Open Invited Track Submission for IFAC WC2017, Toulouse, France

Demonstrator of reactive navigation and grasping in domestic environments with the Pepper robot

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Abstract: This open invited track addresses the topics of multi sensor based navigation and grasping with the human-shaped robot Pepper, from SoftBank-Aldebaran Robotics. Domestic environments are considered, which are in essence not shaped for robots and entail uncontrolled experimental conditions (illumination changes, projected shadows, acoustic noise, etc.), hardly predictable humans, mobile obstacles, etc. The developed algorithms will be publicly demonstrated during live experiments on Pepper platforms. To help authors to prepare their papers and source code, the website mentioned herebelow provides a downloadable software development kit and simulator, as well as additional information.

Keywords: Autonomous robotic systems; Guidance navigation and control; Perception and sensing.

1. INTRODUCTION

This open invited track is focused on multi sensor based navigation and grasping with the human-shaped robot Pepper. Domestic environments are considered, which are in essence not shaped for robots and entail uncontrolled experimental conditions (illumination changes, projected shadows, acoustic noise, etc.), hardly predictable humans, mobile obstacles, etc. The developed algorithms will be publicly demonstrated by their authors during live experiments on Pepper platforms.

2. IFAC TECHNICAL COMMITTEE FOR EVALUATION

TC4.3 Robotics.

3. DETAILED DESCRIPTION

The above text, as well as this section, will be publicly available on the website `http://laris.univ-angers.fr/fr/vie-unite/pepper-robot-demonstrator.html`.

SoftBank Robotics, the worldwide leader in humanoid robotics, makes and markets humanoid and programmable robots. In 2014, the company unveiled the human-shaped robot Pepper. Pepper is 1.20m tall, 48.5cm wide, 42.5cm deep, and weighs 28kg. It has two arms and a three-wheel driven mobile base, for a total of 20 degrees of freedom. Pepper is intended to be a "personal emotional robot", that is, a day-to-day companion endowed with the ability to perceive emotions of humans and interact with them in a natural and intuitive way, through its body movements and its voice. Several companies have been using it–SoftBank (Japan), Nestlé (Japan), Carrefour (Europe), SNCF (France), etc.–as an interface to surprise, entertain and inform their customers through interactive animations and demonstrations.

Pepper was not specifically designed for domestic use. However, it is endowed with enough capabilities to perform functions in domestic environments, which are in essence not shaped for robots due to uncontrolled experimental conditions, little predictability of human activities, etc. This is why contributions are called for, addressing the topics of **multi sensor based navigation and grasping in domestic environments**. A typical task may be stated as "go to the kitchen, get the medicine box on the table and bring it back", or "find the soft-drink can, take it and pour it into a glass held by a human"; it may entail vision- and laser- based navigation among dynamic obstacles, eye-arm coordination for grasping, dual arm coordination, etc. **A specific feature of this Open Track is that the developed algorithms will be publicly demonstrated during live experiments on Pepper platforms just after the oral presentations.**

4. ADDITIONAL INFORMATION FOR AUTHORS

The URL `http://laris.univ-angers.fr/fr/vie-unite/pepper-robot-demonstrators.html` *will point to a more informal webpage which will include the following practical information for authors. This webpage will be updated by the organizers on a regular basis. It will include a FAQ, possibly a forum, etc.*

4.1 Environment

The environment will be fully traversable, but won't be specifically prepared for the robot. The visual and acoustic conditions won't be controlled (illumination changes, projected shadows, etc.). Human passers-by and other mobile obstacles may populate the scene.

4.2 The Pepper robot

The mobile base of Pepper is equipped with lasers, ultrasonic sensors and gyroscope. Its head has two HD cameras (forehead and mouth), a 3D vision system (in the eyes). Each hand is underactuated: it has 5 fingers which can be opened or closed at the same time in order to grasp objects. Visit `https://www.ald.softbankrobotics.com/en/cool-robots/pepper`.

4.3 Downloadable software

You can easily get documentation and software. To download it, you just have to create an account and get the resources, e.g., `https://community.ald.softbankrobotics.com`.

Documentation   The documentation can be got from the URL `https://community.ald.softbankrobotics.com/en/resources/documents/language/en-gb`.

Software Development Kit   An SDK and the documentation can be got through the official community website (`https://community.ald.softbankrobotics.com/en/resources/software/language/en-gb`).

Pepper is ROS compliant!   Visit the ROS page for Pepper `http://wiki.ros.org/pepper`.

Simulator   A simulated robot can be used with Choregraphe, a software that can be downloaded from the Community website. Then, any code can be tested on a simulated robot (e.g., `http://doc.aldebaran.com/2-4/software/choregraphe/connection_widget.html`, section "How to connect Choregraphe to a simulated robot").

A ROS Gazebo simulator is available at `https://github.com/ros-naoqi/pepper_gazebo_plugin`.

4.4 Miscellaneous

FAQ   A FAQ will be maintained on this page.

Forum   We will install a dedicated forum and/or a mailing-list so as to maximize exchanges with contributors. This way, contributors can share their experience, interact with the organizers so as to refine scenarios, etc.

5. ABOUT ORGANIZERS

Patrick Danès is a Full Professor in Robotics at Université Toulouse III Paul Sabatier and LAAS-CNRS, Toulouse, France. His teaching activities concern robotics, automatic control and signal processing. His research has addressed various control and estimation topics in robotics, the most recent one being binaural active audition for robots.

Rodolphe Gelin is Director of Research, Head of Collaborative Projects, and leader of the Innovation team at Softbank Robotics. His interests are to develop new technologies for current robots and continue exploration of humanoid robotics.

Natalia Lyubova is a Research Engineer in the Innovation Department of SoftBank Robotics. Her topics of interest include artificial intelligence, computer vision and learning.

Alexandre Mazel is Software Innovation Director at SoftBank Robotics. His topics of interest include the exploration of new interactions between environment, humans, and humanoid robots, producing behaviors for production, research and demonstration.