



Alex Jones

Farmhand Automation Portfolio





FARMHAND AUTOMATION

An Autonomous Platform for Sustainable Agriculture

Beginnings

In the Spring of 2019, Farmhand Automation was formed with a pre-seed investment to investigate the feasibility of creating a robotics company in New England to serve small to mid-scale farmers. With 1:1 matching funds from the Maine Technology Institute, Farmhand's founder, Alex Jones, has led the boots on the effort in the Southern Maine region, developing a 2,500 square foot test field, meeting with farmers and prototyping our first proof of concept.



About Alex

Maine Native, 10 years of agriculture and technology experience. Most Recently Head of Product and later Director of Customer Success US/Canada for robotics inventory management systems at Seattle's iUNU. Previously Product Manager for New England's largest online local food procurement and payments platform Forager.com and Product Designer at the University of Maryland Honey Bee Research Lab.



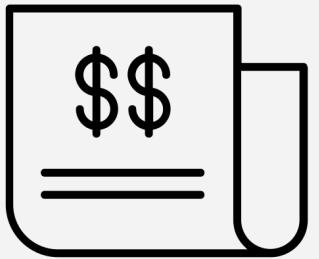
"Alex, In my farmer meeting last year, and increasingly so this year, concern about labor availability, skill and cost has been driving crop decisions more than any other factor."

- John Schreiber, Portland Maine's Rosemont Market Produce Manager



Needs of the Small Scale Farm

Challenges and Opportunities



Costs

Most machinery too expensive to scale operations



Crops

10 ~ 100 varieties can be grown in a single operation



Geography

Decentralized across geographic regions with multiple climates



Our Focus

The Small Scale Farms

AKA: Millennial Farmers

- 28-35 Years Old
- Market Gardener, Diverse Vegetable Production
- Intensive growing practices using hand tools
- Wanting to scale but don't want commitment of heavy machinery

Our Focus

The Mid Scale Farms

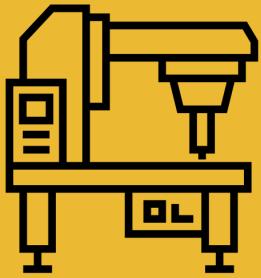
AKA: Gen X Farmers

- 38-55 Years Old
- Wholesale Vegetable Producer under 15 Varieties
- Heavy Use of tractor and large field areas
- Looking to spend less time on tractor and reduce costs



Solutions

Distributed Tools for Decentralized Farmers



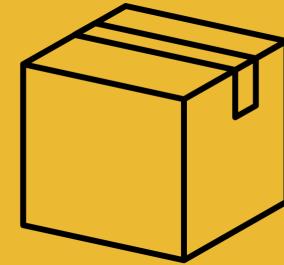
Digital Manufacturing

Low cost solution with a focus on digital manufacturing.



Diverse Farmscapes

A solution that scales across many plant types.

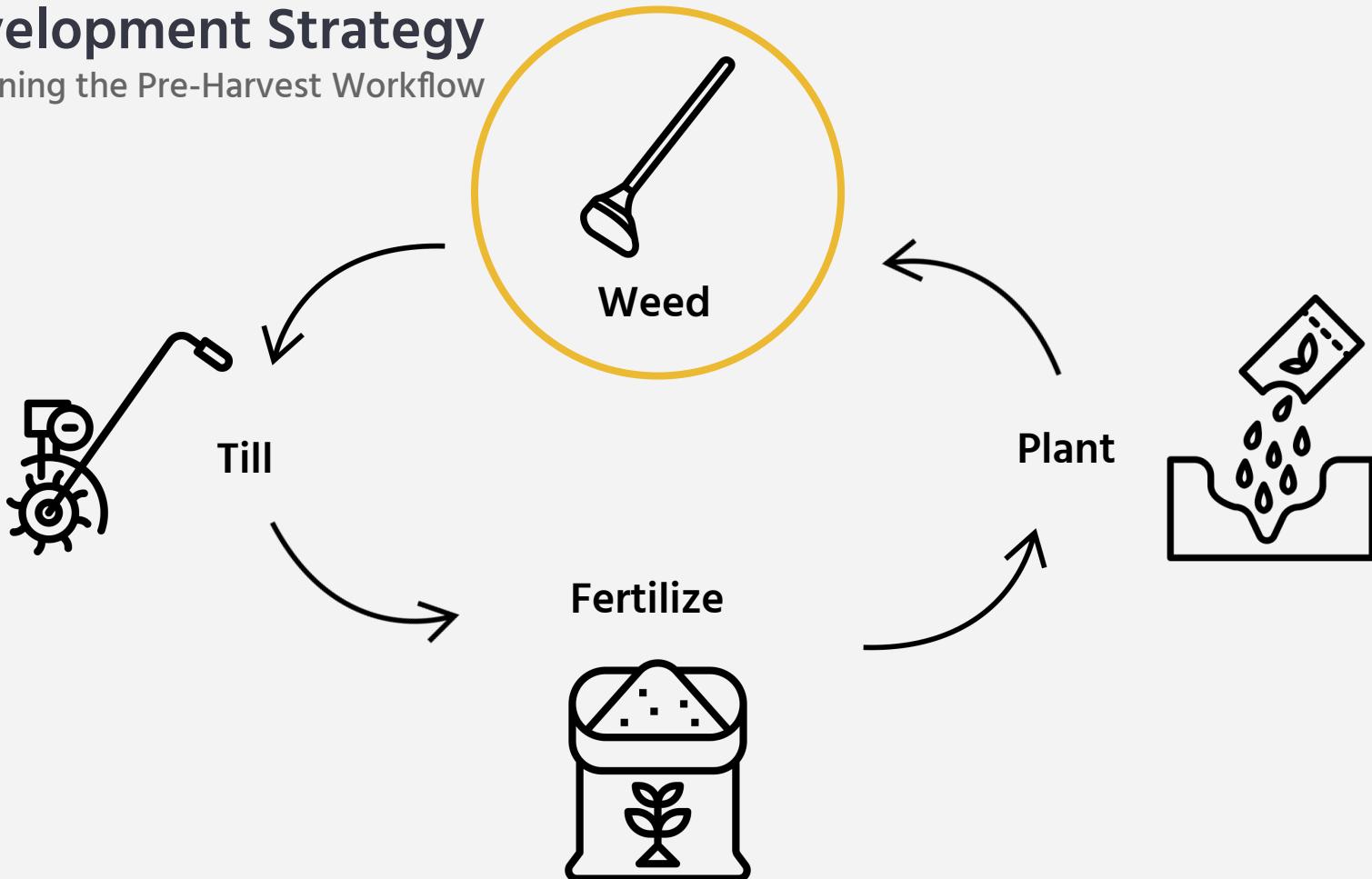


Flat Pack Shipments

Direct sale to customers shipped partially assembled with a total weight of < 200lb.

Development Strategy

Examining the Pre-Harvest Workflow





Technology Roadmap

What is Likely Achievable



Weeding



Planting



Fertilizing



Tilling



Harvesting



Bunching

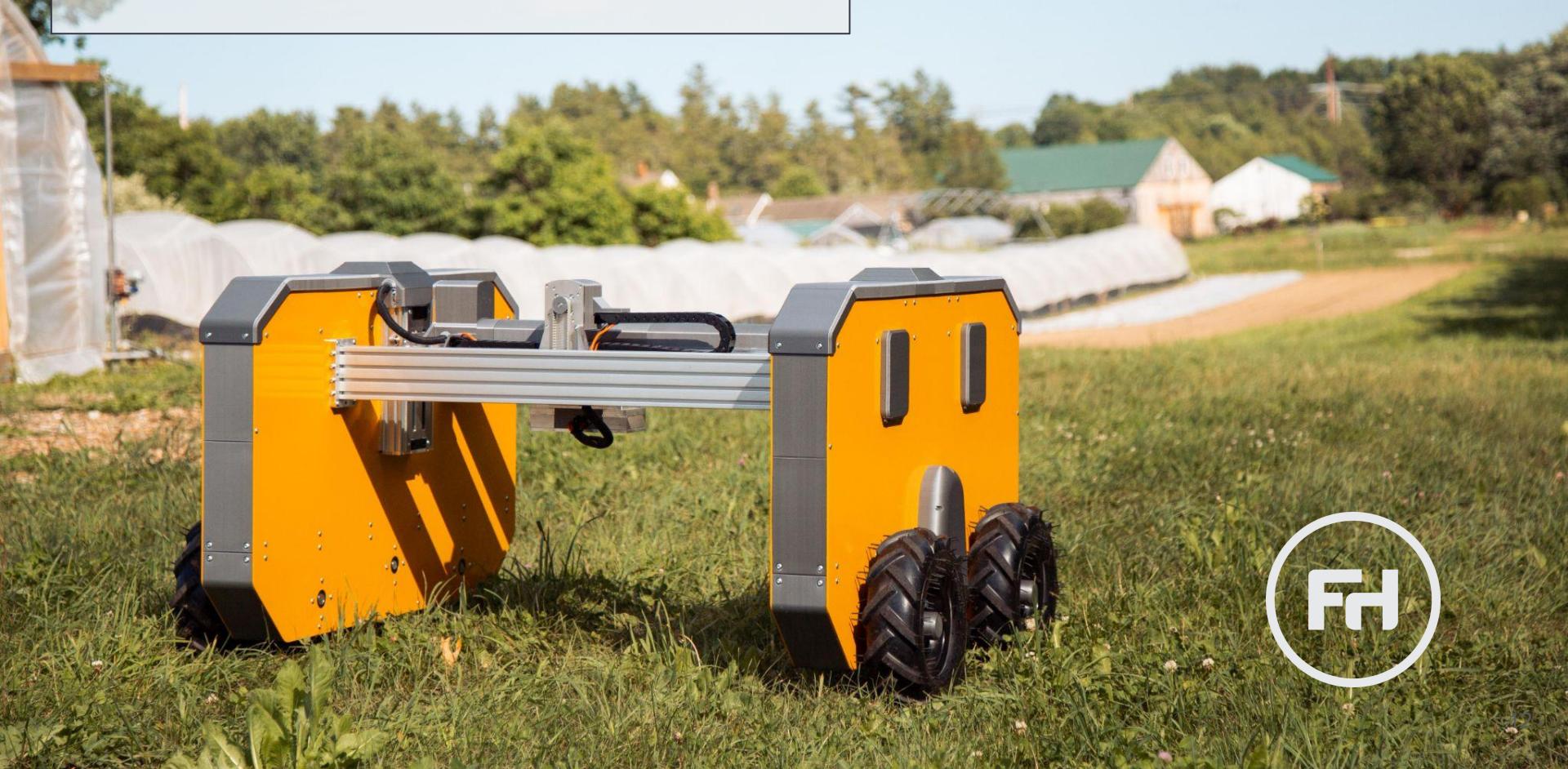


Packing

3-5 years

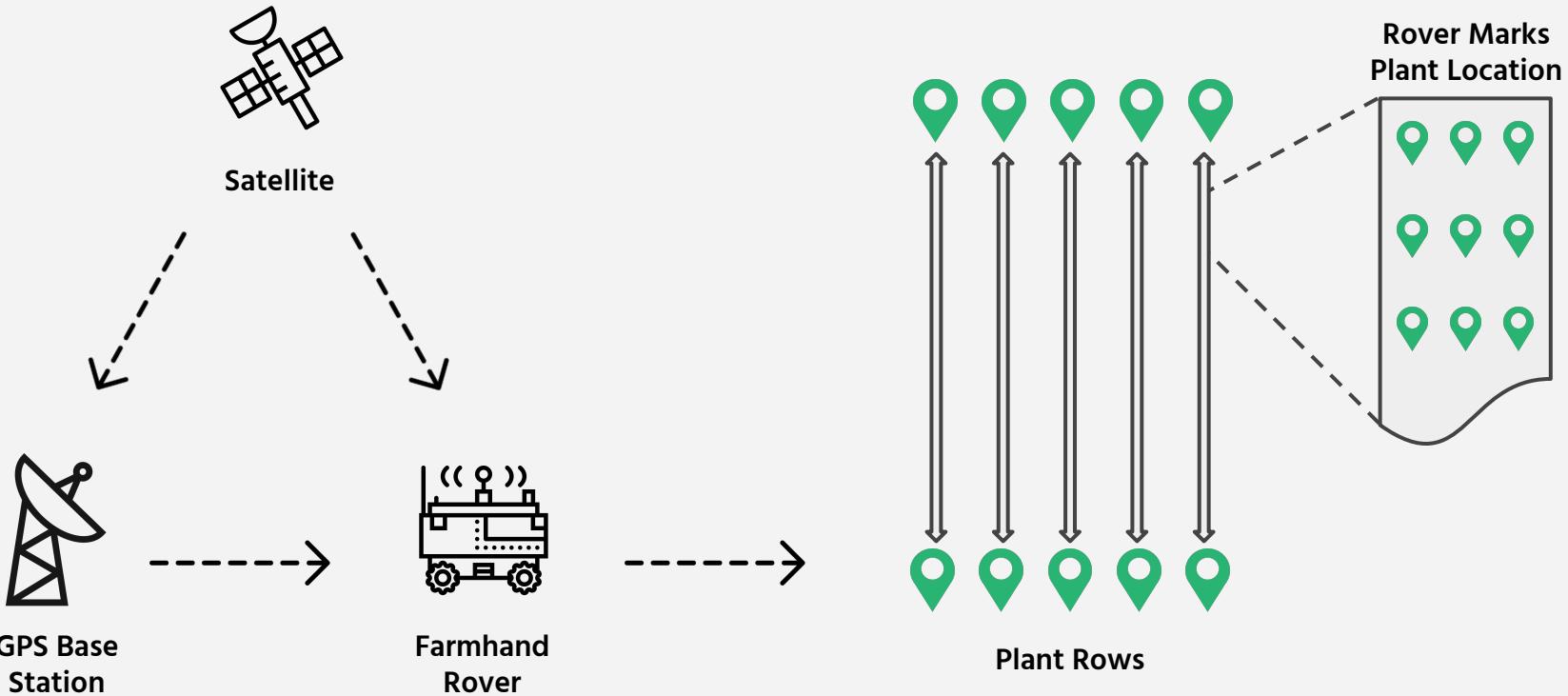
5-7 Years

Introducing the Farmhand Rover

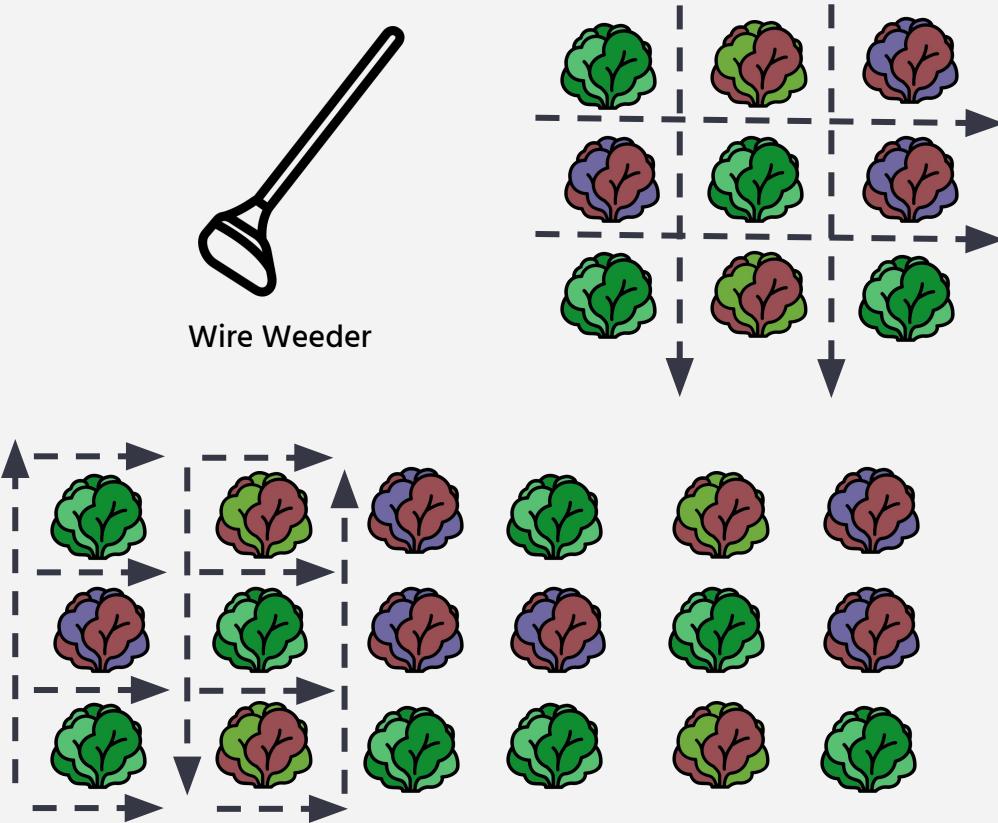
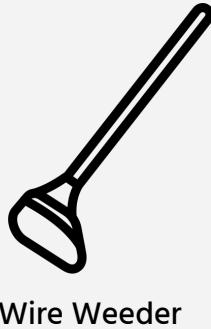
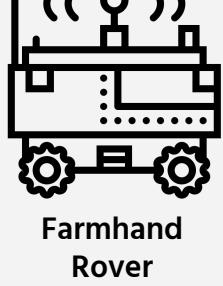


GPS Positioning Framework

Centimeter Level Accuracy



Our Approach to Weeding



New Wave of GPS Positioning

Last Decade



Last 5 Years



Last 18 Months



GPS In a Car

3 Feet Accuracy

\$300



Survey Grade GPS

12 Inch Accuracy

\$3000

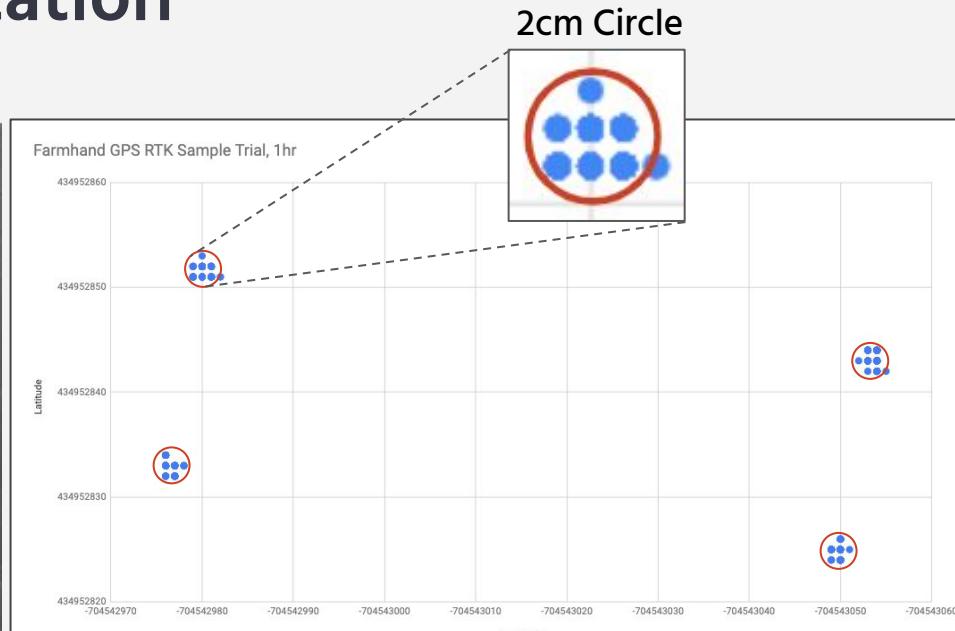


Differential GPS

< 1 Inch Accuracy

\$200

Farmhand GPS Implementation



Above: Automated Testing Unit on Office Rooftop.
97% Accuracy within +/- 1cm over 1K Cycles in Urban Environment



Project Review: Summer 2019

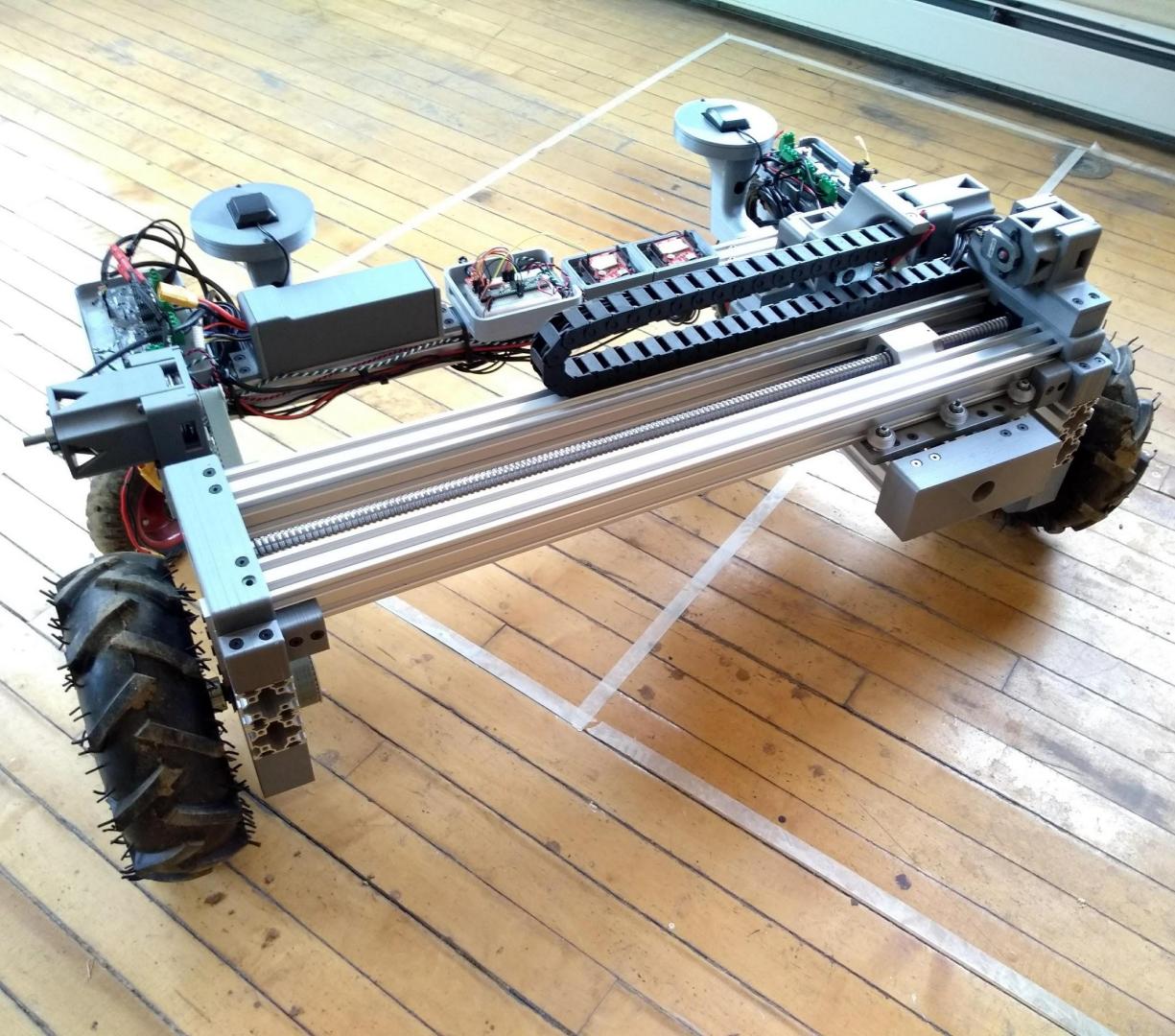




Modular Rover

Proof of Concept

- Designed to be accessible to small scale vegetable growers typically growing in 30" wide beds
- Modular with 2 independent drive trains with 2 x 1Kw motors
- 1605 lead screw driven 2 axis gantry for holding tools
- Dual GPS RTK for centimeter accuracy position and heading



Community Partners



BROADTURN
FARM

EST 1862

RIVERSIDE
FARM

Community Co-Designers



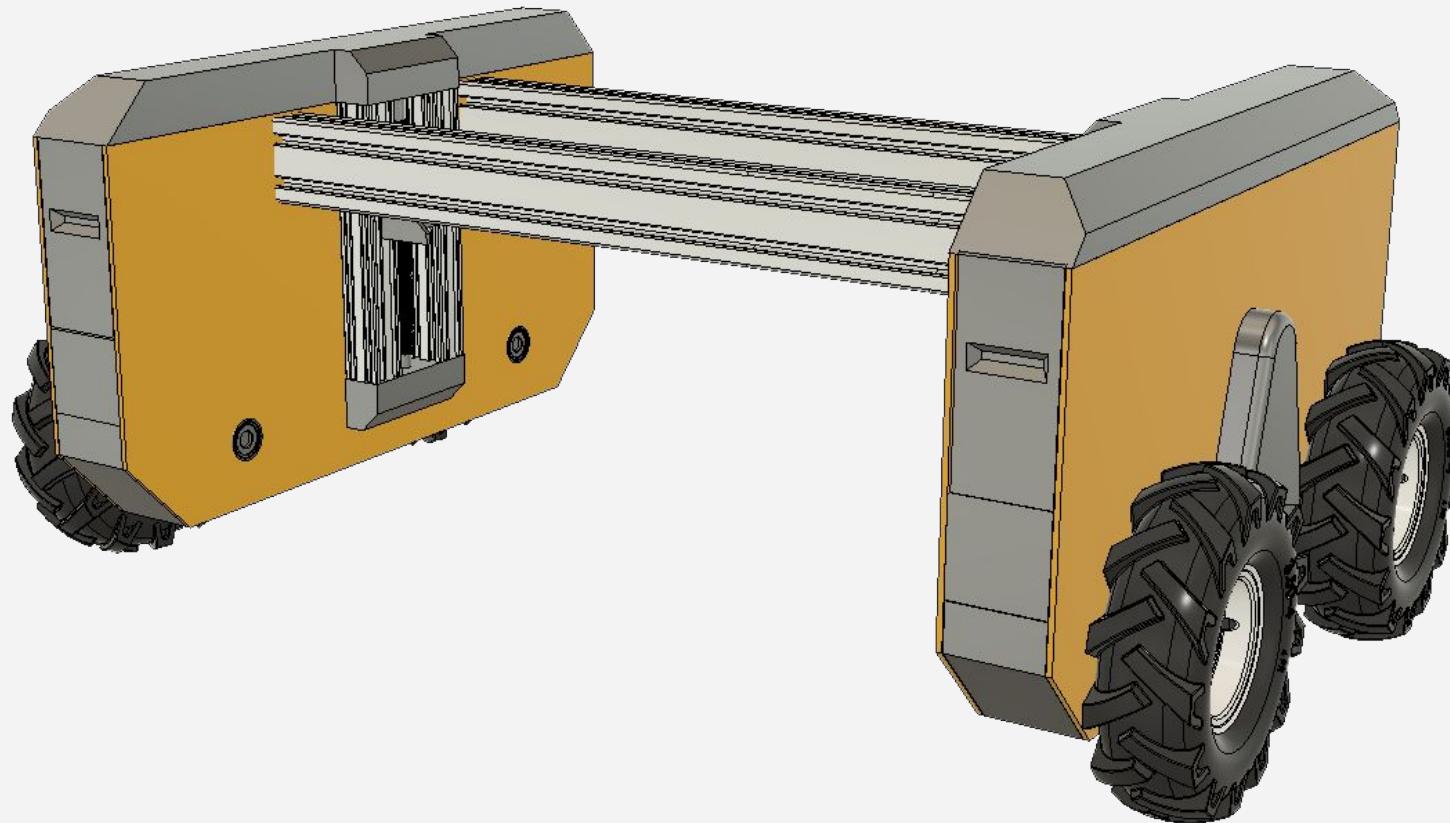


Product Review: Summer 2020



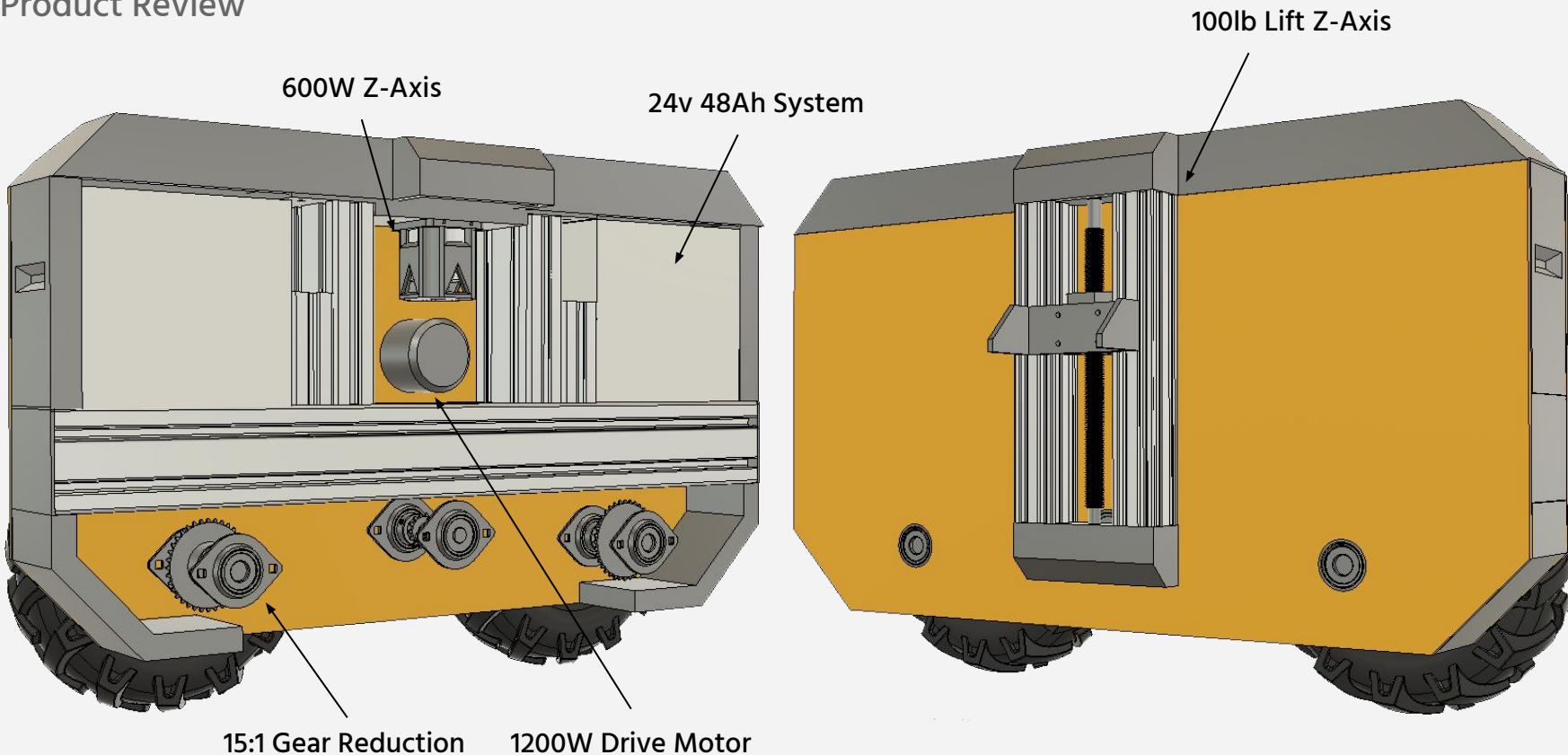
Summer 2020 : Farmhand 2.0

Product Review



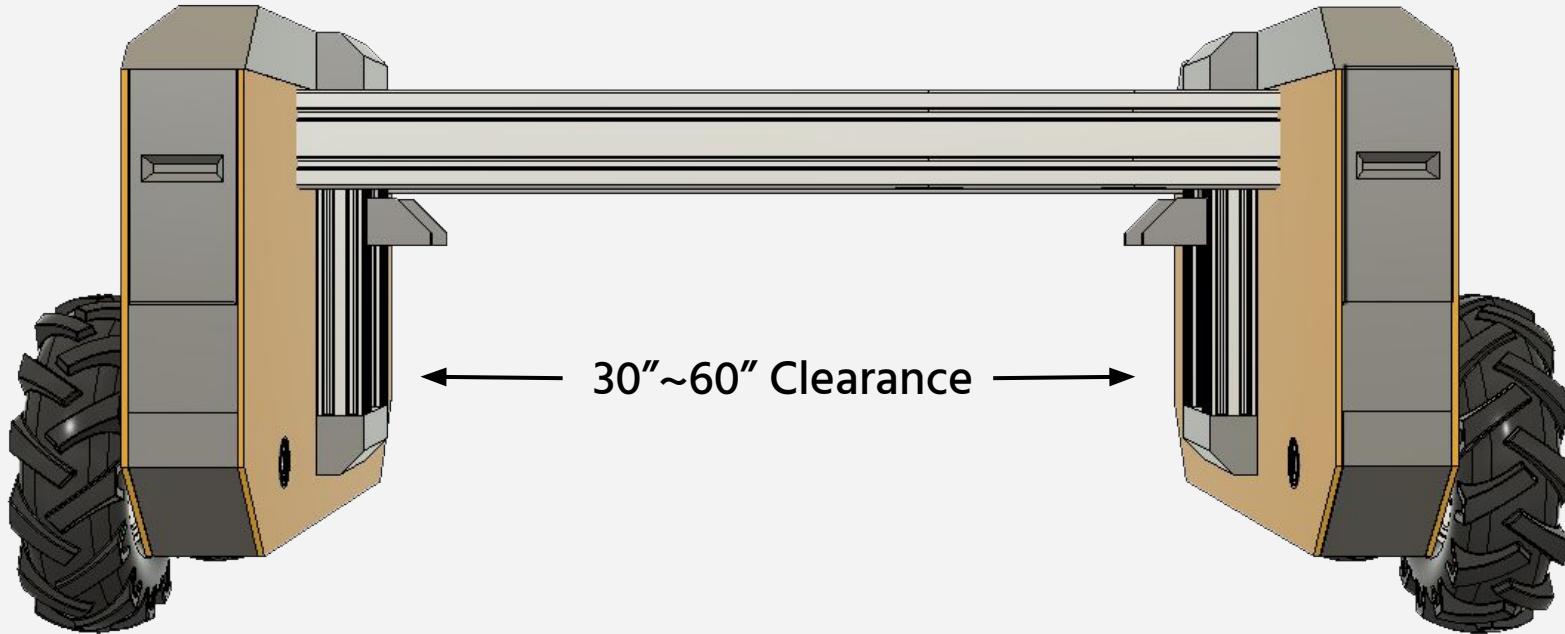
Summer 2020 : Farmhand 2.0

Product Review



Summer 2020 : Farmhand 2.0

Product Review



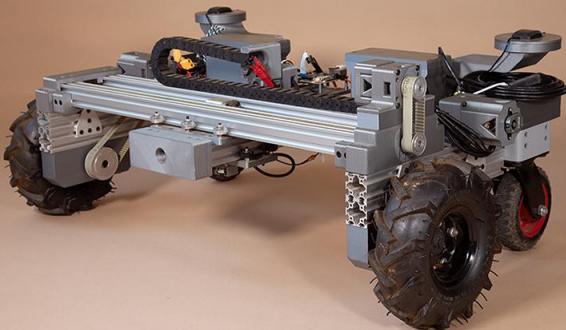


Summer 2020 : Farmhand Rover

Product Review

Phase 1 Prototype

- 30" x 30" Footprint
- 5" Height Clearance
- 30 lbs



Phase 2 Prototype

- 54" x "36 Footprint
- 14" Height Clearance
- 100 Lbs





Product Review: Summer 2021



Summer 2021 : Farmhand Rover V3

Product Review



Weeding in Action

Product Review



Solar Charging and Base Station

Product Review



CNC Machined Parts

50

Machined Components

40

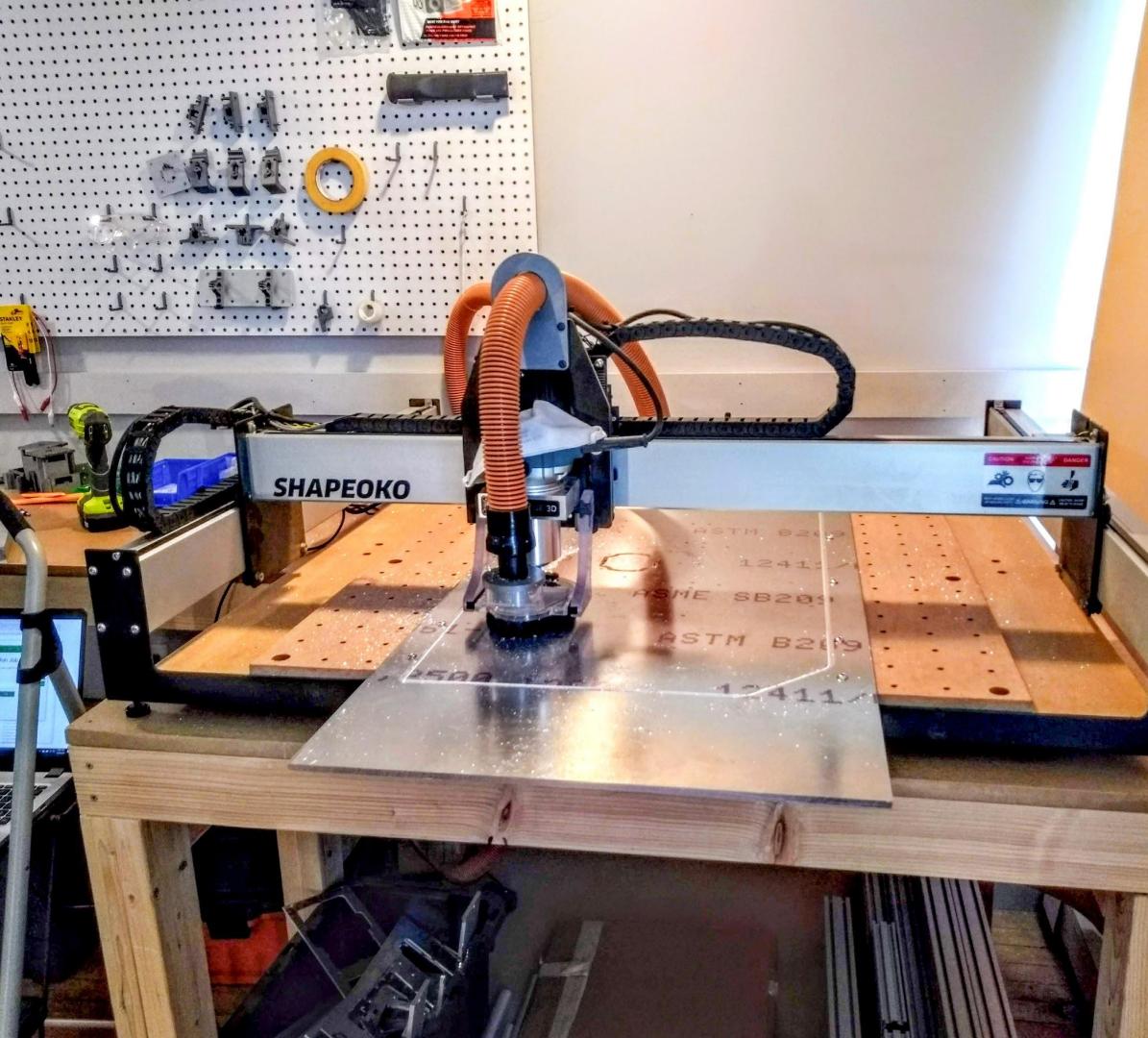
Hours of Machine Time

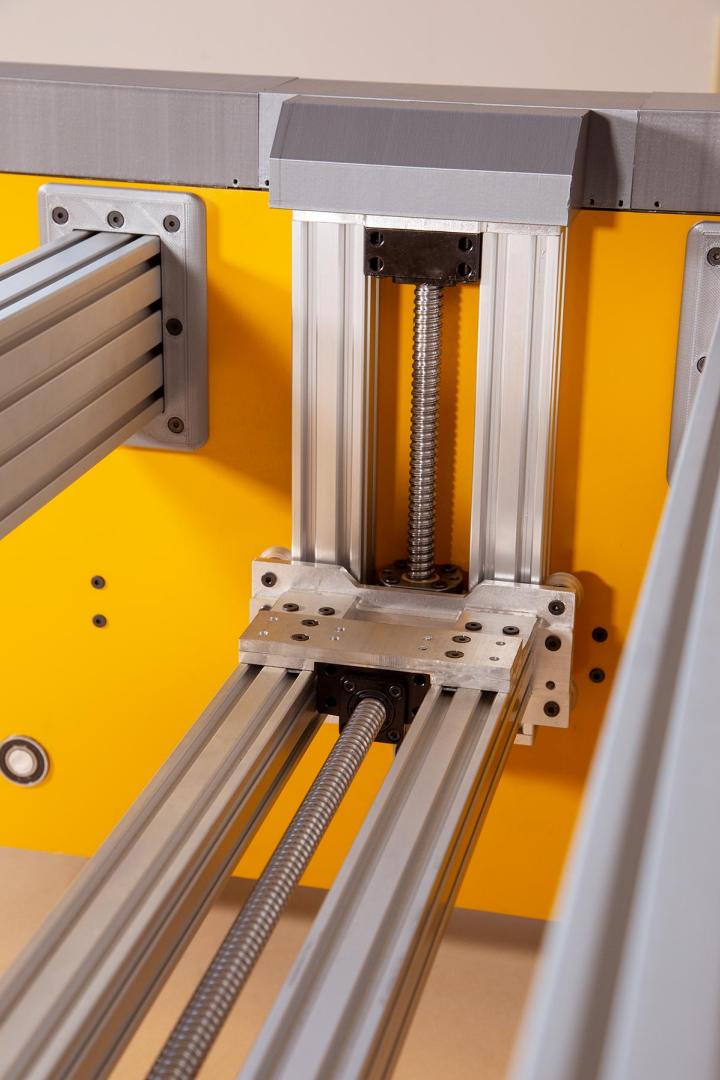
500%

Savings Machining In-House

\$1,800

Cost of CNC Machine



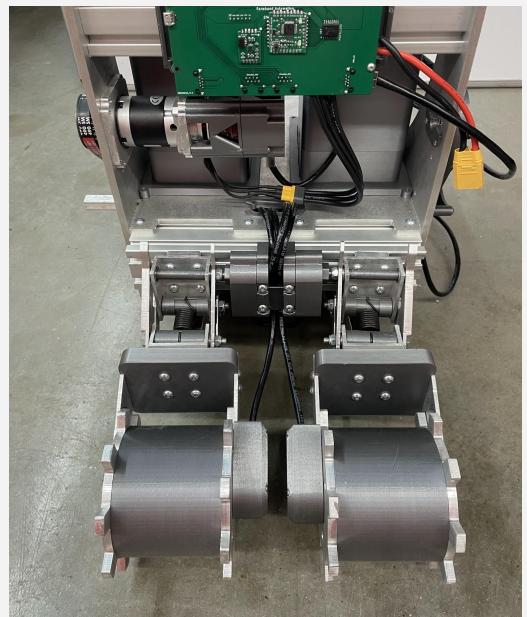
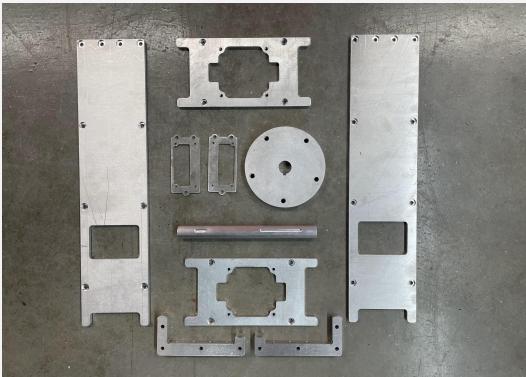
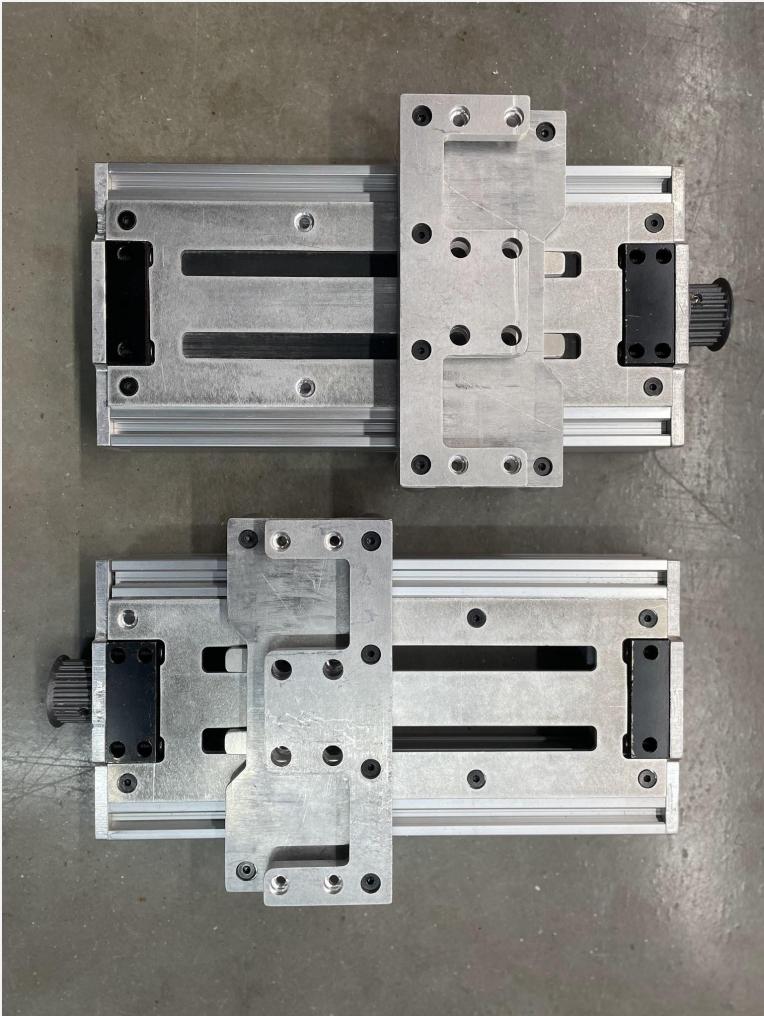


3D Printed Parts



CNC Aluminum

Chain Drive



3D Printed Components

65

Hours of Machine Time

6.7

Kg of Plastic Components

\$174.13

Total cost in plastic



Total Costs

\$6407.24

Total Unit Cost in Single Quantities

\$5,507.24

Final BOM Cost

2 Days

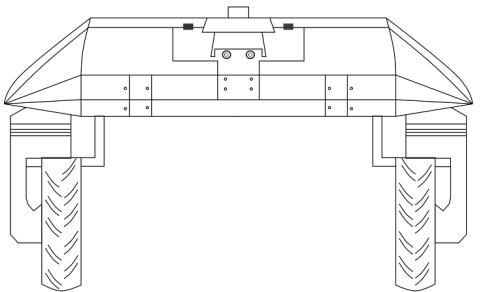
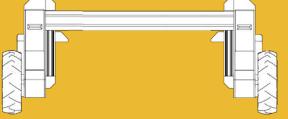
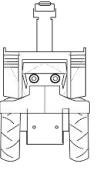
Estimated Assembly Labor

\$500

Estimated Freight



Affordability of Community Robotics

			
"Dino"	"Tharavold"	"Farmhand Rover"	"OZ"
Naio Technologies	Saga Robotics	Farmhand Automation	Naio Technologies
70" Wide	78" Wide	45" Wide	15" Wide
50" High	32" High	20" High	23" High
1,764 lbs	396 lbs	120 lbs	242 lbs
\$120,000	\$75,000	\$25,000	\$30,000



Team And Workspaces







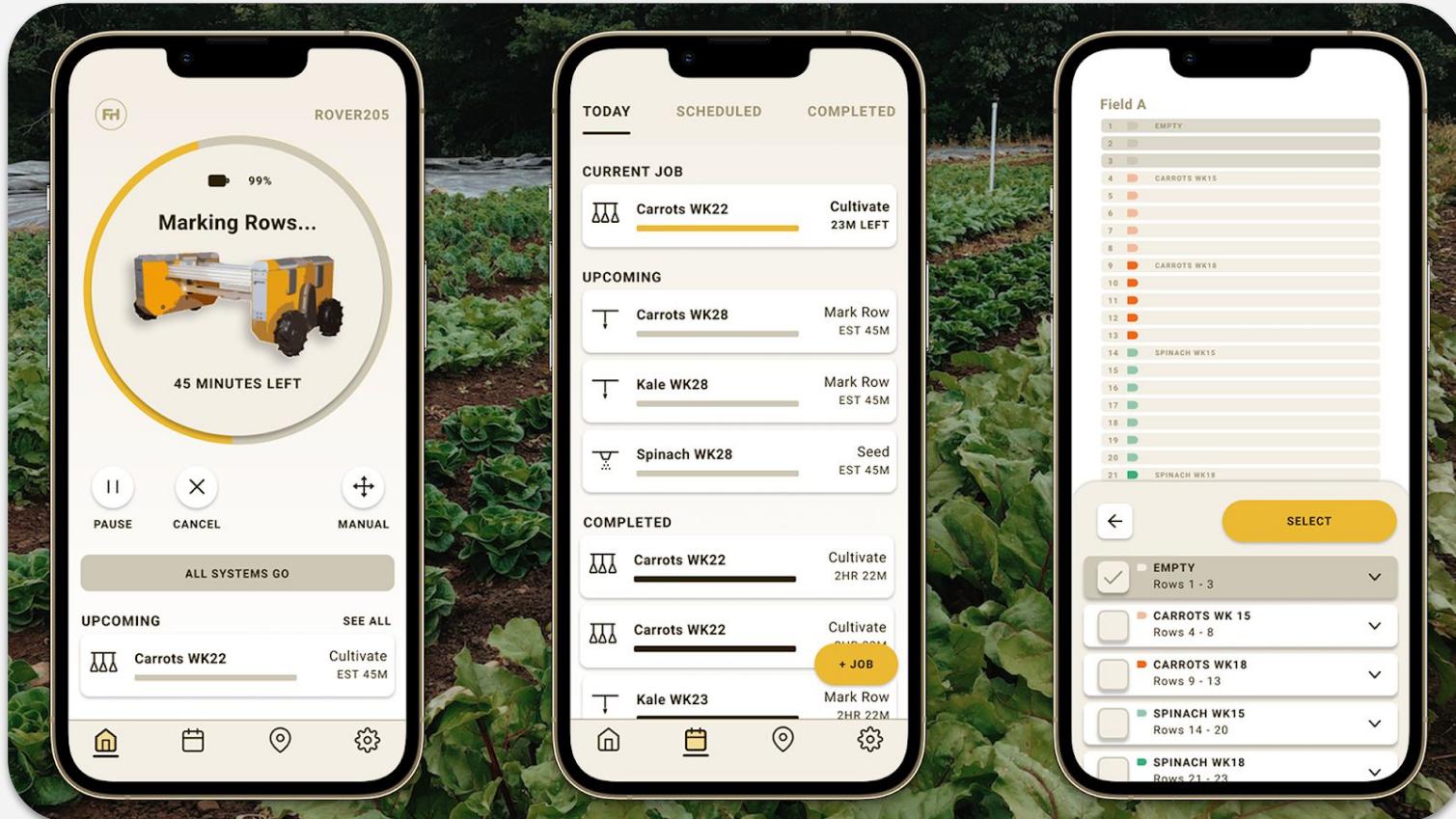


Mobile App

User Interaction Design by Alex Jones



Farmhand Mobile App

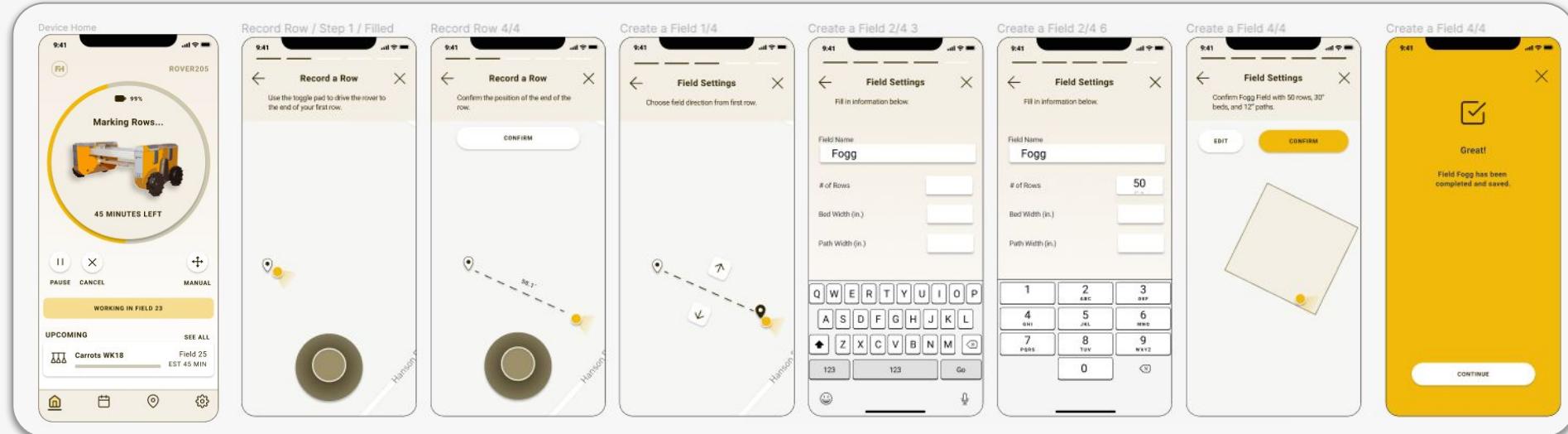


Planting Flow for Automated Seeder

The image displays a sequence of nine mobile application screens illustrating the planting process for an automated seeder. The screens are arranged horizontally, showing a progression from a main job list to detailed planting configurations.

- Job - Main:** Shows a summary of current, upcoming, and completed jobs. Current jobs include "Lettuce WK23" (Cultivate, 23 min left) and "Carrots WK25" (Cultivate, EST 45 MIN). Upcoming jobs include "Radish WK35" (Seed, EST 45 MIN). Completed jobs include "Lettuce WK23" (Cultivate, 7 HR 22 MIN) and "Beets WK18" (Cultivate).
- Job / Add Job / Action:** A screen titled "Add A Job" with the instruction "Tap a job you would like to add." It features three buttons: "CULTIVATE" (with a pitchfork icon), "MARK ROW" (with a row marker icon), and "SEED" (with a seed icon).
- Jobs Screen - Select Plant:** A search screen titled "Select A Plant" with a search bar containing "LE". Below the search bar are lists of plants: BEAN, BEETROOT, CHARD, GARLIC, KALE, RADISH, SQUASH, and TURNIP. To the right are lists: BEAN, BUCKWHEAT, FENNEL, LETTUCE, ARUGULA, BEETROOT, ONION, SPINACH, and TURNIP. A keyboard is at the bottom.
- Jobs Screen - Choose Intensity:** A search screen titled "Select A Plant" with a search bar containing "LETTUCE". Below the search bar are lists: BEAN, BEETROOT, CHARD, GARLIC, KALE, RADISH, SQUASH, and TURNIP. To the right are lists: BEAN, BUCKWHEAT, FENNEL, LETTUCE, ARUGULA, BEETROOT, ONION, SPINACH, and TURNIP. A keyboard is at the bottom.
- Jobs Screen - Choose Intensity:** A search screen titled "Select A Variety" with a search bar containing "LETTUCE". Below the search bar are lists: BIB, GREEN, MIXED, and SPICY. To the right is a list: VIVIAN. A keyboard is at the bottom.
- Jobs Screen - Choose Field:** A map view titled "Select Rows" showing two fields: FIELD A and FIELD B. A callout indicates "Pinch zoom on the map to see rows to mark." Below the map is a list of rows: CARROTS WK15 (Rows 4 - 8), CARROTS WK16 (Rows 9 - 12), EMPTY (Rows 1 - 3), EMPTY (Rows 27 - 28), and SPINACH WK15 (Rows 14 - 20). A "CONFIRM" button is at the bottom.
- Jobs Screen - Choose Crop:** A list titled "Sort by Plant Name" showing various crop entries with checkboxes and dropdown menus. Examples include CARROTS WK15 (Rows 4 - 8), CARROTS WK16 (Rows 9 - 12), EMPTY (Rows 1 - 3), EMPTY (Rows 27 - 28), and SPINACH WK15 (Rows 14 - 20).

Direct Rover Control and Field Setup

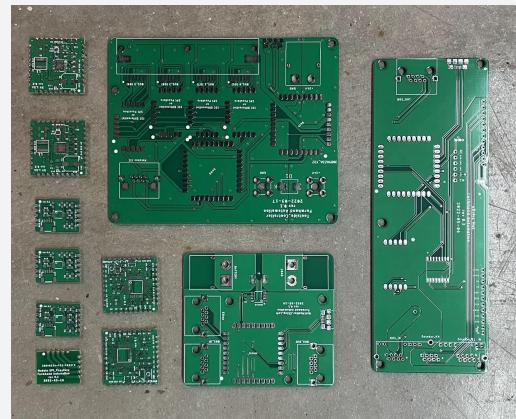
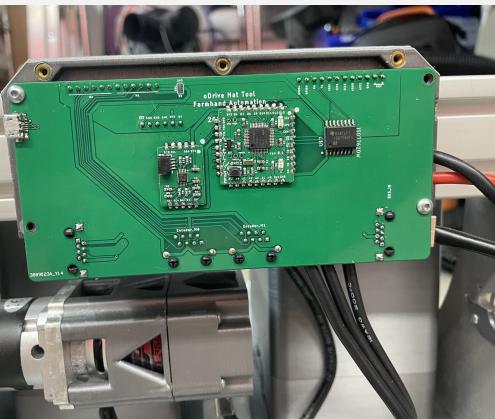
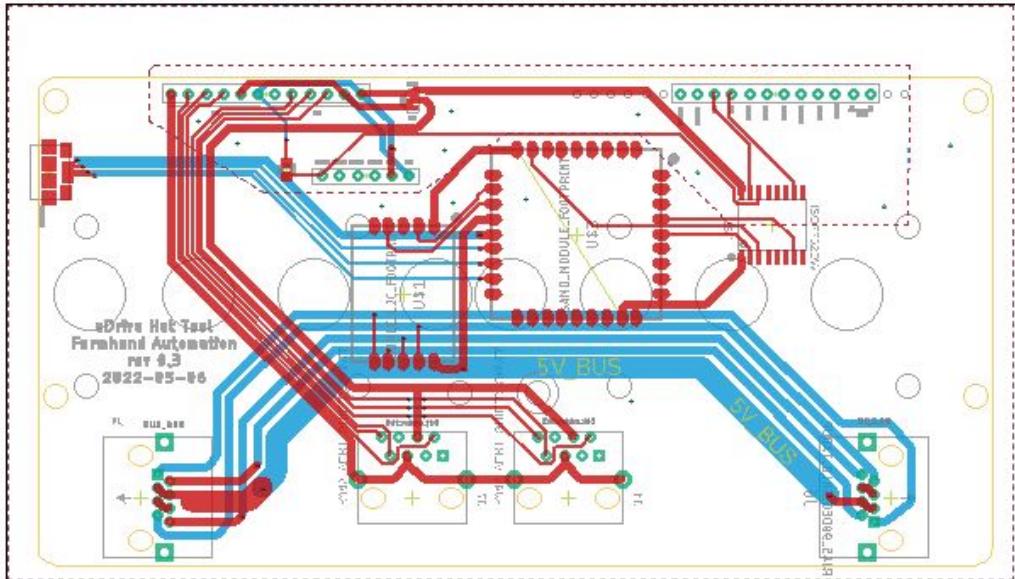
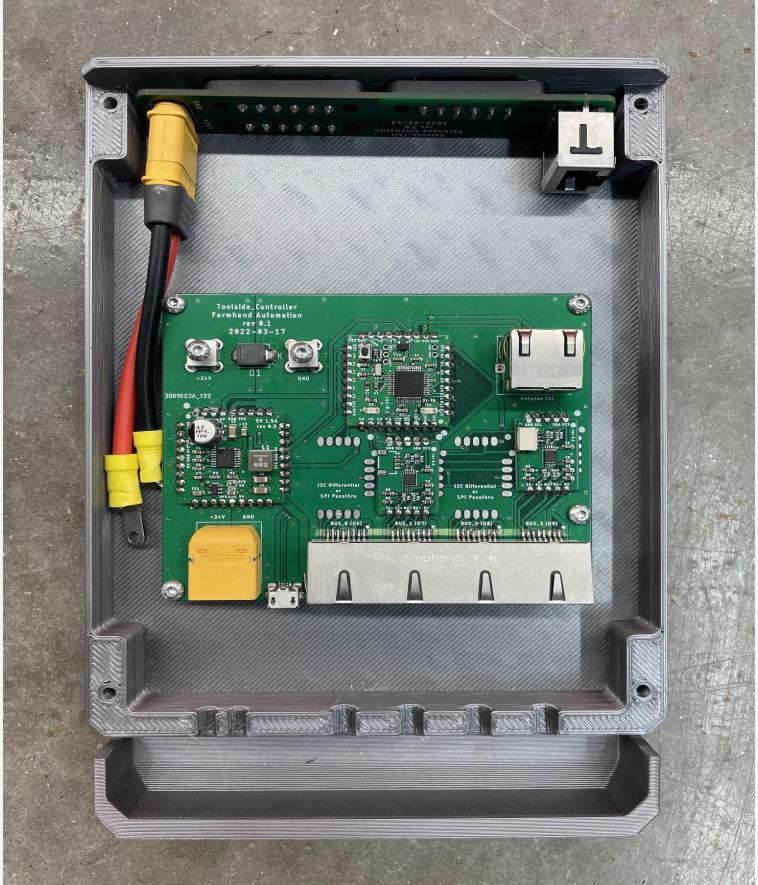




Mentored Co-Designs With Novice Engineers



Modular PCB Framework



Automated Seeder Attachment



Power Weeder Attachment

