A Balloon Robot with Wheel Paddles for Agricultural Use

Buoyant, paddle-steered robot navigates crops with high efficiency and minimal plant damage.

Agricultural technology, including agricultural robotics, has come a long way in the last few decades, emerging as a cornerstone of modern farming practices. Today, two primary classes agricultural robots exist, including UGVs (Unmanned Ground Vehicles) and UAVs (Unmanned Aerial Vehicles). Both types of robotics have been designed to offer continuous, detailed crop monitoring, allowing farmers to have better insights into the health and status of their field crops than ever before imagined. However, UGVs and UAVs both suffer from limitations inherent to their designs. UGVs commonly struggle traversing large or uneven terrain, and their weight and size requirements can make it difficult to maneuver among close-planted crops, while UAVs generally lack the ability to get too close to crops for fear of damaging them with their blades, hindering close-range scanning capabilities. Both technologies also struggle with fuel efficiency, since all their power for mobility and monitoring must come from batteries or fossil-fuel-based energy sources. Given these limitations, researchers at Purdue University have developed a novel design for an agricultural robot that eliminates issues surrounding maneuverability, proximity, and efficiency. Their design relies on an innovative balloon, which provides buoyancy, coupled with gentle rotary paddles for steering with reduced risk of crop damage. This new kind of agricultural robot, though unorthodox, promises to break barriers in continuous crop monitoring, providing greater protection against harmful pathogens and improving yield for farmers everywhere.

Technology Validation:

Theoretical kinematic motion of the robot has been evaluated. These theoretical dynamics have then been used in three simulations using MATLAB to model the motion of the robot. The first simulation used a forward dynamics model, while the second two relied on the inverse dynamics model.

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Category

Agriculture, Nutrition, & AgTech/Ag Robotics & Automation
Energy & Power Systems/Hydrogen & Fuel Cell Systems
Automotive & Mobility Tech/Micromobility & Smart Urban Infrastructure

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Advantages:

-Improved fuel efficiency due to buoyancy

-Reduced risk of crop damage due to rotors typical of traditional UAVs

-Improved maneuverability over UGVs

-Suitable for any terrain

-Improved close-range scanning capabilities compared to traditional UAVs

-Agricultural robots as a whole offer many advantages to farmers due to their ability to continuously and methodically monitor crops

Applications:

-Continuous monitoring of agricultural crops for disease, damage, and other factors that may reduce yield.

TRL: 3

Intellectual Property:

Provisional-Patent, 2024-06-20, United States

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