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Performance Analysis of Vision-Based Transparent Obstacle Avoidance for Construction Robots

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Abstract : Construction robots are receiving more and more attention as a promising solution to the manpower shortage issue in the construction industry. The development of intelligent control techniques that assist in controlling the robots to avoid transparency and reflected building obstacles is crucial for guaranteeing the adaptability and flexibility of mobile construction robots in complex construction environments. With the boom of computer vision techniques, a number of studies have proposed vision-based methods for transparent obstacle avoidance to improve operation accuracy. However, vision-based methods are also associated with disadvantages such as high computational costs. To provide better perception and value evaluation, this study aims to analyze the performance of vision-based techniques for avoiding transparent building obstacles. To achieve this, commonly used sensors, including a lidar, an ultrasonic sensor, and a USB camera, are equipped on the robotic platform to detect obstacles. A Raspberry Pi 3 computer board is employed to compute data collecting and control algorithms. The turtlebot3 burger is employed to test the programs. On-site experiments are carried out to observe the performance in terms of success rate and detection distance. Control variables include obstacle shapes and environmental conditions. The findings contribute to demonstrating how effectively vision-based obstacle avoidance strategies for transparent building obstacle avoidance and provide insights and informed knowledge when introducing computer vision techniques in the aforementioned domain.

Keywords : construction robot, obstacle avoidance, computer vision, transparent obstacle
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