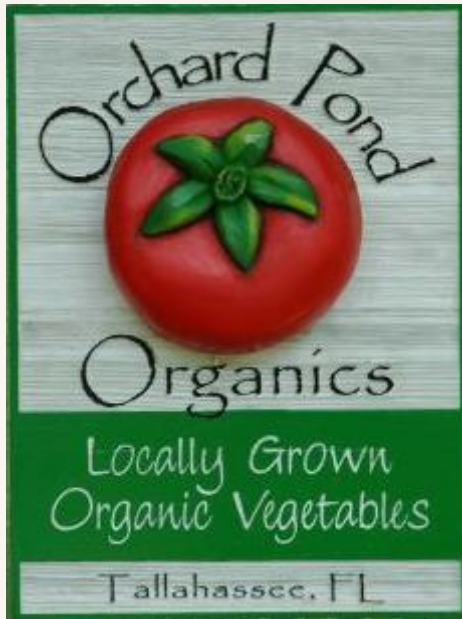


Weeding Robot Team 11



Sponsor: Jeff Phipps

Advisor: Dr. Clark

Student Members:

Ian Nowak (EE)

Coen Purvis (ME)

Amanda Richards (ME)

Grant Richter (ME)

Jeremy Rybicki (EE/CpE)

Nathan Walden (ME)



Background Information

- Purpose
 - To create an autonomous robotic system to remove weeds from a plot
- Orchard Pond Organic Farm
 - About the farm
 - About the sponsor
- Constraints
 - 3/8th inch ground compression
 - Affect all weeds in a given area
 - Should not disturb below 1 inch of soil



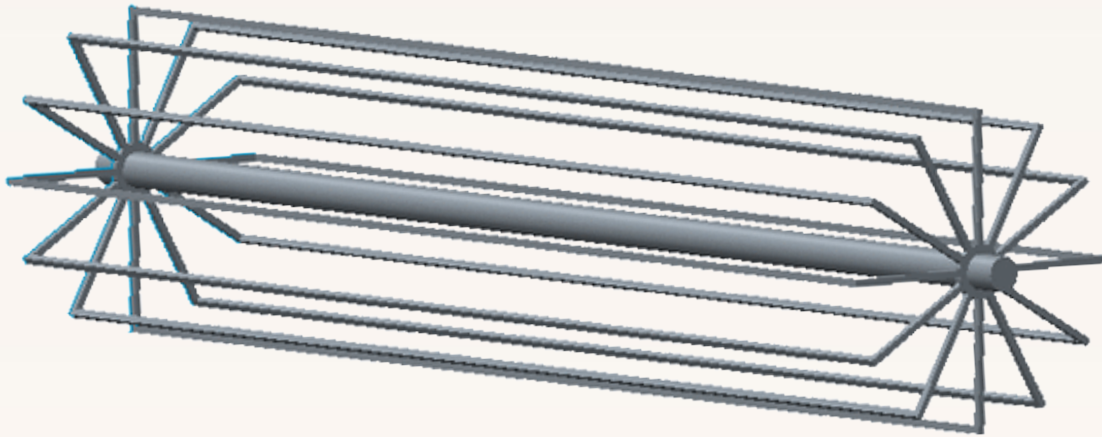
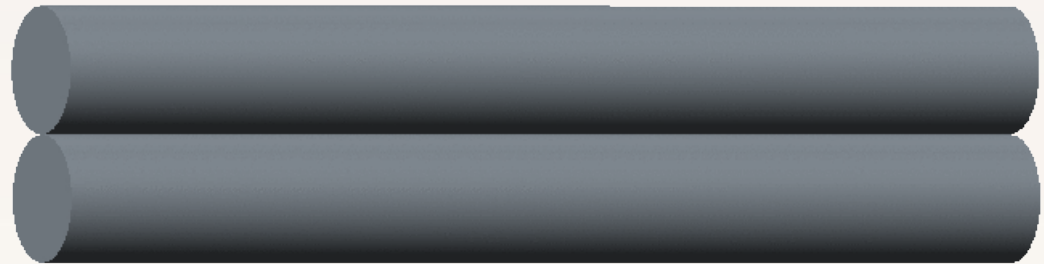
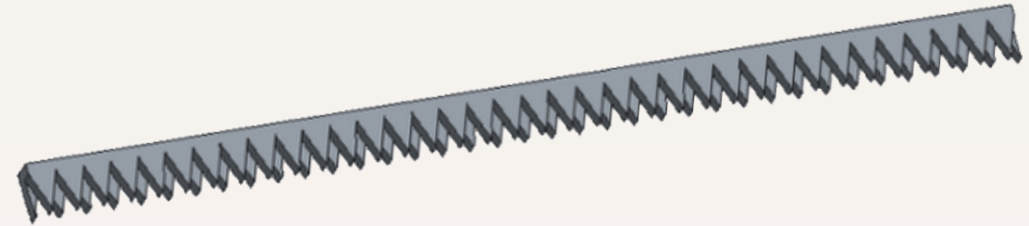
General Area

- Major roadblock for the project
 - Future decisions strongly affected
- Desirable compared to “find and pick”
 - Cost, weight, simplicity, weed density
- Much more viable for scope of this project



Weeding Mechanism

- Previously Presented Designs
 - Teeth, Roller, and Basket
- Challenges of Teeth/Roller
 - Solution found with Basket



Team 11

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Grant Richter

Midterm I Presentation



Team 11
Slide 5 of 17

Grant Richter
Midterm I Presentation

Locomotion

- Treads initially desirable
 - Distributes ground pressure
 - Navigates rough terrain
 - High maintenance, cost, and complex
- Wheels
 - Little maintenance required



www.pololu.com

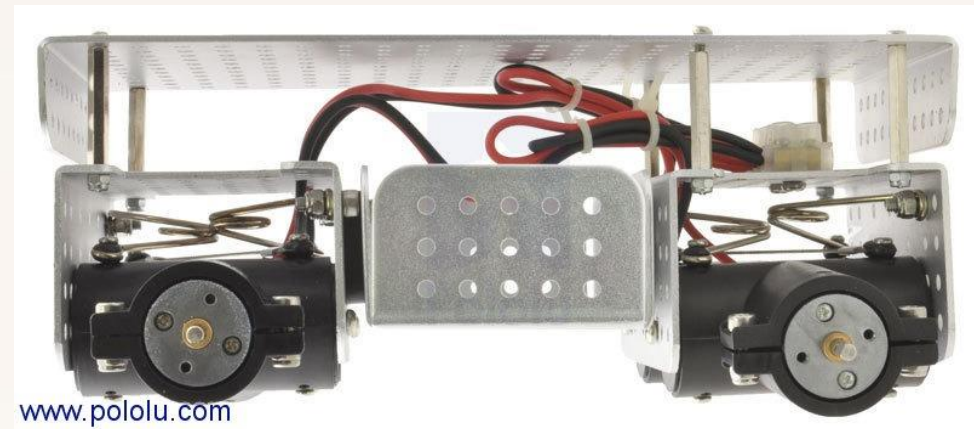
Frame

- Light enough to meet weight requirements
- Sturdy enough to support all components
- Perforated steel plate desired building material



Team 11

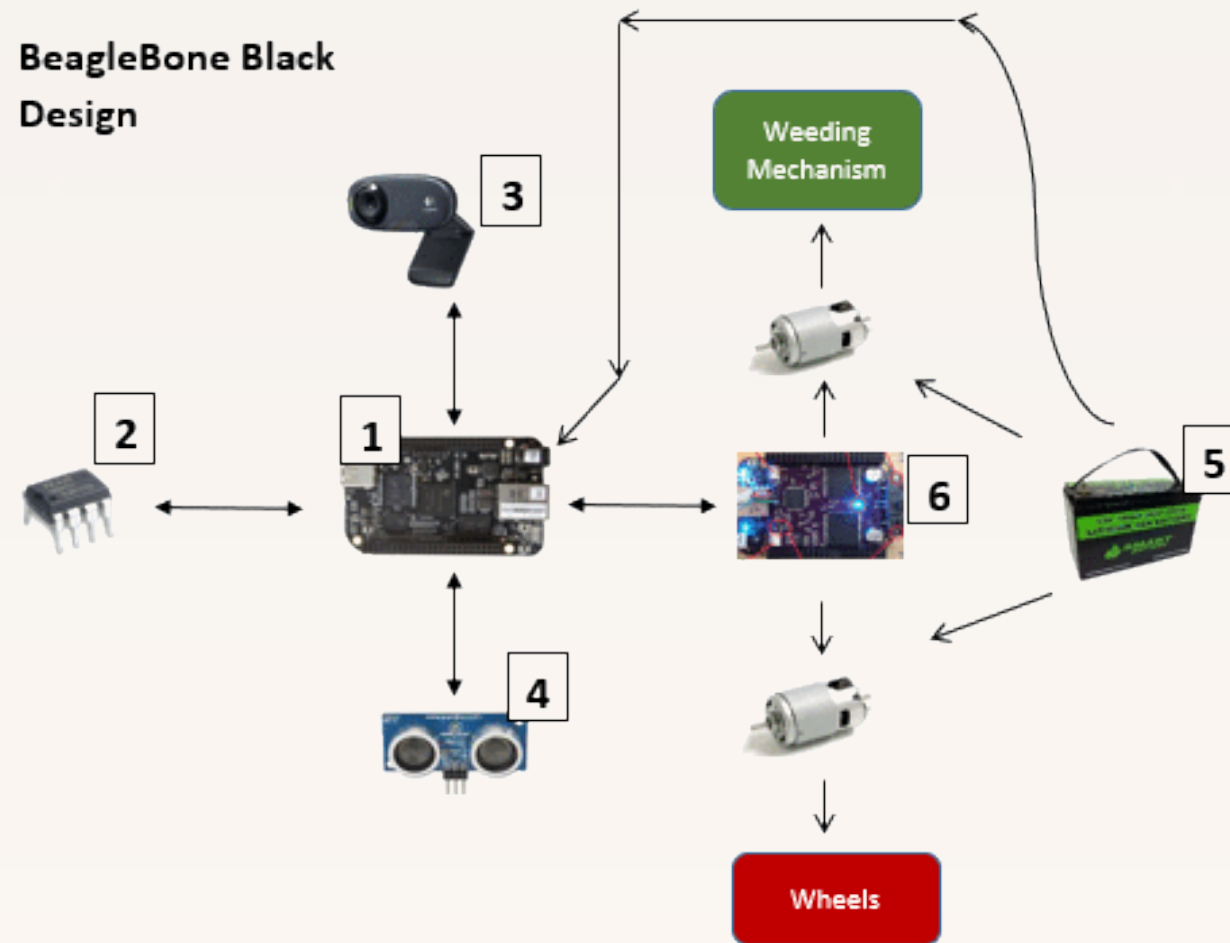
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Grant Richter

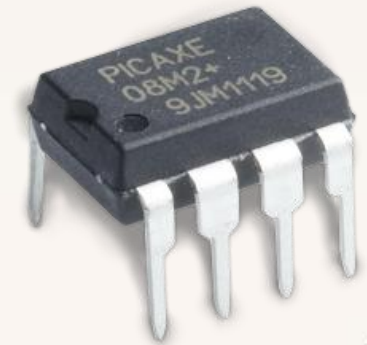
Midterm I Presentation

Electrical System Overview



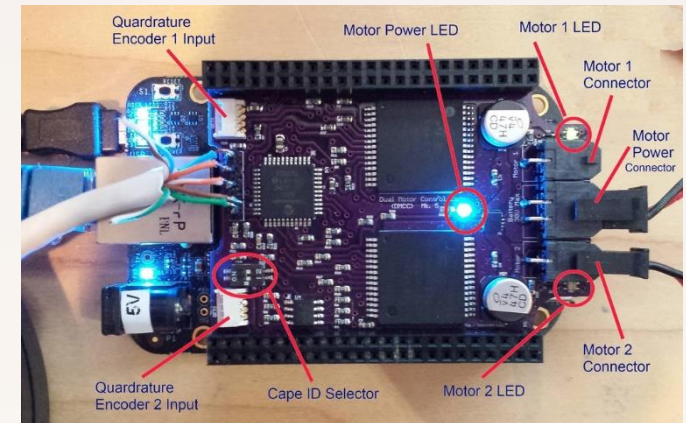
System Control

- BeagleBone Black
 - System on a Chip
 - Running Linux
 - More than capable to handle any number of configurations
 - Room for advancement
- PICAXE-08M2 Microcontroller
 - Very low power
 - Takes control during waiting periods to increase battery longevity
 - Will hold device in stand-by for 1-3 days



Driving the Design

- Dual Motor Controller Cape (DMCC) Mk.6
 - Can control a motor with a range of specifications
 - 5V – 28V
 - Up to 7 Amps continuous draw
 - Stackable to handle up to 8 motors
- Motor and battery selection
 - Still in Prototyping Phase
 - Selection dependent on size and method of operation of the weeding mechanism



Computer Vision



- Utilize OpenCV an image processing library
- Sensors include a combination of WebCam and Ultrasonic Ranging module
 - Logtech C310 USB 2.0 HD WebCam
 - Runs natively with Linux
 - No interfacing issues
 - Uses USB to free up GPIO Pins and to give greater functionality with OpenCV
 - SainSmart HC-SR04 Ranging Detector Mod Distance Sensor (Blue)
 - Secondary measure
 - Needed since only one camera will be used for computer vision giving no depth perception

Prototyping and Field Testing

- Prototyping
 - Basket weeding method
 - Lessons learned
- Field Testing
 - Weed characteristics
 - Weed density
 - Compression Test



Analysis

- Method used to determine weight range
- Soil Depression constrained to $\frac{3}{8}$ of inch
- 10 lbs. wheel created a .25" depression with a surface area of 2.5" x 1.5"
- $\frac{10lbs}{2.5" * 1.5"} = 2.67psi$ $2.67psi * \left(\frac{\frac{3}{8}}{.25}\right) = 4psi$
- $4psi * (2.5" * 1.5") * 4$ wheels = 60 pounds for a 4 wheeled robot

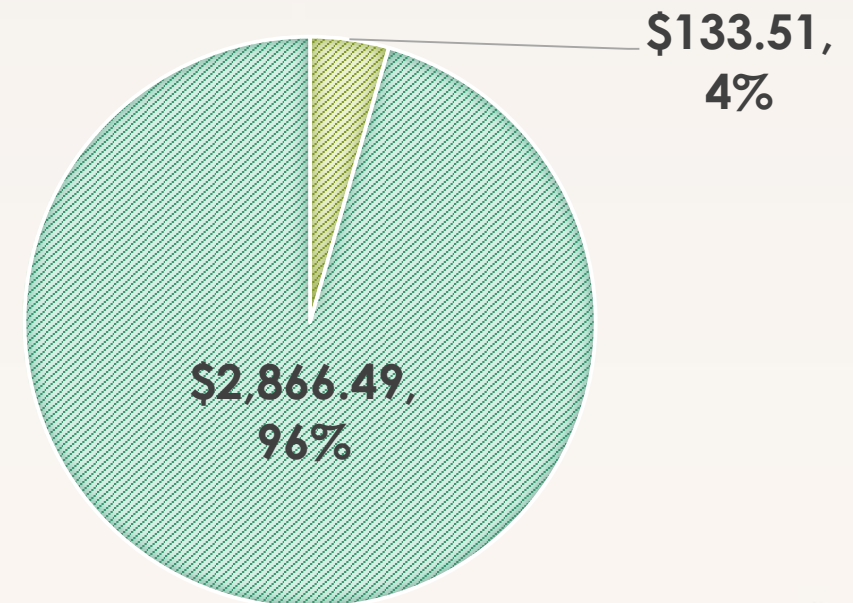


Budget

	Actual
TOTAL BUDGET	\$3,000.00
TOTAL EXPENSES	\$133.51
REMAINING	\$2,866.49

ACTUAL

■ TOTAL BUDGET ■ TOTAL EXPENSES



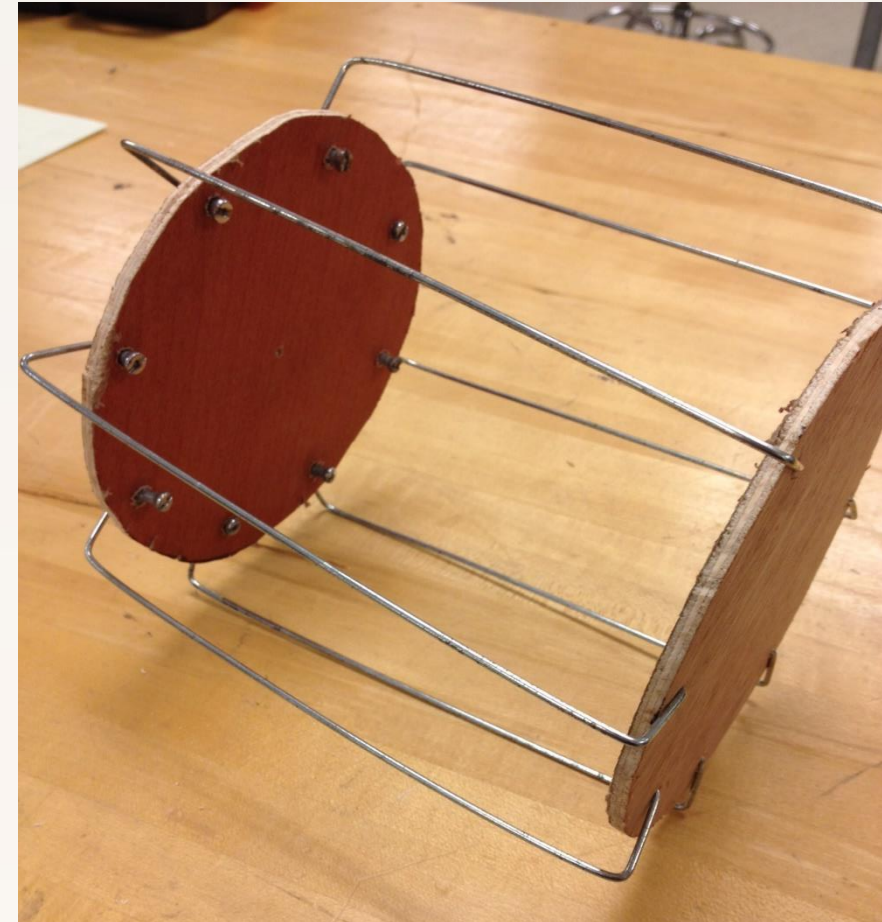
Future Steps

- More Prototyping and Testing
- Ordering Parts
- System Development
- CAD drawings and dimensioning



Team 11

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Coen Purvis

Midterm I Presentation

References

Motor Shield

<http://exadler.myshopify.com/products/dual-motor-controller-cape-dmcc-mk-6>

BeagleBone Black

<http://linuxgizmos.com/beaglebone-black-speeds-up-to-1ghz-drops-price-to-45-dollars/>

PICAXE 08M2

<http://www.picaxe.com/>

All-Terrain Chassis

<http://www.pololu.com/product/1564>

Basket weeding video

<http://www.youtube.com/watch?v=dWxJRNArUBk>