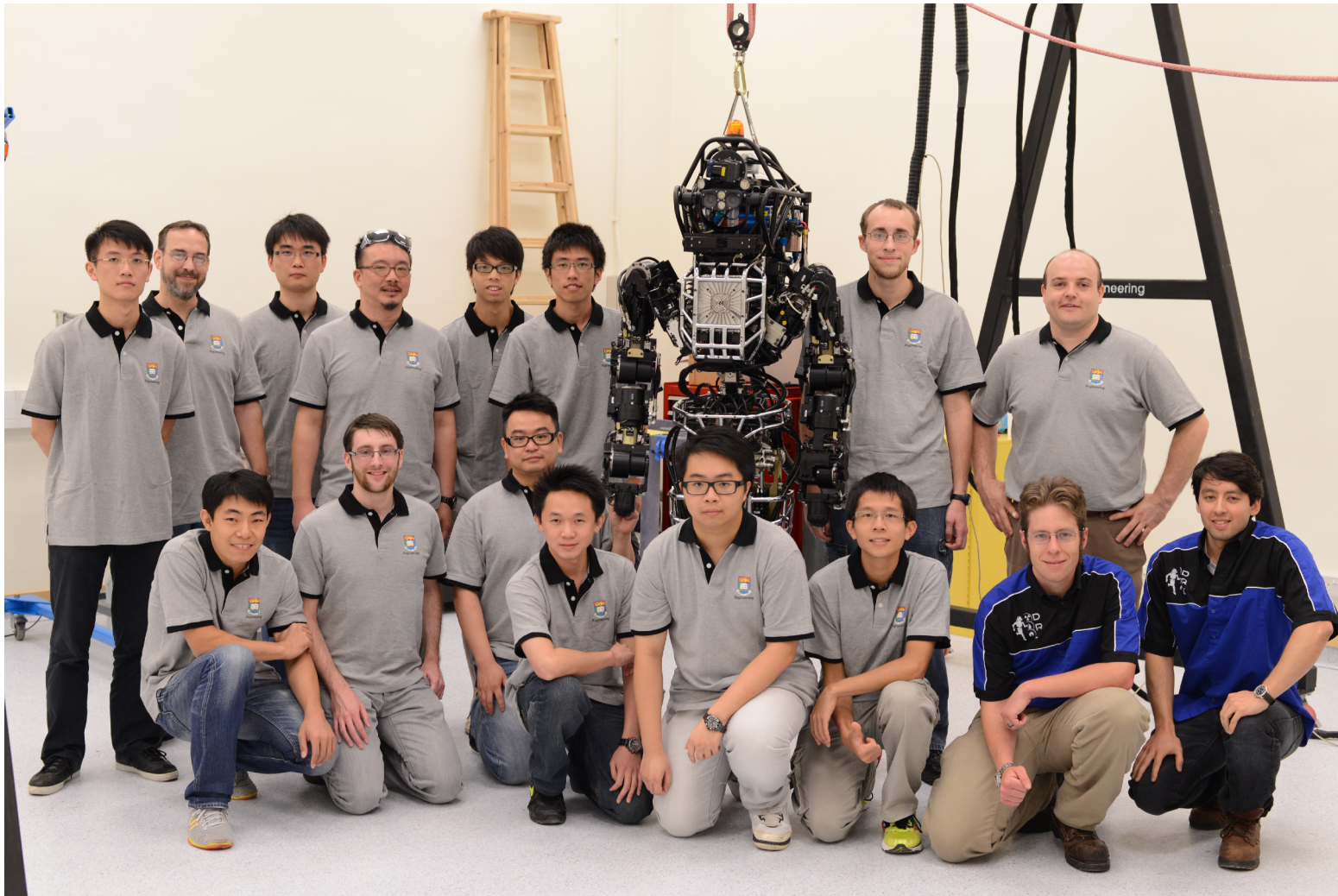


ROS, Atlas and the DARPA Robotics Challenge



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Research Associate
Advanced Robotics Laboratory
HKU

Team HKU



DARPA Robotics Challenge

WHY THE DARPA ROBOTICS CHALLENGE TASKS?

The story of the DARPA Robotics Challenge (DRC) begins on March 12, 2011, the day after the Tohoku, Japan earthquake and tsunami struck the Fukushima-Daiichi nuclear power plant. On that day, a team of plant workers set out to enter the darkened reactor buildings and manually vent accumulated hydrogen to the atmosphere. Unfortunately, the vent team soon encountered the maximum level of radiation allowed for humans and had to turn back. In the days that followed, with the vents still closed, hydrogen built up in each of three reactor buildings, fueling explosions that extensively damaged the facility, contaminated the environment and drastically complicated stabilization and remediation of the site.

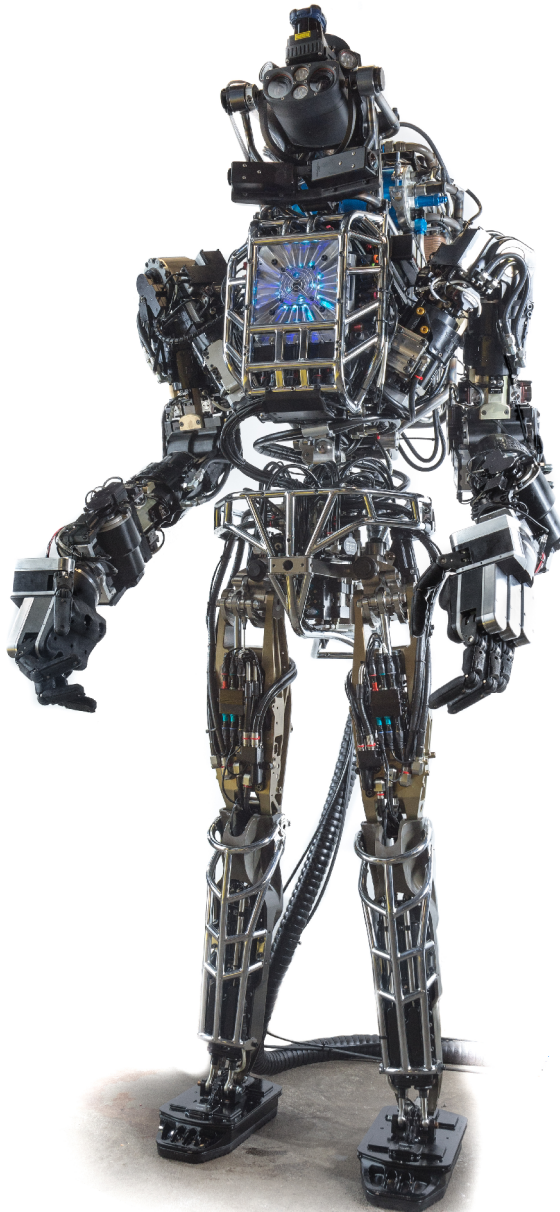
At Fukushima, having a robot with the ability to open valves to vent the reactor buildings might have made all the difference. But to open a valve, a robot first has to be able to get to it. The DRC tasks test some of the mobility, dexterity, manipulation and perception skills a robot needs to be effective in disaster response.



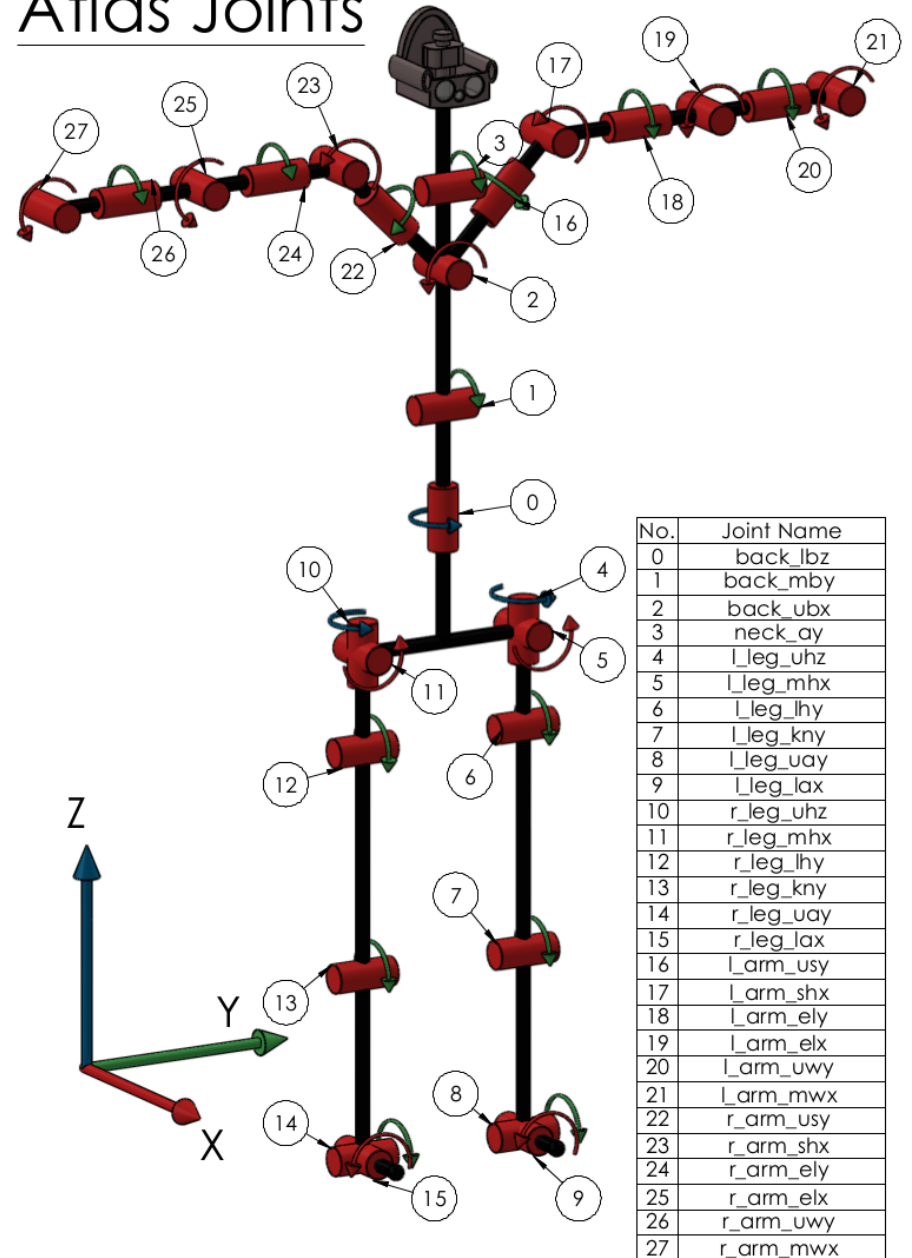
ROBOTICS
CHALLENGE
2013
TRIALS

#DARPADRC

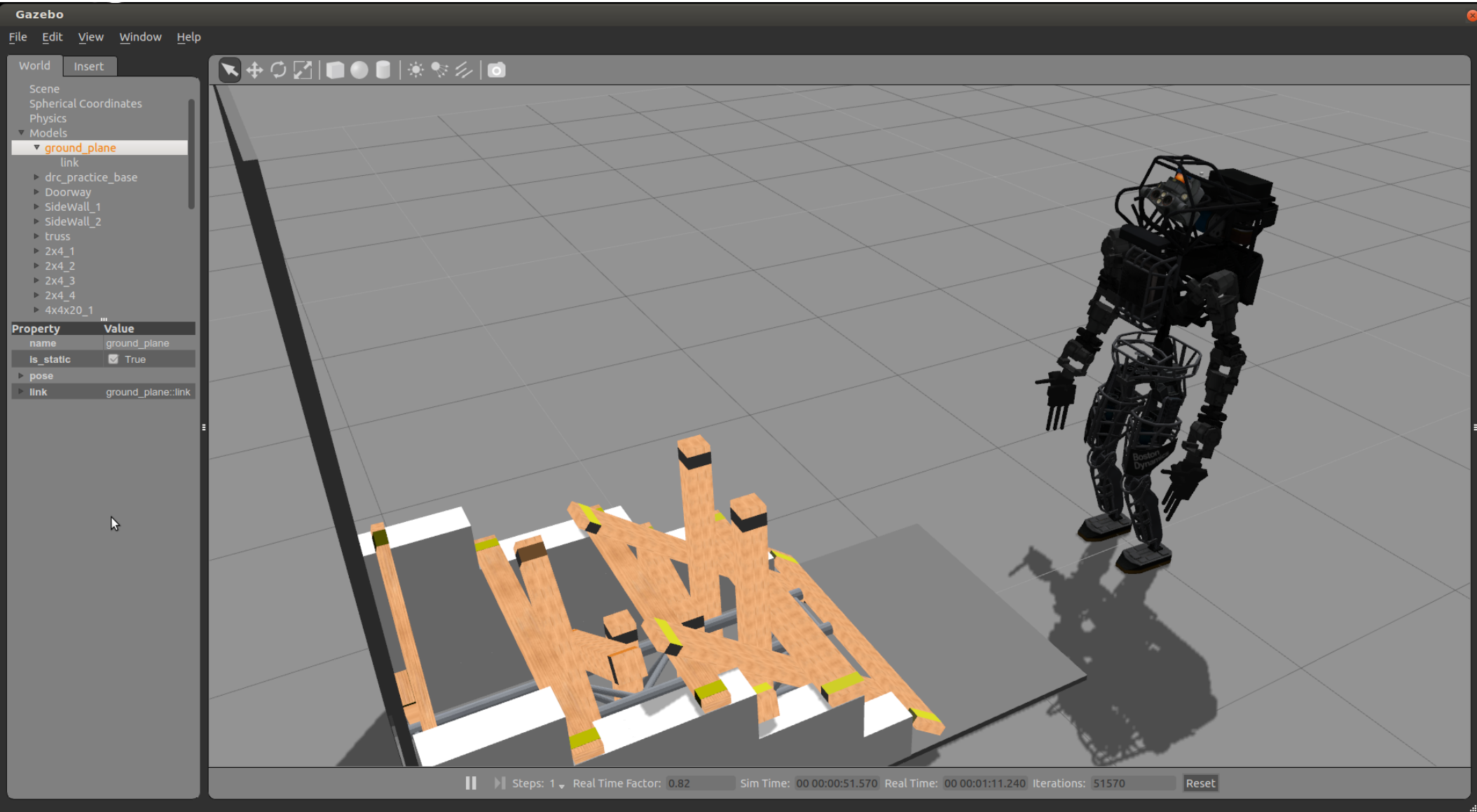
Atlas



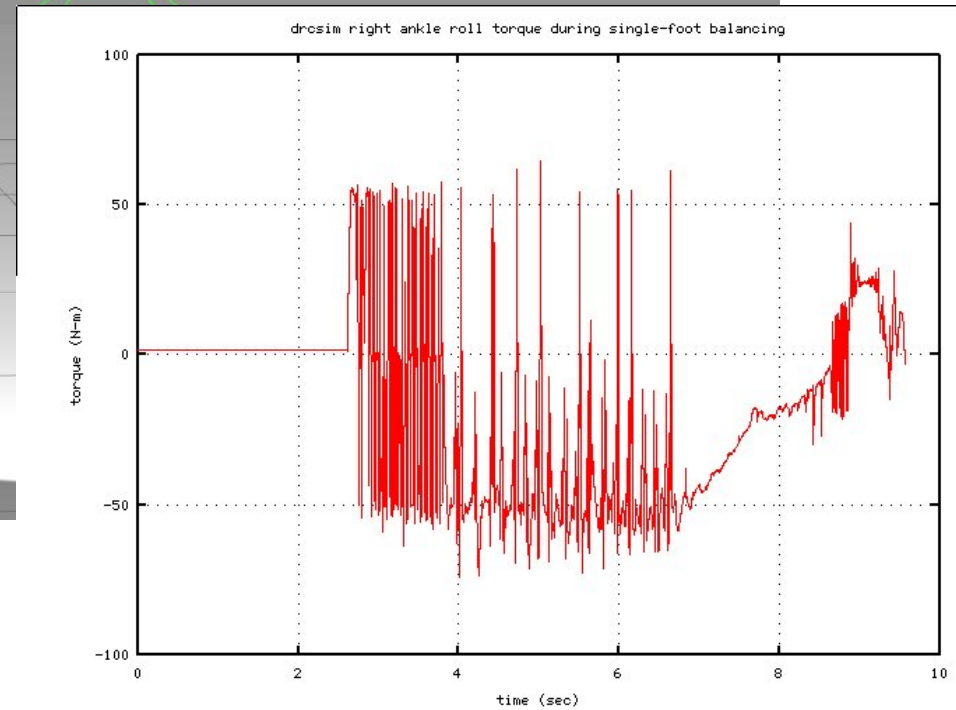
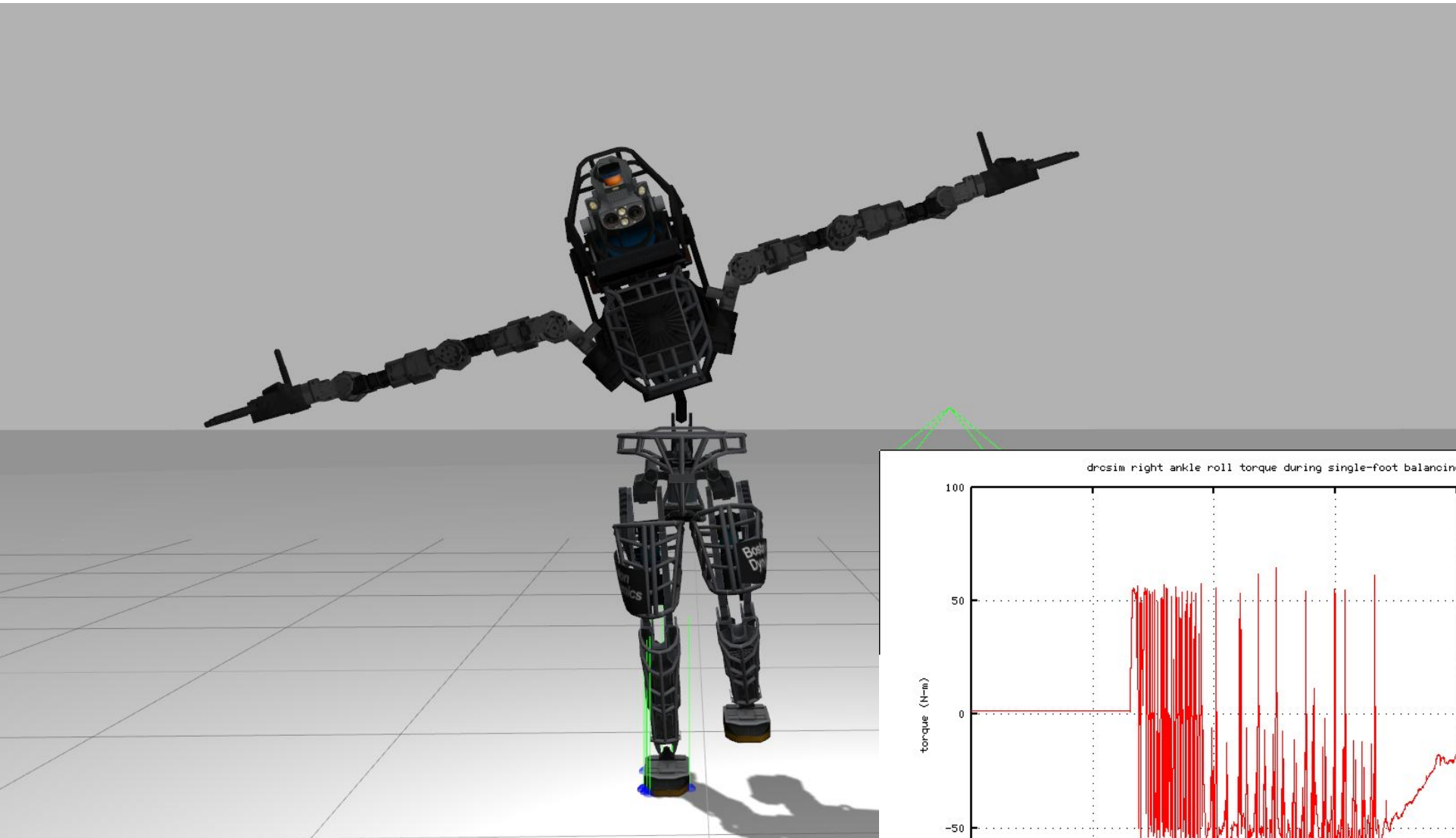
Atlas Joints



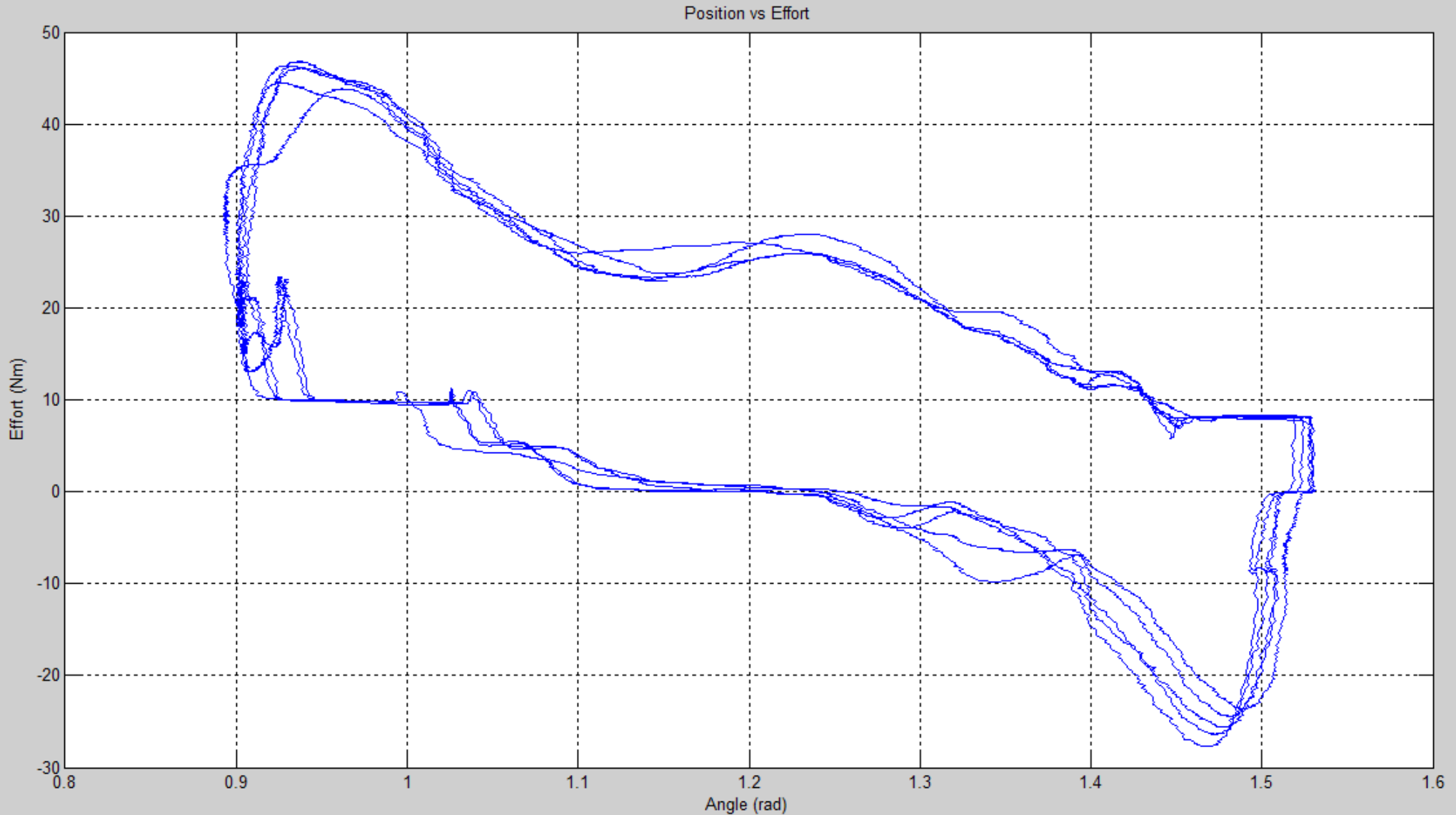
Gazebo + DRCsim



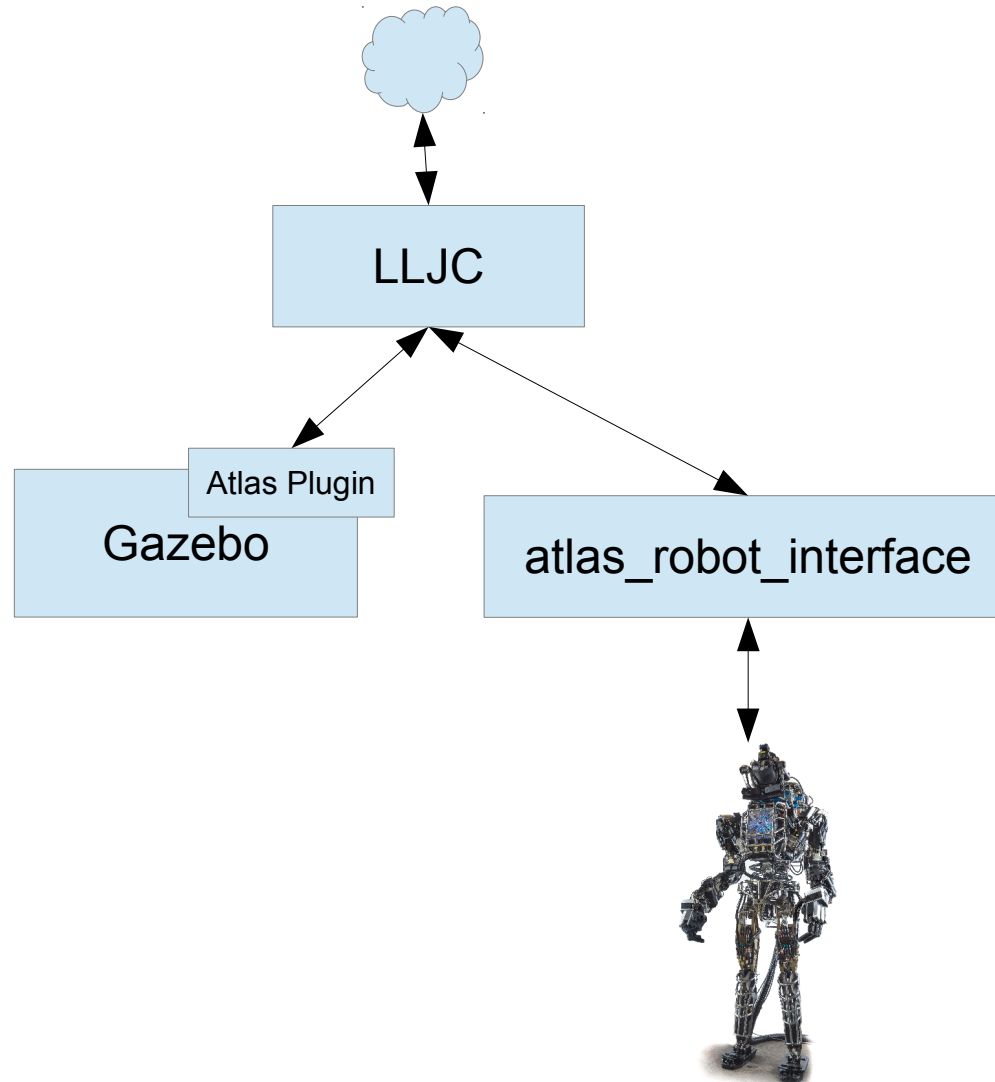
Gazebo + DRCsim



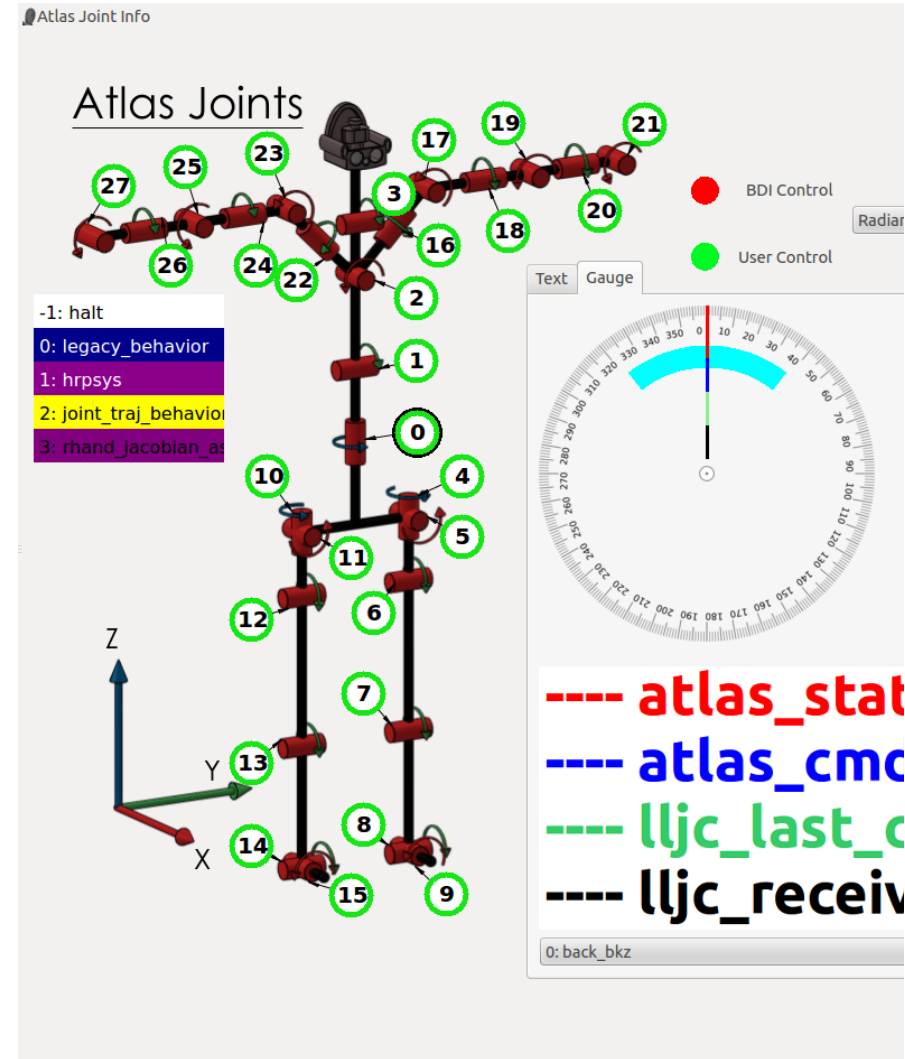
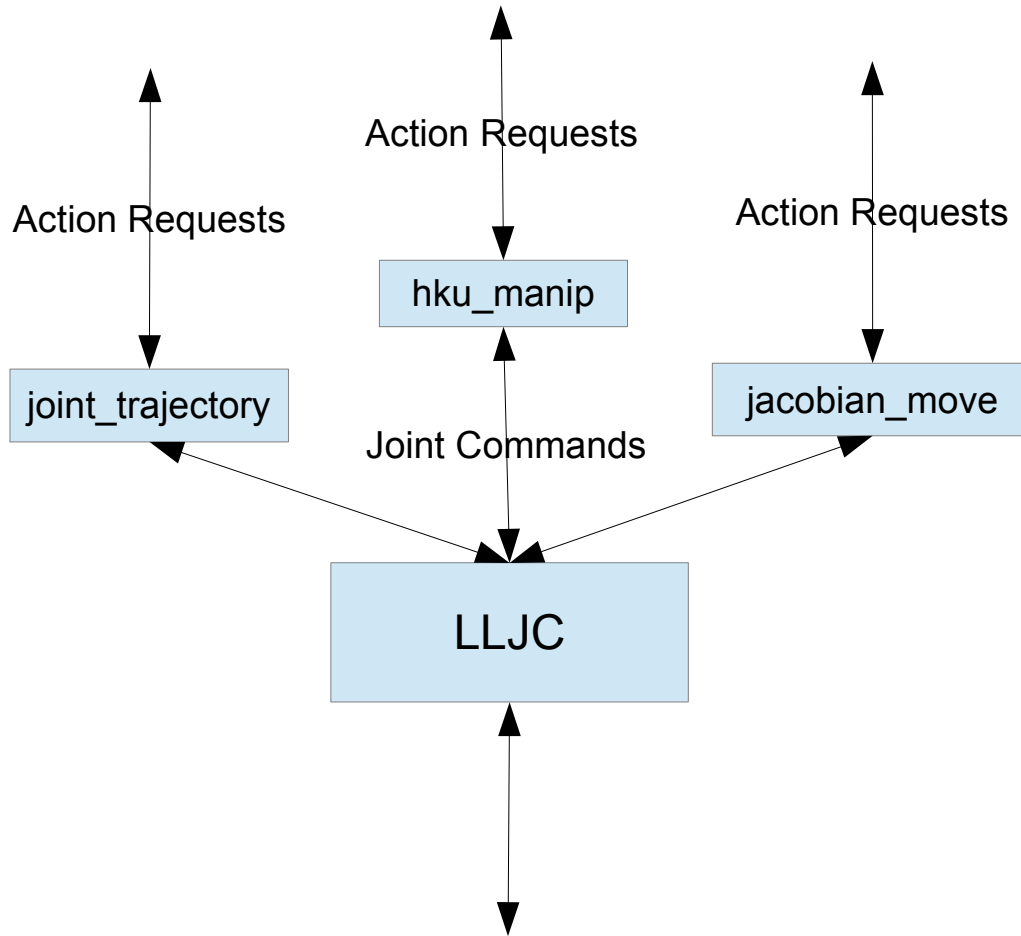
Gazebo + DRCSim



Controlling Atlas



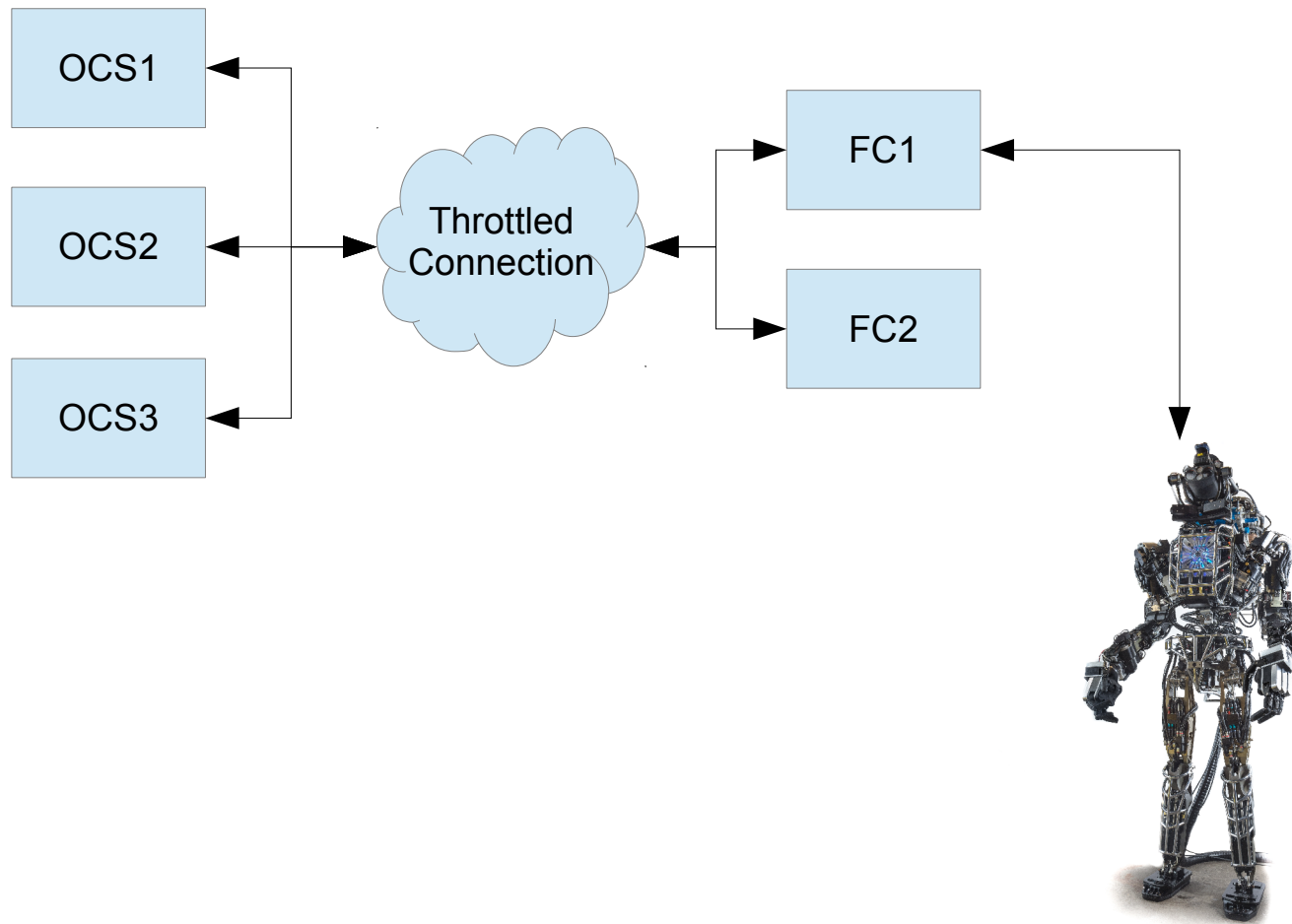
Controlling multiple behaviours



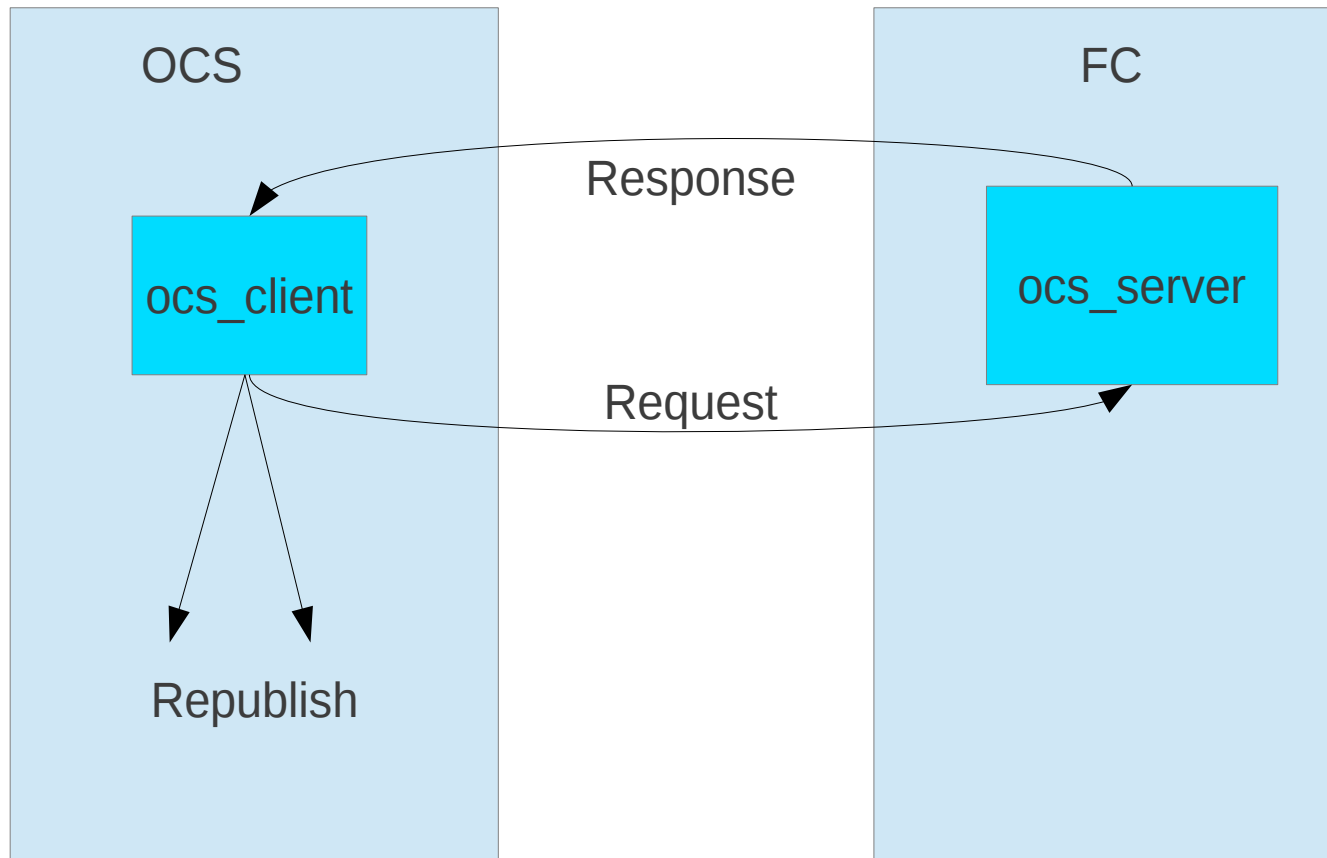
Egg Demo



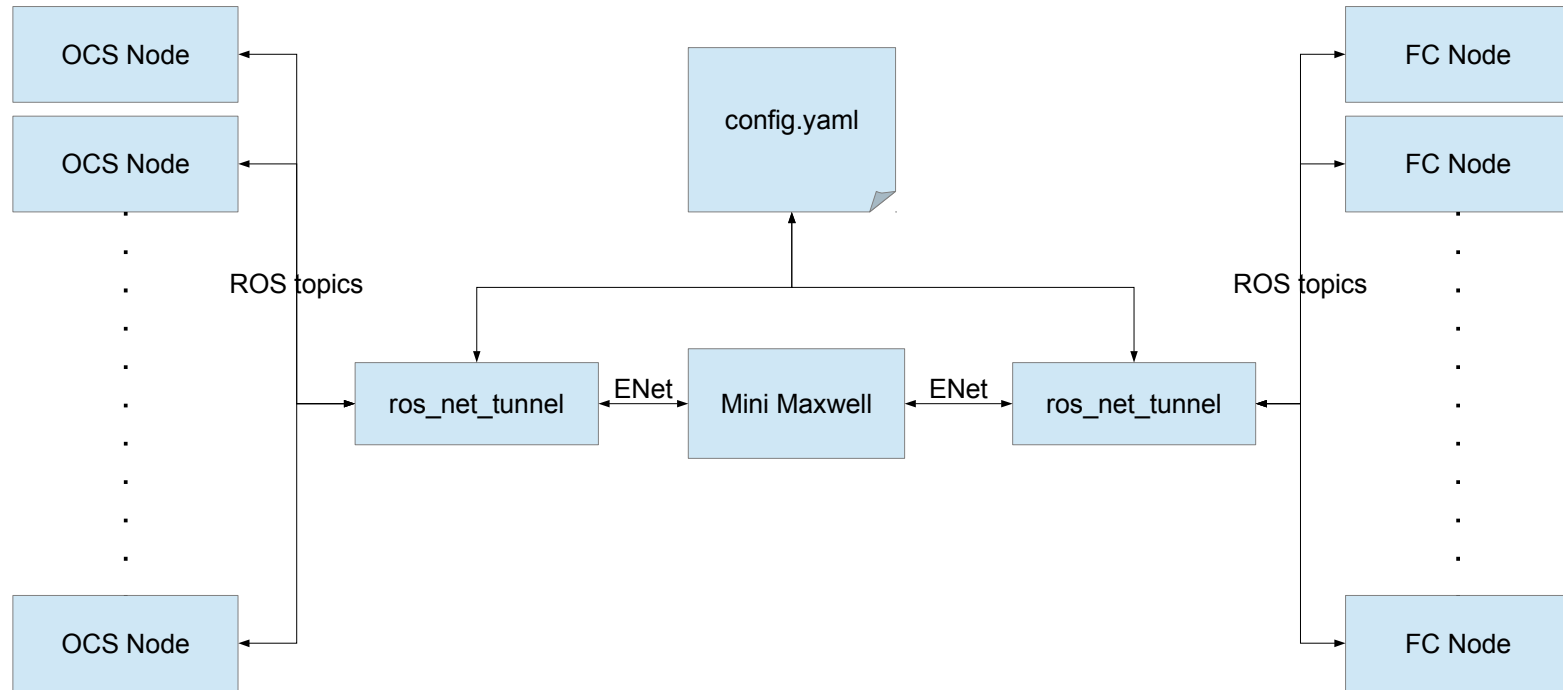
DARPA Challenge Networking



DARPA Challenge Networking

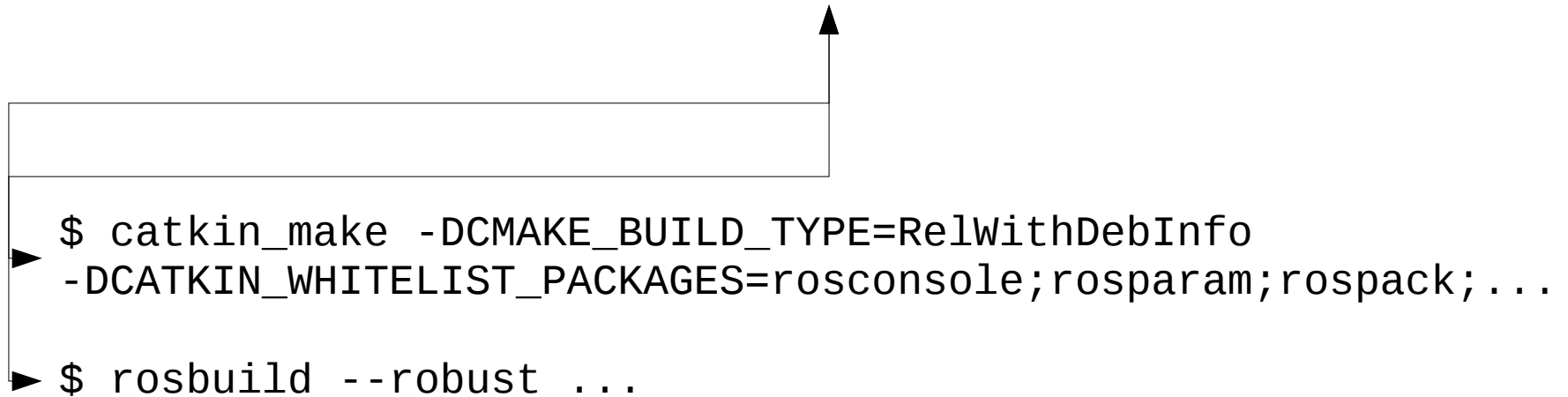


ros_net_tunnel



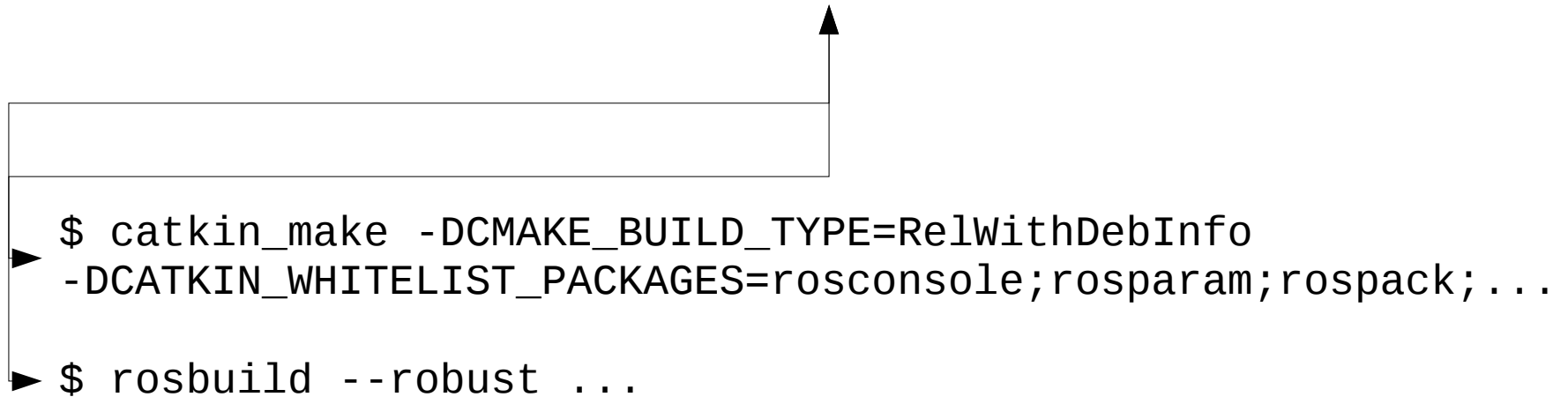
hku_make

```
$ hku_make atlas_robot_interface
```



hku_make

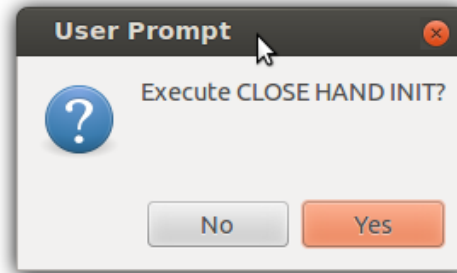
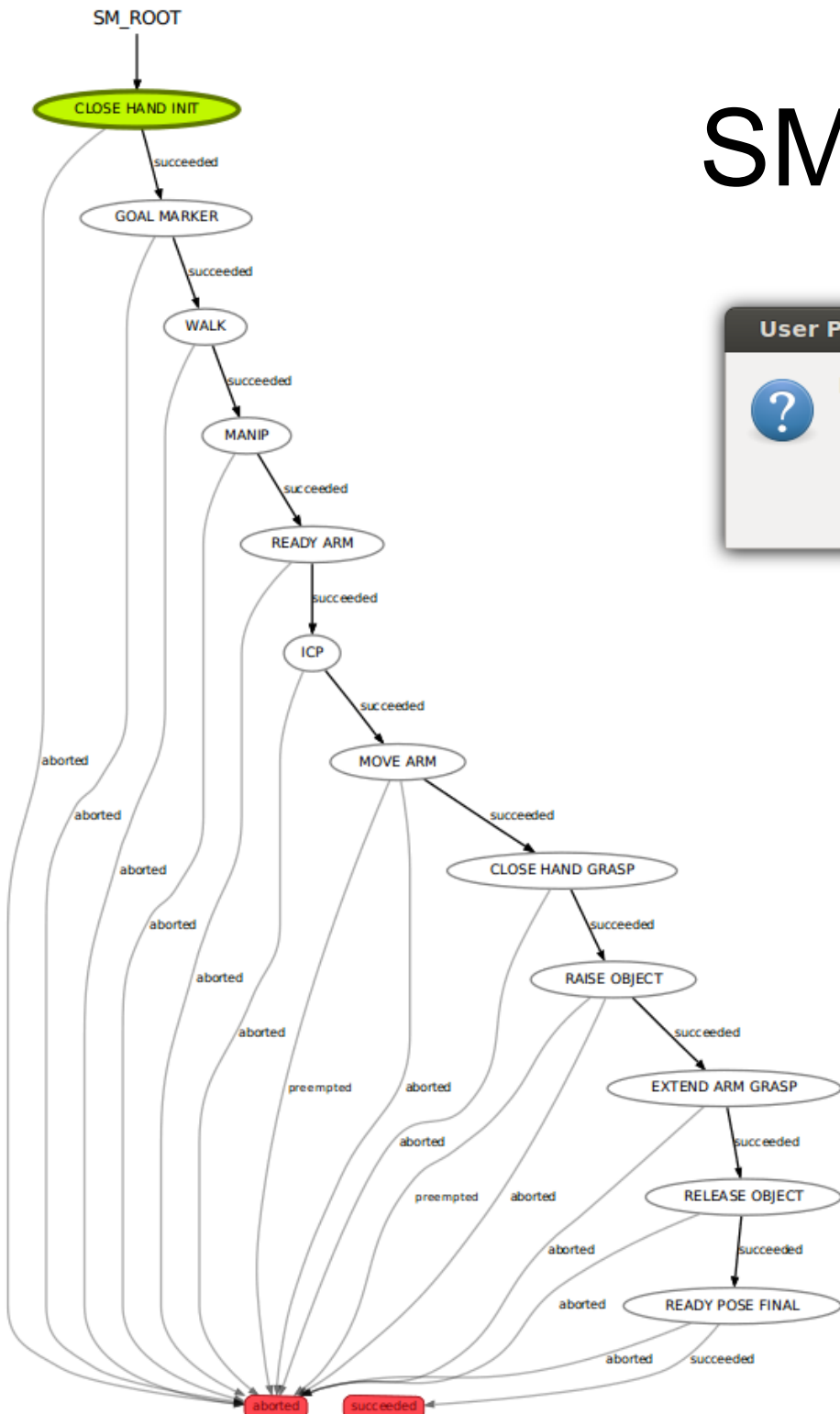
```
$ hku_make atlas_robot_interface
```

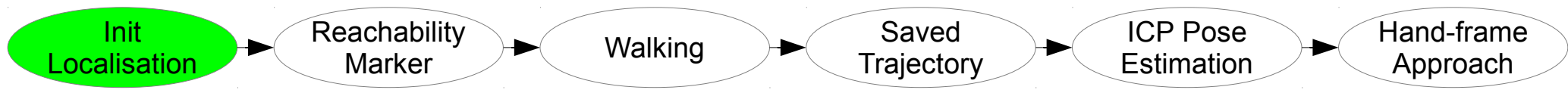


```
< Success! >
```

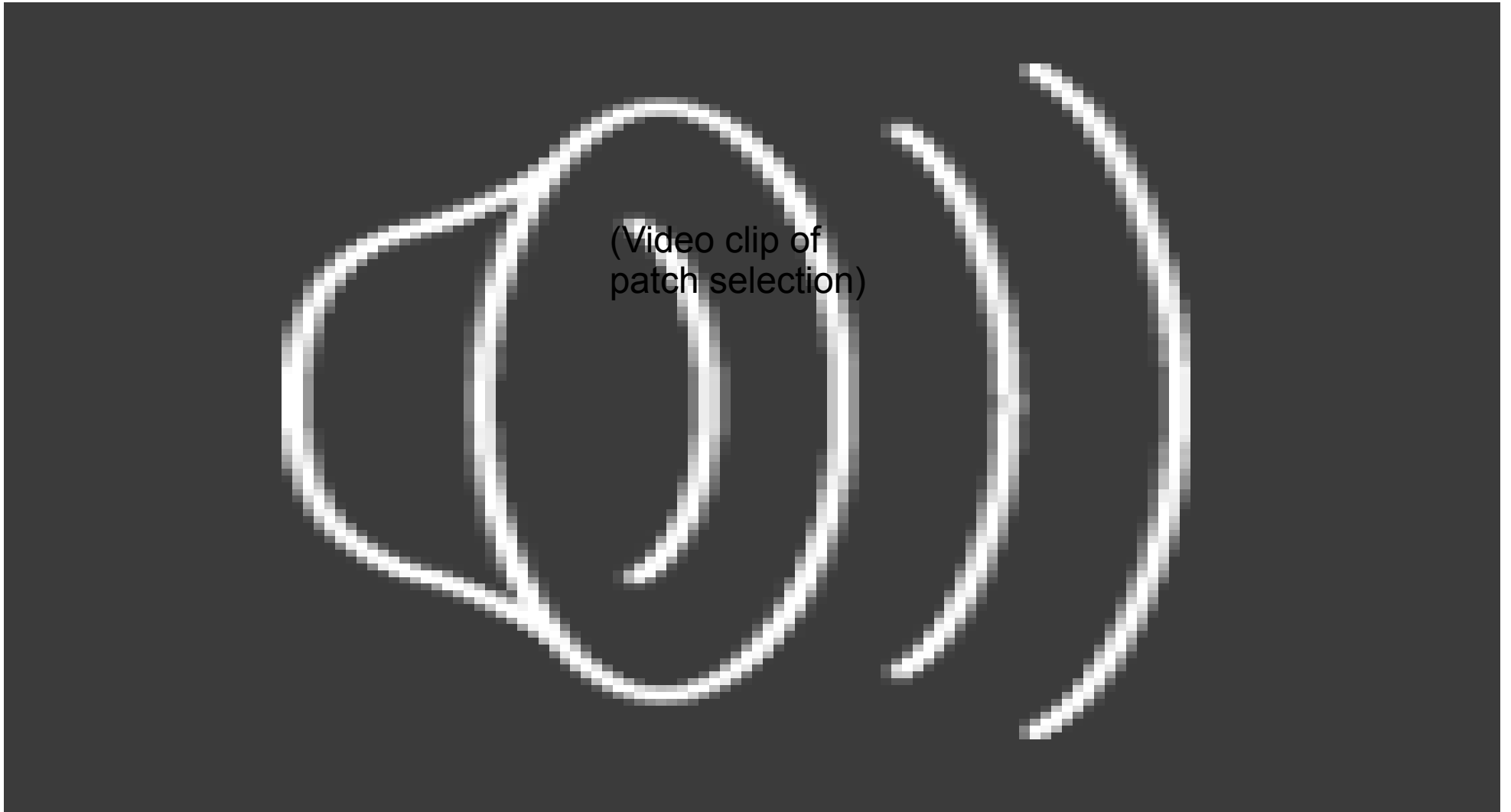
```
-----  
  \      ^ _ ^  
  \      (oo)\_____  
      (—)\_____)\/\  
          ||-----w||  
          ||           ||
```

SMACH





Localisation



Init
Localisation

Reachability
Marker

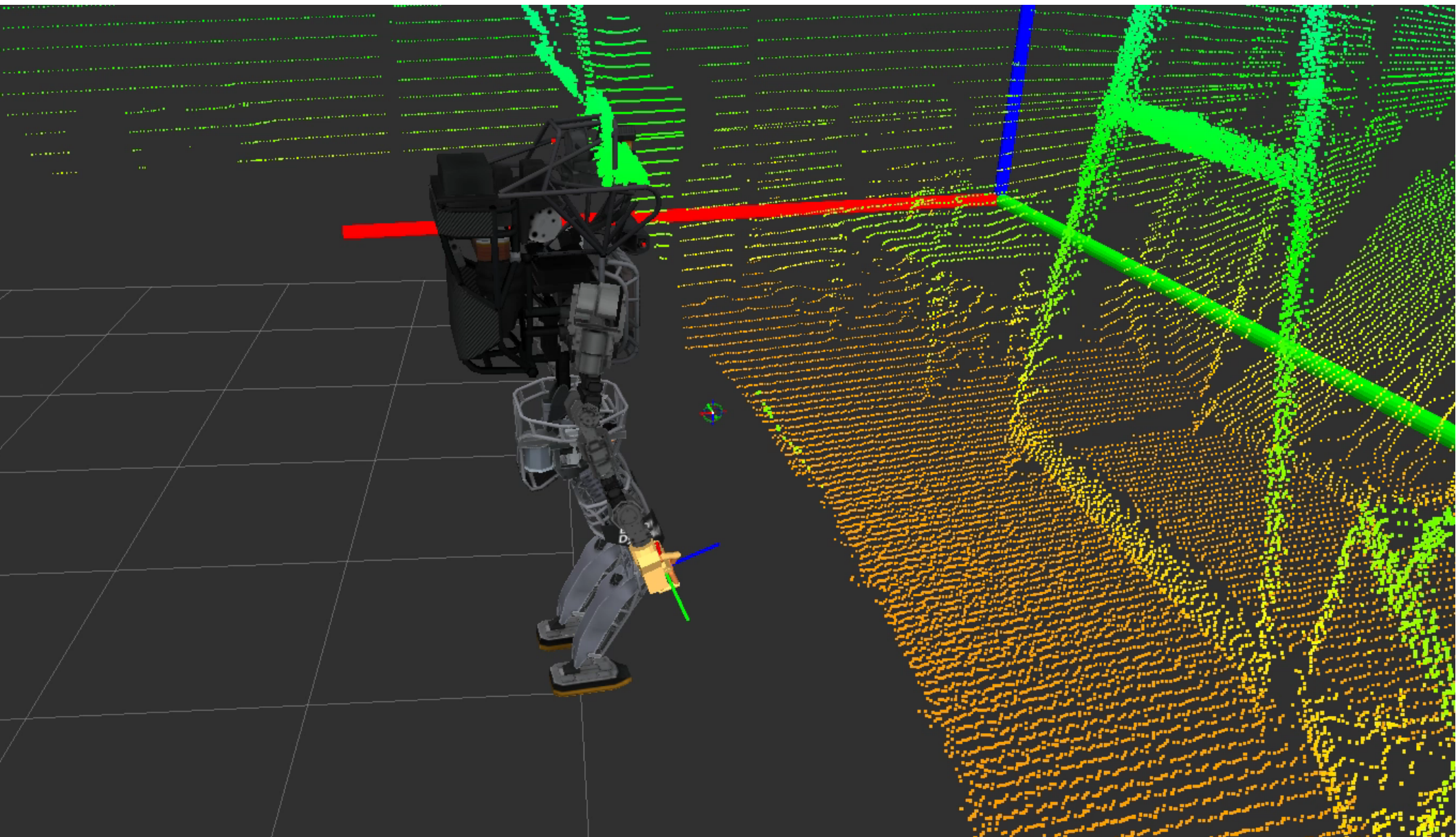
Walking

Saved
Trajectory

ICP Pose
Estimation

Hand-frame
Approach

Localisation



Init
Localisation

Reachability
Marker

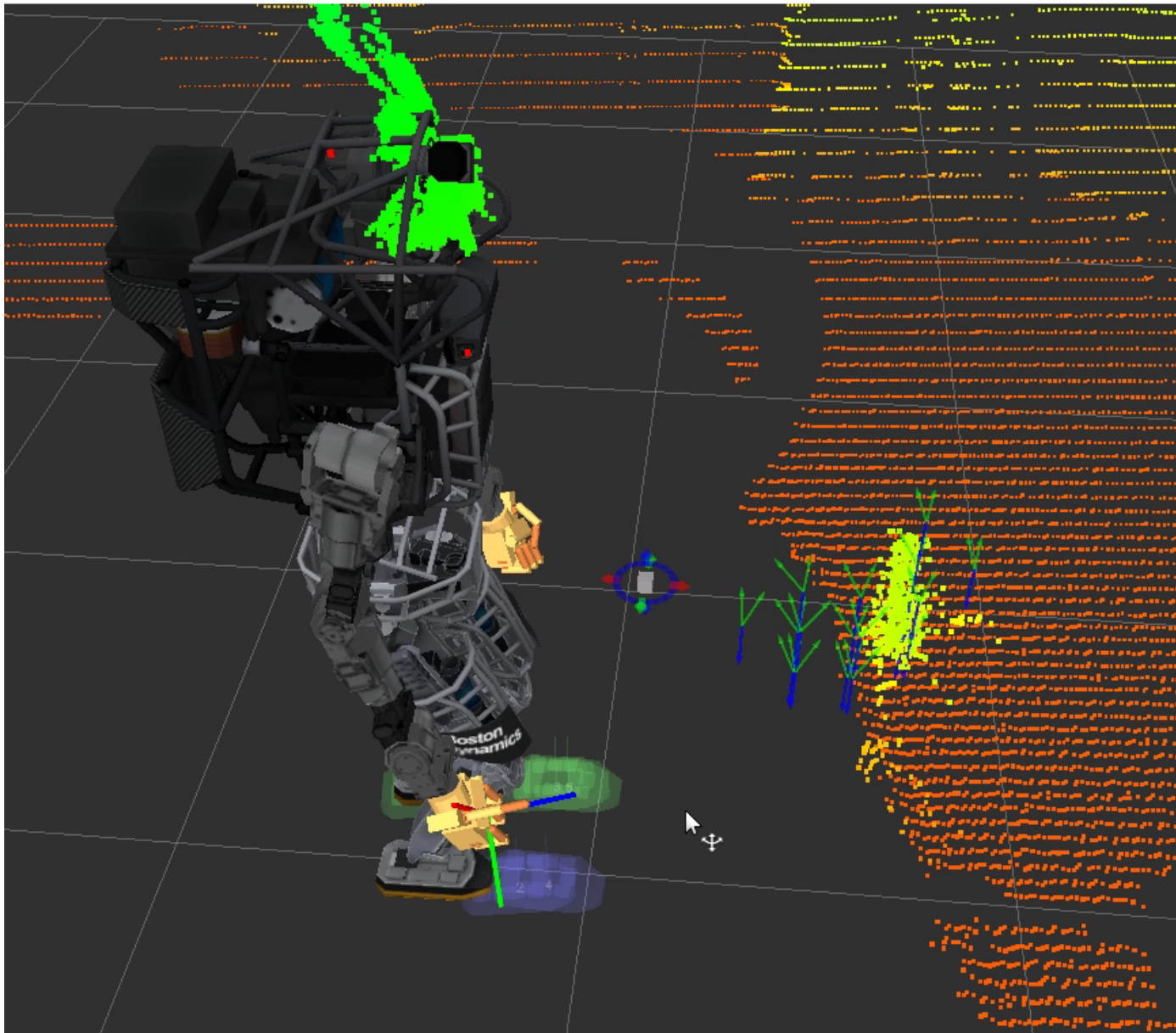
Walking

Saved
Trajectory

ICP Pose
Estimation

Hand-frame
Approach

Reachability Marker



Init
Localisation

Reachability
Marker

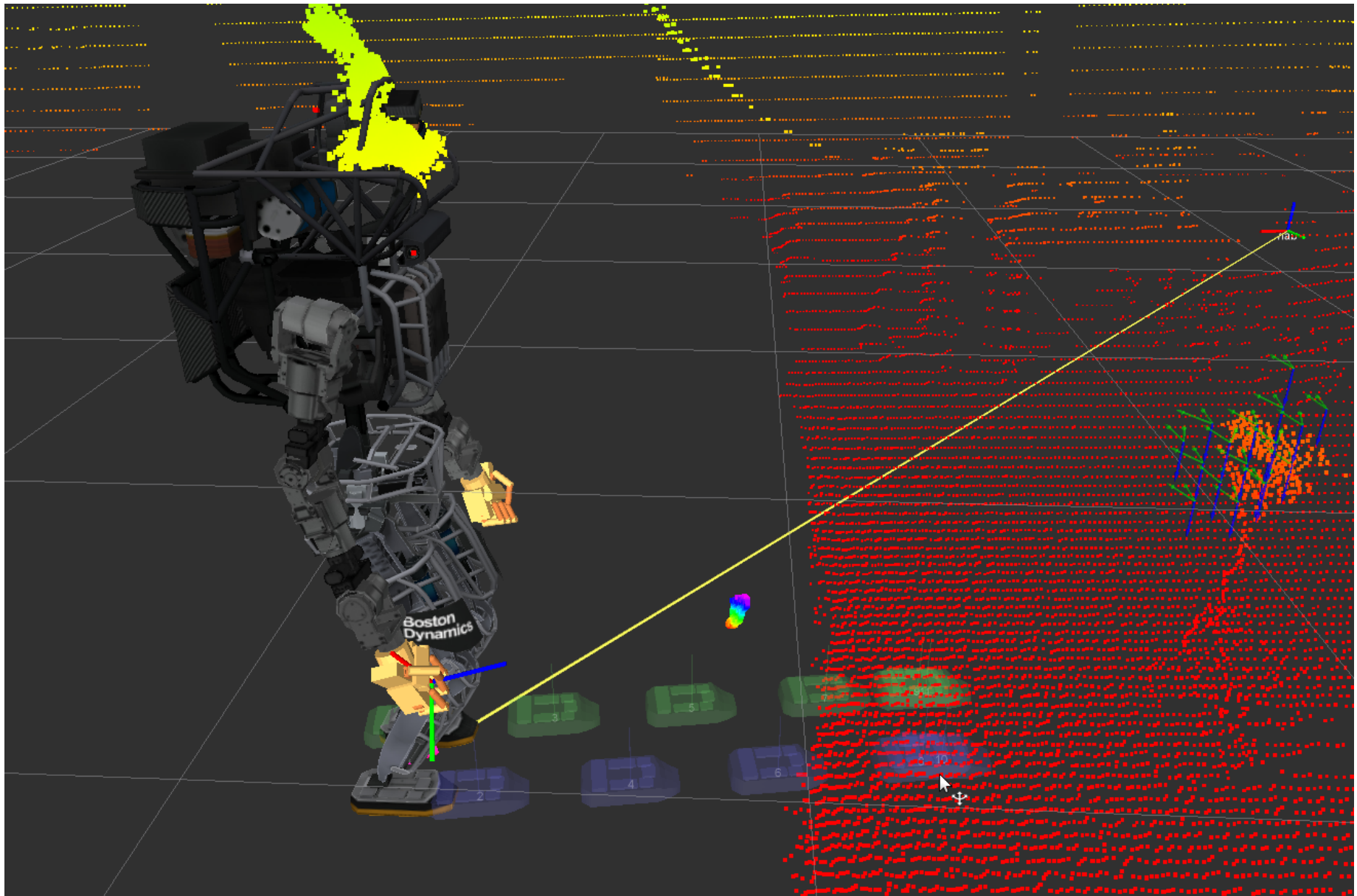
Walking

Saved
Trajectory

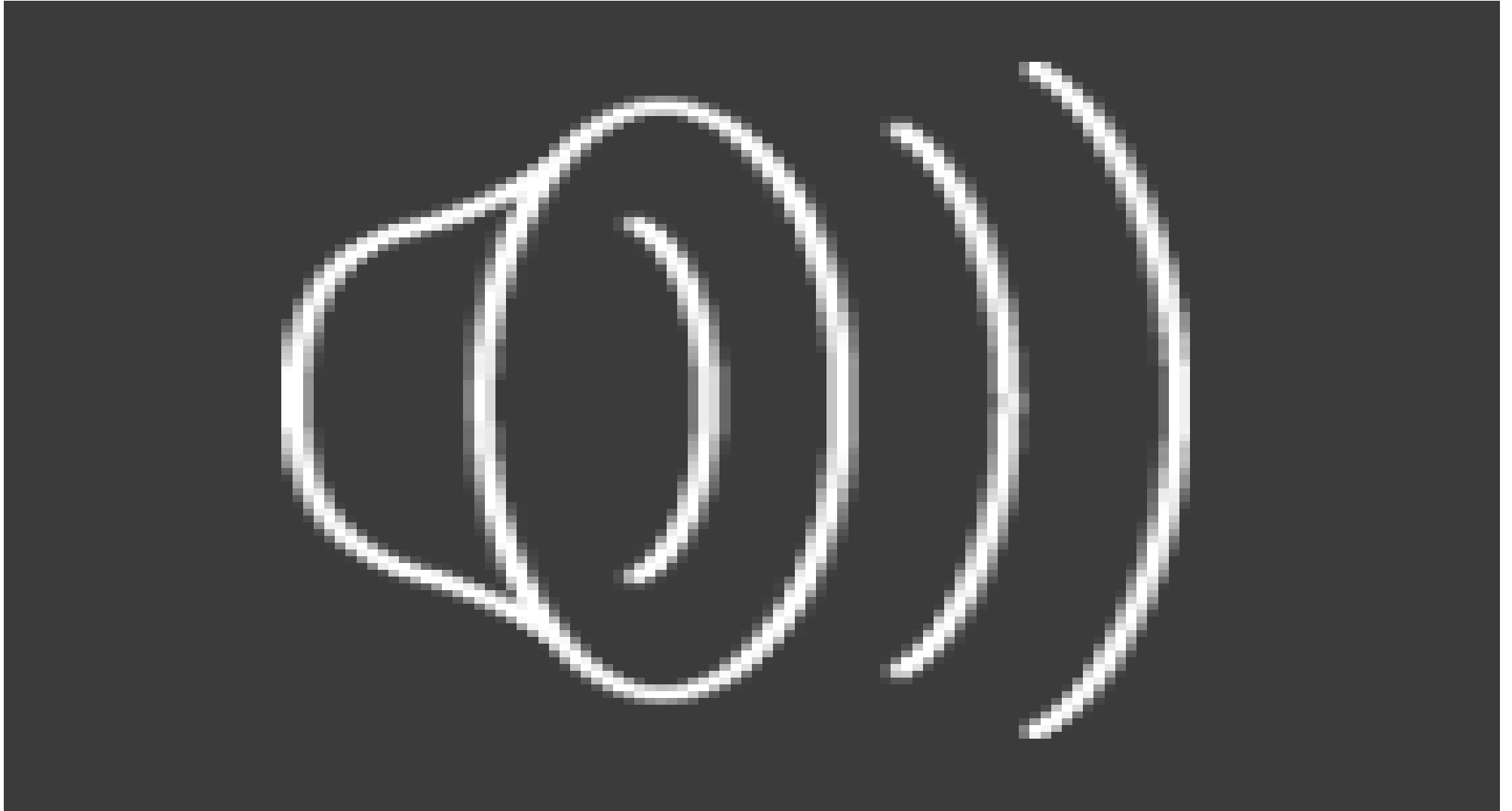
ICP Pose
Estimation

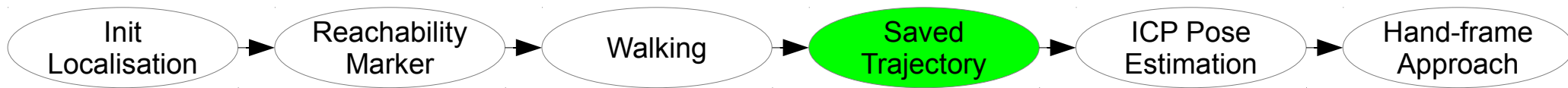
Hand-frame
Approach

Walking



Walking Demo





Saved YAML Trajectories

```
---  
# Message name, preferably unique  
- hmi_msgs: right_sandia_hand_close  
  
# actionType corresponds to the behavior type defined  
actionType:  
  4  
  
# actionCode is used to set sub behavior types  
actionCode:  
  1  
  
# 0: not selected, 1: position control, 2: compliant control - 28 joints to select  
selection: [  
  1, 1, 1, 1, 1, 1, 1, 1,  
  1, 1, 1, 1, 0, 0, 0, 0,  
  0, 0, 0, 0, 0, 0, 0, 0,  
  0, 0, 0, 0  
]  
  
# Angle for each joint  
angle: [  
  0.0, 1.5, 1.7, 0.0, 1.5, 1.7, 0.0, 1.5,  
  1.7, 0.0, 0.8, 1.1, 0.0, 0.0, 0.0, 0.0,  
  0.00, -70.0, 0.0, 0.0, 0.0, 0.0, 0.0, 80.0,  
  0.0, 0.0, 0.0, 0.0  
]  
  
# For backward compatibility with old format. 0: degree, 1: radian  
unit:  
  1  
  
# Time to reach this pose  
duration:  
  1.00
```

Init Localisation

Reachability Marker

Walking

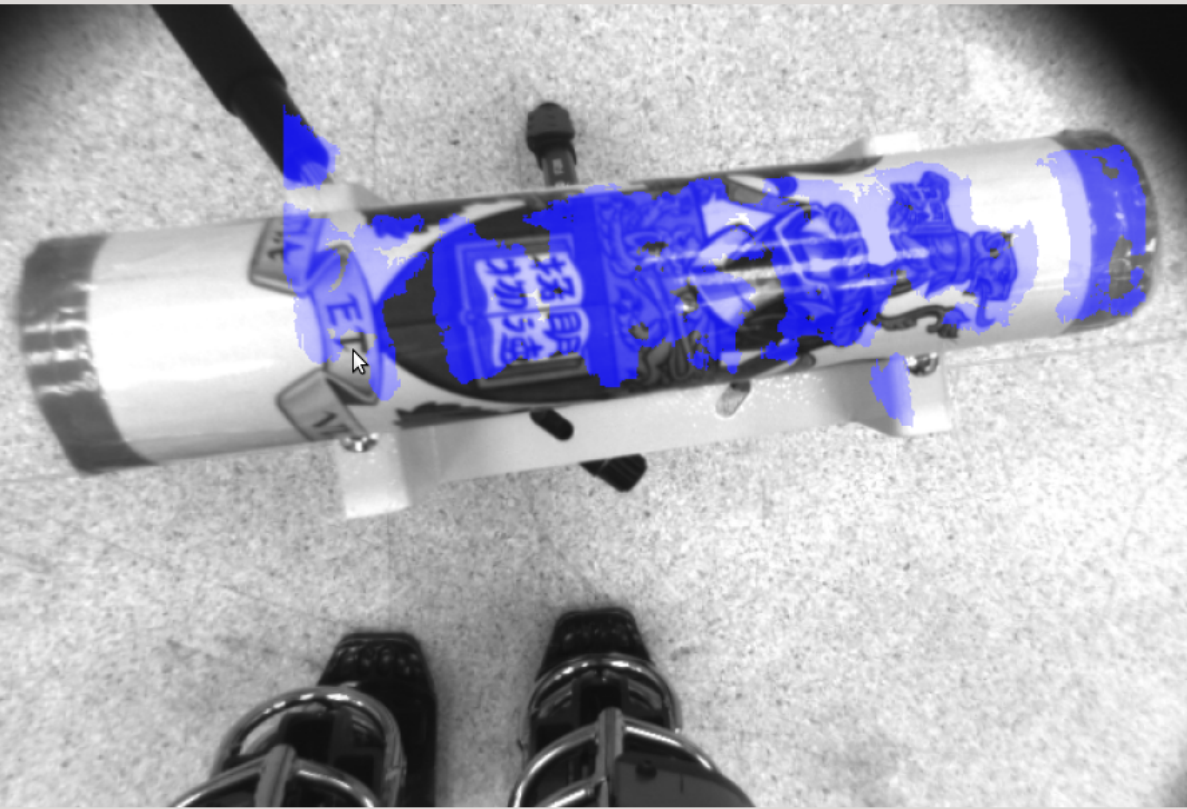
Saved Trajectory

ICP Pose Estimation

Hand-frame Approach

ICP Pose Estimation

image_window



Right Hand Camera View Controller

Move Along :

Pelvis Frame Grasp Frame

Constrain :

Hand Normal Grasp Axis

Up



Down

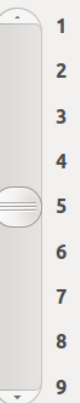
Move Time (sec) Move Distance (cm)

Fast



Slow

Small



Large

Re-Orient

Un-Freeze

Status Enable valid Action Server from LLJC

Init
Localisation

Reachability
Marker

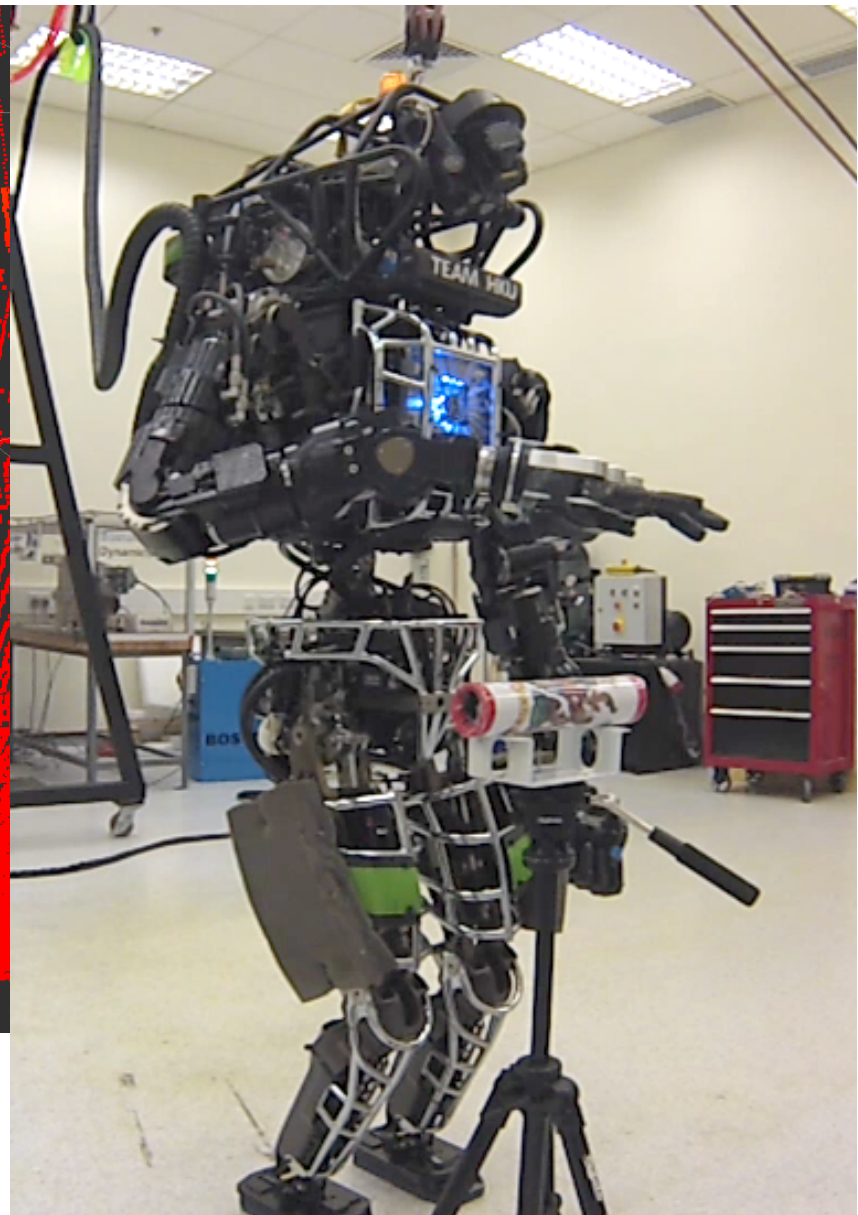
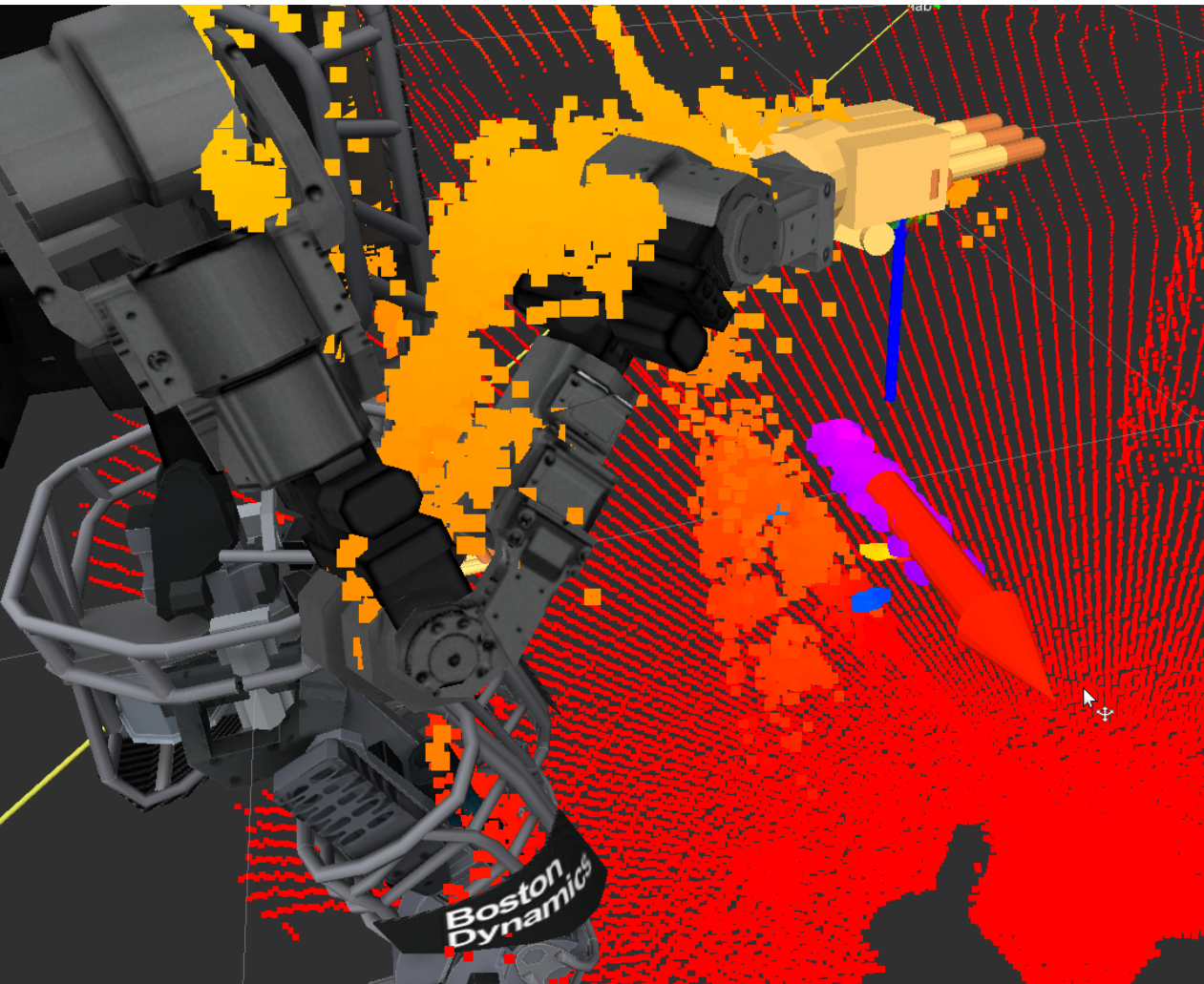
Walking

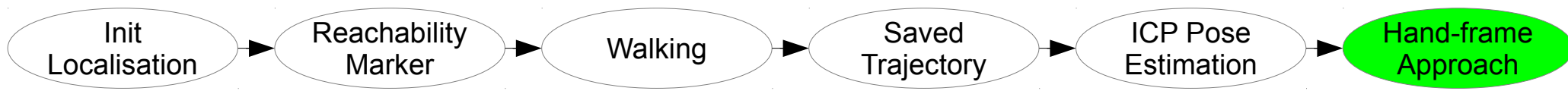
Saved
Trajectory

ICP Pose
Estimation

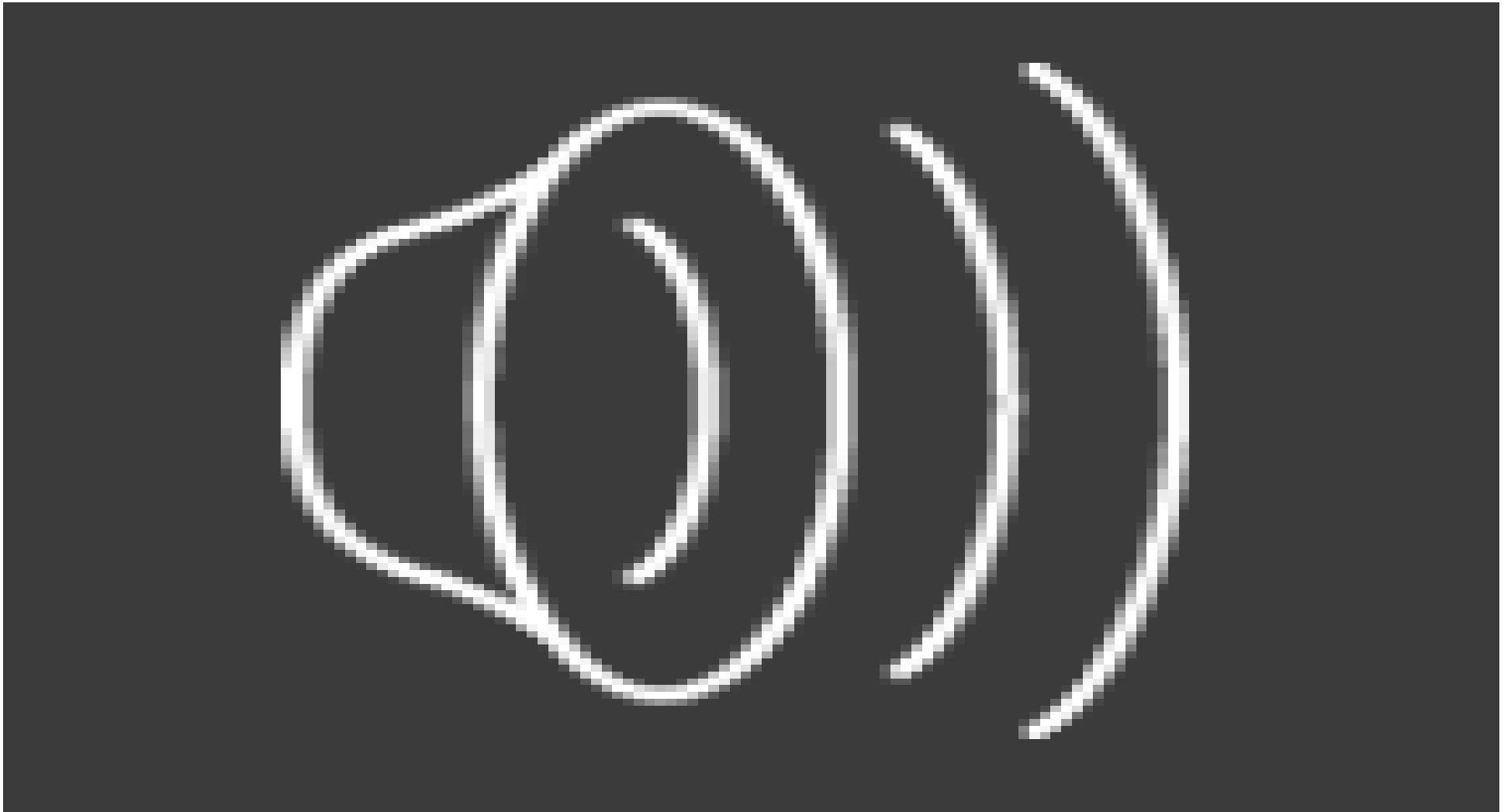
Hand-frame
Approach

ICP Pose Estimation

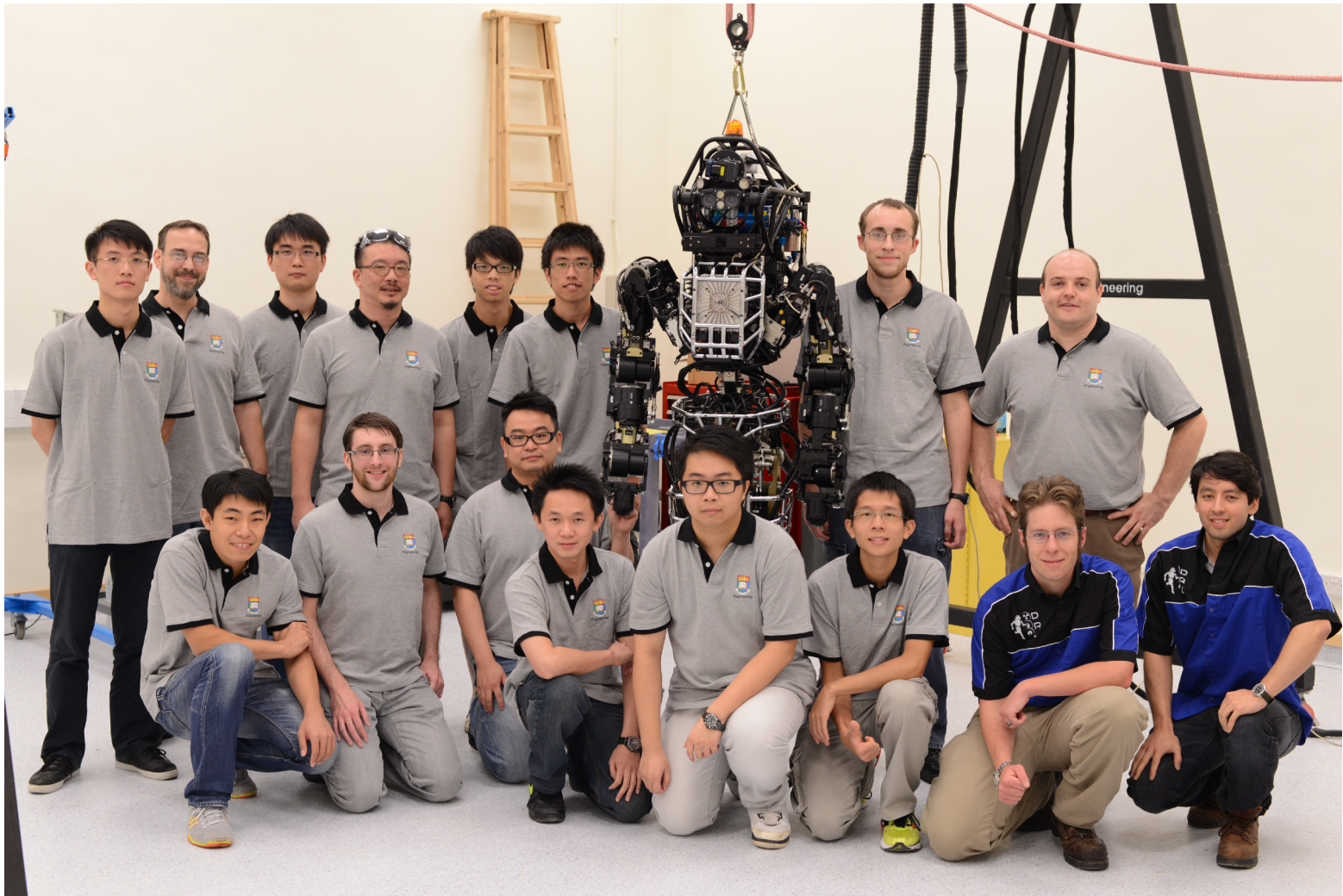




Hand-frame approach



Thanks!



Movelt!

