

Scorpius-3D Team Research Proposal on Simulated Soccer Environment with Humanoid Agents

Khashayar Niki Maleki¹, R. Yeylaghi Ashrafi¹, Sadegh Mokari¹,
Mohammad Hadi Valipour¹, Ashkan Rashedi¹, M. BoorBoor², and M. R. Jamali³

¹ Department of Electric and Computer Engineering, Faculty of Engineering, Shahid Rajaee University, Tehran, Iran

² Department of Electric Engineering, Islamic Azad University, South Tehran Branch, Tehran, Iran

³ Control and Intelligent Processing Center of Excellence, School of Electrical and Computer Engineering, University of Tehran, Tehran, Iran
{kh.niki, r.yeylaghi, s.mokari, m.h.valipour, a.rashedi}@srttu.edu, m.boorboor@gmail.com, m.jamali@ece.ut.ac.ir

1 Introduction

Creation of a mechanical machine in human shape, having the same locomotion and even more capabilities has always been one of the human beings desires. Thus research on humanoid robotics is one of the most exiting topics in field of robotics [3]. There are lots of projects in this field [4...7], most of them are focused on biped walking and running [1, 4, 6]. Now, after many researches, there are still some unknown secrets about human locomotion nature, physics and dynamics, which may increase difficulty of problem. Biped locomotion is involved with many complex processes, that is controlling a very large number of *degrees of freedom* (DOFs), the non-linear dynamics of the humanoid body and a wide range of interactions with the environment (gravity field, landscape, perturbations, etc.) [1]. The challenges we are involved in humanoid biped locomotion can be set apart in some separated sections such as; stepping, walking, running, etc. They are overlapped in some of controlling items. This separation is based on disparity in whole robot behavior and transactions between its modules and parts (e.g. joints, muscles) with each other and the environment. The most advanced commercial robots have gained impressive results (Fig. 1). Many different solutions have been experimented to achieve stable biped locomotion. Regarding *trajectory based* [1] that can be done with various optimization and constraint (e.g. ZMP, COP, etc) satisfaction algorithms, *using AI approaches* [8] regarding The neural network algorithms, reinforcement learning and neuro-fuzzy approaches. Simulation as a fast and also reliable approach is widely used in recent researches [1]. The recent RoboCup simulation environment named “spark” is a good platform for implementation of robots and the methods employed for controlling them.

In this proposal we described our implemented algorithm for controlling the “soccerbot” simulated robot and our objectives for RoboCup 2007 in section 2, our goals and future works in the next section.

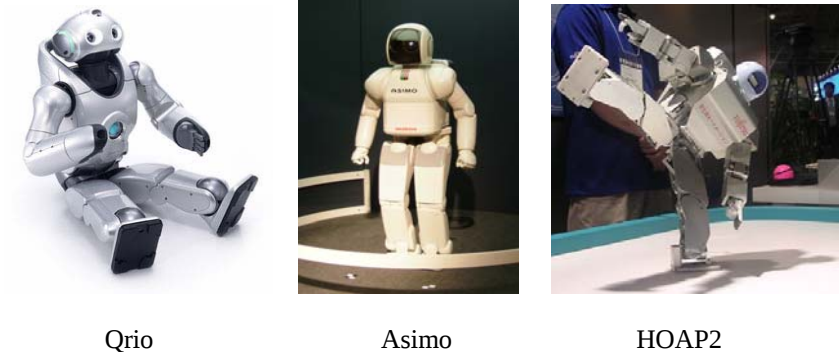


Fig. 1. Most advanced commercial robots

2 Implementation and objectives for Atlanta 2007

The most recent RoboCup soccer 3D environment is a platform for implementation and experimentation of humanoid robots in soccer field. In the previous version, the soccer agents used to be a sphere which had completely different locomotion. Inception and analysis of this new version of biped robot agents and its capabilities in a new environment was our first mission in this scope. The next one was body movement and some basic controls that was based on some heuristic experiments, biped locomotion with stability control is next one, results that we want to achieve them, are robot actions look like a soccer player, therefore we have implemented some primary skills in soccerbot such as walking, kicking, rotating, simple jumping and all body parts movement with our access to this humanoid robot joints.

After related researches about HOAP2 that is the most similar humanoid robot to soccerbot, we find a dynamical and mechanical human locomotion method that was implemented on HOAP2 fujitso humanoid robot [1]. This method helped us in walking, one of challenges that we involve with them and the most one.

At this level of researches and works, we have applied skills, which we want to show them in qualification step in Atlanta RC 2007, and now our objective is to improve soccerbot biped locomotion, and develop current controller to rich high speed in walking and so keep balance. Motivation of this development is to participate in Atlanta RC 2007 with some high level skills, such as speed based walking and control the robot in high speed biped locomotion (AI algorithms may be used), effective kick and keep balance, directional and smooth jumping, avoiding from fall down, standing on feet after undesired fall down, improved rotation that is related to movement speed, complete data update from vision and other sensors, and offer most items in a humanoid robot behavior in grass field at all.

3 Goals and future works

This stage of Soccer Simulation in Robocup competitions is a good condition to see the result of previous researches in high level skills on a humanoid simulated robot. So we want to enter to another phase of humanoid soccer robot skills, which we've researched in them on previous sphere version of soccer simulation server [2]. Those skills can be shoot, dribble, pass, powerful prediction, and etc. And at last control robot behavior in this multi agent system as an efficient object in individual manners and whole part team strategies.

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