Κουρήτες 2007

Technical University of Crete
RoboCup

Robot Champions!
RoboCup

- RoboCup: robotic soccer competition
  - started in 1993/1994 by Hiroaki Kitano in Japan
  - RoboCup federation: www.robocup.org

- Extensions
  - RoboRescue: search and rescue missions
  - RoboCup Junior, RoboCup@home, RoboDance

- Vision
  - “By the year 2050, to develop a team of fully autonomous humanoid robots that can win against the human world soccer champions”
  - 2002 was the first year with a humanoid robot league!
  - "One small step for a ROBOT, one giant leap for mankind."™
Where do we stand today?
RoboCup Divisions

RoboCup Rescue
Application for Practice

RoboCup Junior
Kids - future generation Education

RoboCup Soccer
Challenge for the Technology

Technical University of Crete, Chania, Greece
RoboCup Soccer Leagues

- **Simulation League**
  - 11 vs. 11 independent software agents

- **Small-Size Robot League**
  - 5 vs. 5 small robots up to 18 cm in diameter

- **Middle-Size Robot League**
  - 4 vs. 4 robots up to 50 cm in diameter

- **Four-Legged Robot League**
  - 4 vs. 4 Sony AIBO robots

- **Humanoid Robot League**
  - autonomous biped humanoid robots

Technical University of Crete, Chania, Greece
Why RoboCup?

- **Research Challenges**
  - can I see clearly? [machine vision]
  - what do I see and where? [object recognition]
  - where am I? [localization]
  - what do I do? [planning]
  - how can I help? [coordination]
  - how can I move? [motion control]
  - do I have to do everything? [integrated solutions]
  - can I take my time? [real-time]

- **Applicability**
  - autonomous teams of robots in dynamic environments
  - search and rescue, planetary exploration, surveillance, ...
# RoboCup Participation

<table>
<thead>
<tr>
<th>Event</th>
<th>Place</th>
<th>Teams</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>RoboCup 2007</td>
<td>Atlanta, USA</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>RoboCup 2006</td>
<td>Bremen, Germany</td>
<td>440</td>
<td>35</td>
</tr>
<tr>
<td>RoboCup 2005</td>
<td>Osaka, Japan</td>
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<tr>
<td>RoboCup 2004</td>
<td>Lisbon, Portugal</td>
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<tr>
<td>RoboCup 2003</td>
<td>Padua, Italy</td>
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<tr>
<td>RoboCup 2002</td>
<td>Fukuoka/Busan, Japan</td>
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<td></td>
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<tr>
<td>RoboCup 2001</td>
<td>Seattle, USA</td>
<td>141</td>
<td>22</td>
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<td>RoboCup 2000</td>
<td>Melbourne, Australia</td>
<td>110</td>
<td>19</td>
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<td>RoboCup 1999</td>
<td>Stockholm, Sweden</td>
<td>85</td>
<td>23</td>
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<tr>
<td>RoboCup 1998</td>
<td>Paris, France</td>
<td>63</td>
<td>19</td>
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<td>RoboCup 1997</td>
<td>Nagoya, Japan</td>
<td>38</td>
<td>11</td>
</tr>
</tbody>
</table>
Local RoboCup Events

- **Japan Open**
  - since 1998

- **German Open**
  - since 2001

- **US Open**
  - since 2003

- **Australian**
  - since 2003

- **Other Opens**
  - Brazilian, Latin American, Dutch, China, Spanish, Iran, ...
Four-Legged League

Robotic dogs chasing a ball!
Sony AIBO ERS-7 Robots

- Stereo Microphone
- IEEE 802.11b Wireless LAN
- Acceleration Sensor
- Vibration Sensor
- Wireless on/off Switch
- Volume Switch
- Paw Sensors
- Speaker 64 Chords
- MIDI Sound
- Edge Detection Sensor
- 350K-pixel Image Sensor
- Distance Sensor
- Illume-Face LED panel
- Features - front
Four-Legged League
Four-Legged 2007 Field
Four-Legged Game
Four-Legged League Challenges

- **Motion**
  - legged locomotion: 3 degrees of freedom per leg
  - ball handling: grab, dribble, kick with legs, body, head

- **Vision**
  - directed sensing: 3 degrees of freedom on the head
  - “unstable” camera view during locomotion

- **Localization**
  - limited view of landmarks, perceptual aliasing

- **Behavior**
  - coordination of multiple robots, dynamic role assignment
Team Κουρήτες (Kouretes)

- **History**
  - the team was founded in January 2006

- **Kouretes**
  - ancient Cretan warriors who were protecting ancient god Zeus when he was born by Rhea in a cave in the mountains of Crete

- **Names**
  - Επιμήδης (Epimedes)
  - Ίδας (Idas)
  - Ιάσιος (Iasios)
  - Παιωναίος (Paioneus)
  - Ηρακλής (Heracles)
Where it began ...
Where it continued ...
Where it kept going ...
Where it stands ...

- **Pioneer**
  - the first (and only) RoboCup team in Greece

- **Participation**
  - RoboCup 2006 [ Technical Challenges ]
  - RoboCup German Open 2007 [ Four-Legged League ]
  - RoboCup 2007 [ MS Simulation Competition ]

- **Website**
  - [www.intelligence.tuc.gr/kouretes](http://www.intelligence.tuc.gr/kouretes)

- **Publicity**
  - TV: Mega, Κύδων, Νέα Τηλεόραση
  - Radio: Sky Radio, EPA
  - Press: Χανιώτικα Νέα, Έθνος, Τα Νέα
  - Magazines: Στιγμές, Popular Science
Κουρήτες 2006

They started this!
RoboCup Team Κουρήτες 2007

Κουρήτες 2006

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RoboCup Team Κουρήτες 2007

Members
- Επιμενίδης Βουτσάκης
- Ιωάννης Βαρελάς
- Πέτρος Πατέλης
- Ευδόξιος Μπαράτης
- Αθανάσιος Τέγος
- Χαράλαμπος Ταµπίτσικας
- Μιχαήλ Ζαµπετάκης
- Γεώργιος Κόντες
- Βασίλειος Νικολαϊδης
- Αναστάσιος Μωραΐτης
- Κων/νος Χαλδέζος
- ...
RoboCup Team Κουρήτες 2007

Open Challenge

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Passing Challenge
New Goal Challenge
Κουρήτες 2007

They kept the tradition!
RoboCup Team Κουρήτες 2007

Κουρήτες 2007

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Kουρήτες 2007 Members

- Color Table and Localization
  - Πέτρος Πατέλης, Γεώργιος Πιερρής
- Beacon Recognition
  - Αλέξανδρος Παράσχος, Χρυσαυγή Κοντογεώργου
- Goal Recognition
  - Σουζάννα Βολιώτη
- Behavior Control
  - Γεώργιος Κόντες
- Motion Control
  - Ανδρέας Πανάκος
Kουρήτες 2007 Code

■ German Team 2004
  – complete modular architecture in C++, xABSL
  – various tools for debugging, development

■ S.P.Q.R. 2006
  – modified color table, image processor, self locator
  – new behavior control module based on petri-net plans

■ Κουρήτες 2007
  – modified the image processor module
  – implemented a new goal recognition module
  – modified the self locator module
  – implemented new coordinated behaviors
  – implemented new grab and kick actions
Kουρήτες 2007 Image Processor

Technical University of Crete, Chania, Greece
Κουρήτες 2007 Localization

Technical University of Crete, Chania, Greece
Kouretes 2007 Petri-Net Plans
RoboCup Team Κουρήτες 2007

Κουρήτες 2007 Coordinated Behavior

Technical University of Crete, Chania, Greece
RoboCup Team Κουρήτες 2007

Κουρήτες 2007 Special Kick

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RoboCup Team Κουρήτες 2007

Κουρήτες 2007 Education

- **Reading group**
  - discussion of related papers
  - weekly meeting throughout the fall semester

- **Diploma theses**
  - *Coordinated Soccer Play using Petri-Net Plans*, Γεώργιος Κόντες
  - *Vision-Based Robust Landmark Recognition*, Σουζάνα Βολιώτη

- **Courses**
  - *Αυτόνομοι Πράκτορες, προπτυχιακό/μεταπτυχιακό* (ΗΜΜΥ)
  - *Αλγόριθμοι για Προβλήματα Ρομποτικής, μεταπτυχιακό* (ΜΠΔ)
Kouretes 2007 Demonstration

Technical University of Crete, Chania, Greece
RoboCup German Open 2007

Hannover, Germany
16-21 April 2007
RoboCup German Open 2007

- **Event**
  - organized annually for the last six years
  - part of Hannover Messe, the largest industrial fair in Germany

- **Participants**
  - 150 teams from 13 countries in all leagues
  - 46 teams from 13 countries in the Senior Leagues
Participants

Technical University of Crete, Chania, Greece
We were there, too!
Four-Legged League

Teams

- Cerberus (Turkey)
- GermanTeam (Germany)
- Hamburg Dog Bots (Germany)
- Harzer Rollers (Germany)
- Impossibles (Iran)
- Kouretes (Greece)
- Northern Bites (USA)
- NUBots (Australia)
- TeamChaos (Spain)
- The Cat (The Netherlands)
### Group A

<table>
<thead>
<tr>
<th>Gruppe A</th>
<th>Spiele</th>
<th>Punkte</th>
<th>Torverhältnis</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUBots (A)</td>
<td>4</td>
<td>12 / Erster</td>
<td>35 (41) : 0</td>
</tr>
<tr>
<td>Team Chaos (ESP)</td>
<td>4</td>
<td>7 / Zweiter</td>
<td>5 : 8</td>
</tr>
<tr>
<td>The-CAT (NL)</td>
<td>4</td>
<td>4 / Vierter</td>
<td>2 : 13</td>
</tr>
<tr>
<td>Harzer Rollers (D)</td>
<td>4</td>
<td>5 / Dritter</td>
<td>6 : 7</td>
</tr>
<tr>
<td>Hamburg Dog Bots (D)</td>
<td>4</td>
<td>0 / Fünfter</td>
<td>0 : 22 (26)</td>
</tr>
<tr>
<td>Gruppe B</td>
<td>Spiele</td>
<td>Punkte / Platz</td>
<td>Toreverhältnis</td>
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<tr>
<td>-----------------------</td>
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<td>----------------</td>
</tr>
<tr>
<td>GermanTeam (D)</td>
<td>4</td>
<td>12 / Erster</td>
<td>30 : 2</td>
</tr>
<tr>
<td>Northern Bites (USA)</td>
<td>4</td>
<td>9 / Zweiter</td>
<td>19 : 10</td>
</tr>
<tr>
<td>Impossibles (IRAN)</td>
<td>4</td>
<td>1 / Fünfter</td>
<td>3 : 21</td>
</tr>
<tr>
<td>Cerberus (TR)</td>
<td>4</td>
<td>4 / Dritter</td>
<td>9 : 11</td>
</tr>
<tr>
<td>Kouretes (GR)</td>
<td>4</td>
<td>3 / Vierter</td>
<td>4 : 21</td>
</tr>
<tr>
<td>Zeit / Time</td>
<td>Mittwoch/Wednesday</td>
<td>Result</td>
<td>Donnerstag/Thursday</td>
</tr>
<tr>
<td>------------</td>
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<td>--------</td>
<td>---------------------</td>
</tr>
<tr>
<td>9 - 10</td>
<td>NUBots - Team Chaos</td>
<td>8 - 0</td>
<td>NUBots - The Cat</td>
</tr>
<tr>
<td>10 - 11</td>
<td>GermanTeam - Northern Bites</td>
<td>8 - 0</td>
<td>GermanTeam - Impossibles</td>
</tr>
<tr>
<td>11 - 12</td>
<td>The Cat - Harzer Rollers</td>
<td>0 - 0</td>
<td>Team Chaos - Harzer Rollers</td>
</tr>
<tr>
<td>12 - 13</td>
<td>Impossibles - Cerberus</td>
<td>2 - 2</td>
<td>Northern Bites - Cerberus</td>
</tr>
<tr>
<td>13 - 14</td>
<td>NUBots - Dog Bots</td>
<td>14 - 0 (10 - 0)</td>
<td>The Cat - Hamburg Dog Bots</td>
</tr>
<tr>
<td>14 - 15</td>
<td>GermanTeam - Kouretes</td>
<td>8 - 1</td>
<td>Impossibles - Kouretes</td>
</tr>
<tr>
<td>15 - 16</td>
<td>Team Chaos - The Cat</td>
<td>1 - 0</td>
<td>NUBots - Harzer Rollers</td>
</tr>
<tr>
<td>16 - 17</td>
<td>Northern Bites - Impossibles</td>
<td>7 - 0</td>
<td>GermanTeam - Cerberus</td>
</tr>
<tr>
<td>17 - 18</td>
<td>Harzer Rollers - Hamburg Dog Bots</td>
<td>6 - 0</td>
<td>Team Chaos - Hamburg Dog Bots</td>
</tr>
<tr>
<td>18 - 19</td>
<td>Cerberus - Kouretes</td>
<td>4 - 1</td>
<td>Northern Bites - Kouretes</td>
</tr>
</tbody>
</table>
RoboCup Team Κουρήτες 2007

Κουρήτες 2007 Excitement

Technical University of Crete, Chania, Greece
Four-Legged League Results

Final Ranking

- [1st place] German Team (Germany)
- [2nd place] NUBots (Australia)
- [3rd place] Northern Bites (USA)
- [4th place] Cerberus (Turkey)
- [5th / 6th place] Team Chaos (Spain), Harzer Rollers (Germany)
- [7th / 8th place] Kouretes (Greece), The Cat (The Netherlands)
- [9th 10th place] Impossibles (Iran), Hamburg Dog Bots (Germany)
Lessons Learned

- Light can change
  - light might not be uniform, may be changing
  - need to able to adapt, need better tools

- Vision is a prerequisite
  - if you cannot see, you cannot play

- Move faster
  - the fastest robot has an advantage

- Murphy’s Law
  - if something can go wrong, it will go!

- Do not wait till the last minute!
  - implement and test, test, test, test, ...
RoboCup Team Κουρήτες 2007

Happy Κουρήτες @ German Open 2007

Technical University of Crete, Chania, Greece
Ευχαριστίες

- Πολυτεχνείο Κρήτης
  - πρωτανικό συμβούλιο
  - οικονομική ενίσχυση
  - κάλυψη εξόδων συμμετοχής

- Ενορία Κουνουπιδιανών
  - π. Δημήτριος Αλεξανδράκης
  - αίθουσα πολιτιστικού κέντρου
  - Ιανουάριος 2007 – Μάιος 2007
The Future

- **Four-Legged League?**
  - last year with AIBO robots?
  - new robot dog next year?

- **Simulation League**
  - Prof. Nikos Vlassis (DPEM)

- **Ideally**
  - 4 undergraduate students (diploma thesis)
  - 1 postgraduate student or faculty member

- **Interested?**
  - talk to us!
Thank you!

for your support and attention