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## JOINT ACTIONS FOR AN AIBO TEAM

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### ASSIGNMENT FOR THE PROJECT 'DESIGN AND ORGANIZATION OF AUTONOMOUS SYSTEMS'

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VERSIE 0.3 – 4 JANUARY 2006

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### INTRODUCTION

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This document describes the introduction of joint action for a system of soccer playing robots, which are competing in the four legged league of RoboCup. The basis of the project will be the software developed by the Dutch Aibo Team 2005 [1], which was a port of the software [2] of the German Team developed in 2004. In the four legged league all software is open-source. The Dutch Aibo Team could also have chosen a different basis for their developments. The decision for the Germans was made during a previous project of the course 'Design and Organization of Autonomous Systems' [3],[4]. It was a good decision, because the German Team became World Champion in 2004 and 2005.

The goal of the RoboCup Project is to let a robot soccer team win from a human team in 2050. For that reason every year the circumstances become more realistic. This year the circumstances for the Aibo League are nearly equal to the previous year, to stimulate the emergence of teamplay [5]. It is the challenge for this year students to design and evaluate behaviors that make use of information from the teammates.



Figure 1: An example of teamplay: the passing challenge of the RoboCup 2006<sup>1</sup>.

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<sup>1</sup> <http://www.robocup2006.org/>

The project will deliver a report that describes the model of joint actions, and the experiments performed to demonstrate the value of this modification (favorably as function of the reliability of underlying modules), for instance by playing ‘fooling around’. ‘Fooling around’ is an extension of a passing game, as illustrated in figure 1, with an opponent that chases the ball. The applicability of the created model in a more complex game can be estimated by playing a full soccer game in the last week of the project. The modifications to the behaviors will be documented on a website and a technical report. The documentation will also include clear, correct and working instructions on how to install and use the software.

At the last day of the project the findings will be presented to the students of the course ‘Design and Organization of Autonomous Systems’. The invitation of this mini-conference will also be given to interested members of the Dutch Team. This event is scheduled on Friday 3 February.

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### TASKS TO PERFORM

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The following tasks need to be performed. The team has to decide how these tasks are going to be divided. A planning with global task assignments and detailed ticket distribution needs to be developed in the first week. The progress and modification of this planning will be discussed during a meeting each week.

- Download and read the descriptions of the Dutch [1] and German Team [6].
- Get sufficient machines to install and test the software, based on the planning and task assignments.
- Install all required software, like Open-R<sup>2</sup>, GameController<sup>3</sup> and TortoiseSVN<sup>4</sup>.
- Download the software of the Dutch Team<sup>5</sup>.
- Install and test the existing Dutch Team code by creating a logfile as described in the appendix of the Dutch Technical Report [1].
- Investigate what needs to be modified to the existing behaviours to the play the ball in a team.
- Extend this world representation to incorporate a chasing teammate so that fooling around is possible.
- Investigate the dependency of the new behaviours to the reliability and frequency of the provided information.
- Design a system that learns to select the appropriate kick depending on the location of the chasing robot and its teammates.
- Setup a structure for the report and make each team member contribute to this report, based on the agreed planning.
- Investigate the reliability of the used information during a real soccer game.
- Design promising modifications for the soccer game behaviours.
- If possible, get the software running and report as much as possible about the findings.

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<sup>2</sup> <http://www.germanteam.org/GT-install.zip>

<sup>3</sup> <http://www.cse.unsw.edu.au/~willu/GameController/>

<sup>4</sup> <http://tortoisesvn.tigris.org/>

<sup>5</sup> <svn://info.science.uva.nl/scratch/svn/DAT/trunk/DT2005/>

During the course of the project, it would become clear that the assigned task has a relation with many interesting research subjects.

- The on-line recognition of opponent robots. This task is on the agenda of many groups, and would be a significant contribution to the field.
- The simulation of opponent localisation by the broadcasting of the location by opponent robots.
- The localisation of robots on the field by independent means, such as ceiling cameras. This is not only valuable to improve the self-localisation, but also during the development of opponent localisation.
- Broadcasting the independent localisation as Oracle information to the real robots, to estimate the effect of reliable information to the team play.
- Learning to optimise the parameters in the current kick-library.
- Simulation of the movement of ball after a kick in the robot-simulator.

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#### SUGGESTED READING

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The following documentation, available on the web, is suggested reading before the project starts:

- [1] J. Sturm, A. Visser and N. Wijngaards: 'Dutch Aibo Team: Technical Report RoboCup 2005', October 2005, <http://www.dutchaiботeam.nl/research/publications/DAT2005TechReport.pdf>
- [2] Woiyl Hammoumi, Vladimir Nedovic, Bayu Slamet and Roberto Valenti: 'Improving self-localisation and behaviour for Aibo's soccer-playing robots', University of Amsterdam, February 4th, 2005. <http://www.science.uva.nl/~arnoud/education/DOAS/2005/Project2005/AiboFieldLocalization.pdf>
- [3] Brammert Ottens, Aron Abbo, Peter Johan van der Meer and Manfred Stienstra: 'Aibo Project 2004 - German Team Report', University of Amsterdam, January 29, 2004. <http://www.science.uva.nl/~arnoud/education/DOAS/2004/Project2004/FinalReport1.pdf>
- [4] Patrick de Oude, Tim van Erven, Jochem Liem, Tim van Kasteren: 'Evaluation of CMPack 2003', University of Amsterdam, January 29, 2004. <http://www.science.uva.nl/~arnoud/education/DOAS/2004/Project2004/FinalReport2.pdf>
- [5] RoboCup Technical Committee: 'Sony Four Legged Football League Rule Book' (2006 rules, as of November 8, 2005), <http://www.tzi.de/4legged/pub/Website/Downloads/Rules2006.pdf>
- [6] Thomas Röfer et al.: 'German Team – Robocup 2004'. <http://www.germanteam.org/GT2004.pdf>
- [7] P. Stone and M. Veloso: 'Beating a defender in robotic soccer: Memory-based learning of a continuous function, in *Advances in Neural Information Processing System*, p. 896-902. MIT press, Cambridge MA, 1996.

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