

# CAMBADA – An Open-Source Overview

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## Introduction

CAMBADA (acronym for Cooperative Autonomous Mobile roBots with Advanced Distributed Architecture) is the Middle-Size League soccer team of the Aveiro University, Portugal (Fig. 1). It is part of the IRIS research group in IEETA/DETI (Institute of Electronics and Informatics Engineering of Aveiro).



Fig. 1 / Middle-Size League final in RoboCup Portuguese Robotics Open 2016.

We acknowledge that RoboCup is a huge commitment from scientific and research groups all over the world on developing better and smarter robots that one day will be able to help us (humans) in our daily lives. To achieve this huge desideratum, sharing open-source solutions and scientific results among teams plays a crucial role.

This poster summarizes the CAMBADA contributions to the community in terms of open-source solutions.

## Agent Architecture and Tools

<https://github.com/CAMBADA/cambada-pub>

One of our research group main focus is on Software Engineering and Development Tools. These have proven to play a major role in the success of the team. In January 2015, we released a clean version of our software architecture, which also includes a simulation environment (Fig. 2) and a control and debugging application (Fig. 3).

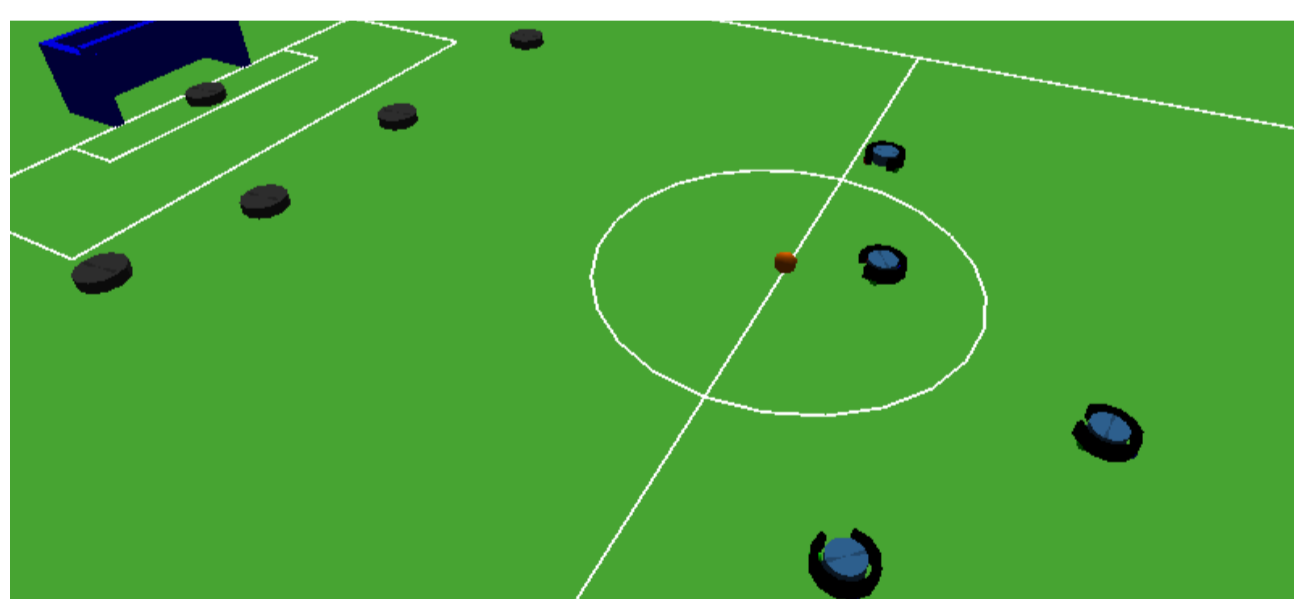


Fig. 2 / Simulation Environment

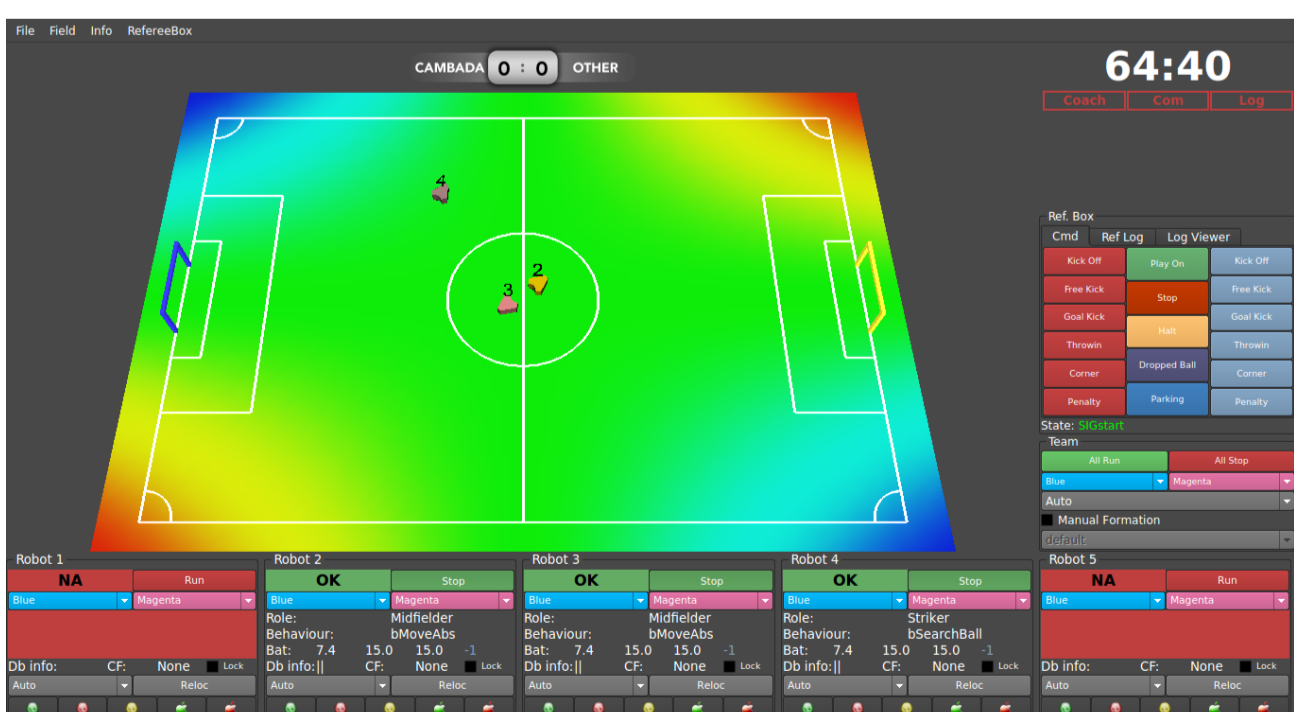


Fig. 3 / Basestation Application

CAMBADA wish to thank all team members that, over the years, have given their contribution to this overall work.

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## Hardware Platform

<http://robotica.ua.pt/CAMBADA/robocup2016.htm>

The Middle-Size League is already a very challenging one, which can make it even more difficult for new teams to join. This is our motivation to release our hardware (mechanical and electrical components – Fig. 4) every year together with our qualification materials for free download and use.

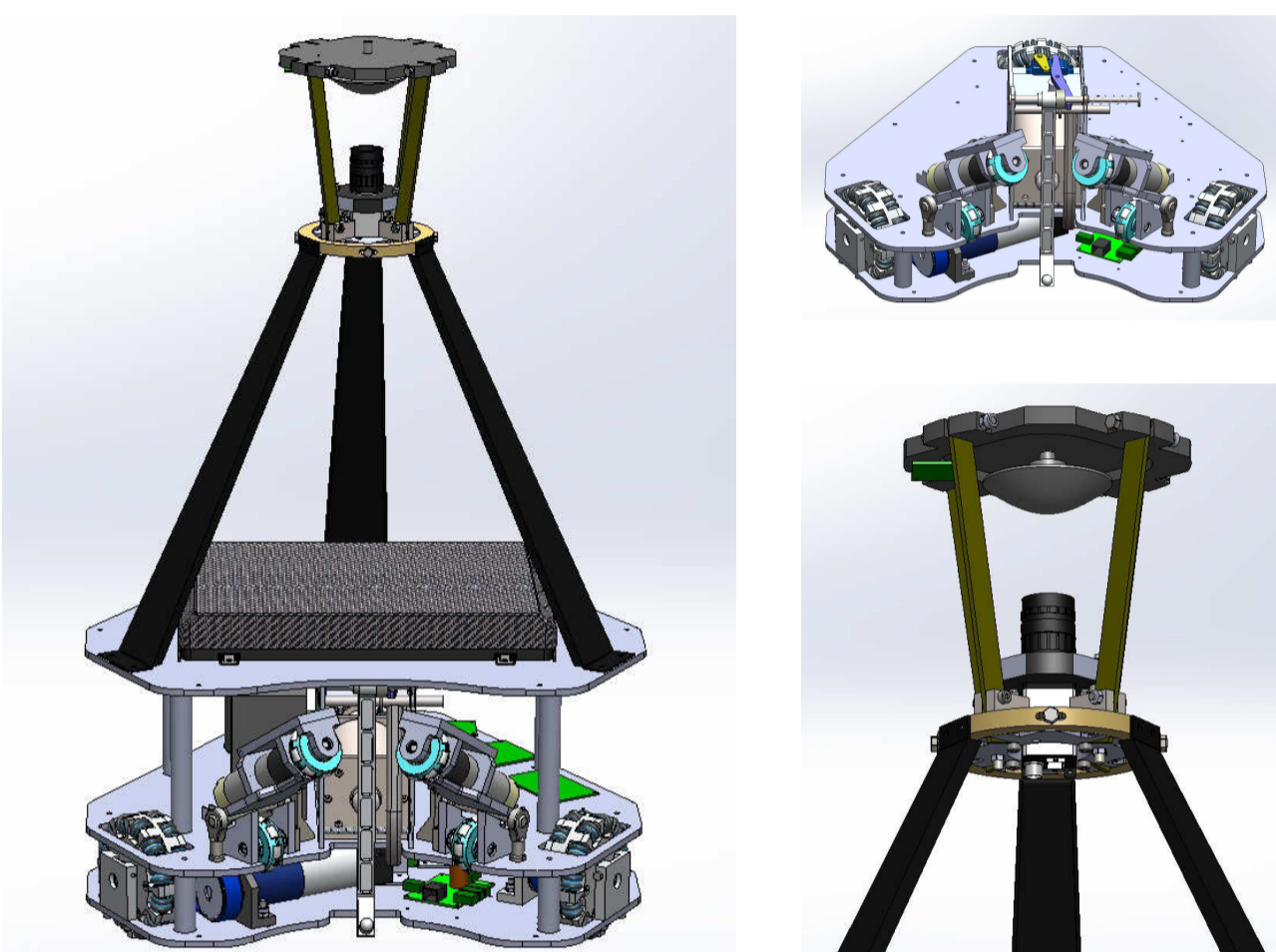


Fig. 4 / Some renderings of the current platform

## RtDB + Comm

<https://github.com/CAMBADA/cambada-pub>

The Realtime Data-Base (RtDB) is the middleware we developed that includes local state variables together with snapshots of remote ones (Fig. 5). This remote information is updated transparently to the application level by means of an adequate real-time management system (Comm).

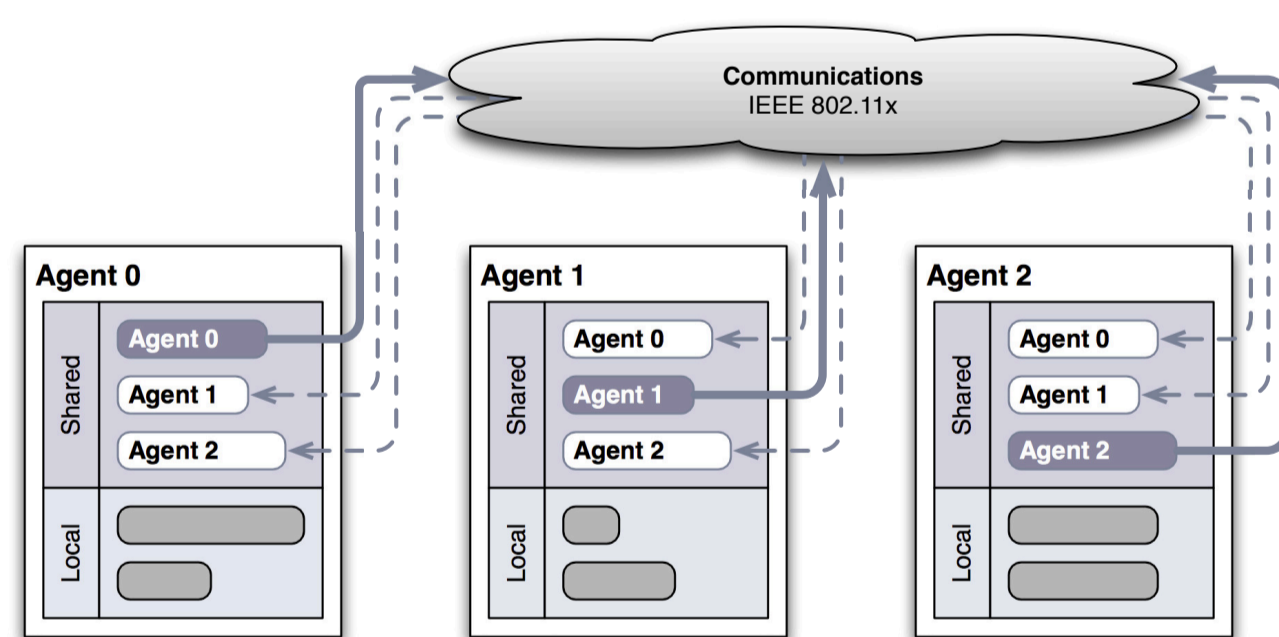


Fig. 5 / RtDB example with 3 agents

Moreover, the RtDB is a blackboard, accessible to the application using a set of non-blocking primitives that yields fast data access for both intra-robot and inter-robot communication. In the scope of the Middle-Size league, we know for a fact that, currently, several teams use our open-source solution.

## UAVision Library

<http://sweet.ua.pt/an/uavision/>

UAVision is a library for color-coded object detection that is currently being used by our robots. The library has a modular design and can be stripped down into several independent modules.

## RefBox 2015

<https://github.com/RoboCup-MSL/RefBox2015>

- **Integrated Information Logging** – during the matches, teams world state is logged and distributed after the match
- **More natural user interaction** - allow teams to change strategies during the match using voice commands
- **Authorized connected clients:**
  - Referee Client
  - Audience Client (Fig. 6)
- **Connection to a RefBox remote control** – this is a prototype that features an LCD screen for feedback, stop/start buttons and a vibration motor



Fig. 6 / RefBox2015 Audience Client

## V MSL Workshop

<https://www.youtube.com/user/CAMBADAmSl/videos>

We opened our lab to the RoboCup community by organizing the 5th MSL Workshop in our hometown during the European Robotics Week 2015 (Fig. 7).

- **Day 1** - formal presentations and an invited speaker talk. These presentations were live broadcasted and simultaneously recorded, being now available for on-demand visualization on Youtube.
- **Day 2** - hands-on session
- **Day 3** - open discussion, focused mainly on the roadmap for the league.



Fig. 7 / V MSL Workshop, in Aveiro, Portugal

## Conclusion

The CAMBADA commitment to contribute to the RoboCup community led us to release this set of tools, solutions and designs. We are absolutely convinced that it would have been impossible to get to the current level if we did not have had access to other open-sourced projects. This is our main motivation to keep contributing in the same direction – the only one capable of leading us (RoboCup community) to the objective of winning a football match with a team of robots against a team of humans by 2050.