Development of a novel robotic system for in-filed corn leaf spectroscopy imaging

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Abstract

Corn (*Zea Mays*) is one of the most valuable row crops grown in the United States. Thus, securing and increasing the yield of corn is necessary for the progression of society. However, blindly applying excessive nitrogen fertilizer to reach higher yield has resulted in disastrous consequences. Therefore, it is crucial to precisely monitor the nitrogen content in the corn plant and provide suggestions on nitrogen application is crucial to increase the sustainability of agriculture.

Currently, spectroscopy imaging has been proved effective in measuring nitrogen content in corn plants. However, the trade-off between throughput and data quality is rarely addressed and it has become an obstacle to scale up the application of spectroscopy imaging. Hence, in this study, we have developed a new robotic system to operate a proximal imaging device to capture a spectroscopy image of a single corn leaf. The robot has 3-DoF, including one rotational and two translational actuators. One 3-D camera works as the perception system to detect and localize the targeted corn leaf. The manipulator is a uniquely designed spectroscopy imaging device that captures spectroscopy images with low-noise and high-resolution. Once deployed, this robot could capture high quality images for a single leaf within 30 seconds and free human from laborious field work.

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