



# **ERL Consumer Service Robots Test Bed Certification**

## **ISRoboNet@Home Test Bed**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 780086.

**Test bed name:** ISRoboNet@Home Test Bed

**Test bed web page URL:** <http://welcome.isr.tecnico.ulisboa.pt/isrobonet/>

**Name of Institution where test bed is hosted:** Institute for Systems and Robotics at Instituto Superior Técnico, U. Lisboa, Portugal

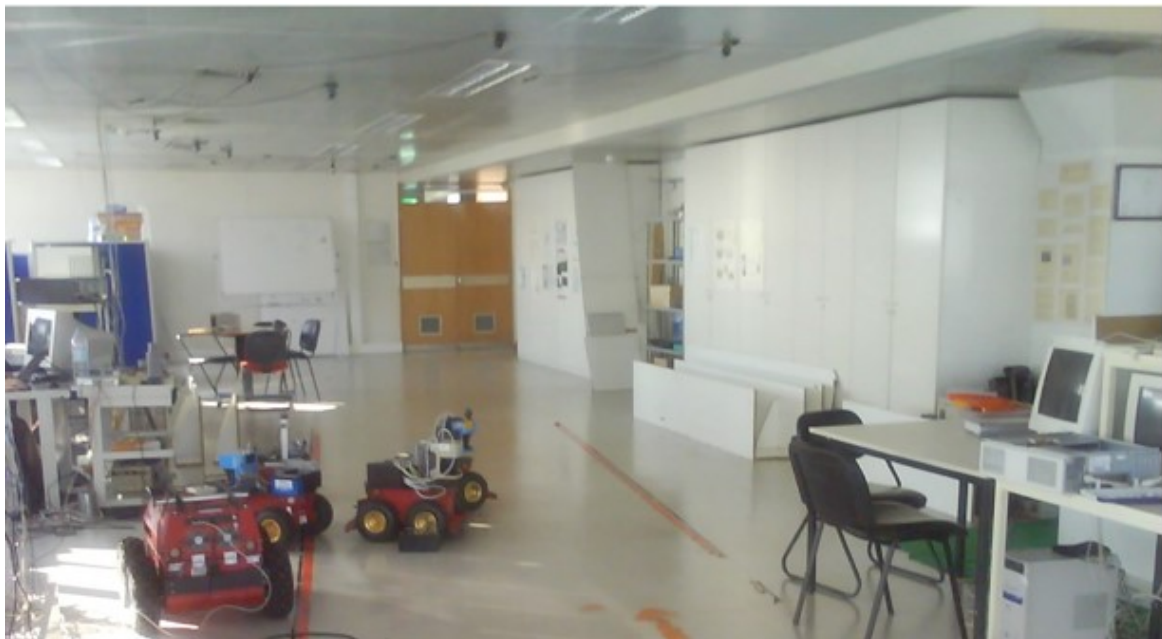
**Designation of the lab/department/group where test bed is located:** Intelligent Robots and Systems group

**Name of responsible person:** Pedro U. Lima

**Contacts of responsible person:**

- **E-mail:** [pal@isr.tecnico.ulisboa.pt](mailto:pal@isr.tecnico.ulisboa.pt)
- **Tel.:** +351-218418274

**Pictures with overview of the test bed**







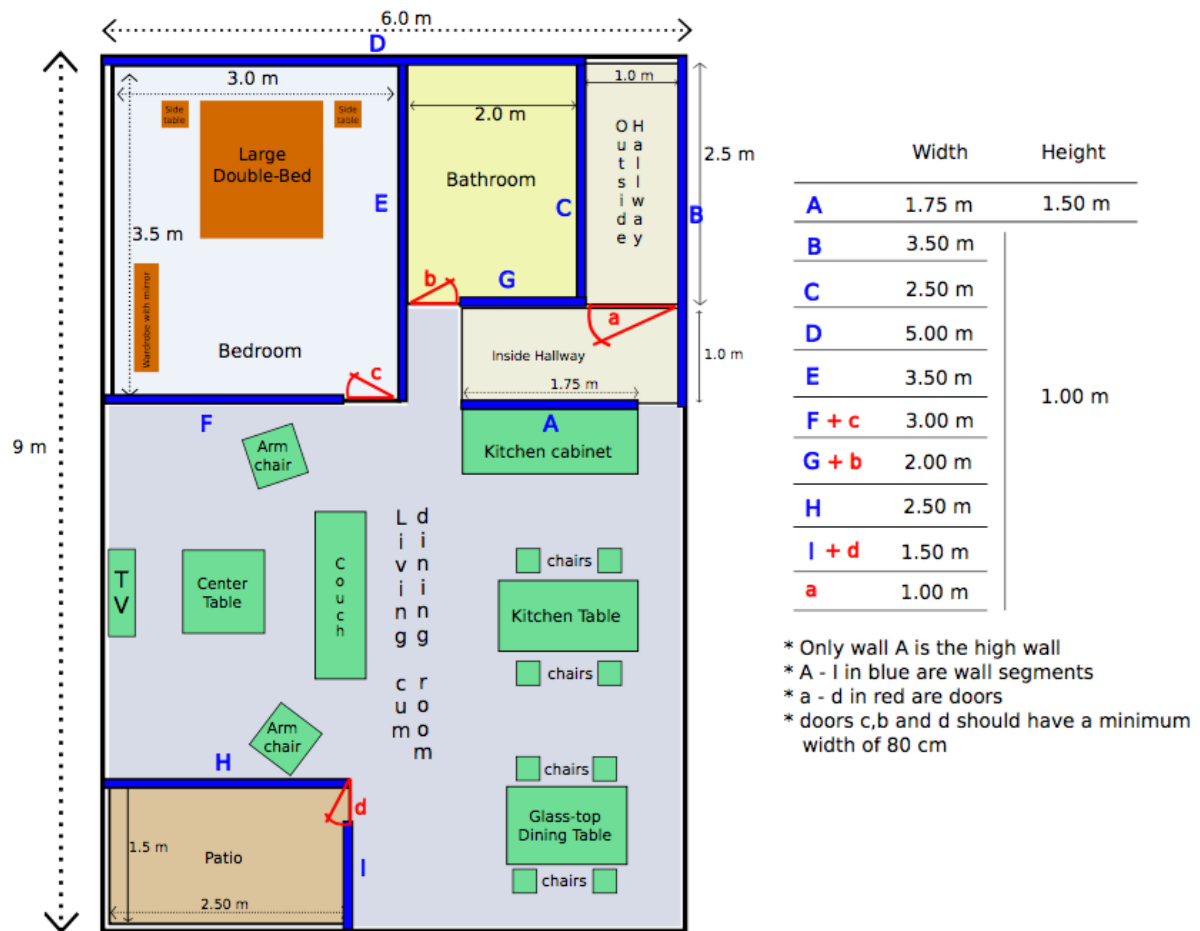
**Short description of the facility, including the type of furniture used, wall materials, available objects and robot platforms**

The test bed consists of a networked robot system composed of 10 IP (cabled-networked) cameras, wirelessly networked with several mobile robots, and an apartment which includes several home automation devices.

The apartment part is based on the ERL-SR rulebook and is composed of:

- Rooms (accessible to the robot): living room (windows, couch, two armchairs, one coffee table, one TV table and one large floor lamp), dining room (one glass-top dining table and two dining chairs), kitchen (one kitchen table and two chairs, kitchen cabinet with multiple drawers and wash sink, two wall-mounted kitchen shelves), inside hallway (with one coat-rack), bedroom (one window, a double bed, two side tables, two table lamps and one large wardrobe with mirror).
- Spatial areas (inaccessible to the robot): outside hallway, bathroom, patio.
- Well-levelled floor, uniform all over the testbed, but including carpets.
- Wooden walls, most of them 50cm high, but including one, behind the kitchen, 200 cm high.

Test bed layout, including dimensions, areas and room designs



### List of home automation devices available, including photo, make, model and main features

- Server: A computer used to manage the network.
- Switch: An Ethernet switch used to connect all the devices.
- AP: An Access Point the mobile robot wirelessly connects to. Acts as a bridge between WLAN and LAN. The Access Point (Cisco AIR – AP1042N-E-K9) works in Dual-band Standalone 802.11a/g/n.
- Ethernet Camera: 1 perspective camera facing the Outside Hallway. The AXIS P1344 camera parameters (frame rate, resolution, colour gains) can be changed over



Ethernet.

- Home Automation Devices:
  - 1 motor to control the window blinds,
  - 3 controlled power plugs,
  - 1 light dimmer,
  - 1 doorbell button.
- SMARTIF IO: This module controls the different devices/sensors existing in the house. It is prepared to add more devices in case of need.
- SMARTIF Server: Device responsible for the communication between the SMARTIF IO and the network.

### Motion Capture (MoCap) system available (make, model, and main features) if any

The apartment test bed includes a Motion Capture System (MoCap) based on 12 OptiTrack PRIME13 cameras (1.3MP, 240FPS). This system provides real-time tracking data of rigid bodies (position and attitude) at a very high rate.

### Other relevant information

The test bed includes many Navigation-Relevant Objects (e.g., couch, tables, chairs), Manipulation-Relevant Objects (e.g., glasses, cups, cans, plates, forks, knives, books) and Perception-Relevant Objects (e.g., cereal box, cans, cups, glasses).

Many of the objects in the apartment were selected to set a long-term agenda concerning perception, navigation and manipulation issues. There are pillows with different solid colours but also patterns, transparent and opaque cups, wooden and glass table-tops, mirror in the wardrobe front, etc.

**Current list of ERL Consumer Service Robots TBMs and FBMs for which the test bed is certified** (i.e., meets both the rulebook specifications and has available the required devices).

Benchmark	Minimum required system / devices	Available in Test Bed
TBM1: Getting to know my home	RSBB	Yes
TBM2: Welcoming visitors	RSBB, IP camera at entrance	Yes
TBM3: Catering for granny Annie's comfort	RSBB, HAD	Yes
TBM4: Visit my home	RSBB	Yes
TBM5: General purpose service robot	RSBB	Yes
FBM1: Object perception functionality	RSBB, MoCap	Yes
FBM2: Navigation functionality	RSBB, MoCap	Yes
FBM3: Speech recognition functionality	RSBB	Yes

*Table 1: List of the ERL-SR benchmarks with their corresponding required systems*