Warthog Robotics
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Introduction

Warthog Robotics is a traditional robotics research and extension group at the **University of São Paulo (USP)** that develops robotics technology. **Antares** is a service robot designed to contribute to the scientific and robotics community by assisting with household tasks. From a simple concept, Antares has evolved into a complex hardware and software system capable of performing tasks in the RoboCup@Home league.

Figure 1: Antares: Real robot (Left), CAD model (Right)

Hardware

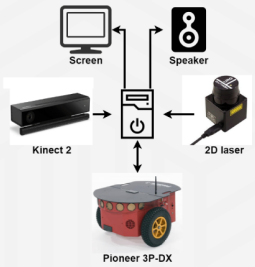

Figure 2: Overview of Antares' sensors and actuators

Antares' structure is composed by a **Pioneer 3-DX** as its main support, locomotion and power supply. It has a **LIDAR** and a **camera sensor**, a **LCD screen**, **external speakers**, a **microphone** and a **computer** to process and integrate the equipment's functions and environment interactions. The mechanical structure is metalon and plastic based and designed and manufactured for Antares.

Software Overhaul

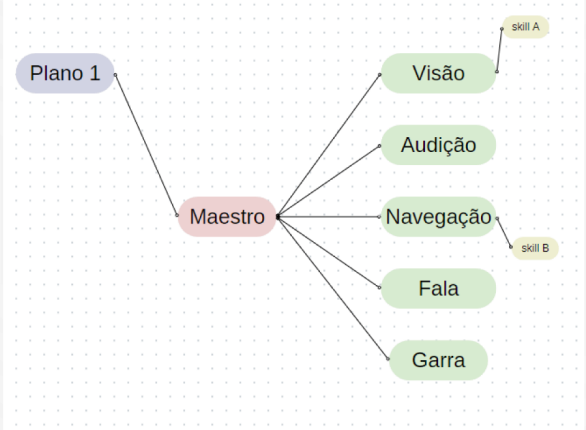

Figure 3: The components of the new architecture

- **Skills:** corresponds to the low-level actions, such as 'go to ...', 'listen to ...', 'find the object ...', etc.
- **Managers (Vision, Navigation, Speak, Listener and Arm):** customises the skills behaviours with custom arguments and queue the requests from the conductors.
- **Conductor:** communicates with the managers and the plans, forwarding messages in between the two components. Conductors redirect the requests from the plans to the suitable managers (vision, navigation, etc).
- **Plans:** implements the high-level planning for complex tasks. The plans coordinate skills to perform the competition tasks.

Architecture

The older architecture, based on state machines controlled by a central ROS node, was replaced with our new architecture. The new architecture can still be used with state-machines but **its more flexible** than the previous one.
With the overhaul in mind, the old nodes written in ROS1 (Robotics Operating System) are being updated to ROS2. In addition to improve software modularity and compatibility (for future updates), the **nodes are being implemented as Docker containers**, which will be stored on the group's cloud

Modules Update

- **Docker and various package updates**
- **Vision:** YOLOv8
- **Speech-to-text:** Whisper OpenAI and GoogleAPI
- **Text-to-speech Update:** NixTTs Python Package
- **Middleware:** ROS2
- **Person recognition:** Python package face_recognition

ROSaria2

When upgrading from ROS1 to ROS2, a problem was encountered: ROSaria, used for communication between the computer and the Pioneer 3DX locomotion base, had not been ported to ROS2. Since this is the main component of the robot's locomotion hardware, **it was necessary to develop a solution for data transmission between the ROS2 interfaces and the locomotion base's serial communication**. With no publicly available solution, it was decided to create a new ROS package, **zodiac rosaria2**, to upgrade ROSaria to ROS2.

Conclusion

The improvements made to the software and hardware mark a **new transformational moment for the team, which is ready to continue its development**. For future work, we aim to **validate our architectural scheme and improve its multi-system integration**, such as in activities such as follow me. In addition, additional studies on how to ensure precision in the manipulator are necessary. These innovations not only improve the functionality of the robot, but also open up new possibilities for practical applications and advanced research.