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Design and Evaluation of Intent-Aware Interfaces for Human Supervision of Autonomous Mobile Robots

Abstract

Autonomous mobile robots (AMRs) are a prominent example of Physical AI: systems that sense, decide, and act in the physical world. They are increasingly deployed in warehouses, hospitals, and other indoor environments, where they navigate, detect obstacles, and make decisions with limited human intervention. However, conventional monitoring interfaces mainly display robot status, location, and task progress, without communicating what the robot intends to do next or why. This makes it difficult for human operators to anticipate robot behaviour and respond appropriately to unexpected situations. This research proposes the design and evaluation of an intent-aware user interface for supervising AMRs. The interface communicates the robot's intentions, planned paths, environmental observations, and decision explanations, and provides intervention controls such as pause, reroute, and approval of high-risk actions. A prototype will be developed with a simulated AMR operating in a simulated indoor warehouse environment. In a within-subjects user study with approximately 24 participants, the intent-aware interface will be compared with a conventional monitoring interface. Evaluation measures include usability (SUS), situation awareness (SAGAT), trust, cognitive workload (NASA-TLX), and task performance. The expected contributions are a set of interface design principles grounded in Physical AI, a functional prototype, and empirical evidence on how intent-aware interfaces support effective human supervision of autonomous mobile robots.