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

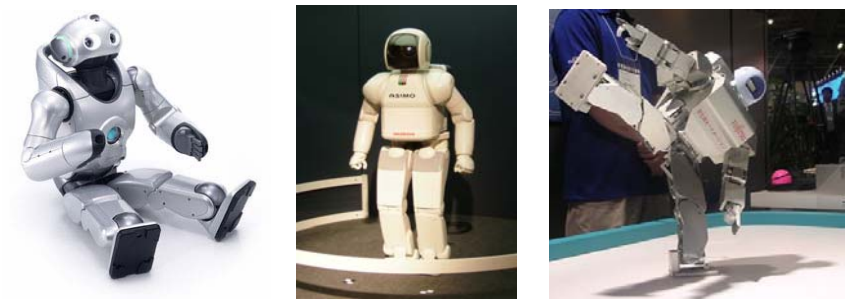
Khashayar Niki Maleki[1], R. Yeylaghi Ashrafi[1], Sadegh Mokari[1], Mohammad Hadi Valipour[1], Ashkan Rashedi[1], M. BoorBoor[2], and M. R. Jamali[3]

[1] Department of Electric and Computer Engineering, Faculity of Engineering, Shahid Rajaee University, Tehran, Iran
[2] Department of Electric Engineering, Islamic Azad University, South Tehran Branch, Tehran, Iran
[3] Control and Intelligent Procesing 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.



Qrio Asimo HOAP2

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 or 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 jaumping, 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.

References:

1. Christian Lathion, Computer Science Master Project, "Biped locomotion on the Hoap2 robot", Biologically Inspired Robotics Group, December 15, 2006

2. Kh. Niki Maleki, R. Yeylaghi Ashrafi, S. Mokari, M. Hadi Valipour, S. Mahdi Hoseini, M. R. Jamali, Caro Locus, "Decision Making in RoboCup Soccer Simulation 3D Environment," Robocup International Symposium, Atlanta, 2007
3. Shuuji Kajita, Takashi Nagasaki, Kenji Kaneko, Kazuhito Yokoi and Kazuo Tanie, "A Hop towards Running Humanoid Biped," P d i n g s *of* me 2001 IEEE, Intematlonal Conference on Robotics *L* Automanon, New Orleans. U April 2001
4. Gienger, M., etal. 'Toward the Design of a Biped Jogging Robot,*' *P n x* of the 2001 ICRA, pp.414w4145. 2001.
5. Hirai, K.. Hirose. M.. HaiLawa. Y. and T a k e d . T., 'The Developnrnt of Honda Hvmaocid Robo~" Proc. of the 1998 ICRA. pp.1321-1326.1998.
6. Inoue, H., Tachi. S.. Nakamura. Y.. .W, K.. et.al, 'Dvaview Of Humanoid Robotics Project of MET' Roc. *Int* Symp. Robotics. Pp.1478-1482, 2001.
7. NirhiwaLi,K., Sugika,T..Ka%ami.S., Kanehim.F.,lnabaM.,andlnoue, H., "Design and Development of Research Platform for Perception-Action Integration in Humanoid Robot: H6:' Pme. Int. Confererre on Intelligent Robors and Systems, pp.1559-1564. 2000.
8. Yamaguchi, I., Soga. E., Inoue, *S* . and TaLanishi, A., "Development of a Bipedal Humanoid Rob1 - Contml Method of Whole Body CaoFeraIive Dynamic Biped Walking -," Roc. of the 1999 ICRA. pp.36b374. 1999.
9. Duško Katić, Miomir Vukobratović, "Control Algorithm for Humanoid Walking Based on Fuzzy Reinforcement Learning," SISY 2006 • 4th Serbian-Hungarian Joint Symposium on Intelligent Systems