

Intelligent Driving Agents

“Microscopic traffic simulation with reactive driving agents”

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Overview of presentation

- Project
- Design of driving agent
- Implementation in prototype simulator
- Results, conclusions and future work



Project

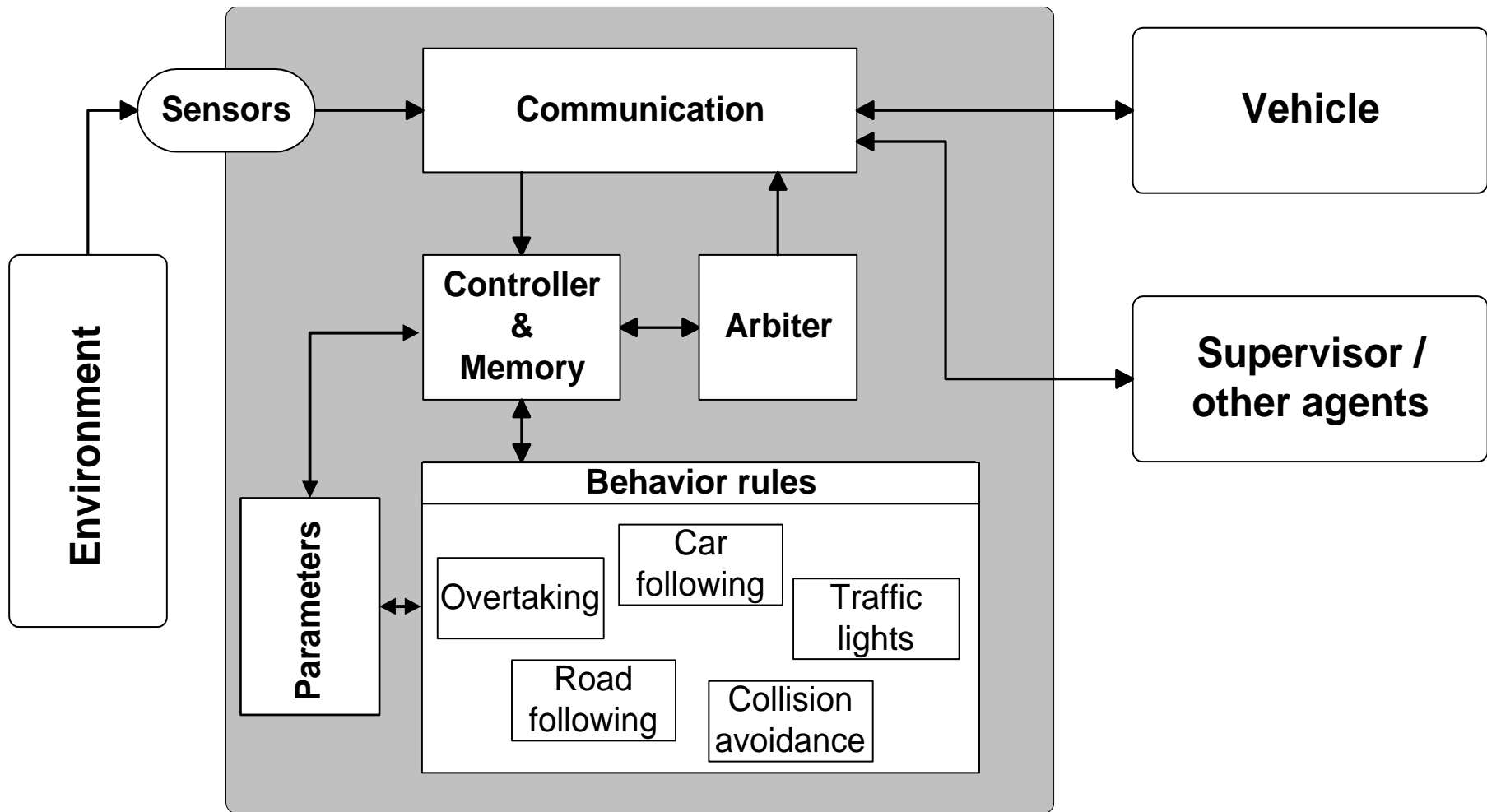
- Create intelligent agent with human-like driving behavior
- Goals:
 1. Perform reasoning from local viewpoint
 2. Investigate interaction between drivers
 3. Create flexible and realistic traffic simulator
- Used **tactical-level** reasoning

Design: driving agent

- Perform human-like tactical driving
- Real-time control of vehicle
- Expandable and flexible functionality



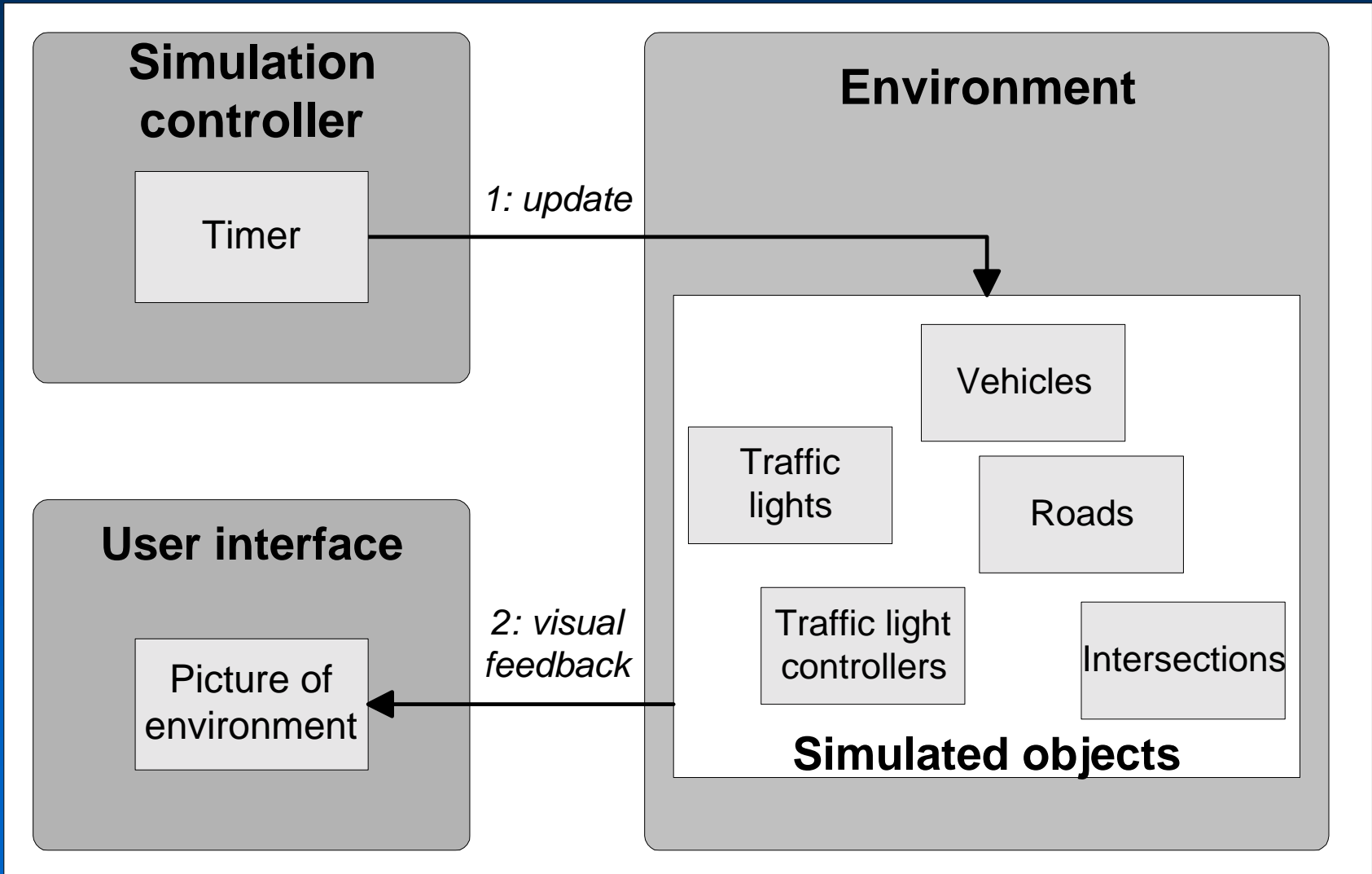
Design: driving agent (continued)



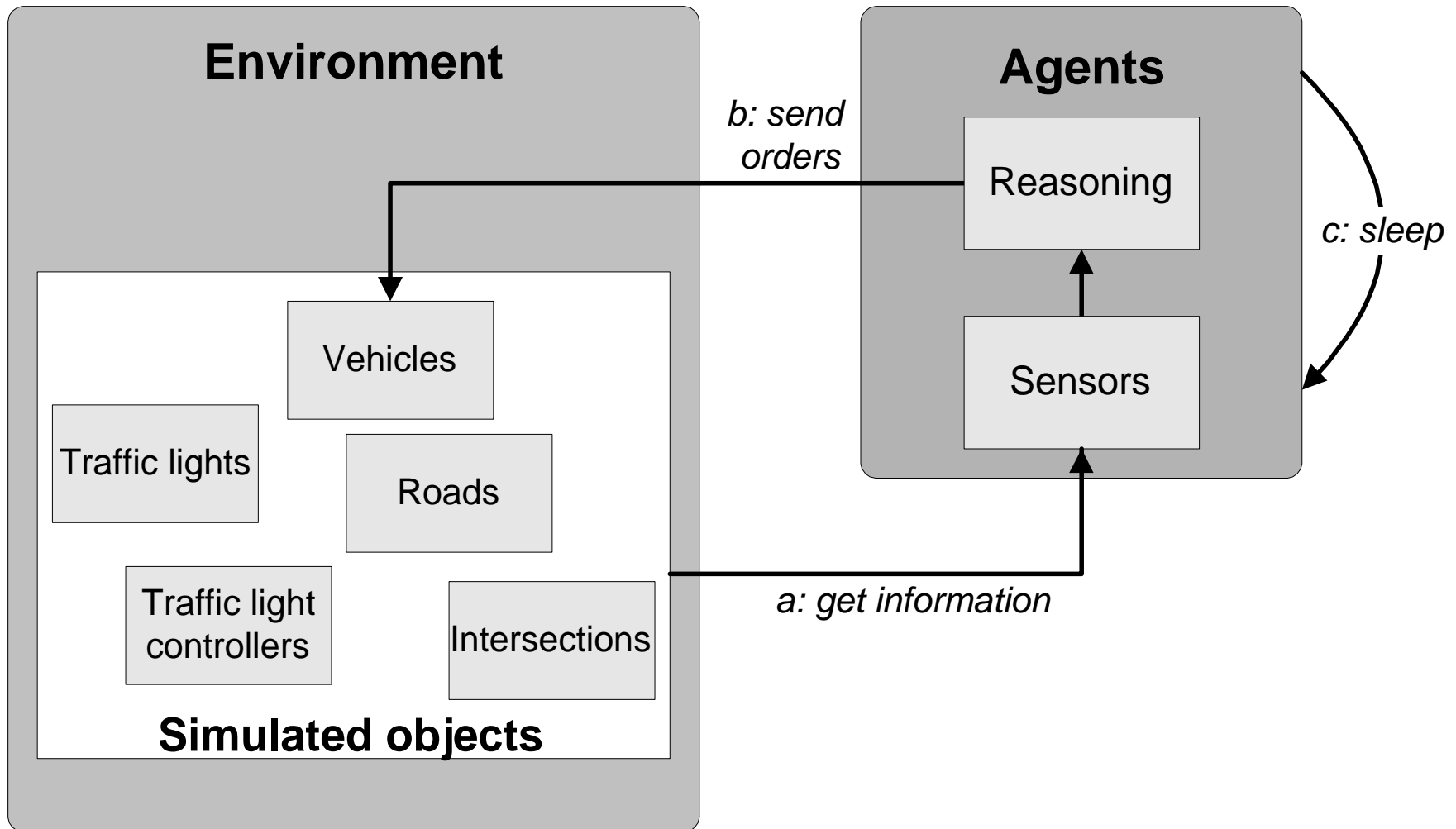
Implementation: simulator

- Decided to create new prototype simulation program
- Time-oriented simulator
- Kinematic 2D motion model

Implementation: simulator



Implementation: agent



Implementation: agent's rules

- Behavior rules are directly coded into the program for fast performance

example: **If** (agent speed < preferred speed)
then Accelerate (normal)

Implementation: example

The screenshot displays the 'Driving Agent Simulator - Demo_Intersection.mdf' window. The main view shows a 2D road intersection with a green car at the bottom left and a red car at the top right. The 'Agent Status Information' panel is open on the right, showing vehicle data and reasoning metrics.

Driving Agent Simulator - Demo_Intersection.mdf
Simulation Agent Help
Time 1 : 2

Agent Status Information

Vehicle Data

| | | | |
|--------------|-----------------------|-----------------|-----------|
| Speed | 19.8 km/h | Position on map | [635,389] |
| Acceleration | -1.9 m/s ² | Road name | road2 |
| Wheel angle | 0.7 degrees | Fuel remaining | 100.0 % |
| Heading | 271.4 degrees | Status | ok |

Agent Reasoning

Cycle nr: 24

| Behaviours | Longitudinal | Lateral | Priority |
|-------------------|--------------|---------|----------|
| Lane switching | - | - | - |
| Car following | -1.9 | - | 40 |
| Traffic lights | 0.0 | - | 30 |
| Change directions | - | - | - |
| Road following | 1.6 | 0.7 | 10 |
| Arbiter | -1.9 | 0.7 | |

Matching speed of vehicle in front.

Process time: 0 ms Total time: 200 ms

Window stay on top

00:00:08 Paused 1 : 10 921,544

Results

- Simulation prototype with
 - Up to 40 vehicles (agents) in real-time
 - Human-like driving behavior
 - Interaction between drivers

Conclusions

- Advantages agent-based simulation
 - increased realism
 - allows more flexibility
 - distributed processing possible
- Disadvantages
 - increase computational load
 - many parameters, more difficult validation

Future work

- Expand simulator and agent functionality
- Use distributed approach (more agents)
- Nanoscopic simulation
- Use agent model to control real vehicles

More info at

http://www.kbs.twi.tudelft.nl/People/Staff/P.A.M.Ehlert/ai/project_IDA.html

