

Multi-View Robotics Imaging System for Distinguishing Visually Similar Wheat Diseases

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Introduction

Breeders usually rely on visual inspections to assess disease symptoms of crop genotypes, a process that is time-consuming and labor-intensive. Existing tools like UAVs and handheld devices have shown some promising results in disease detection, but they are often limited in data resolution or efficiency.

Developing a system that is capable of collecting high-quality images is crucial for automating crop disease assessment, which could further benefit crop breeders.

Objectives

- Design a minimalist robotics system that can capture images of winter wheat for accurate rust disease rating and differentiation.
- Contribute to a scalable and autonomous platform for lower canopy, multi-view data collection to support breeding programs.

Methodology

- **Plant detection and extracting the 3D position** from the targeted plant
- Move the arm to **the targeted 3D Pose** (extracted Position + Orientation) to capture the multi-view images

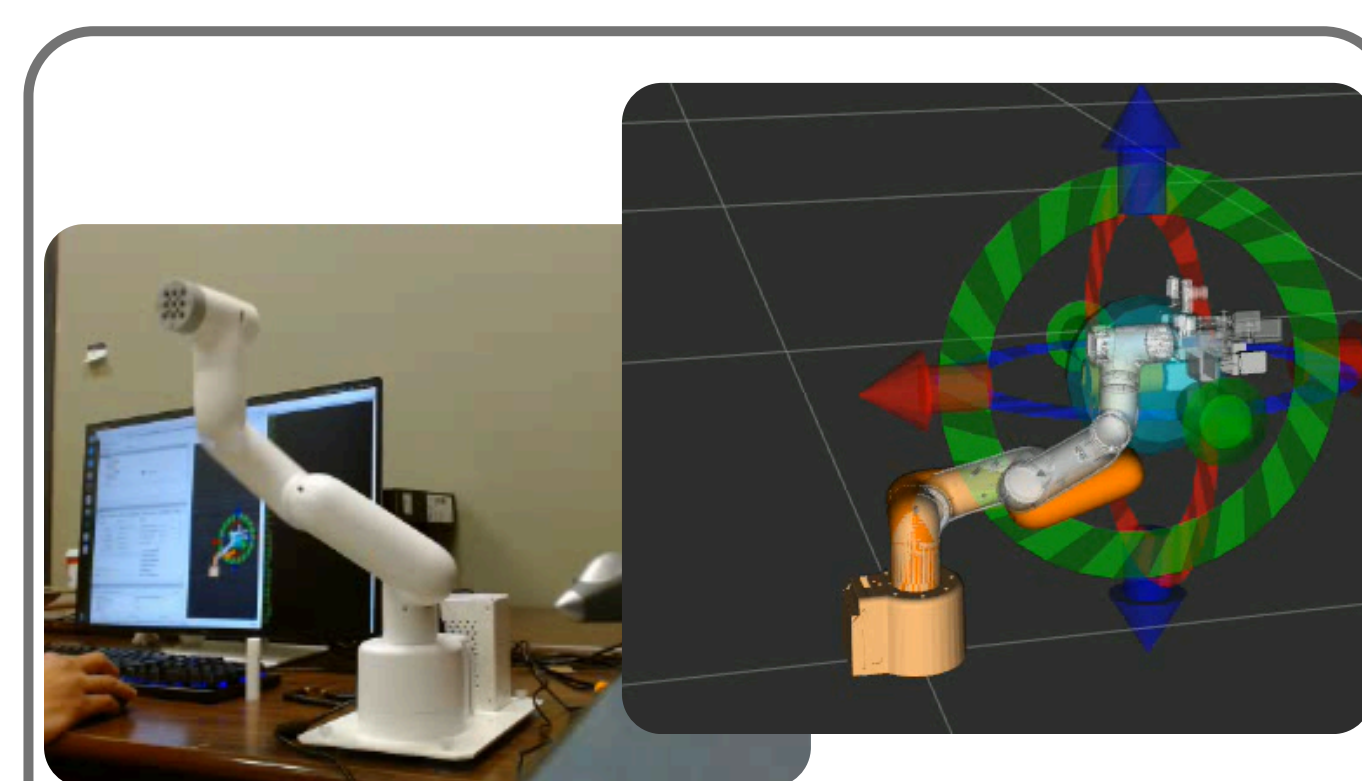


Fig. 1: Synced Sim and Real

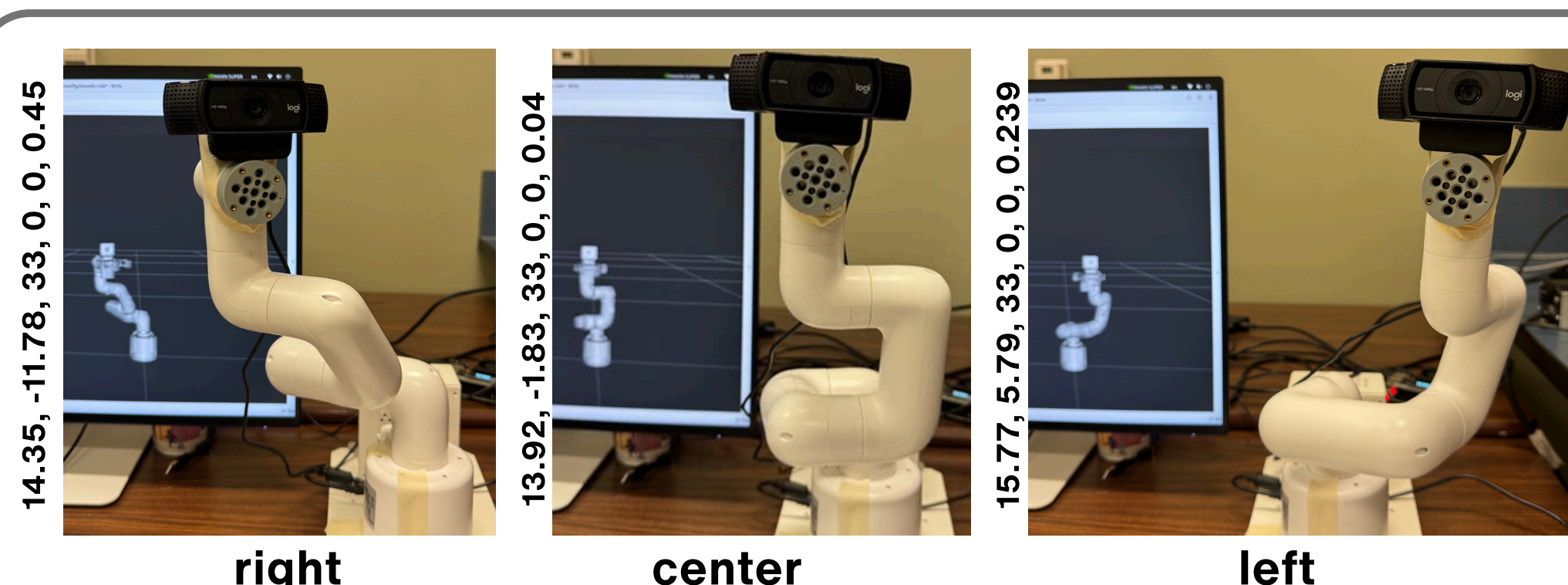


Fig. 3: Three viewing angles for image capture

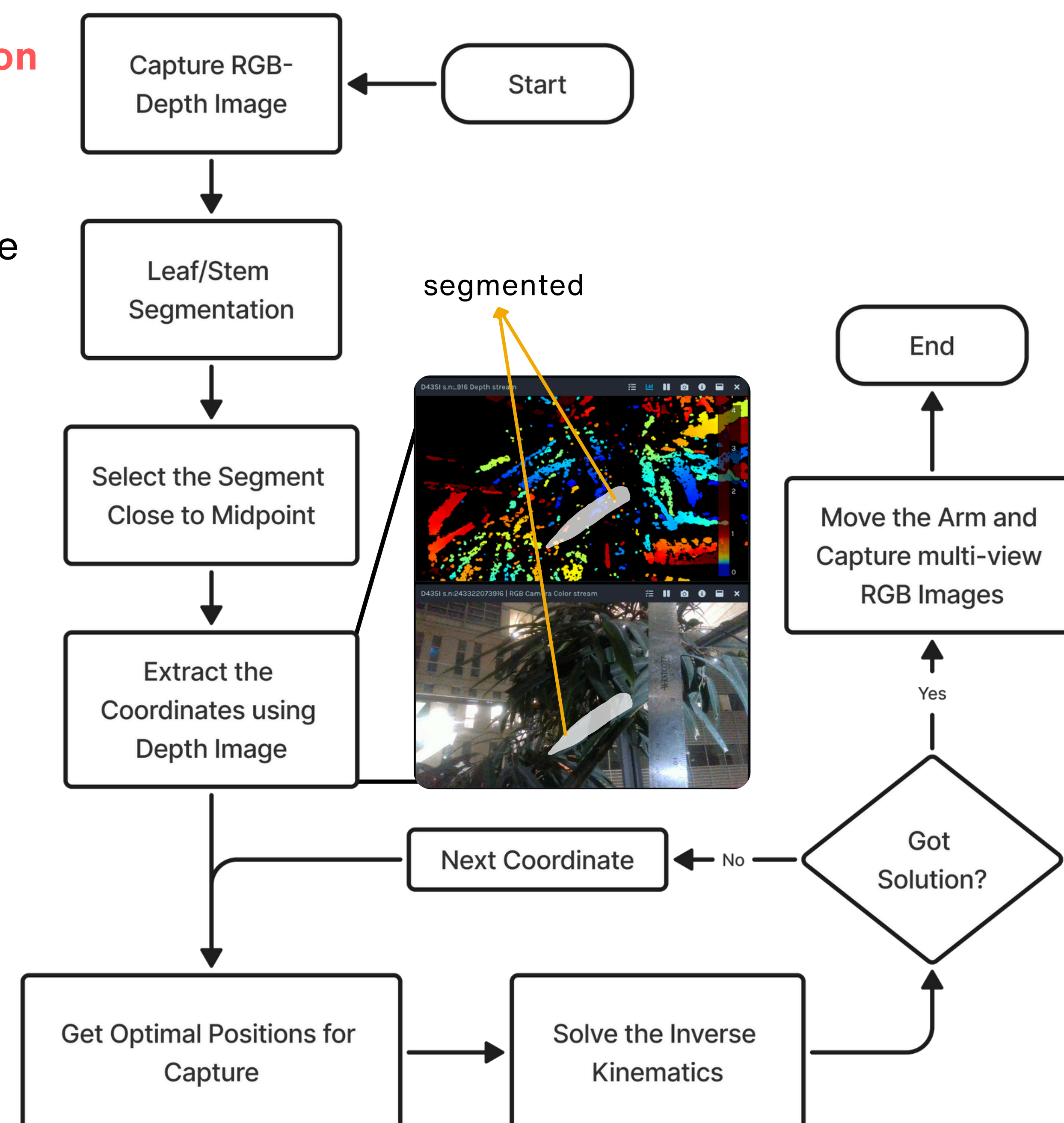


Fig. 2: Overall Flowchart

Expected Results

- **Handy, lightweight and cost-effective arm system** for automatic image capture
- Improvement in Image quality over existing techniques by adding **multi-view close-up capture**
- **Higher accuracy in discriminating visually similar diseases** with multi-view and high-quality RGB images

Future advancement will include a system integrating this system with the automatic robotic vehicles

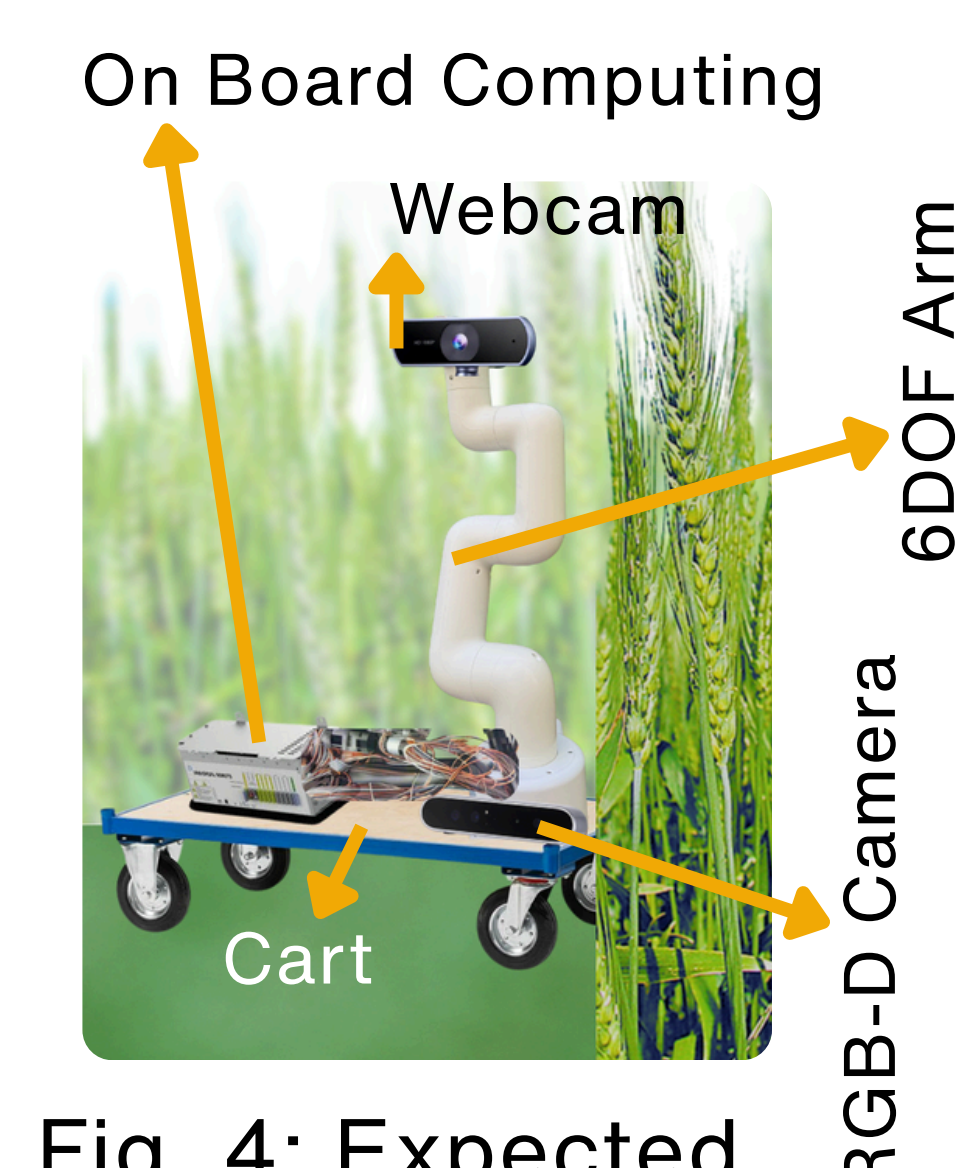


Fig. 4: Expected System in Field

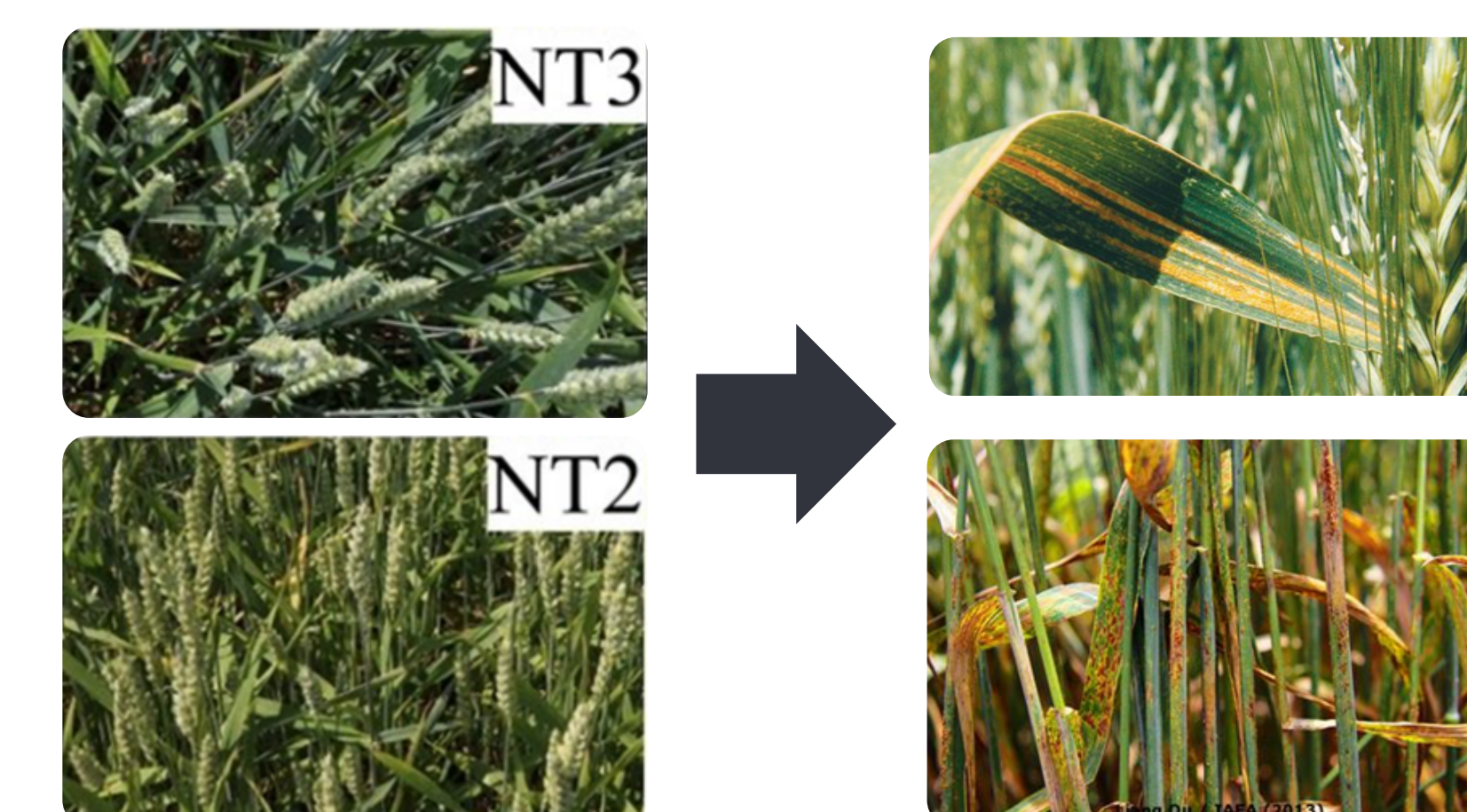


Fig. 5: Expected Quality - drones captured images on the left (Wójtowicz 2025); images on the right are expected to be captured by our system (plantix, Glen)

Research Progress

Most of the work on robotic arm control and manipulation has already been done. Near-future work involves the development of a localization pipeline utilizing vision and depth sensors.

Acknowledgement

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