Wall-Following Control in Mobile Robots Using Sonar, FSM, and PID

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Abstract:

This work presents the use of a Finite State Machine (FSM) controller to manage the actions of a robot navigating a controlled indoor environment. The primary objective is to plan a secure and reliable path for wall-following tasks. We detail the Python-based implementation of the FSM controller and demonstrate how it enhances task precision. The experiment utilized the CoppeliaSim simulator, where we remotely controlled the Pioneer 3DX mobile robot's sensors and motors through Python API functions. The entire experiment took place in a simulated environment with barriers and enclosing walls, which were detected by a series of sensors. The robot successfully followed a pre-determined path and adeptly navigated around the obstacles within this environment. Additionally, we conducted a comparative analysis with an alternative controller, the Proportional-Integrator-Derivative (PID) controller, to identify the most effective algorithm for this task.

Keywords:

Path Planning, Obstacle Avoidance, Pioneer 3DX, VREP, FSM, PID, Sonar sensors.