UI-AI3DD 2008 Research Proposal

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Abstract. The form of human's metatarsus is very important in humanoid actions such as walking and running. Therefore we have decided to divide the metatarsus into pieces so that the agent can control it's balance more easily. To reach this goal we add a phalanx joint to metatarsus. In addition, a trainer has been implemented to enable developers to better control and analyze their agent. The trainer can be used to control and move the joints of the the agent through the use of the keyboard.Also to make the environment of the soccer server more interesting we have added some sounds to each state of the game.

1   Introduction

In order to make the environment of the simulator more realistic and interesting, and to make the implementation of algorithms easier,we have decided to change and develop some parts of the server. The team has also developed a few features for the enhancement of the Humanoid simulators. Moreover we have tried to make simulator compatible with different types of physical engines. Therefore our main efforts have been concentrated on the following four parts:

1. Developing foot architecture
2. Physical Abstract Layer(PAL)
3. Sound system
4. Developing a new Trainer for Spark agent

In the following sections, we will describe each item separately.

2   New foot design for Simspark Agent

Our goal was to develop a foot with the right trade off between mobility and stability. The design consists of three sections: the hind foot, the fore foot and the phalanges as shown in Figure.1. The foot has one passive degree of freedom (DOF) that represents the hind foot, and another passive DOF for the phalanges.

At heel-strike and at toe-off the ankle position is not constrained in one fixed position. This gives the ankle an addition degree of freedom. During the stance phase the contact position moves from the heel to the toe. With this new design of foot the center of rotation follows the same motion. This means that the lever arm of the ground reaction force is already reduced with respect to a flat foot, where the ankle and the center of rotation are constrained in the same fixed point.

2.1 Phalanx's (Toe) role in walking

The SPDMS [sole pressure distribution measurement system] was developed for the purpose of investigating the role of humans toes and the change of the sole pressure distribution during a walk by the existence of the toes. We can conclude that the big and the second toe work effectively when all toes exist while walking, the existence of the big toe is important to realize a normal walk, and the toes have a role in stabilizing the walk. The current agent's foot is flat and does not have the advantages of the existance of toes while walking. Therefore, we decided to create a big toe and a rectangle instead of other toes as phalanges. The foot is developed to mimic the human one, this makes the calculation of the movement models more efficient.
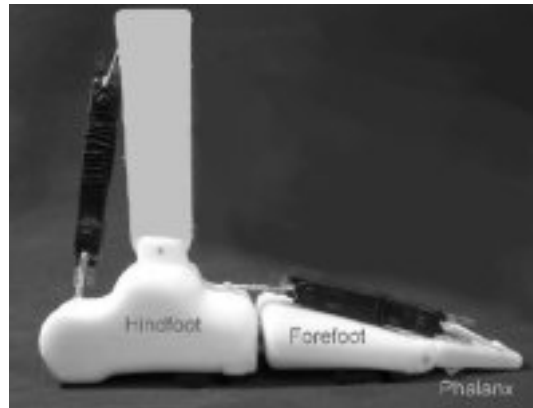

Fig. 1. Foot Design

3 Trainer

Considering the new humanoid agents, the trainer class of the simulator is very restricted. A more featured trainer will facilitate motion desing and implementing optimization or learning algorithms. At first, it will let the trainer to put the

agent in a desired shape. Later, it is possible to let the trainer describe a full state including physical properties (e.g. velocity) of the agent's body parts.

4 Soccer Sound System

The Sound is one of the parameters that makes the environment of the soccer sever more interesting. In order to add the sound to this environment there are some libraries such as SDL Mixer and fmod that could be useful for this goal. We have implemented a class named SoccerSound that uses SoundStream methods such as Load and Play. In this class, in each cycle the state of the game is obtained and a relative sound is played. For example whistle for Kick off state and hooray... of fans for Play on state.

5 Future Works

Due to the limited available time weve had for the development of the soccer simulator environment,the team has mainly tried to familiarize and adjust itself with the new server. We have some plans to implement till the contest. One of our plans is extending the sound system and adding new sounds to soccer server. For example sound of ball collision with the ground. We also want to add a statistic menu at the end of the game to give some information about the game. We will extend the TrainerCommandParser class in the simulator to make the implementation of the learning algorithms and motion design more easier through communication with the supervisor. We also plan to add a Physical Abstraction Layer(PAL) to the sever that makes the server compatible with different types of physical engines. So that the sever can use different physical engines for simulation.

References

1. Thomas W. Secord, H. Harry Asada, A Humanoid Foot with Polypyrrole Conducting Polymer Artificial Muscles for Energy Dissipation and Storage IEEE Int. Conf. on ThD5.1 Robotics and Automation 2007
2. G. Gini, U. Scarfogliero, M. Folgheraiter, Human-Oriented Biped Robot Design: Insights into the Development of a truly Anthropomorphic Leg IEEE Int. Conf. on Robotics and Automation Roma, Italy, 10-14 April 2007
3. P. Sardain and G. Bessonnet, Gait Analysis of a Human Walker wearing Robot Feet as Shoes, IEEE Int. Conf. on Robotics and Automation, pp.22852292, 2001.
4. K. Adachi, B. Endo and S. Nishizawa, The Trajectry of the Point of Application of the Resultant Force of Body Mass at Different Waikng Speeds -Statistical Analysis of Human Walking- , Folia Primatol, Vol.66 , pp.160180, 1996.
5. L. Nolan, D. C. Kerrigan, Keep on Your Toes: Gait Initiation from Toe-standing, Journal of Biomechanics, Vol. 36, No. 3, pp.393401, 2003.
6. D. Prampero, P.E, The Energy Cost of Human Locomation on Land and in Water, Int. J. Sports Med., Vol.7, pp.5572,1986.

7. Katic D, Vukobratovic M: Control Algorithm for Humanoid Walking Based on Fuzzy Reinforcement Learning.
8. Parseghian A: Control of a Simulated, Three-Dimensional Biped Robot to Initiate Walking, Continue Walking, Rock Side-to-Side, and Balance.
9. Stone P: Layered Learning in Multi-agent Systems.