# Mixed Reality Competition:
# 5DPO Team Description Paper

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**Abstract.** . 5dpo is a team created in 1998 in the Faculty of Engineering of the University of Porto in Portugal. The team regularly participates in RoboCup middle-size and small size leagues, achieving, in this last league very good results since its first participation. In RoboCup 2006, held in Bremen, Germany, the team was vice-champion on this league. The team research focus is on computer vision, robot control and data fusion. Thus, the research developed in the context of the small-size league by our team can be easily extended to new challenges and applied in a large extent to the new Mixed Reality league.

**Keywords:** Robotic Soccer, Eco-Be, Augmented Reality, RoboCup, Small-Size League, Computer Vision

## 1 Introduction

The Mixed Reality Competition is a new RoboCup league that started in RoboCup 2007. The Mixed Reality Competitions evolved from a simulation subleague held in RoboCup 2007 in Atlanta, where 12 teams took part.
The Mixed Reality Competitions at RoboCup-2008 will be part of the RoboCup Soccer Simulation League and cover a range of events, all of which serve to form a bridge between simulation and physical robotics through the use of standard robot hardware in the developed mixed reality environments. The approach is based on a miniature Eco-Be robot and the associated multi-robot system that deploys robots on a computer screen playing surface upon which an environment for the robots can be displayed.
This environment is very challenging for a team with our long background in RoboCup small-size and middle size league, enabling to test several algorithms and approaches difficult to test in a purely robotic environment. Thus, our team is greatly interested in start participating in the Mixed Reality league and associated development effort, starting in 2008.
The rest of the paper is organized as follows. Section 2 presents xxx

# 2 5DPO Team – Small-Size, Middle-Size Robots

## 2.1 Overview

The 5dpo team is affiliated with the University of Porto, Portugal. The 5dpo name is an important player in robotic competitions since the start on small size league in 1998 and latter also in Middle Size League and plan to have humanoid league team competing at the highest level soon.

The team is very visible both locally and internationally. The national visibility is due to frequent presence in national schools, demonstrations at the university and national RoboCup games. We also compete frequently at both European and World RoboCup events with nice results. Team members are also members of the national society for robotics and are present in the RoboCup executive committee.

## 2.2 Affiliations and people involved

Currently we have a total of 8 people that may be involved in the development of the 5DPO Mixed Reality team. These people include: 2 Phd students, 3 undergraduated student and 3 faculty members.

## 2.3 Participation and results in past robotic competitions

5DPO participates in several RoboCup competitions, small-size since 1998 and middle-size since 1999. The team has 2 podiums on World Robocups, 2 wins in European RoboCups and 5 podiums in European Robocups.

**Fig. 1.** 5dpo small size and middle size league robots

Recent and relevant participations:

- 1st place German Open 2007 (“small-size robots”), Hannover - Germany
- 2nd place RoboCup 2006 (“small-size robots”), Bremen - Germany
- 1st place RoboLudens 2006 (“small-size robots”), Eindhoven - Netherlands
- 2nd place German Open 2004 (“small-size robots”), Paderborn - Germany
- 3th place German Open 2003 (“midlle-size robots”), Paderborn - Germany
- 2nd place German Open 2003 (“small-size robots”), Paderborn - Germany

### 2.4 Organization of robotic related events

We have also been involved in the organization of several Conferences, Workshops and Competitions related with Cooperative Robotics and RoboCup:

1. Festival Nacional de Robótica 2004 – Portuguese Robotics Open 2004 (Organizing Comittee), Palácio de Cristal, Porto, April, 22-25, 2004
2. Encontro Científico do Robótica 2004 (Scientific Meeting of the Portuguese Robotics Open), – Conference Chair, Porto, Biblioteca Almeida Garrett, April, 23-24, 2004
3. BEST Course “Join the robolution” FEUP, September 2006

4. (numerous demonstrations at schools and in the university)

### 2.5 Past and ongoing funded research projects

We are/have been involved in several research projects concerning cooperative robotics and multi-agent simulation, including, among others:

- Portus Project: A Common Framework for Cooperative Robotics (FEUP + LIACC-FEUP + ISR-Porto) - FCT - POSI/SRI/41315/2001
- Lemas Project: RoboCup team for the Sony-legged league using learning (LIACC-FEUP + ISR-Porto) - FCT/POSI/ROBO/43926/2002
- ACORD: Adaptive Coordination of Robotics Teams, (LIACC-FEUP, Univ. Aveiro) - PTDC/EIA/70695/2006

In our website http://www.fe.up.pt/~robosoc more information may be consulted regarding these research projects.

## 3 Developments, Research Program and Educational activities

Our robotics and RoboCup experience is large our current research is:

- Cross platform strategic planning - study the interchange of our knowledge between the several RoboCup leagues and produce interesting gameplays with simple but effective strategies
- Virtual Chip Kicking - study the changes needed in the system to have an advanced game-play simulator with virtual controlled chip kicking ability and virtual 3D ball

We also plan to:

- Study Real 3D vision systems under RT – study data fusion of multiple inexpensive cameras (based on the small size vision system)
- Real Balloon Ball – Study the introduction of a real ball that could be similar to a balloon with close to zero weight – this ball can bounce and fly and would need the 3D vision system
- Human Team Interface – Study the interface to allow a team of humans to compete against a computer controlled team – very interesting for demonstrations

The implementation of such studies will bring new life to the citizen robots!

## 7 Conclusions and Future Work

Our team has a vast experience in general robotics and numerous well classified RoboCup participations. The Mixed Reality League is very interesting to allow further exploration of the 5dpo team's research. Work proposals include creating virtual controlled chip kicking such as exists in small size league. Our vast experience

in real leagues also enables us to aim at tests with real balls that can bounce and fly (a balloon with near zero weight).
We plan also on developing a vision system with automatic calibration based on our own 5dpo vision system for the small size. The relatively controlled environment of the Mixed Reality league, without the obvious difficulties of the small-size environment, offers the ideal framework for developing and testing this system

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