Design and Organization of Autonomous Systems

Introduction

Objectives DOAS

- Know the concepts that are important in the design of Intelligent Autonomous Systems.
- Understand the problems that are to be solved.
- Identify the solutions found.
- Build a framework to organize future developments.

Organization DOAS

- **Course** consists of lectures and projects on system architecture and design
- **Lectures** in first two weeks.
- **Project** assignments for 5-6 students.
- **Examination**

  The grade for this course will be based on the results of the **Project**. All registered students will be assigned to a project.

DOAS

Topics lectures:

- Architectures used in autonomous systems (general aspects, distributed and embedded systems).
- Case studies: AIBO and Intelligent vehicles

Project:

- Case study in integration
- Applies the material of the lectures
- Clear assignment of tasks to the members of the team
- Team writes an article about their project and review the articles of the others
- Final mini conference with external invites

Projects 2005

1. **Robot Companion for elderly care** *Frans Groen*
2. **Intelligent Sensor Network** *Peter van Lith*
3. **Java Camera** *Peter van Lith*
4. **Probabilistic Resource Allocation in Distributed Fusion Systems** *Gregor Pavlin and Jan Nunnink*
5. **Interactive response system for crisis management** *Marinus Maris*
6. **Intelligent Traffic Light Control** *Bram Bakker and Leon Kester*
7. **AIBO Field Localisation** *Arnoud Visser*

Schedule week 2

day	room	lecturer	subject	remarks
Monday 10th, 10:00-13:00	P.019	All	Kick-off meeting Projects	
Tuesday 11th, 10:00-12:00	P.018	Arnoud Visser	Architectures of Autonomous Systems	Chapter 3-4 of syllabus
Wednesday 12th, 10:00-12:00	P.018	Arnoud Visser	Case studies of Autonomous Systems	Marie Architecture and Aibo Architecture
Thursday 13th, 10:00-12:00	P.019	Marinus Maris	Distributed Systems	Hand-out
Friday 14th, 10:00-12:00	P.018	Peter van Lith	Embedded Systems	Hand-out

Schedule week 3

day	room	lecturer	subject	remarks
Monday 17th, 10:00-12:00	A.102	Dariu Gavrila	Looking at people	
Tuesday 18th, 10:00-12:00	A.102	Dariu Gavrila	Intelligent Vehicles That See	
Thursday 20th, 10:00-13:00	P.019	All	Progress meeting Projects	

Schedule project

Project

All registered students will be assigned to a project. Three times plenair meetings will be scheduled.

week 2: kick-off meeting (Monday 10th, P.019, 10:00-13:00)

week 3: progress meeting (Thursday 20th, P.019, 10:00-13:00)

20 minutes presentations

week 5: deadline draft article (Tuesday 1th, 16:00, pdf on website)

week 5: deadline review article (Wednesday 2nd, 16:00, see form)

Exchange of draft final report

week 5: deadline final article (Thursday 3rd, 16:00, pdf on website)

Hand in final report

week 5: mini-conference (Friday 4th,Kruislaan 403, F0.13, 9:30-13:00)

20 minutes presentations

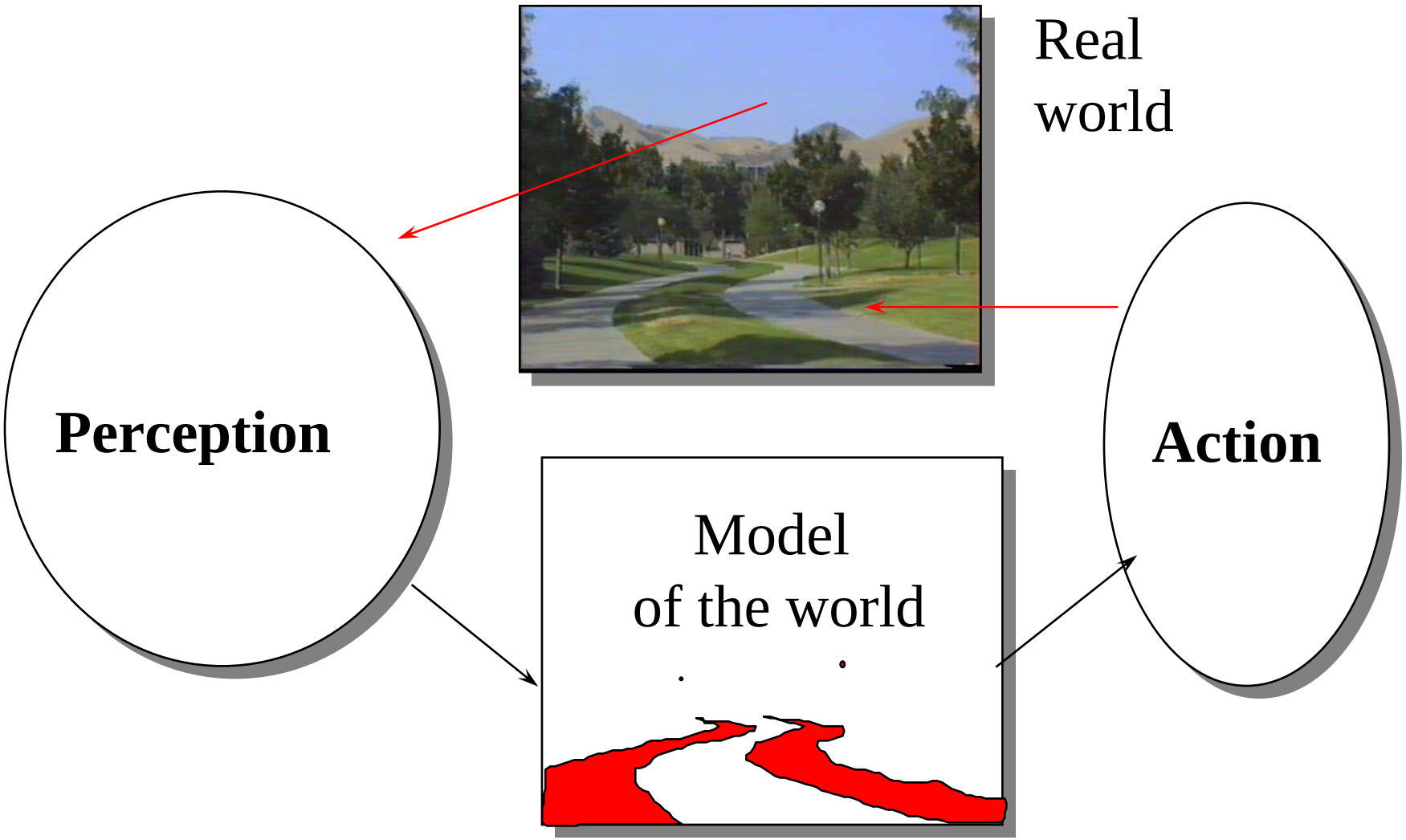
Program for today

10.00-10.10	Frans Groen	Introduction of the course DOAS
10.15-10.20	Frans Groen	Robot Companion for elderly care
10.25-10.30	Peter van Lith	Intelligent Sensor Network
10.35-10.40	Peter van Lith	Java Camera
10.40-11.00	**Coffee break**	
11.00-11.10	Jan Nunnink	Probabilistic Resource Allocation in Distributed Fusion Systems
11.10-11.20	Marinus Maris	Interactive response system for crisis management
11.20-11.30	Bram Bakker	Intelligent Traffic Light Control
11.30-11.40	Arnoud Visser	AIBO Field Localisation
11.40-12.00	**Assignment** of students to projects	
12.00-13.00	**Detailed discussion** of projectleaders with studentteam	

Project assignments

- Consists of literature study of the assigned topic
- Proposal of architecture and design of an Autonomous System
- Realization of a critical part of the selected approach
- Evaluation of the selected approach against other initiatives
- Mini-conference Article and Presentation.

Perception - Action Cycle



Components

- **Perception**
  - computer vision
  - sound interpretation
  - touch (also on a distance)
- **Model**
  - representation
  - modeling
  - data fusion
- **Action**
  - adaptive behavior
  - planning
  - exploration, navigation

Global aspects

- Architecture
- Learning and adaptation because the robot can perceive the results of its action
- Simulation

Application Area's (1)

- **Service**

  cleaning devices, goods (food, mail) distribution, robot guide dog
- **Space**

  planetary rovers, robot arms in space
- **Surveillance and Safety**

  watching over public places, fire and pollution detection/ inspection after disasters
- **Transport**

  driver assistance , intelligent vehicles, automated highway, container transport

Application Area's (2)

- **Agriculture**

  harvesting, spraying
- **Defense**

  mine detection, bomb dismantling, unmanned vehicles, robot soldier
- **Entertainment**

  microsoccer, intelligent adaptive games, robots in film industry
- **Mining**

  unmanned excavation

Trends

- From ***structured static*** environments to ***unstructured dynamic*** environments
- From ***robots*** to ***embedded autonomy*** in existing systems
- Form single robots to **multi-robot** systems
- To **semi-autonomous** systems interacting with humans

Needs

- Real robustness
- Reactive to human gestures (motion) and speech (sound)
- Human understandable communication between systems.
- Autonomy well integrated with tele-operation