UTUtd2004-3D Team Description Paper

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Abstract. 3D soccer simulation is a new section of RoboCup simulation league, which will be held at the RoboCup 2004 for the first time. It is a more realistic and interesting version of the soccer simulation server 2D. The simulator is implemented based on simulation system[1] and SPADES[2] simulation middleware system. UTUtd-3D is a new team based on the experiences of UTUtd-2D team. Since the simulation server 3D is recently introduced, we have started our work from scratch and have spent most of our effort on the agents' basic skills, especially on ball handling and the player motion acceleration control. The team strategy is focused on the positioning of players and the team formations....

1 Introduction

UTUtd-3D is a new team, which started its activity based on the experience of UTUtd-2D in the soccer simulation leagues, at the Parallel Lab. in Math and Computer Science Department of Faculty of Science, University of Tehran. RoboCup soccer simulation 3D project is our team members' final project of BS Degree. Our goal is to have a research project on Multi-Agent Systems (MAS) and their implementations in the simulated environments.

In MAS, the agents are defined in a world model and act autonomously based on the teammates designed goal. RoboCup is a great application for this purpose. RoboCup Soccer Simulation Server 3D (rcssserver3D) is a model of physical world and is based on SPADES[1], which gives us unique properties. SPADES is an event-based system, which can be distributed among several machines. So we have focused on the design of Agents and have not restricted the design with networking and time management problems. For making a complete simulation with SPADES, it's enough to have a world model and some agents, which think, act, and sense. Each agent receives data and sends actions. Rcssserver3D is relatively new and it is different from 2D, therefore the work has

[1] Macro kogler and oliver obst.Simulation League: the Next Generation, springer 2003.
[2] System for Parallel Agent Discrete Event Simulation witch was first introduced at the Robocup 2002 Symposium.

been started from basics and we intend to create a base source code with software engineering concepts.

The structure of this paper is to be as follow: Section 2 describes agents' skills, which are now the most fundamental problems in rcssserver3D. The most effort has been spent on improving basic skills, especially localization of the player, ball handling and player motion acceleration control. Section 3 describes the team's strategies, player types, player positioning and the team formations. Last section is conclusion and also describes some ideas for future works.

2 Agent Skills

In simulated environments like RoboCup, the agent is an entity that can sense, think and act. The agent has some special skills, which are used to fulfill the team's goal. These tasks should be very well developed to get success in 3D environment, which is more complex. Since there are limited sets of commands for agents in the current version of rcssserver3D (just Kick and Drive), it is difficult to develop good skills. So far, our agents have the ability to shoot, pass, dribble and ball intercepting.

A moving agent needs to know its current position in the field to do any of these tasks. For agent localization, the agent's distance from surrounding flags in the field is used. Each time the agent senses, it gets the relative position of the flags. Thus, we need to know the player's velocity, so a velocity estimator function has been developed for the program.

Another important issue is the player's motion control. The problem is to stop a player in a defined position, regardless of its current velocity and direction, but because of player's mass, when we stop accelerating to the player, it doesn't stop immediately and it takes some distance to stop. The only thing we can apply is the Drive command. The physical solution of this problem ends up to a complicated differential equation, which has a set of possible solutions. We choose one of them by binding the problem with an estimator function which has nearly an optimal error. We find a force, which has a direct relation to the distance between the player and the destination position based on a decision-making function; it decides whether the speed must be increased or decreased. It also determines the proper direction for this force, which consists of two distinct elements: Radial and Perpendicular. Radial is the direction of vector connecting the current position of the player to its destination and the perpendicular direction makes 90 degree with radial direction.(Fig.1 shows an example)

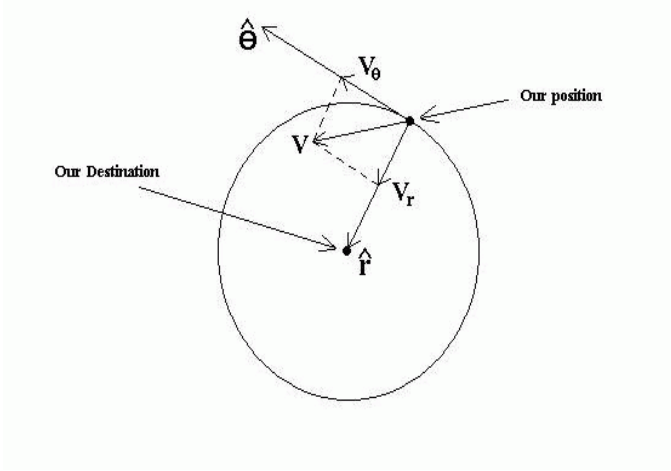

Fig. 1.

3 Team Strategy

In Multi-Agent Systems such as soccer simulation, in addition to individual player's skills, the team needs a general strategy to guide the agents to choose and use the best actions. In order to have a synchronized team, it is necessary to have a good tactic, formation and players' positioning. To build up our team strategy, we have used the SBSP[2] method and formation idea used in UvA-Trilearn 2003[3] which was implemented in 2D soccer simulation. The default formation in our team is 4-3-3, which is an offensive formation. Whenever our team owns the ball, the process will be to find the position of the other teammates, pass the ball through and take it to opponents' field and at last score a goal. And if our team doesn't own the ball, according to each player's position a factor and a range are defined to help it to choose the best action to use. Different player types can also be defined (i.e. goalie, forward wing, etc.); some of the tasks of players are unique like goalie. We have already started defining these tasks and their developments will be fulfilled very soon.

4 Future works and conclusion

Basic skills of our agents and team strategies, which have been developed so far, are described in this paper. All of these works has been implemented in a very short time and there are several ideas that we are developing now or planning as further works. Improving the agents' skills is one of the items in our agendas. Indeed there are several physical behaviors in a real soccer competition that can be applied in a 3D simulation like heading, tackling, actions of goalie, etc and we intend to implement them in our simulation.

The most important point in teams' strategies is to find a good decision-making algorithm to apply. A player who has the ball in control, according to the parameters (which is mentioned in section 3) should decide whether to dribble, pass or shoot. There are many strategies to choose for the team and we intend to use the idea of "Globally Computed Geometric Area"[4] introduced by UTUtd-2D team. This idea, which uses fuzzy algorithms, assigns a number between zero and one for each (x, y, z) position in the field every moment. This number which is calculated with the function g(x, y, z) expresses how much position (x, y, z) is strategic. It means that at the current moment, having both player and ball in that position how much it can help the team to achieve more goals. For example the value of g(x, y, z) in somewhere near the opponent goal where is suitable place to shoot through the goal is one and in somewhere with lots of opponents is zero , because simply we have no chance to make a score. There is also another function; p, which changes from one player to another and, its value depends on the relative positions of the teammate players, opponent players and ball, etc. If the position of the player is (x, y, z), he should kick the ball to a point, which has the maximum Expected value (g*p). This maximum value can be calculated with finding the maximum gradient of g*p.

5 Acknowledgement

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