

FAUbot

Purposeful Navigation of a Robot in a Simulated Environment

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Caroline Kaufhold
Daniel Danner, Peter Kranz,
Rainer Mueller, Sven Pfaller

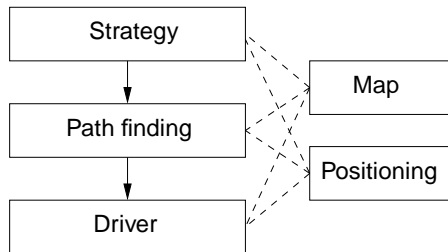
Chair for Pattern Recognition (Computer Science 5)
Friedrich-Alexander-University Erlangen-Nuremberg



System Design Overview

1 Controllers

- 1 Strategy - high-level decisions
- 2 Pathfinding - obstacle avoidance and shortest paths
- 3 Driver - Sensor scheduling and engines controller



2 Map - maintain world model

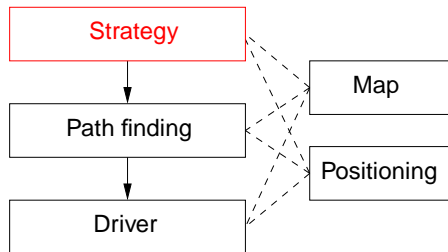
3 Position - self-localization



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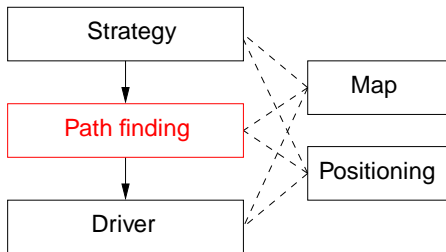
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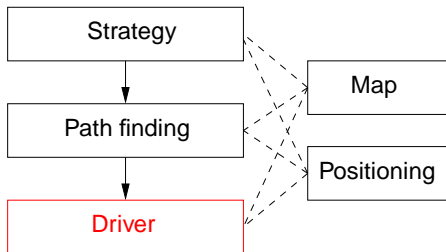
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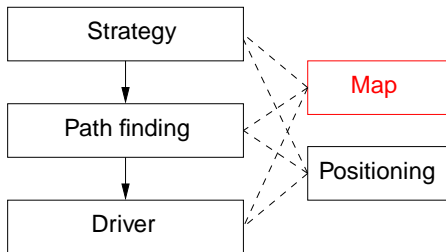
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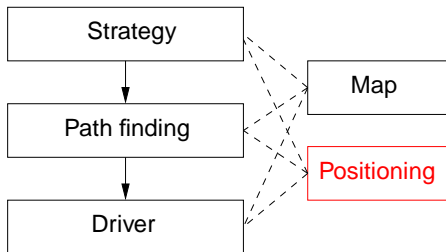
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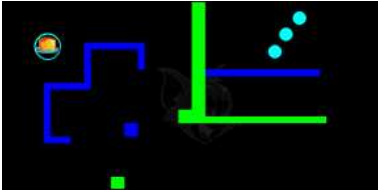
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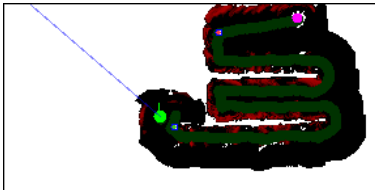
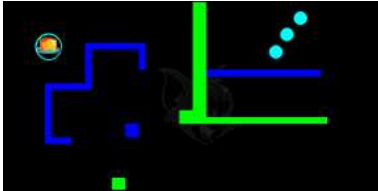
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Graphical User Interface



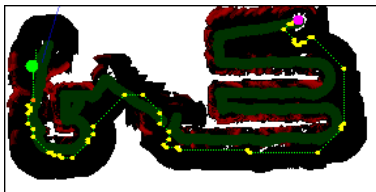
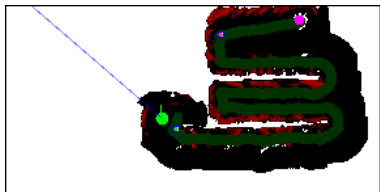
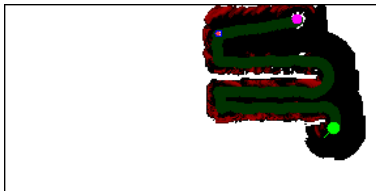
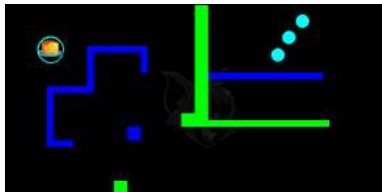


Graphical User Interface





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Sensor Scheduler

A Dynamically scheduled sensors

- 3 buckets priority queue





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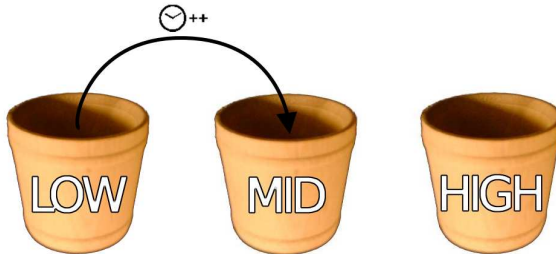




Sensor Scheduler

A Dynamically scheduled sensors

- 3 buckets priority queue

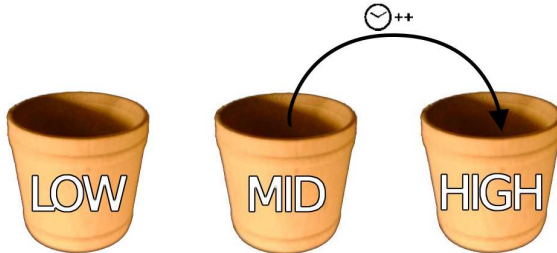




Sensor Scheduler

A Dynamically scheduled sensors

- 3 buckets priority queue





Sensor Scheduler (2)

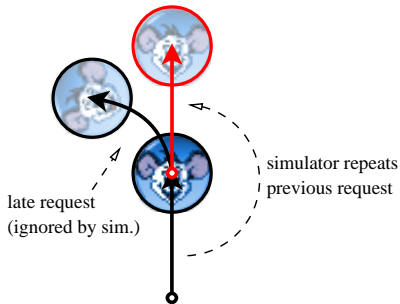
B Hard real-time scheduled sensors

- immediate sensor requests
- guaranteed result in `latency` cycles
- HRT-request $\xrightarrow{\text{latency}}$ world model update



Cycle Time Constraint

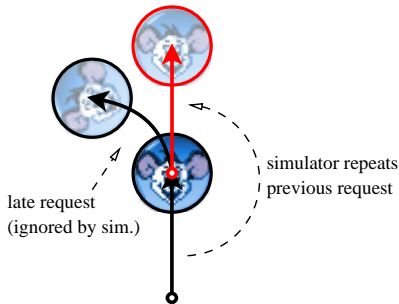
Problem





Cycle Time Constraint

Problem



Solution

if
computation time $> 0.7 \cdot$ cycle time

then
motor request wont be sent
→ simulator uses previous
request



FAUbot Features

1 Navigation

- WallFollower: Obstacle bypassing
- Approach to beacon: Decision points for lifelock avoidance
- Return to home: A* for shortest safe path

2 Engines

- Manually tuned curve driving speed
- Braking in one cycle

3 Probability map

- Obstacle probabilities
- "Visited" entries