Master Thesis Idea

Title: Runtime Monitoring and Recovery for Robust Mobile Robot Operation under Real-World Failures

This thesis investigates how a real mobile robot system can detect abnormal operating conditions and recover from them autonomously instead of relying on immediate human intervention. A representative application setting is autonomous inspection or delivery, where faults such as camera occlusion, localization failure, planner failure, or temporary blockage of the path may occur during execution.

The key idea is to treat failures as a normal part of real-world deployment and to develop system-level mechanisms that can identify them early and trigger suitable recovery behavior.

- Define a set of relevant runtime failure cases for a real mobile robot platform and implement a corresponding fault-injection setup.
- Design monitoring and recovery mechanisms that detect abnormal conditions and trigger actions such as stopping, replanning, relocalization, backing up, or retrying a task.
- Evaluate detection performance, recovery success, system stability, and overall task completion under realistic failure scenarios.

Relevant references: Serena S. Serbinowska et al., “Verification of Behavior Trees with Contingency Monitors”; Faseeh Ahmad et al., “Adaptable Recovery Behaviors in Robotics: A Behavior Trees and Motion Generators (BTMG) Approach for Failure Management”.

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