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Designing and development of agricultural rovers for vegetable harvesting and soil analysis

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Abstract

To address the growing demand for sustainable agriculture practices, new technologies to boost crop productivity and soil health must be developed. In this research, we propose designing and building an agricultural rover capable of autonomous vegetable harvesting and soil analysis utilizing cutting-edge deep learning algorithms (YOLOv5). The precision and recall score of the model was 0.8518% and 0.7624% respectively. The rover uses robotics, computer vision, and soil sensing technology to perform accurate and efficient agricultural tasks. We go over the rover's hardware and software, as well as the soil analysis system and the tomato ripeness detection system using deep learning models. Field experiments indicate that this agricultural rover is effective and promising for improving crop management and soil monitoring in modern agriculture, hence achieving the UN's SDG 2 Zero Hunger goals.

Introduction

Global population growth poses a significant challenge for agriculture in fulfilling rising food demand. Precision agriculture and automation are crucial in meeting this problem by increasing agricultural productivity while saving resources. In this study, we propose an agricultural rover outfitted with advanced deep-learning algorithms to alter vegetable harvesting and soil analysis in farming practices.

In the recent era, precision agriculture has played an important role in maintaining future food security with less labor and energy and at the same time improving environmental management to ensure a productive agricultural output [1]. Many regions face labor shortages in agriculture due to changing demographics and migration to urban areas. Automation can assist in bridging this gap by reducing the requirement for human labor. While an initial investment in automation technologies may be required, long-term cost savings can be realized by cutting labor expenses and increasing farm output.

Sensor-enabled growth monitoring systems, drones, and satellite photography can provide real-time information about crop health, nutritional deficits, and growth rates. This data