Uproot Robotics
Farming Sustainably

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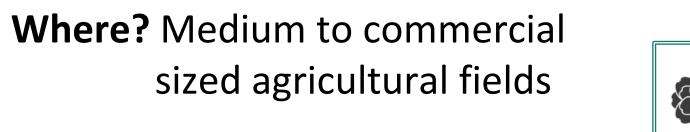Group 17 – 2020 Mechatronics Engineering, University of Waterloo

upRoot Robotics
Farming Sustainably

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Farming Sustainably

Problem Space

What? Lettuce, scalable to different crops

When? All life-stages of the crop-cycle to ensure effective weed management

Where? Medium to commercial sized agricultural fields

Additional Criteria:
Inter-row & intra-row capabilities, Modular SW for continued research

An Unsustainable System

Problem

The rising global population demands increased agricultural yields, which has been met with increased herbicide use. Herbicide use in agriculture is causing environmental damage.

Need Statement

A need exists for a sustainable alternative to herbicides for use in agriculture.

Solution

Our team leverages robotics and image processing designed to autonomously remove weeds from crops.
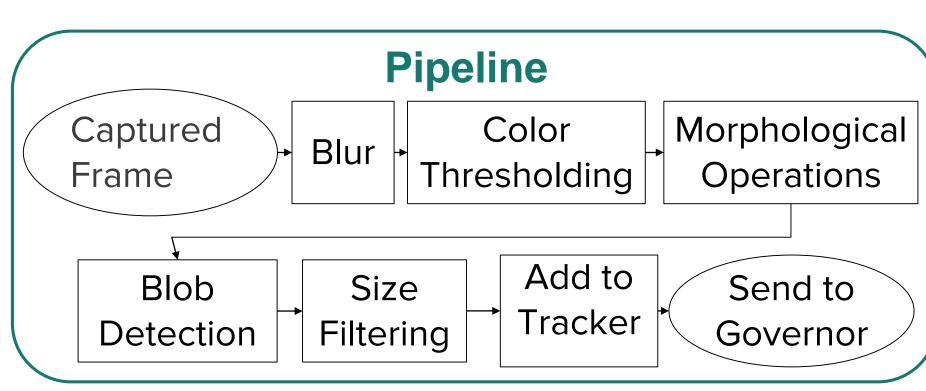
The Delta Arm

Materials Used:

Acrylic (Biceps, End-Effector Platform)

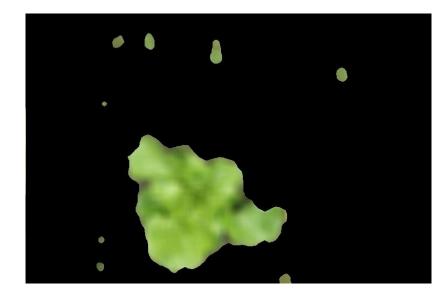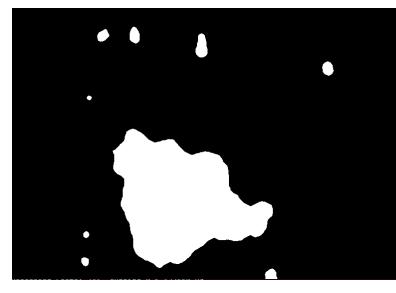6061 Aluminum (Robot Base, Supports, Forearms, Ball joints, Brackets, Enclosure)
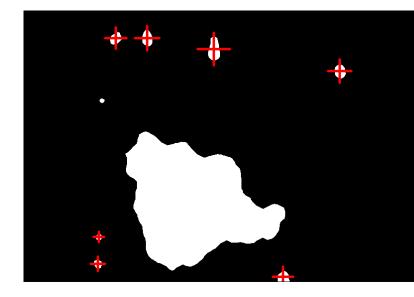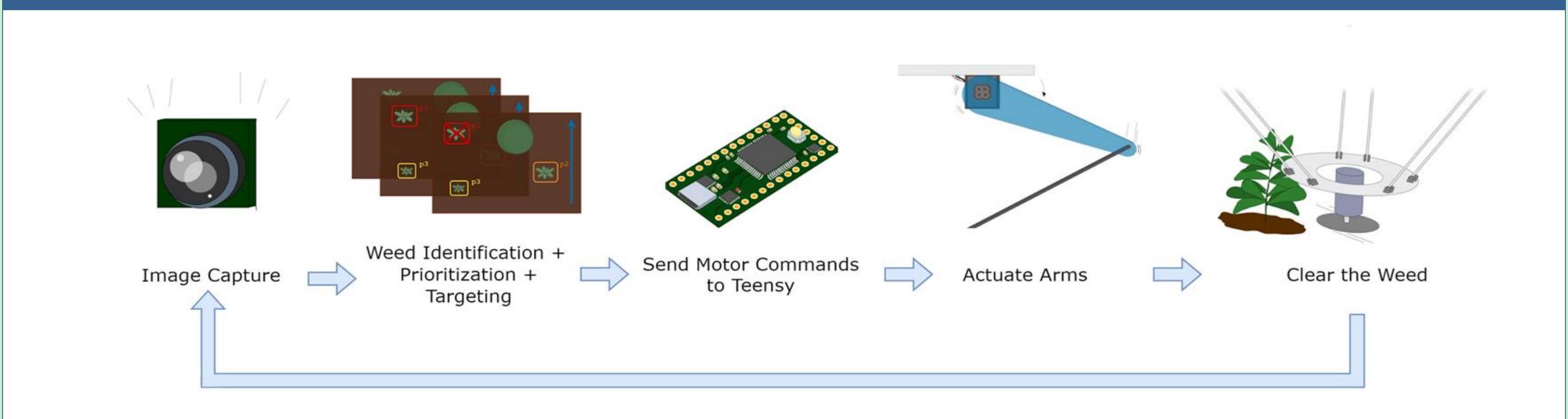
Working Envelope:

Vision

Pipeline

Captured Frame → Blur → Color Thresholding → Morphological Operations

Blob Detection → Size Filtering → Add to Tracker → Send to Governor

Testing

Hardware:
Nvidia Jetson Nano System-On-Module,
Nvidia Maxwell GPU Architecture

How We Do It

Image Capture → Weed Identification + Prioritization + Targeting → Send Motor Commands to Teensy → Actuate Arms → Clear the Weed

What's Inside the Box?

DC Power Supply

Teensy | Motor Drivers | Motor Encoders

Perf Board

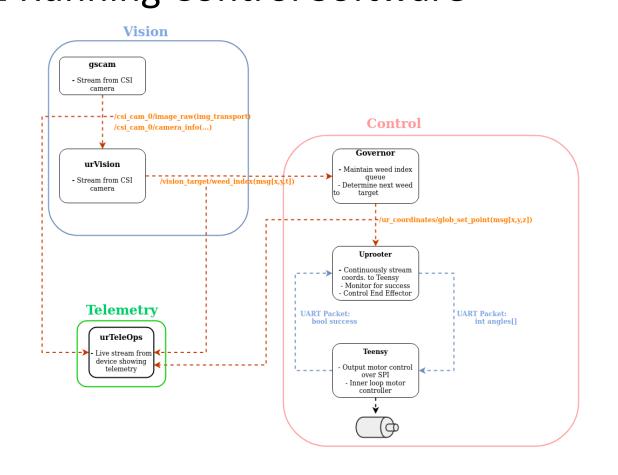Power Breakout Board | Jetson Nano

Software

Hybrid architecture to decouple control & vision

ROS (Robot Operating System) program running on the Nvidia Jetson Nano

Teensy 3.2 Running Control Software

Future Directions

Gen 1 can be easily attached to any autonomous mobile platform.

Continual Development on Vision Technology

Switch over to AI-powered CV algorithms

Contact

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