ABSTRACT

Camera-based object detection is a key component in developing mobile robots that can visually interact with their surroundings. Deploying such systems on embedded platforms like the Raspberry Pi, however, poses challenges in processing efficiency and detection accuracy. This study evaluates the feasibility of applying a modern object-detection algorithm in resource-constrained robotic systems by designing and implementing a YOLOv11-based detector on the myAGV robot for a simulated plant monitoring application. The research method comprises creating a custom dataset with 'grass' as the primary target object, model training, and systematic testing on the robot to evaluate performance under varying distance and light intensity conditions. Comprehensive test results show the system achieves an F1-Score of 0.85 with an average inference speed of 0.55 FPS on the Raspberry Pi 4 platform. This study also successfully identified distance as the primary limiting factor, with optimal performance achieved within a 20 to 50 cm range, while the system proved robust against the tested light variations. These findings confirm that the YOLOv11 model offers a viable performance balance for this application and provide a foundation for the future development of monitoring robots for precision agriculture.

Keywords: object detection, YOLO, Raspberry Pi, plant monitoring, mobile robot