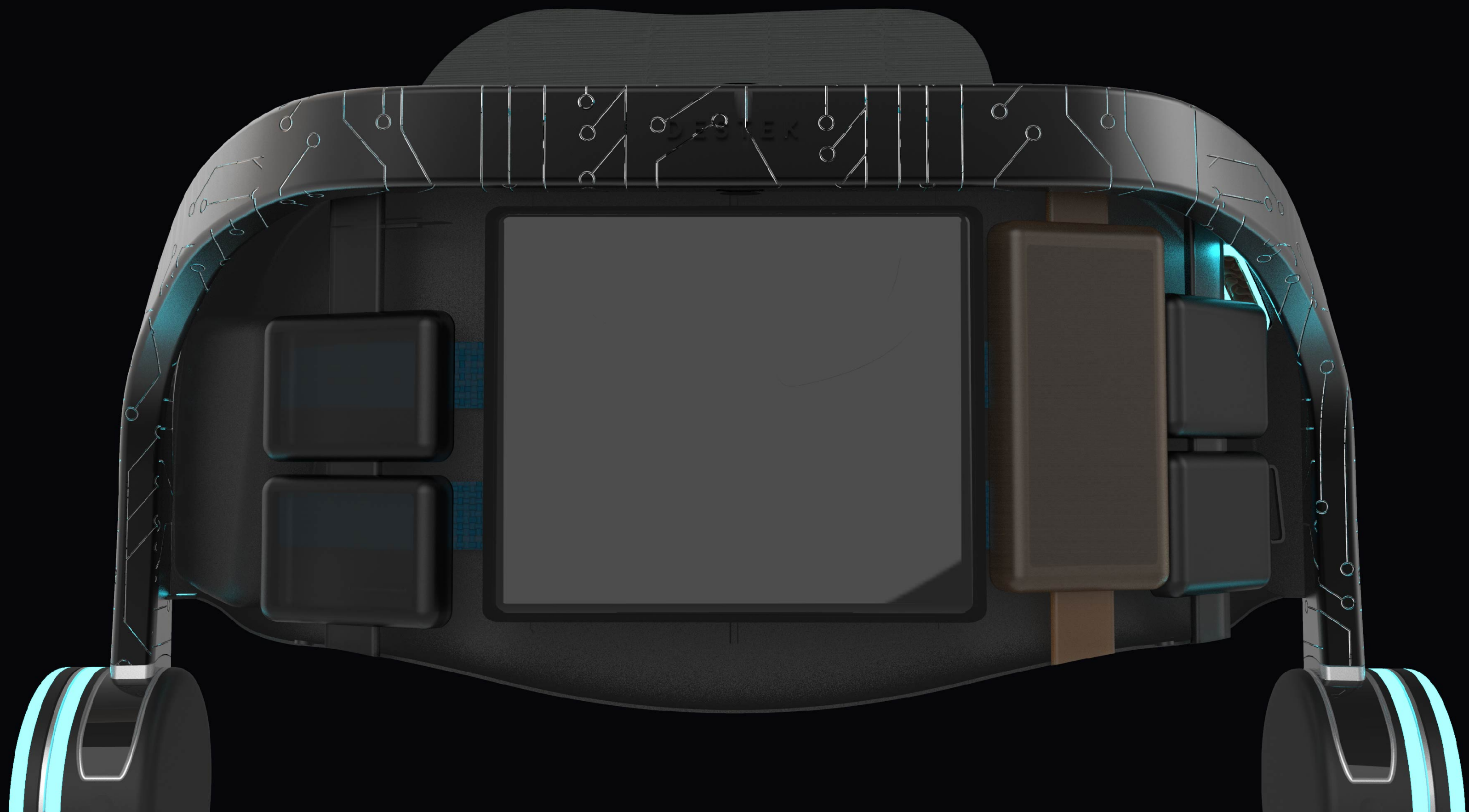
Mild Steel:
Mild steel (steel containing a small percentage of carbon, strong and tough but not readily tempered), also known as plain-carbon steel and Low carbon steel. It is now the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Mild steel contains approximately 0.05–0.25% carbon making it malleable and ductile. Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing.

Nylon Polyurethane
Awarded combination in medical usage related to air permeability. The skin can breathe from the combination of polyurethane and nylon.

Plexy

Strip Led

PVC



USER CAN GO TO PERSONALIZATION ON THE FABRIC PART
DIMENSIONS ARE IN 5 CATEGORIES ACCORDING TO BODY SIZES.



TAKE THE STEP FORWARD

THANK YOU