



## Master Thesis Idea

### **Title: Safe Decision-Making and Recovery under Incomplete Perception in Mobile Robot Systems**

This thesis studies how a mobile robot system should make safe and effective decisions when its perceptual information is incomplete, uncertain, or partially blocked. Representative settings include blind corners, temporary occlusions, narrow passages, limited camera coverage, and related partially observable navigation tasks.

The thesis is concerned with system-level decision-making under incomplete perception: when to continue, slow down, stop, yield, switch behavior, or trigger a recovery action. The precise experimental scenario can be adjusted depending on student experience and system maturity.

- Define a concrete partially observable robotic scenario, such as blind-corner navigation or constrained multi-robot interaction, that reliably exposes safety and deadlock issues.
- Develop mechanisms for safe decision-making, behavior switching, conflict handling, and recovery under incomplete perception.
- Evaluate the resulting system with respect to safety, deadlock recovery, decision stability, task progress, and overall operational reliability.

**Relevant references:** Cagatay Pek et al., “OA-MPC: Occlusion-Aware MPC for Guaranteed Safe Robot Navigation with Unseen Dynamic Obstacles”; Yuda Chen et al., “Deadlock Resolution and Recursive Feasibility in MPC-based Multi-robot Trajectory Generation”.

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