Research into Robots Playing Soccer

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What is RoboCup

- RoboCup is a competition of robots playing soccer
- 1991: Alan MacWorth posed this as a challenge problem for AI
- 1997: Dr. Hiroaki Kitano organized the first competition in Japan
- Yearly event. 2000 World Cup in Melbourne

What are the Problems

- Hardware – Mechanics, Actuators, Sensors
- Cheap, robust, reliable platform
- Computer Vision
- Localization, Identity
- Control
  - Accurate, robust, flexible
- Path Planning
- Dynamic obstacles
- Task Planning
- Real-time domain

Control

- Non-holonomic control problem
- Non-linear
- Reinforcement learning
**Path Planning**

- Find a way through a set of obstacles (static or dynamic)

**Dynamic Path Planning**

- Multiple moving obstacles
- Real-time constraint

**Task Planning (AI)**

- When to shoot? When to pass?
- Play defensively/offensively
- Symbolic AI
  - (ball my–team) and (goal–shot blocked) and ...
- Reactive systems
  - If the ball is in front of me and ... then shoot
  - If the ball is behind me then turn ...
- Balance between reactive and strategic planning

**RoboCup 2000 Events**

- Workshop: Scientific developments are presented in a conference style forum
  - > 100 Submissions
  - Distinguished Science Award (4 Papers)
- Humanoid Robot Exhibition
- New league in 2001/2
- Humanoid Soccer Match
RoboCup and the University of Auckland

- University of Auckland competed at the last three games
- In 2000, we competed with two teams in the small sized league
- All Botz: Global vision system. Competed previously. Toy cars.
- 4 Stooges: Local vision team. Fully autonomous. Based on Braeunl’s Eyebot Controller and CMOS Camera. Old All Botz toy cars as base

Setup

- Nice fields, but no camera mounts

Setup of the All Botz

- Completely new ID and orientation methods
- In Stockholm, spend 3 days calibrating colours
- Camera calibration went very quickly. Visual feedback was good. 3D Points improved it. Same method now used by Big Red
- Colour calibration took about 4 hrs.
- Carpet posed no problem
- Problems with the ID? But what to do?
- 4 Stooges calibrated colours most of the time

Problem with Identification

- All robots look alike.
- Different sources
  - Commands
  - Locality
  - Discrepancies between commands and reaction
- Additional problems
  - Time delay, occlusion, car is stuck, car is tipped over
  - Lots of parameters. Bayesian approach. Guess the probabilities of different events
All Botz vs. Yale

Date: 14 Feb 2001

Lecturer: Jacky Baltes

All Botz vs. Singapore Field Rangers

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Looking towards the Future

- Aug 2001: RoboCup in Seattle. Baltes is on the program committee for the workshop.