

P-AgBot: In-Row & Under-Canopy Agricultural Robot for Monitoring and Physical Sampling

GNSS-free robot that navigates crop rows, collects data, and autonomously samples leaves for analysis.

Researchers at Purdue have designed an internet of things enabled agricultural robot platform that can autonomously navigate between rows of crops to make crop morphological measurements and has the capability to sample leaves from crops for further analysis. In order to effectively innovate or optimize agricultural practices, monitoring of crop data is needed to validate the outcome of a particular experiment or practice. However, traditional crop monitoring is costly, labor intensive, and time-consuming.

To more efficiently monitor the status of crops in a field, the researchers developed an agricultural robotics platform (called P-AgBot) that can autonomously navigate between rows of corn or sorghum crops without the need for a signal to a global navigation satellite system (GNSS) that other autonomous crop monitoring systems require. Furthermore, the P-AgBot can make morphological measurements, such as crop height and stalk width, of crops in its vicinity and can use a robotic arm and custom end-effector to sample leaves from plants for further analysis, without the need for human supervision.

Technology Validation:

The P-AgBot was validated in simulation and in field tests. In simulated and field environments, P-AgBot had minimal deviation from the ideal path during navigation. Additionally, P-AgBot had a low % Average Error of around 5% when measuring the crop height and stalk radius for both simulated and real environments. Finally, for the ten successful trials (total of 12), the errors for leaf position estimation were within the tolerable ranges and the gripper was able to successfully grasp the leaf and subsequently cut it.

Technology ID

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Category

Agriculture, Nutrition, &
AgTech/Precision Agriculture &
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Agriculture, Nutrition, &
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Advantages:

- Autonomous navigation, monitoring, and sampling
- Does not require a GNSS connection

Applications:

- Automated crop monitoring
- Automated disease monitoring in crops

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2023-03-31, United States

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