UQ CrocaRoos2k2 Simulation Team

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1 Overview

The CrocaRoos simulated soccer agent is a development platform, to test the feasibility of multi-agent intelligence systems, and algorithms determining the future locations of dynamic objects. The second determining factor, in the design of the base, is to make the agent small and efficient enough to be included as the intelligence systems of physical robot teams. These two factors largely affected the design of the CrocaRoos player-agent base.

Multi Agent Planning System (MAPS) has been used successfully in all of the University of Queensland Robot teams that have participated in RoboCup Robot Soccer World Cups[1, 2]. MAPS requirements are primary focus in the design of the agent.

MAPS technology was developed for use in the University of Queensland's small-size league team, the RoboRoos. MAPS has demonstrated very promising results as a general coordination system in both competition and testing environments[3–5]. It improves coordination among agents by choosing individual goals for each agent that will improve the probability of achieving the team's goal. MAPS coordinates agents through the superposition of potential fields. Each field reflects the probability of positive or negative influence of an environment attribute on the team's goal in the near future. The summation of all these fields, calculates the best choice of action for a particular agent and where on the field it should that action should take place.

In the small-sized league, MAPS utilizes a world model obtained from an overhead camera, and as such has a complete world model. Even with this world view MAPS considers the world from each players perspective when making decisions that accomplish coordinated multi-agent plans[3].

Each robot receives a complete world model from the vision system as well as the MAPS command, which when combined with its own reactive navigation routines, enable it to navigate or kick to the desired location.

In RoboCup Simulation League each agent has to perform independently, utilizing data received from the server as sensor information to build a world view. Data received by each player is relative to that player. MAPS, on independent agents, has to determine actions that will fulfill teams goals based on individual observations. To determine these actions MAPS requires a complete as possible world view.

CrocaRoos 2001 was the previous incarnation of the simulated agent. The former base had a linear approach to processing the data and determining an action.

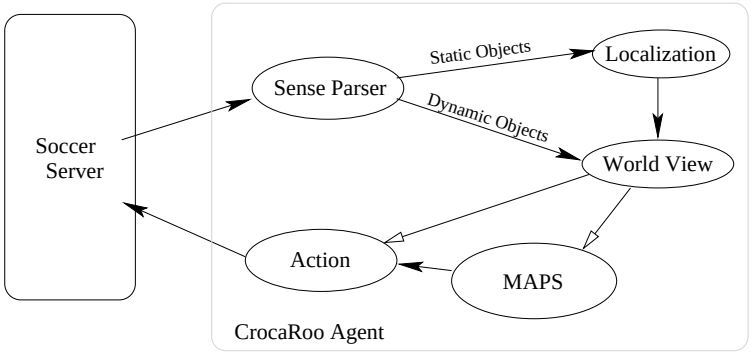

Fig. 1. The CrocaRoos 2001 Player Agent Architecture.

The former player agent took the sensor data provided by the server and manipulated it to get the location of the player and the remaining dynamic objects, the other players and the ball, creating the player world view. This manipulated data was then given to MAPS which determined a plan for this player with respect to the team's goal (kicking the most goals). The Action block, using a form of behaviour intelligence and basic subsumption, then determined how best to perform the desired action. Figure 1 shows the data flow diagrammatically. These blocks were independent of each other but required the prior block to pass the necessary data so that the block could fulfill its own destiny.

While fulfilling the agents goals, passing the required information to MAPS, and being lightweight, problems where apparent with this base. The forming and application of actions appeared to be retarded. Players would move to intercept a pass after the ball had passed them if at all. The bulk of this problem stemmed from the modifying and passing of the data between the blocks, with the player-agent more often than not reacting to old sensor data rather than current or future data.

Another foreseeable problem with the implementation is the conversion from a linear approach to data manipulation, to a parallel or multi-tasking approach as algorithms for predicting world models becomes more processor intensive.

CrocaRoos 2002 has been redesigned to address those issues. It maintains the same action block structure, Lexical Analyzer, Locate, MAPS and Action, but the data no longer passed linearly from one block to the next. Instead, the data is stored stored centrally and each block accesses it as required.

The retardation of the an agent actions was due to decisions based on aging sensor data[7]. Data in the CrocaRoos2k2 agent is kept centrally and the blocks are divided into those that generate the information and those that use it. This central memory holds a history of actions, locations, poses and velocites of the ball and players, as well as holding a prediction of those atributes.

The Locate block uses a history of locations and velocities of the ball and poses and velocities of the all the other players to predict likely world models. Locate also takes

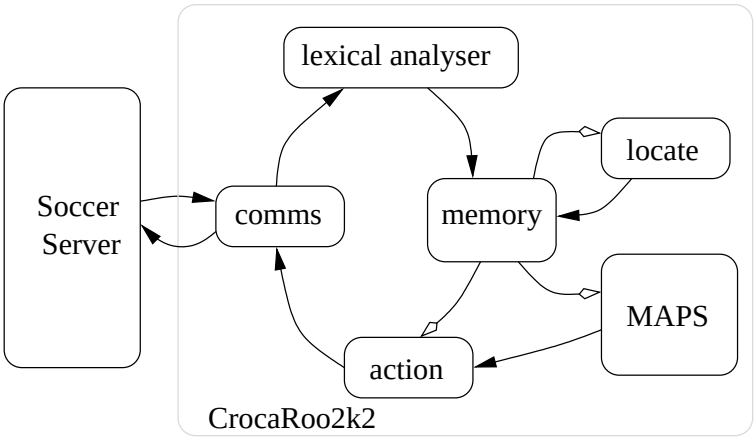

Fig. 2. The CrocaRoos 2002 Player Agent Architecture.

the raw sensor data, manipulated by the Lexical Analyzer using it to correct and update the predicted world models.

MAPS now bases it decisions on the most probable future world model, forming a plan on a what an agent will be doing instead of what it should have done. The Action block converts MAPS' desire to a suitable action to be sent back to the soccer server.

While this concept is similar to that used by the CMU99 team[7], the development of the predicted world model utilizes MAPS as a filter to determine probable locations of players. By determining the probable best actions for each player, the set of likely positions for that player is reduced.

2 Continuing Work

MAPS is currently configured as though it where still receiving a reliable single global view of the field and as such makes plans as though it has correct information of the entire field. To make a decision in the required time, the grid MAPS uses to generate a plan is necessarily coarse. Working in conjunction with determining the most probable locations of moving objects, the MAPS grid and parameters will be refined so that MAPS develops plans more for the immediate area surrounding the player, and on a much finer grid.

Work is also continues on the prediction of where moving objects will be in the robot's near and immediate future. This information and the player agent code eventually helping the GuRoo, the University of Queensland's humanoid robot[6], play soccer, and enabling other teams of robots to work safely in heavily dynamic spaces.

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