



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

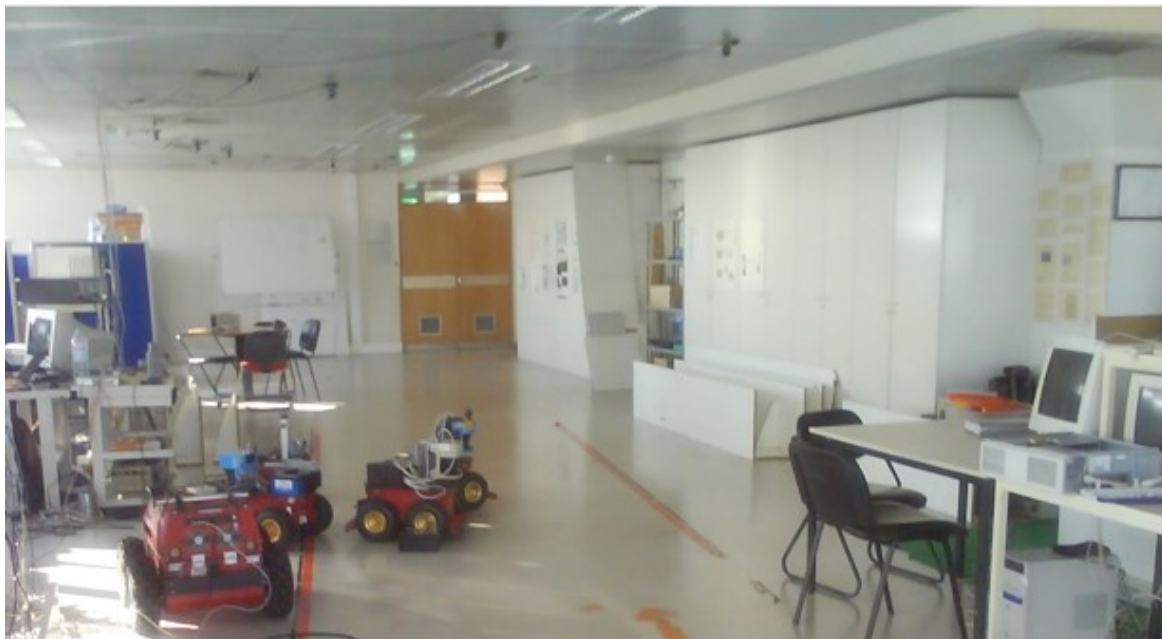
Designation of the lab/department/group where test bed is located: Intelligent Robots and Systems group

Name of responsible person: Pedro U. Lima

Contacts of responsible person:

- **E-mail:** pal@isr.tecnico.ulisboa.pt
- **Tel.:** +351-218418274

Pictures with overview of the test bed







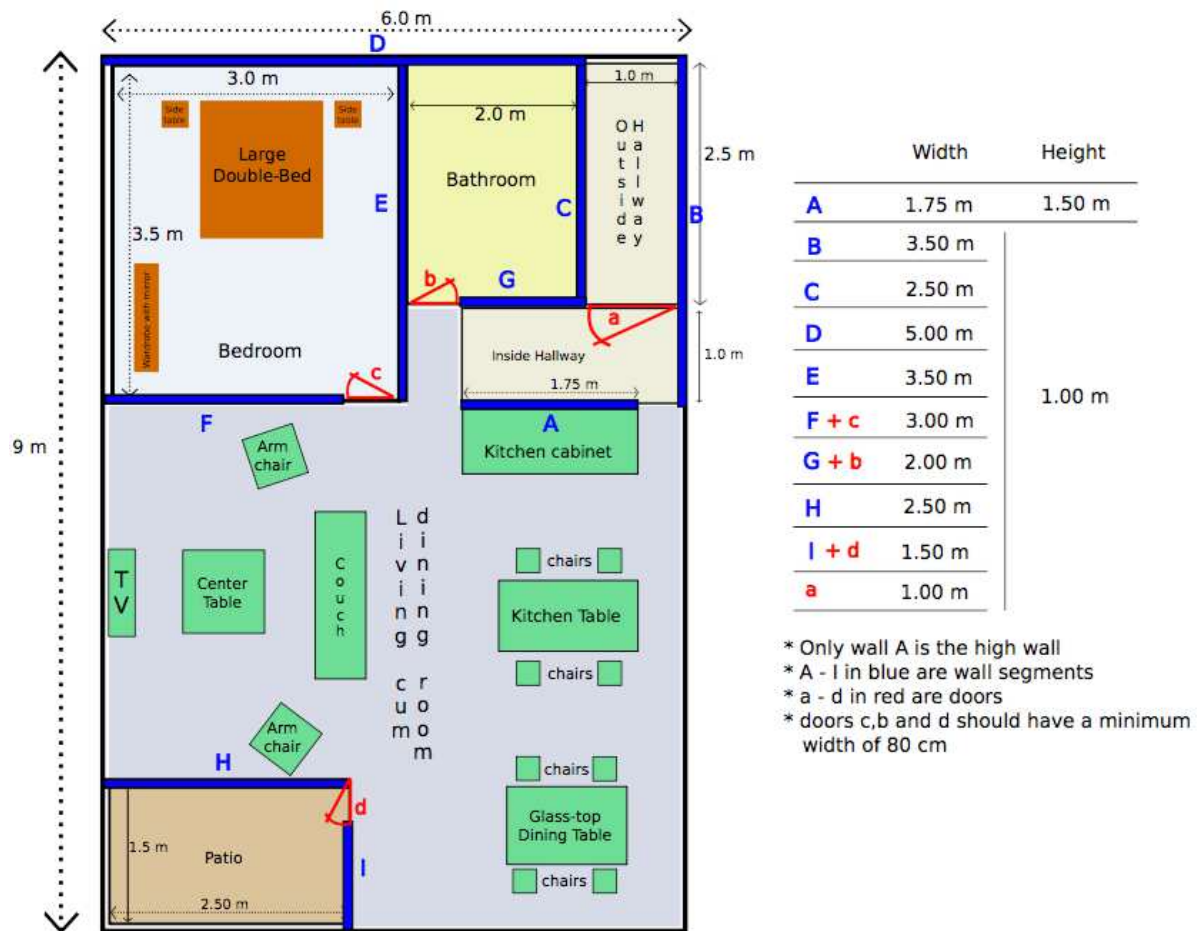
Short description of the facility, including the type of furniture used, wall materials, available objects and robot platforms

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