DRONACHARYA
College of Engineering

Section D

Artificial Intelligence & Robotics

Overview

- Introduction / Terminology
- Examples of Agencies
  - SPOT & Fresh Kitty
  - RoboCup
- Applications of AI and Robotics
- More Examples
- The Humanoid COG
- Film Clip

Terminology

- Artificial Intelligence – The collective attributes of a computer, robot, or other device capable of performing functions such as learning, decision making, or other intelligent human behaviors.
- Autonomous Agent – A hardware (or software) based system that has the following properties:

  autonomy - able to operate without the direct intervention of humans or others

  social ability - able to interact with other agents and possibly humans

  reactivity - able to perceive their environment and respond to changes that occur in it
- Agency – A particular system composed of intelligent agents, such as computers or robots, that cooperate in order to solve a problem.
- Behavior Engineering – A methodology used to develop behavior-based autonomous agents.

SPOT & Fresh Kitty

Fresh Kitty

- Modular, inexpensive, autonomous mobile robot
- 4 wheel toy car design
- Max. speed of 1 foot/sec
- On-board microcomputer supervises and supports the exchange of information
- Rotating turret holds 4 sonars
- Turret also holds an infrared sensor to detect infrared rays
- 32 light sensors detect objects in front of the robot
- Bumpers all around the robot used to follow walls
- Radio modem to communicate with remote agents

SPOT

- Autonomous mobile robot
- 2 independent wheel design
- Max. speed of 1 foot/sec
- On-board microcontroller supervises and supports the exchange of information
- Turret that holds infrared emitters that can be detected at a distance of up to 20 feet
- Bumpers all around the robot used to follow walls
- Radio modem to communicate with remote agents

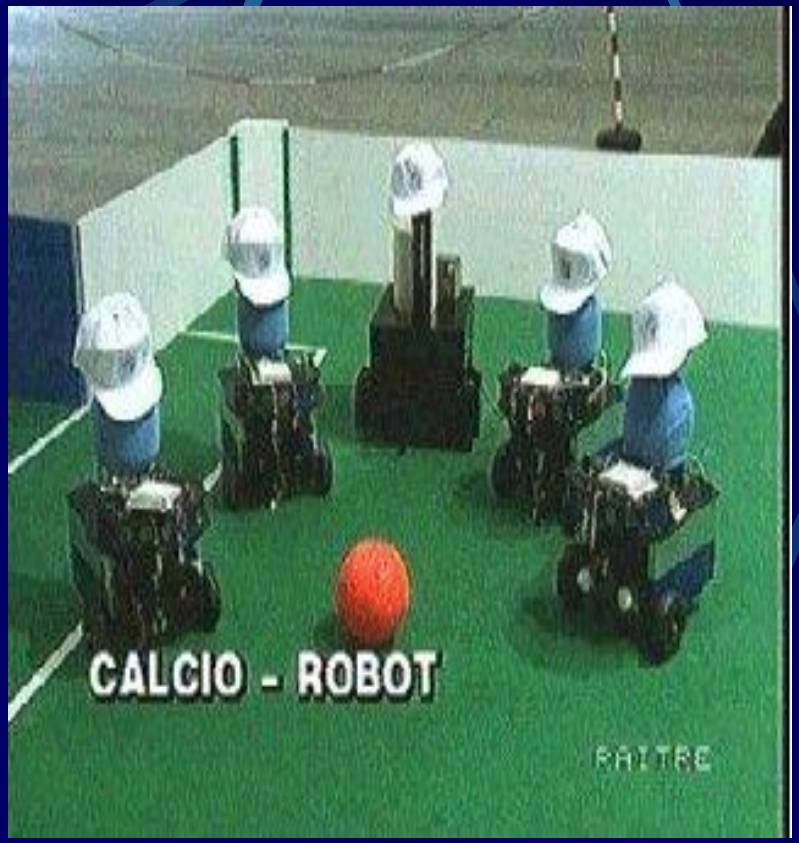
How do SPOT and Fresh Kitty work together?

- SPOT also holds a small brush on its back
- SPOT finds a wall and uses its bumper system and sensors to follow edges and collect dust with its brush
- Through radio frequency and infrared communication SPOT can bring the dust back to Fresh Kitty who has a vacuum cleaner waiting to suck it up


RoboCup

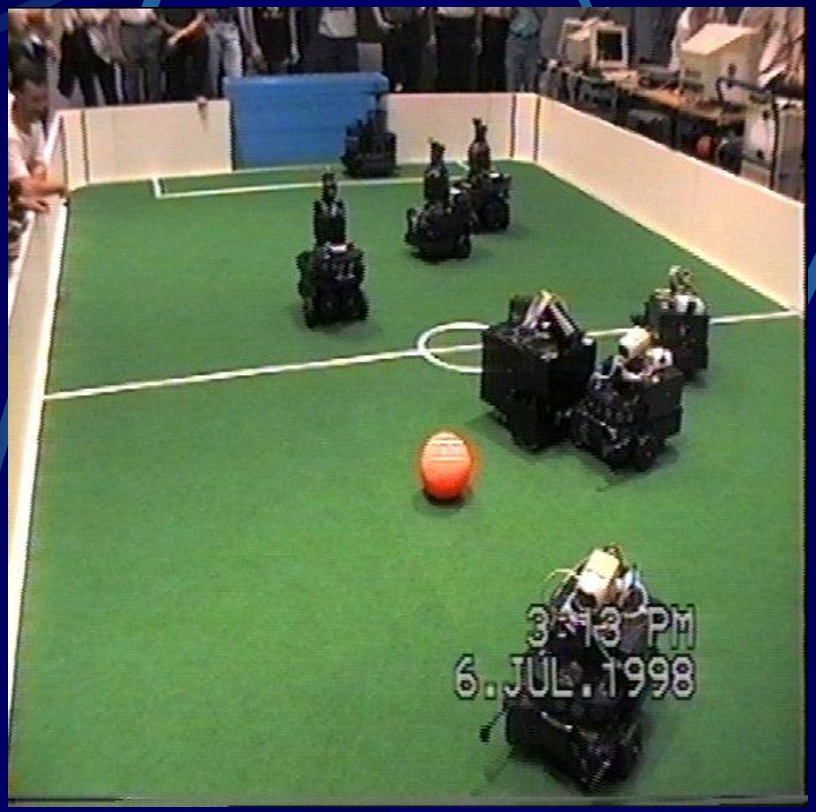
RoboCup

RoboCup is an international research effort to promote autonomous robots.



- Robots must cooperate in…
  - Strategy acquisition
  - Real-time reasoning
  - Multi-agent collaboration
  - Competition against another team of robots

RoboCup



- Each robot has…
  - Pentium 233MHz
  - Linux OS
  - Video camera and frame grabber
  - Sensor System
  - Kicker

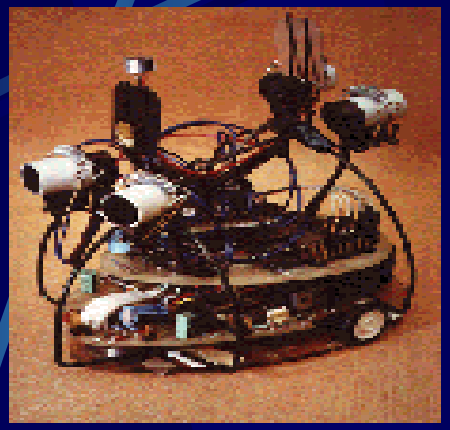
How to the robots make decisions?

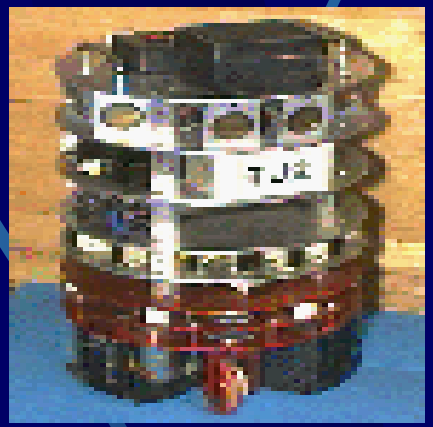
- Control is based on a set of behaviors
- Each behavior has a set of preconditions that either…
  - Must be satisfied
  - Are desired
- A behavior is selected when all of the “musts” become true
- A behavior is selected from several behaviors based on how many desired conditions are true

Applications of AI and Robotics

- Industrial Automation
- Services for the Disabled
- Vision Systems
- Planetary Exploration
- Mine Site Clearing
- Law Enforcement
- And Many Others…

More Examples





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COG

The Humanoid COG

- MIT's finest
- Broken down COG is just a bunch of sensors and actuators
- Except for legs and a flexible spine, COG has all the major degrees of freedom of the human upper body
- Sight exists through video cameras
- Hearing, touch, hand motion, and speech are being added soon

Why build a human-like robot?

Brought to you by Rodney Brooks

- Our bodies are critical to the representations that we use for internal thought and language
- If a robot is looks like a human then it will be natural for humans to interact with it in a human-like way
- To develop similar task constraints