BUTIABots

Brazilian United Team for Intelligent Automation

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Abstract

The ***Brazilian United Team for Intelligent Automation*** (BUTIA) is a team from the Universidade Federal do Rio Grande (FURG). In this presentation we describe the hardware, software and mechanical aspects of the Domestic Robot Intelligence System (DoRIS), and how it was designed to solve tasks in a domestic environment.

Hardware Aspects

DoRIS is built in 5 major parts, as shown in Fig. 1, that are: mobile base, torso, manipulator, sensors and head. Regarding the navigation, a customized third generation PatrolBot is utilized, which is a differential, programmable and autonomous general purpose mobile robot. For the safety of those around and for the robot's robustness, DoRIS has a torso of triangular cross-section measuring around 80 centimeters with shelves to hold it all together.

Fig. 1: DoRIS's mechanical construction.

There are two separate processing units inside the torso, one of them being an Intel NUC, used for ROS master and nodes that not require CUDA faster parallel computing, and a NVIDIA Jetson TX2, dedicated for GPU specific tasks, as the inference of deep neural networks.

Manipulator

The robot includes a self-built 5-DOF arm, employing Dynamixel MX-106T servo-actuators for the shoulder joints and Dynamixel MX-64T servo- actuators for the elbow, wrist and gripper joints. The structure of the links is mainly 3D printed in PETG polymer parts for the shoulder-elbow link, elbow-wrist and gripper frame, with some aluminum parts where a reinforced structure is required.

Software Aspects

The Robot Operating System (ROS) is used as middleware to connect all the packages and to enable them to work together. The core of our system is the Behavior module, that uses ROS Smach to execute each task as a robust state machine. In its construction, many simpler states and useful machines are implemented to be shared across the machines of multiple tasks, which guarantees modularity and less rework. The data used to perform the tasks can be a real-time measure, coming directly from the topics or services from sensors node bridges, or even memorized, coming from a World description module.

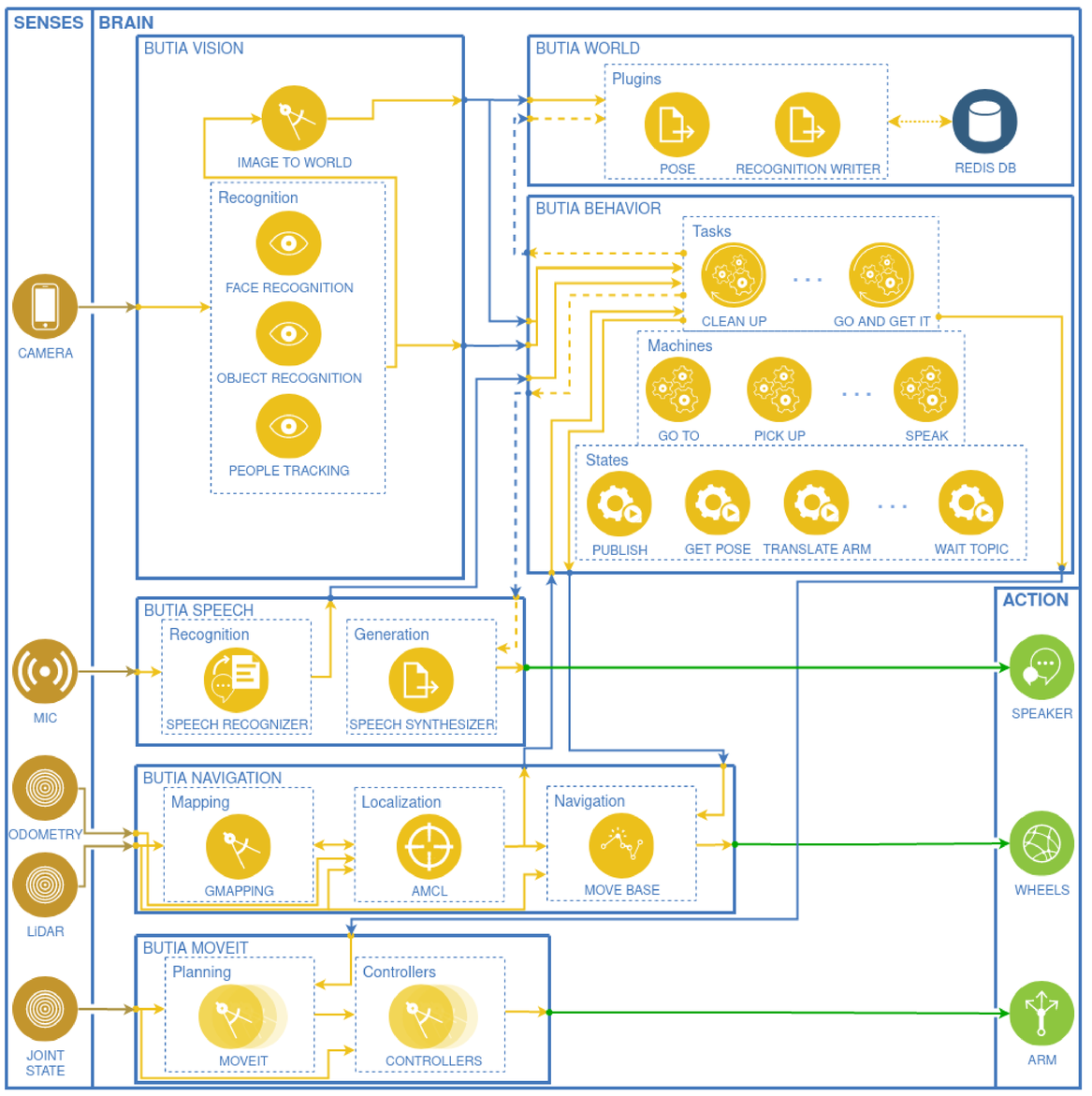

Fig. 2: Diagram of DoRIS software architecture. Communications done by pointed lines are requests and by normal lines are message passing.

Open-source and open-hardware mobile base for service robotics

This binational research project, funded by the RoboCup Federation, aims to foster the development of service robotics in Latin America, specifically through the creation of an open-source and open-hardware mobile base. The aging population in Latin America is growing rapidly, which will strain healthcare systems and create a demand for technologies to assist with elderly care. However, affordable solutions for young researchers in this field are currently lacking.

An Open-Source Robot and Framework for Research in Human-Robot Social Interaction

Human-Robot Interaction (HRI) is crucial for integrating robots into everyday life. To enable effective social interaction, robots need straightforward and understandable interfaces. While traditional screen-based interactions exist, virtual reality (VR) offers a more immersive and realistic experience. In this study, Jubileo, a robotic animatronic face, is introduced as a tool for research and application development in the field of human-robot social interaction. The Jubileo project provides not only a functional open-source physical robot but also a comprehensive framework for operating with a VR interface, facilitating immersive HRI application tests and faster deployment.

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