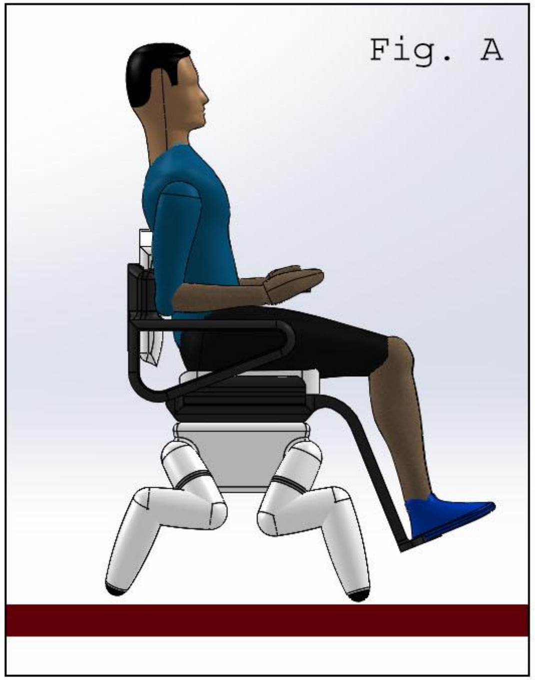
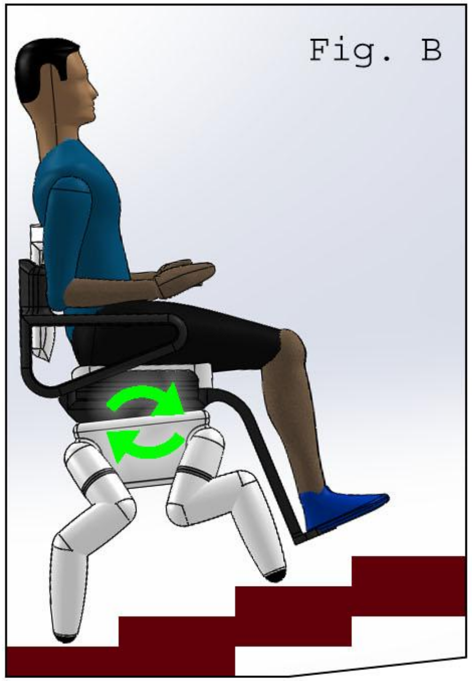
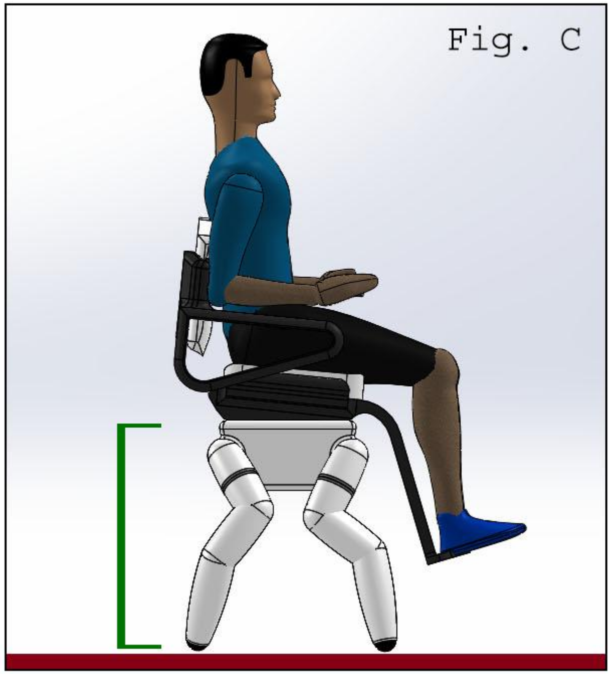
Advantages of the four independent legs system

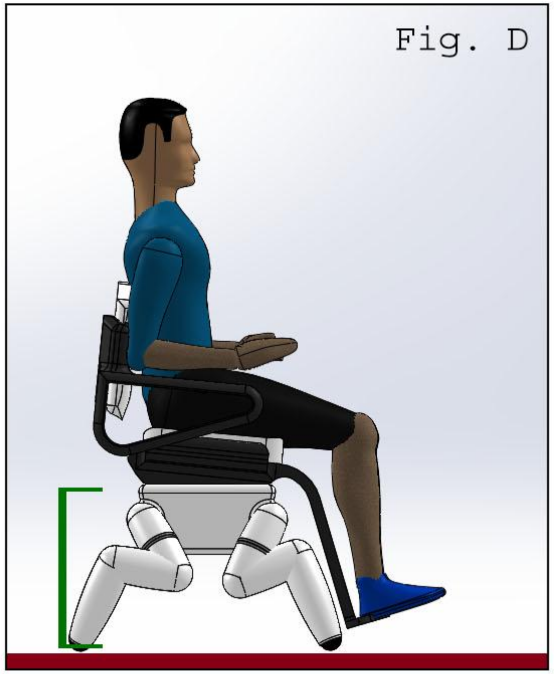


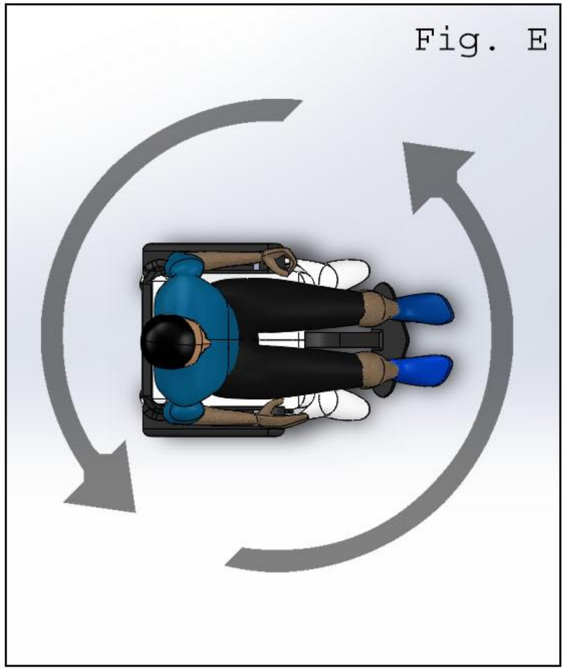


The four independent leg system allows:

- to climb stairs (Fig. B)
- to overcome steps or small obstacles
- to reach a raised position, useful for reaching the top positioned objects (Fig. C)
- to reach a lowered position, useful to pass through narrow environments (Fig. D)
- to be able to rotate 360° in place (Fig. E)







Main Body

The top seat structure can automatically tilt when climbing stairs, or to help mounting/ dismounting from the AWAD.

Connection and movement of the leg - upper section. Will be done with two or more motors and threaded bar/ belt; An omniwheel movement system will also be evaluated

The top seat structure can be removed from the main body for easier transportation.

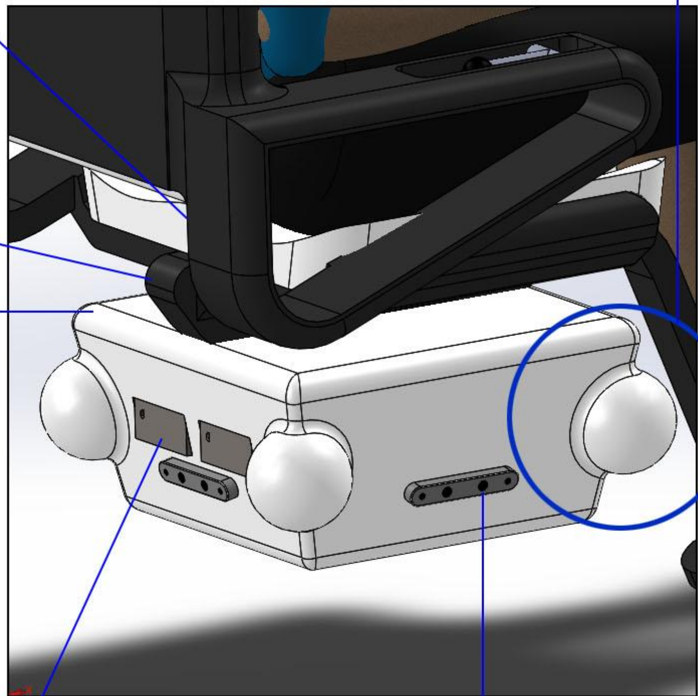
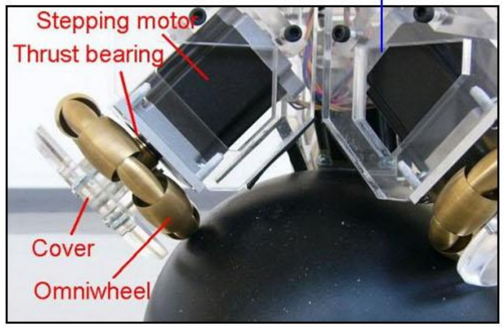
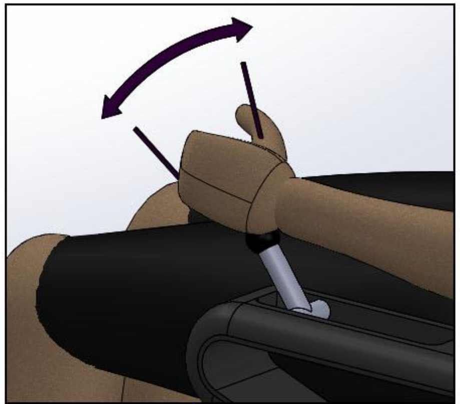


Fig. A



Sim-card based system and GPS enabled integrated board (optional) will help the user that finds himself/ herself in an unwanted situation or emergency. Body status monitoring, like hearth rate sensors, can be integrated into the arm rests



Two removable Lithium-ion batteries, that can be swapped and recharged externally. One can be used while the other one is in charge.

Depth cameras (Intel RealSense or similar) for terrain mapping on 3 or 4 sides. Ultrasonic distance sensors on the bottom.

A lever system integrated into the armrests can be used to charge the batteries in case of emergency enough to make an emergency call or to move for a couple of minutes more.

Leg. Lower segment

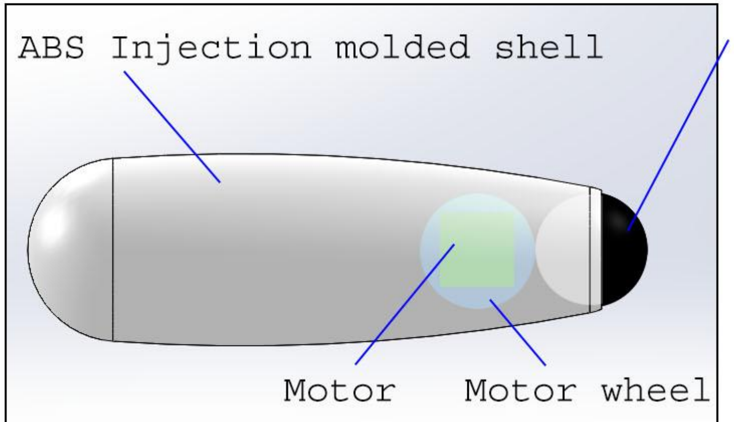


Fig. A

Sphere made of a solid core and rubbery outer material
- can be blocked for “walking type” locomotion (Fig. B)
- can spin with its own motor for “rolling type” locomotion on flat surfaces (Fig. C)
- rolling sphere can rotate in one single axis; another possible configuration can give the rolling sphere two axis of rotation for increased agility (less optimal configuration due to friction) with a system similar to the one shown in Fig.D
- outer shell made with ABS Injection molded, or cast silicone for a more organic look

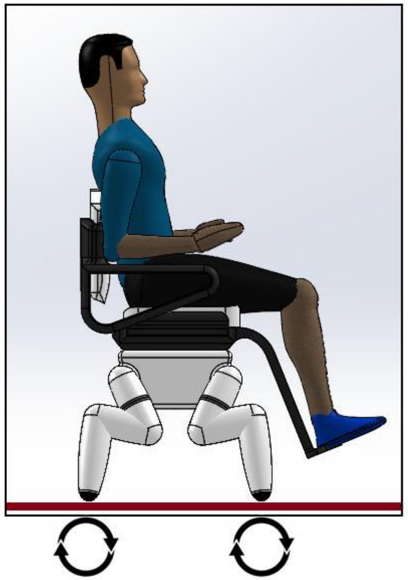


Fig. B

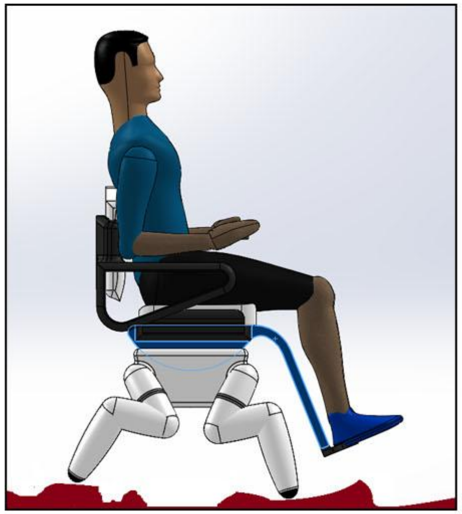


Fig. C

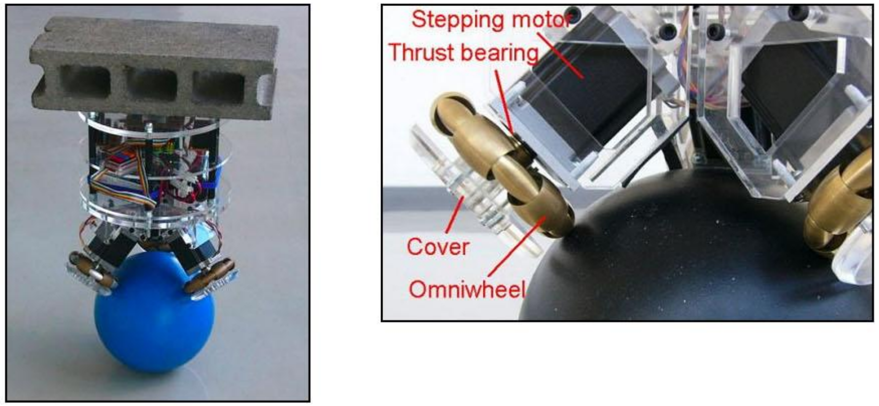
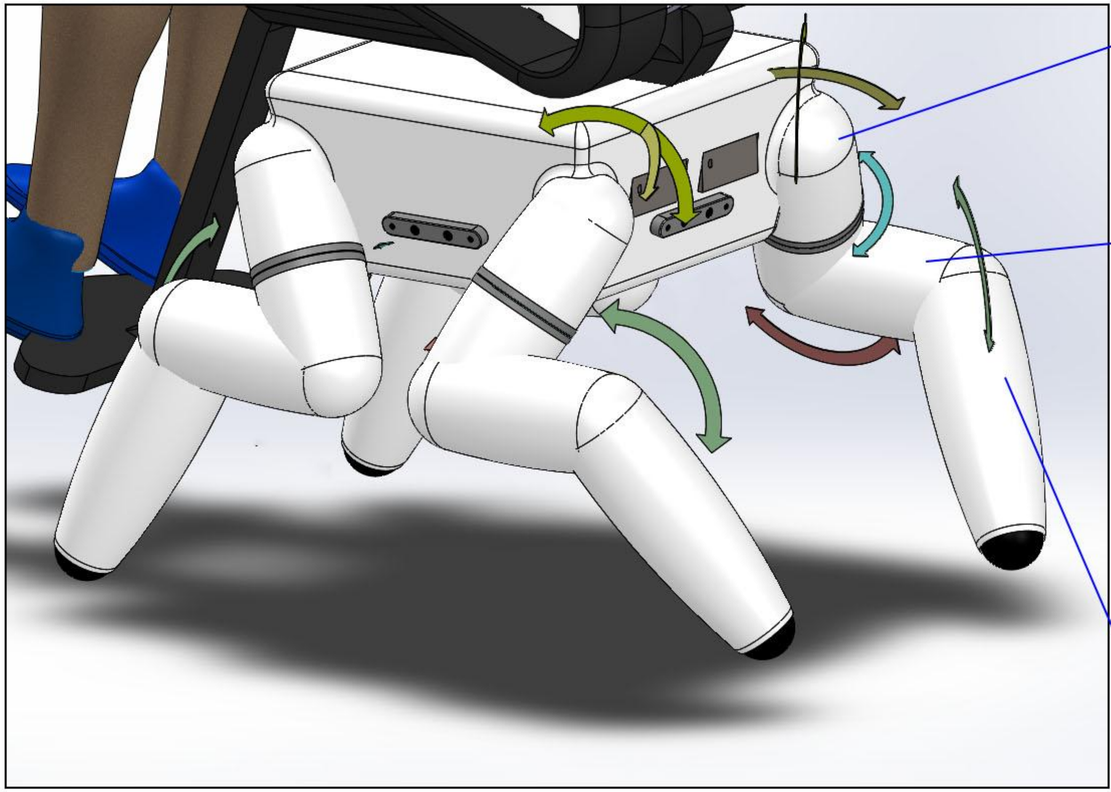


Fig. D
(source: https://robotics.stackexchange.com/questions/88/mechanical-design-for-motorized-spherical-caster-wheels)

Leg Movement Degrees of freedom

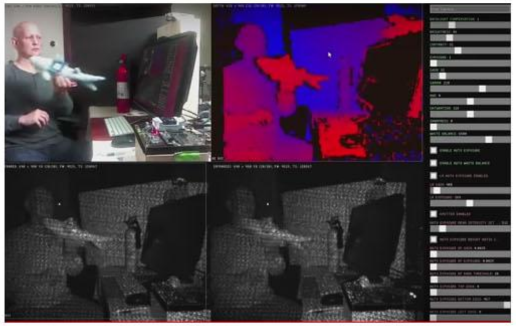


Upper leg segment: 2 D.O.F.
+ Rotation point at mid-length

Mid leg segment: 1 D.O.F.

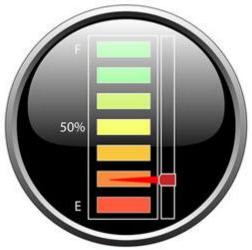
Lower leg segment: 1 D.O.F.

Operating modes



1) Intelligent AUTO mode: the sensors
and depth cameras are used to get a 3D view of the terrain around the user; the integrated control board (based on Nvidia Jetson or similar) adapts the locomotion mode (walking or rolling) according to the terrain / obstacles,using machine learning to improve battery time.

2) Intelligent mode: the user controls via joystick the locomotion type (walking/rolling), speed and direction.



3) Basic mode: rolling mode only.
The user controls via joystick the speed and direction.
Control board is used at a low wattage mode, everything is optimized for battery duration.
This mode is useful when battery left is very low.