Researchers introduce a robotic system to manage weeds and monitor crops

August 8 2023, by Ingrid Fadelli

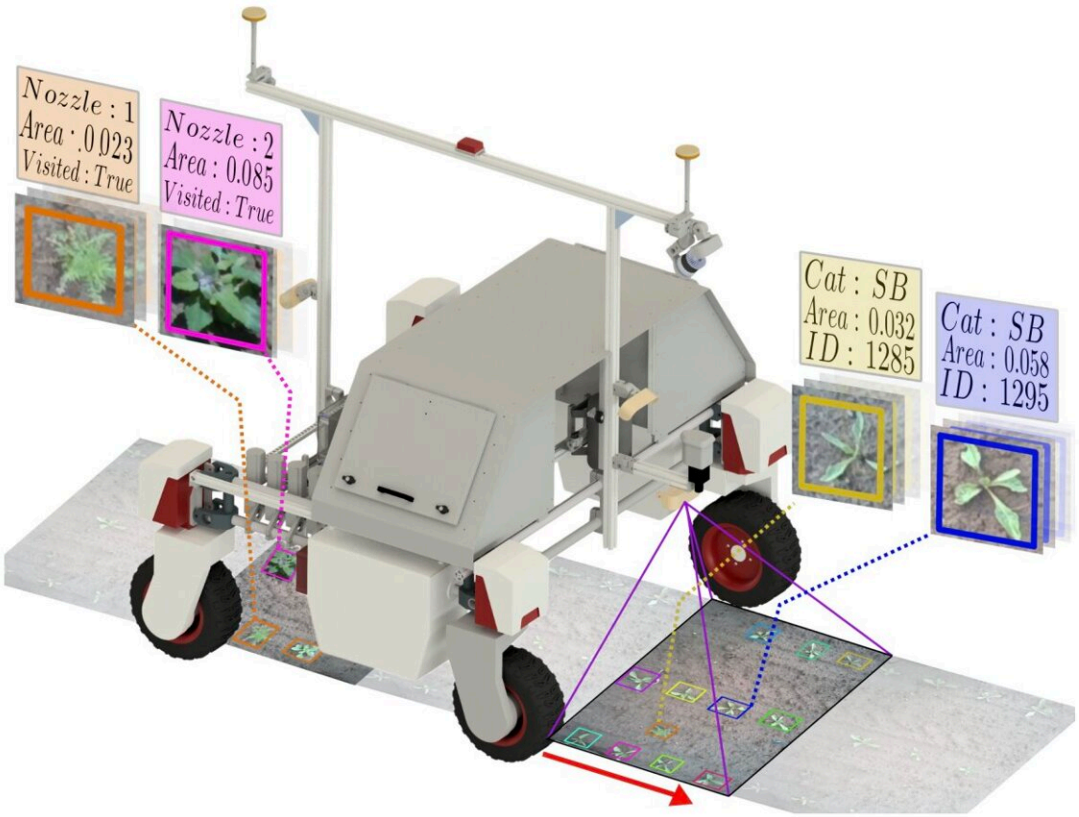

Figure illustrating the BonnBot-I platform. Credit: Ahmadi, Halstead & McCool.

Over the past decade, robotic systems have revolutionized numerous sectors, including the agricultural and farming sector. Many tasks that

were traditionally performed manually can now be potentially automated, boosting efficiency and reducing the workload of farmers and other agricultural workers.

Two aspects of farming that could greatly benefit from automation are weed management and crop monitoring. As the demand for organic foods that are grown using a minimum amount of chemicals and pesticides has risen significantly over the years, many farmers are seeking viable and cleaner strategies to control weeds, eliminate pests and track the state of their crops.

A team of researchers at the University of Bonn has developed a new robotic system that could help farmers to manage weeds and monitor crops more efficiently. This system, dubbed BonnBot-I, was introduced in a recent paperpublished on the pre-print server *arXiv*.

"Cultivation and weeding are two of the primary tasks performed by farmers today," Alireza Ahmadi, Michael Halstead and Chris McCool, the researchers who developed the robot, wrote in their paper. "A recent challenge for weeding is the desire to reduce herbicide and pesticide treatments while maintaining crop quality and quantity. We introduce BonnBot-I, a precise weed management platform which can also perform field monitoring."

The robot created by this team of researchers employs several localization sensors based on GPS technology and odometry. The robot can move through fields to locate, classify, and count plants, while also managing weeds using a variety of tools integrated in its body structure.

Notably, the system is fully compatible with ROS, the primary robotic operating system. As part of their study, Ahmadi and his colleagues also compiled a new dataset for training algorithms to locate and count corn, a crop that can be difficult to spot using computer vision.

"Driven by crop monitoring approaches which can accurately locate and classify plants (weed and crop) we further improve their performance by fusing the platform available GNSS and wheel odometry," the researchers wrote. "This improves tracking accuracy of our crop monitoring approach from a normalized average error of 8.3% to 3.5%, evaluated on a new publicly available corn data set. We also present a novel arrangement of weeding tools mounted on linear actuators evaluated in simulated environments."

So far, the researchers evaluated the BonnBot-I robot in simulated fields that mirrored the typical distribution of crops in actual fields. Their initial findings were promising, suggesting that their robot could eventually become a helpful technology for farmers. In the future, the team could conduct further tests in real-world environments using a physical prototype of BonnBot-I, to further validate its potential.

"We replicate weed distributions from a real field, using the results from our monitoring approach, and show the validity of our work-space division techniques which require significantly less movement (a 50% reduction) to achieve similar results," the researchers wrote. "Overall, BonnBot-I is a significant step forward in precise weed management with a novel method of selectively spraying and controlling weeds in an arable field."

More information: Alireza Ahmadi et al, BonnBot-I: A Precise Weed Management and Crop Monitoring Platform, *arXiv* (2023). DOI: 10.48550/arxiv.2307.12588

Alireza Ahmadi et al, BonnBot-I: A Precise Weed Management and Crop Monitoring Platform, *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (2022). DOI: 10.1109/IROS47612.2022.9981304