

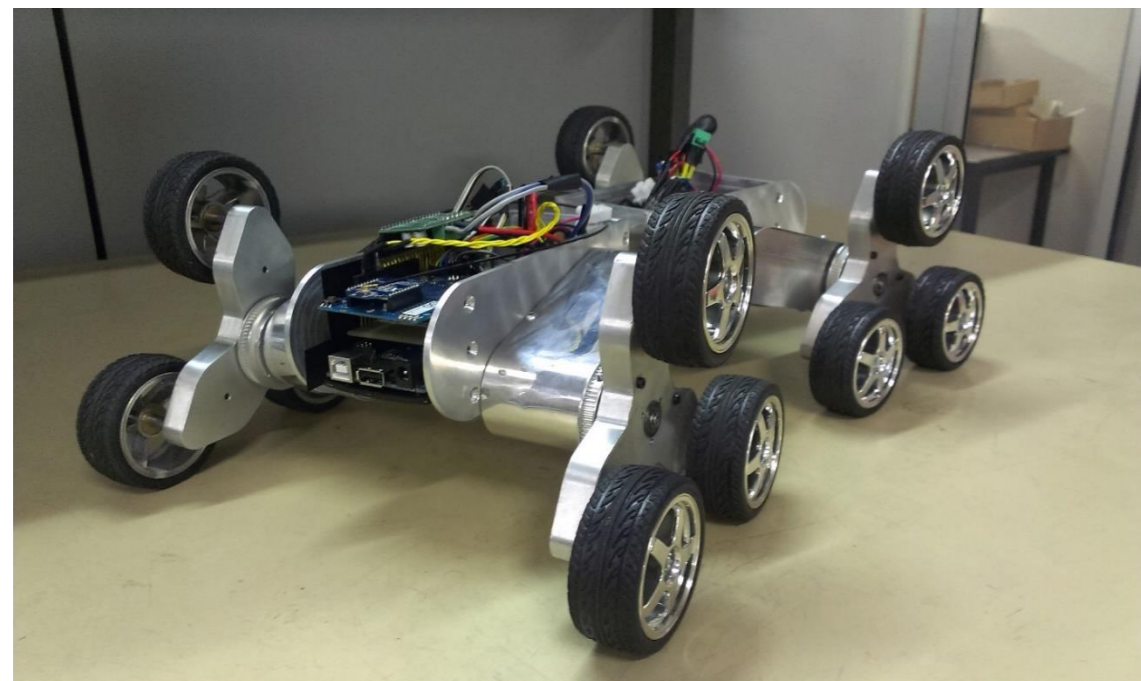
Service Robotics and assistance technologies for elderly and disabled

Epi.Q

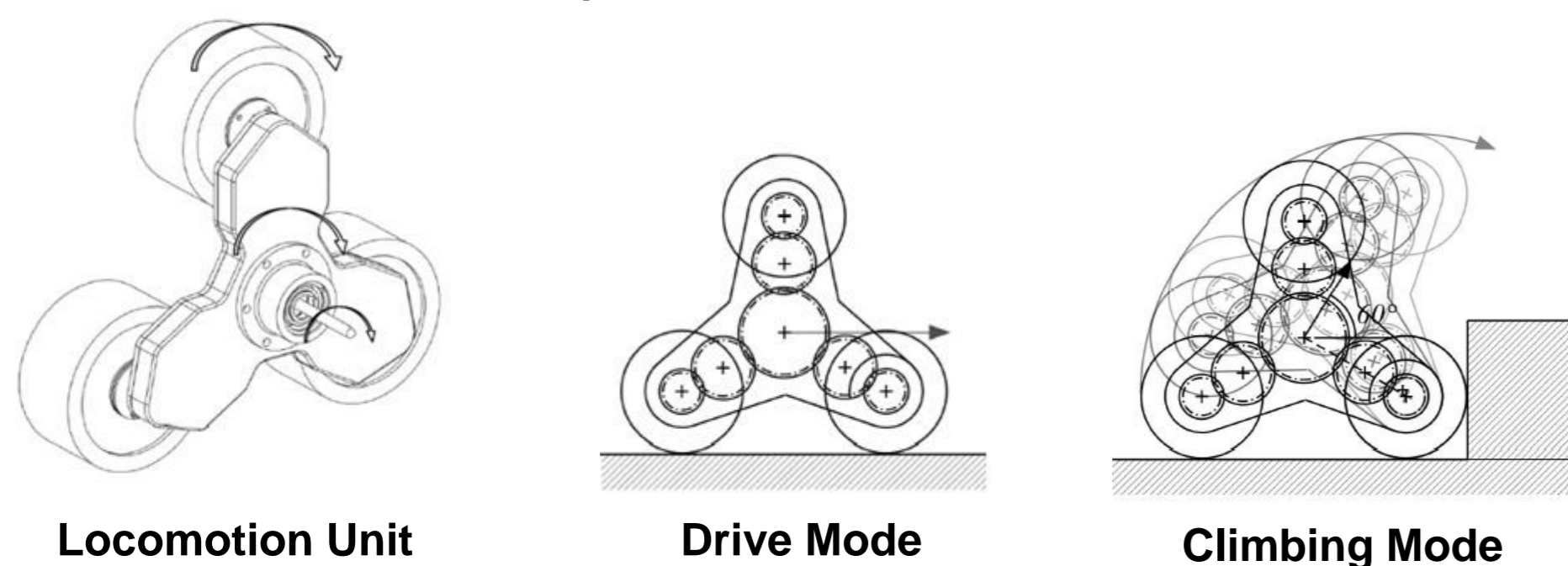
A remote controlled modular UGV with unique locomotion units that dynamically shift between its working conditions: drive and climbing obstacles.

Currently, only the front units are motorized and controlled, but it is planned to test an all unit drive version too.

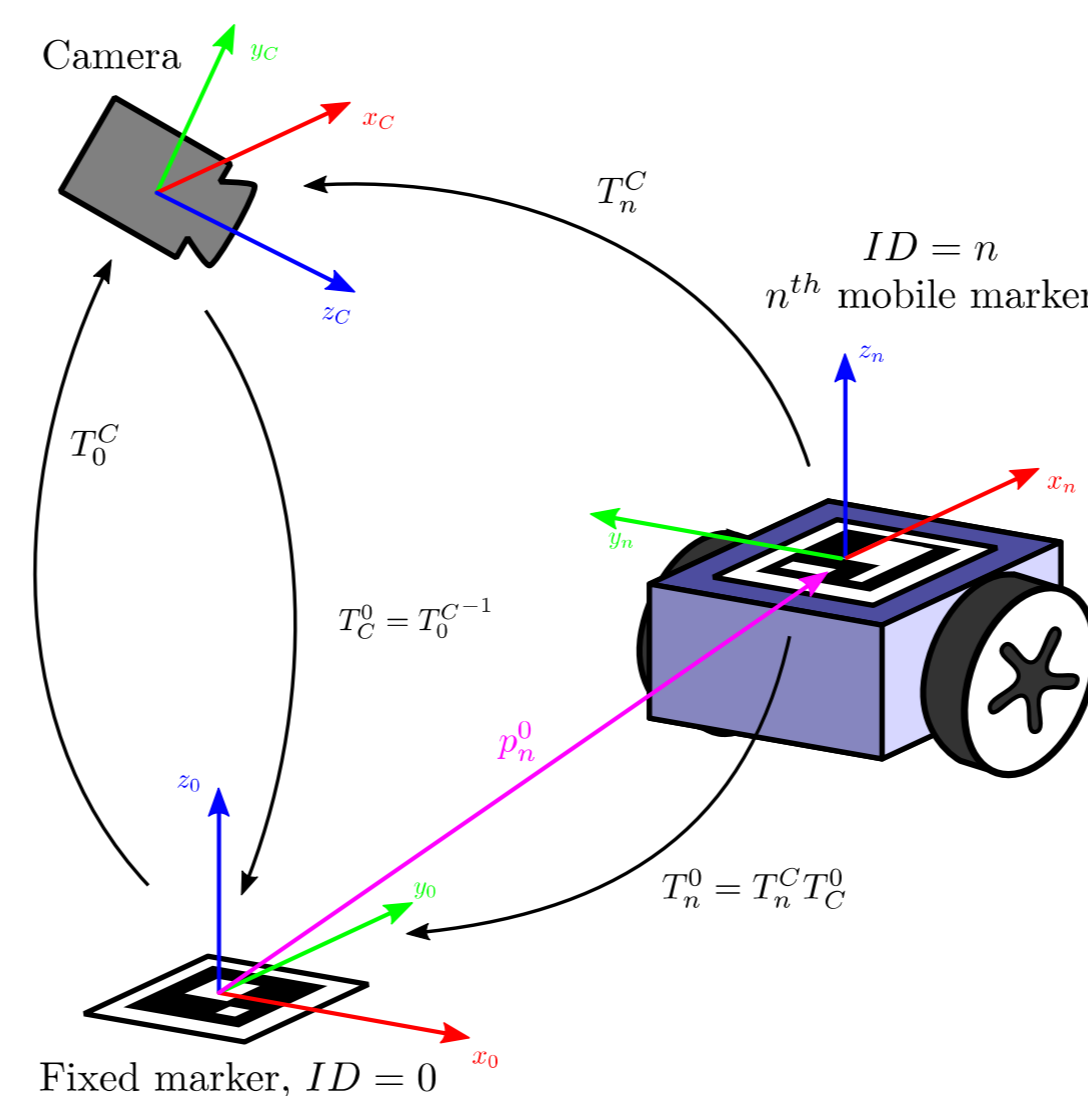
The dynamics of this unique vehicle are under study through several kinematic and dynamic models of increasing complexity.



Epi.Q – modular UGV



Localization with Fiducial Markers



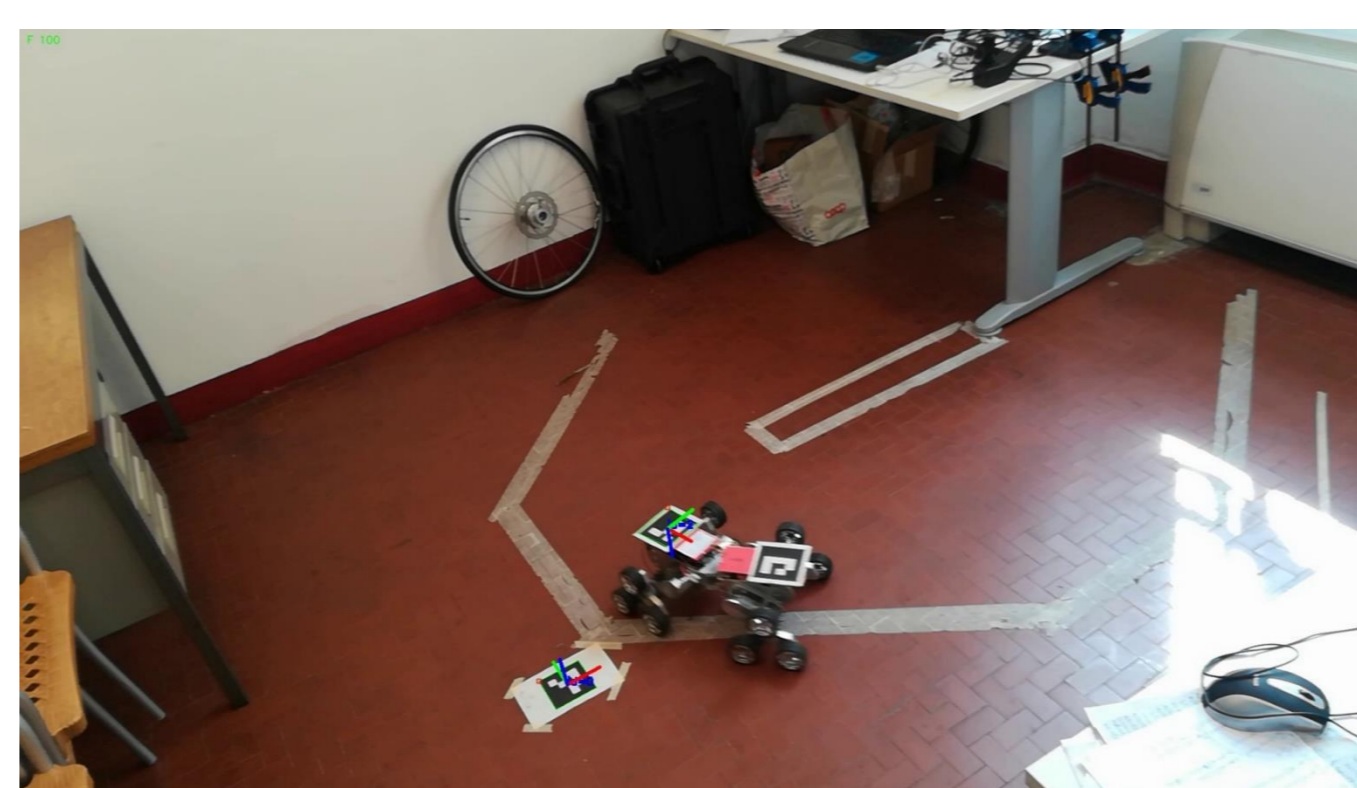
Localization working principle

A low-cost and open source localization system based on fiducial markers recognition has been developed.

Differently from typical camera-based solutions, this system estimates the pose of the robot with respect to a convenient fixed reference frame from which it is easier to interpret the results (i.e. a point in the plane of motion), instead of the camera reference frame.

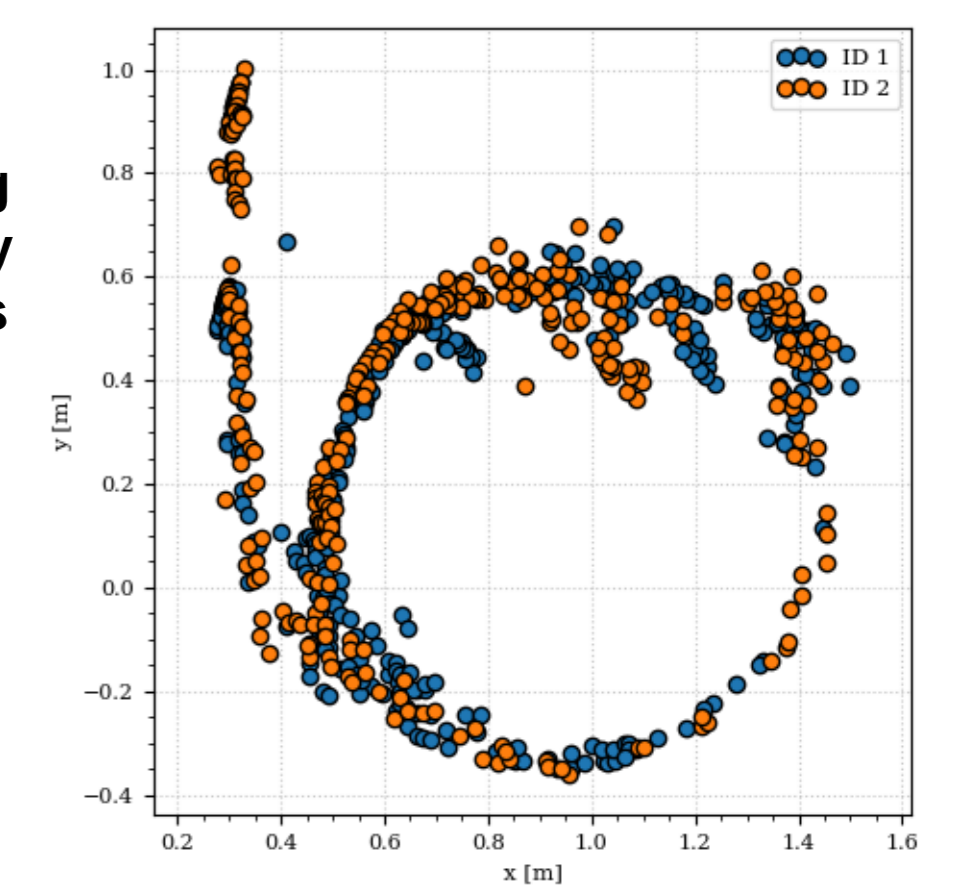
With this solution, the camera can also move freely, avoiding cases of camera occlusion while maintaining consistent results.

The tested system is able to reach precisions below 1 cm within 3 m from the camera and below 1 mm within 1.5 m from the camera.



Frame of the video during localization

Localization during a circular trajectory of the two modules

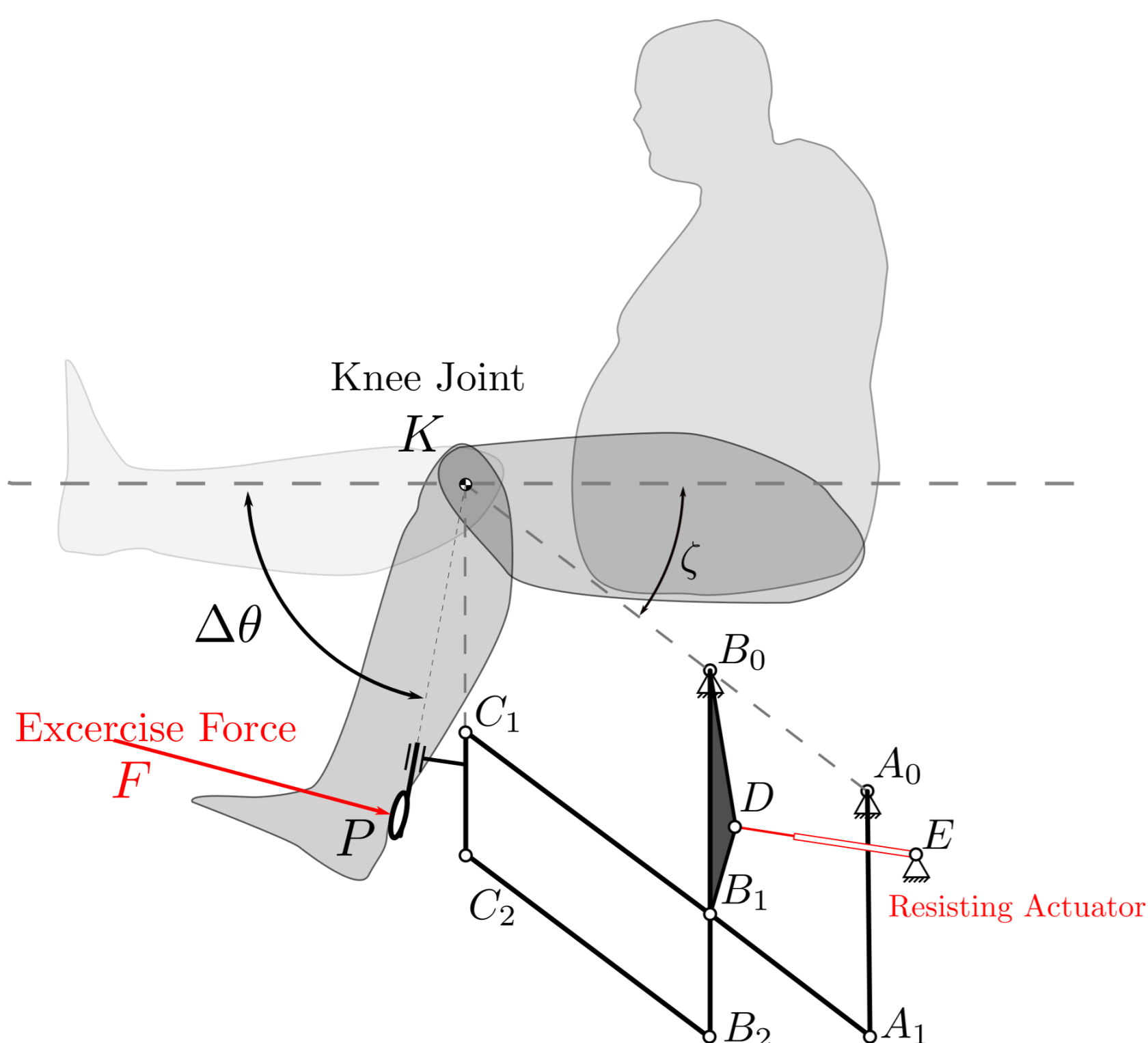
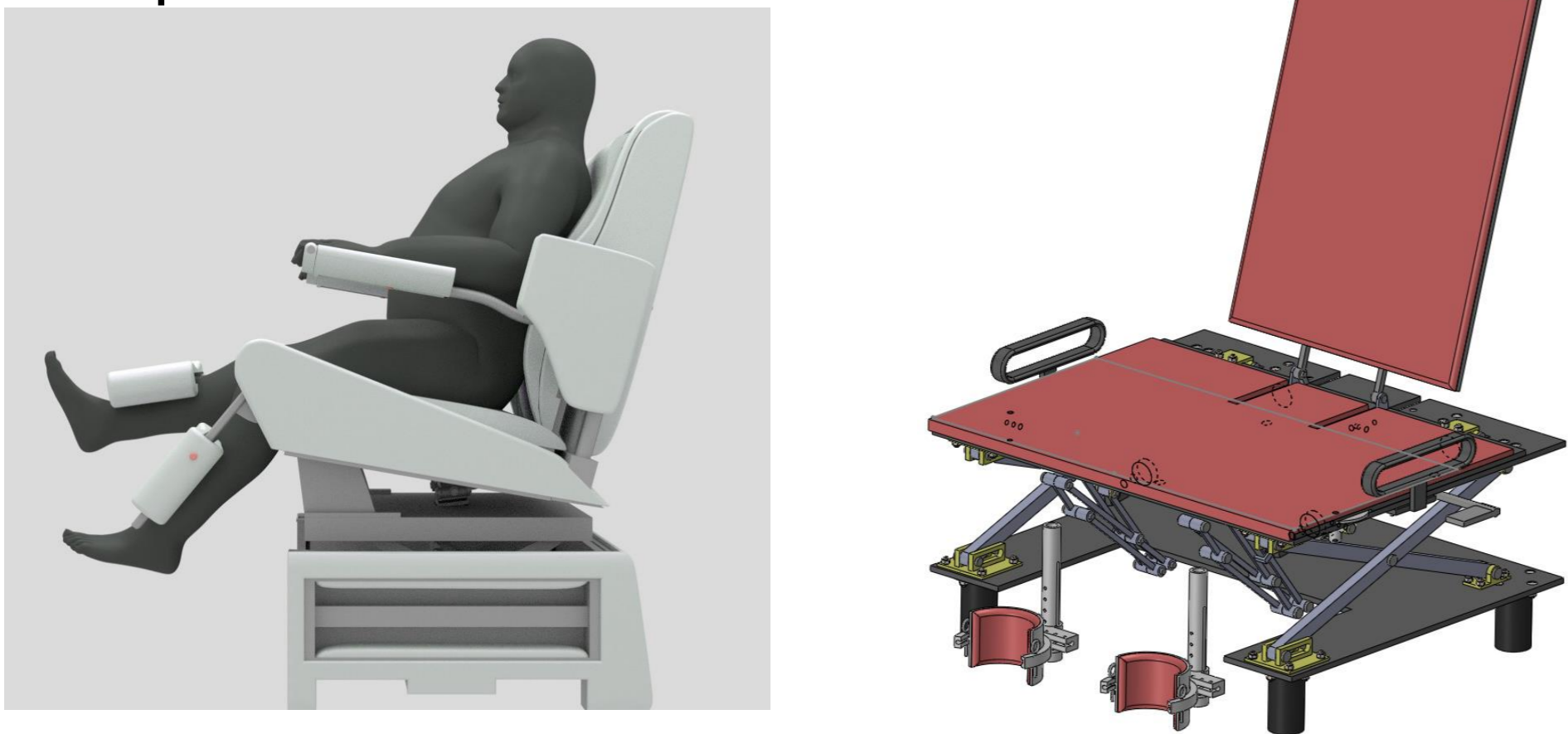


Fidget Chair

Currently during the design phase, this chair aims at approaching simple physical activities, like legs exercises, to bariatric patients in order to recover mobility and muscle tone.

The main theme are the design of an exercise mechanism able to rotate about a virtual joint placed where there is the user knee and the design of several regulation mechanism to make the chair more functionable.

Concept of the chair



Leg Exercise Mechanism

Wheelchair.Q

An electric wheelchair that can face stairways and steps in both directions thanks to a locomotion system like the Epi.Q one.

Currently the work on this prototype is focused on developing the autonomous overcoming of a single step, in both directions, without the intervention of the operator.

In the automatic operation the following state can be defined:

Drive Mode

the user drives manually.

Step Detection

using two LIDARs the wheelchair scans ahead looking for a step.

Fast and Precise Approaches

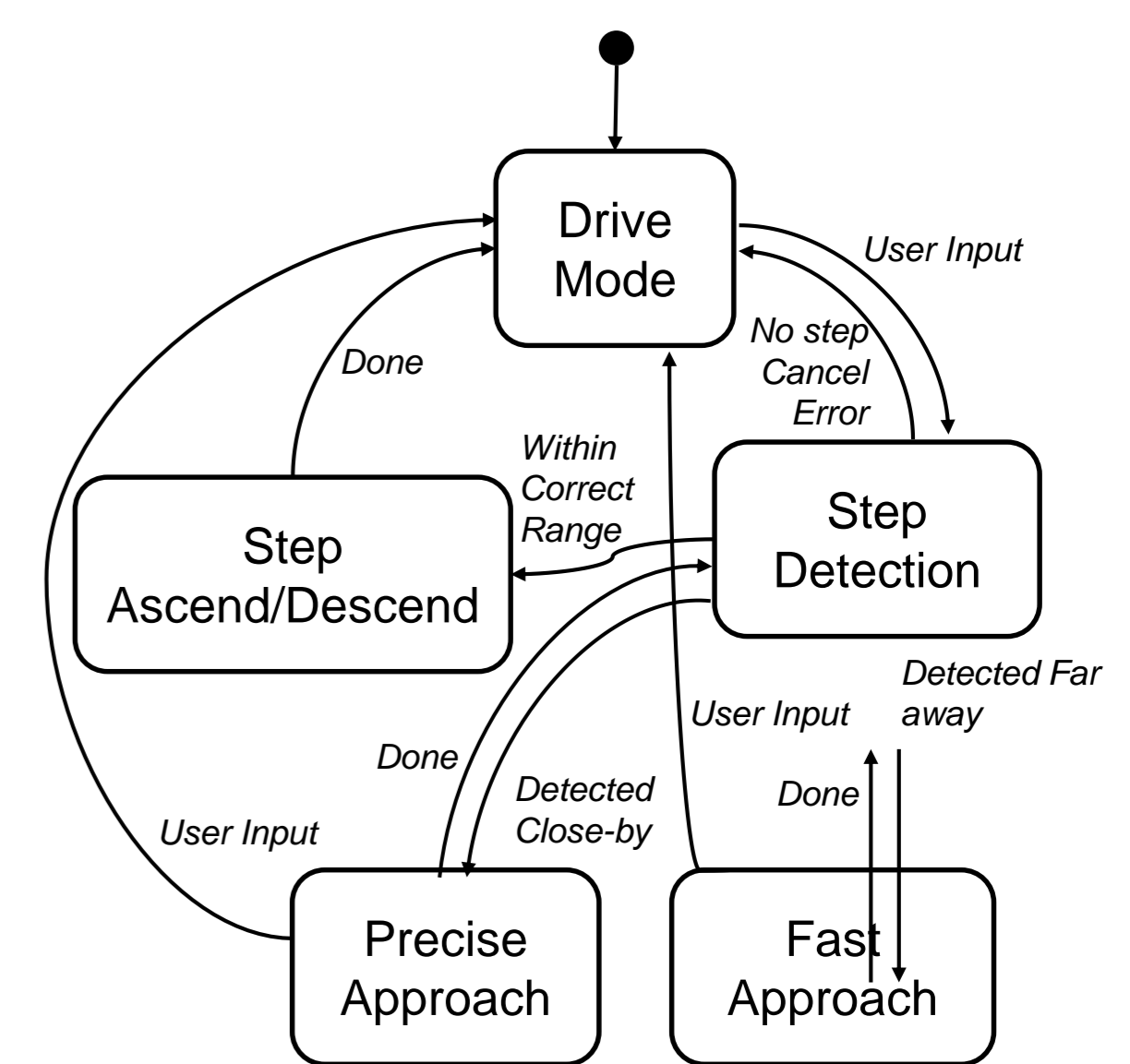
the wheelchair approaches the step, with different precision depending on the distance from it, minimizing the distance and the orientation error.

Ascend/Descend

the single step ascend or descend sequence begins



Wheelchair.Q



Automatic single step climb/descent state machine



Single step sequence