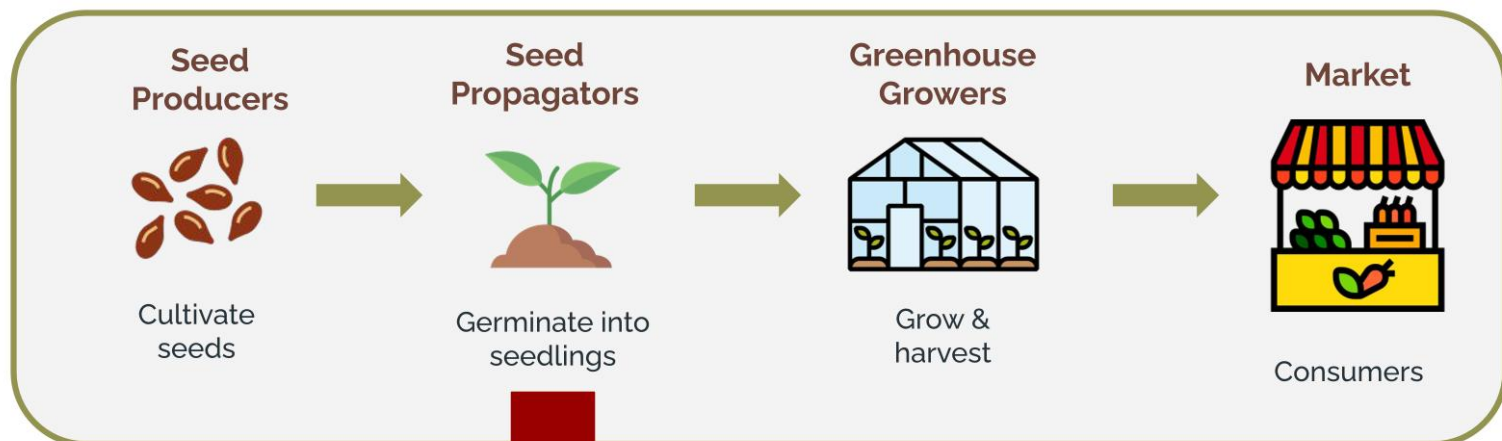


Background and Motivation

The Journey from Seed to Plate In the BC Greenhouse Farming Sector



50% of Seeds do not reach fruit bearing age!

In BC this means:

- \$15 million annual resource loss
- \$10 million annual seed loss

Our Sponsor



A UBC-based startup that is developing a non-destructive, data-driven seed-sorter that removes ineffective seeds before planting

System Predicts:

- Vigour
- Abnormalities
- Disease
- Yield

Predictability enables stability for greenhouse growers

Our Goal

Short Term

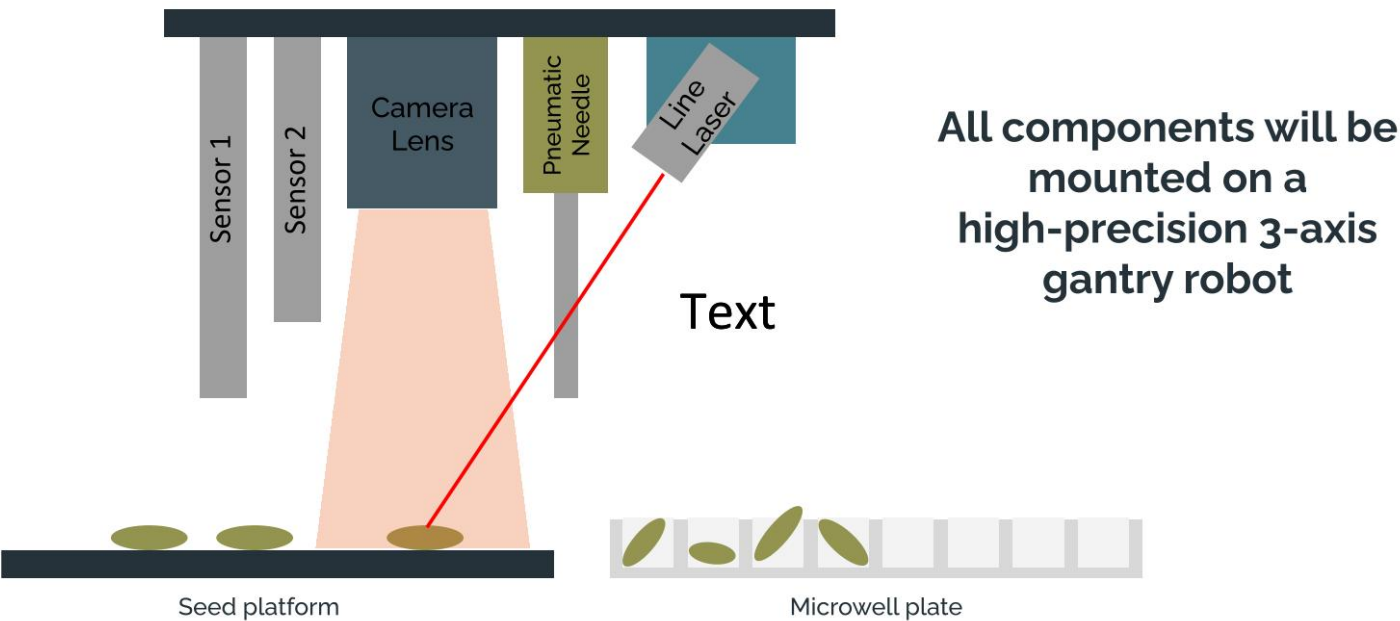
Develop a test-bench that:

- Automates data collection
- Provides more consistent data in less time
- Can be sterilized between batches

Long Term

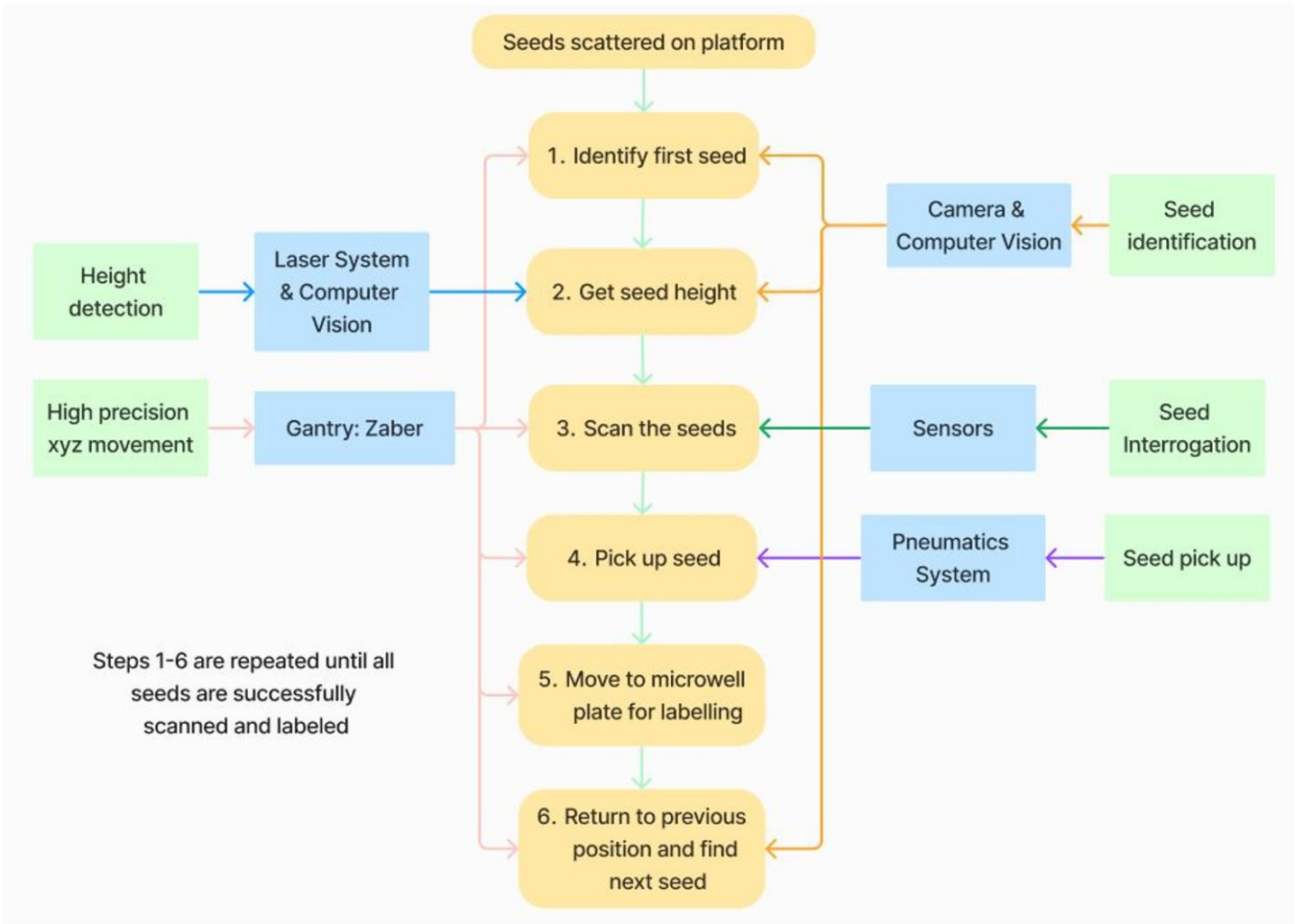
Re-work system so that it can be scaled up to the high throughputs necessary in industry (200, 000 seeds per day)

System Design Overview



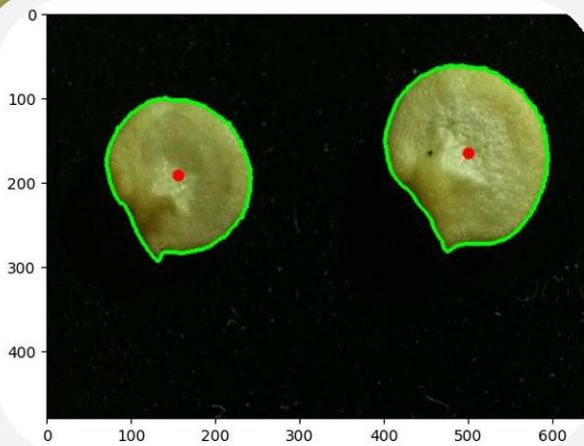
Big Idea: A Test Bench Prototype

- Simple and scalable
- Adds automation to speed up data collection process
- Iterable and can easily be modified to account for changes
- Allows Insporos to verify and improve measurement techniques



Subsystems

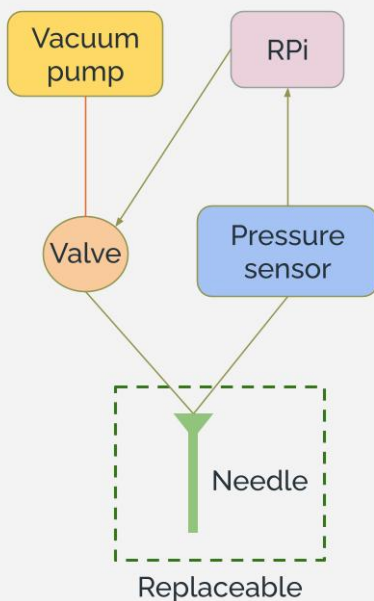
Computer Vision



Computer Vision Analysis of Pepper Seeds

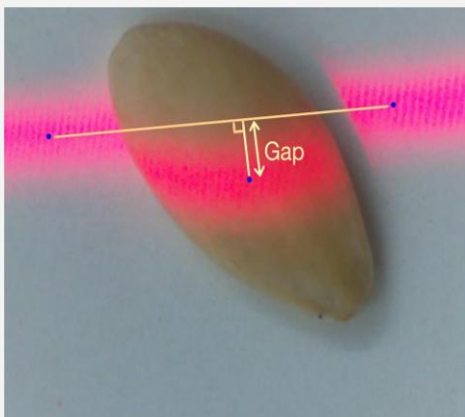
- Utilizes a customized algorithm to search for and locate seeds on the seed plate
- Analyzes seed contours and calculates centroids for precise seed location
- Provides real-time visual feedback for monitoring seed search processes

Pneumatic System



- Utilizes **pressure pump** to create suction power for seed pickup
- The **solenoid pinch valve** controls seed release
- Incorporates **pressure sensor** for seed pickup confirmation
- Replaceable **needle** design ensures sanitary criteria are met
- Demonstrates robust performance across various seed types, achieving a 100% success rate

Laser Height Detection



- Purpose: certain sensors need to be at a specified height above the seed
- Uses a line laser directed at seeds from an angle of approximately 40 degrees
- Measures the gap in the line using computer vision
- Calculates seed height by geometry:
 $\text{Height} = \text{gap} \times \tan(\alpha)$

Results and Conclusions

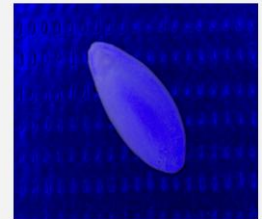
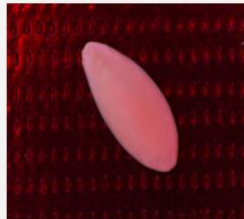
Notable Prototype Results

Automation

Can scan a batch of seeds automatically. This is a significant improvement to the current manual measurement process.

RGBW Imaging

Can take a set of images under red, green, blue and white light for each seed and store the data for further study.



Data Organization

The purpose of the prototype is to collect data on thousands of seeds. Our database system allows users to automatically store and easily access data for each individual seed.

Limitations

Throughput

Currently, only one seed can be measured at a time, which limits the throughput

Sensors

The sensors except RGB have not been integrated into the system yet.

Future Work

Increase throughput

We aim to increase throughput to ~200,000 seeds per day

Integrate sensors into the system

Additional sensors will be integrated and verified over the summer

Sanitization

A rigorous cleaning protocol will be implemented to prevent contamination