



Picker and Pruner Platform

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Team Top Pick

Mechanical Engineering, Senior Design, 2014-2015

Vince Schwartz, Zach Howard, Dhari Aldehani, Dillon Turnbull

Problem Statement



Orchard Ape – one of the current available machines

- Current picking and pruning methods are labor-intensive and physically demanding
- Positioning and climbing ladders consumes time and energy
- Workers must carry as much as 60 pounds of fruit; this demands that they be physically fit but still poses safety risks.
- Current machines do not allow a worker to pick fruit continuously.

Goals

- ▶ Continuous Picking From Machine Operator
- ▶ Controls in One Location
- ▶ Self Leveling Platform on Slopes of Up to 30% (16.7°)
- ▶ Multi Directional Boom to Allow Positioning of Worker
- ▶ Uni-Directional Bin Management

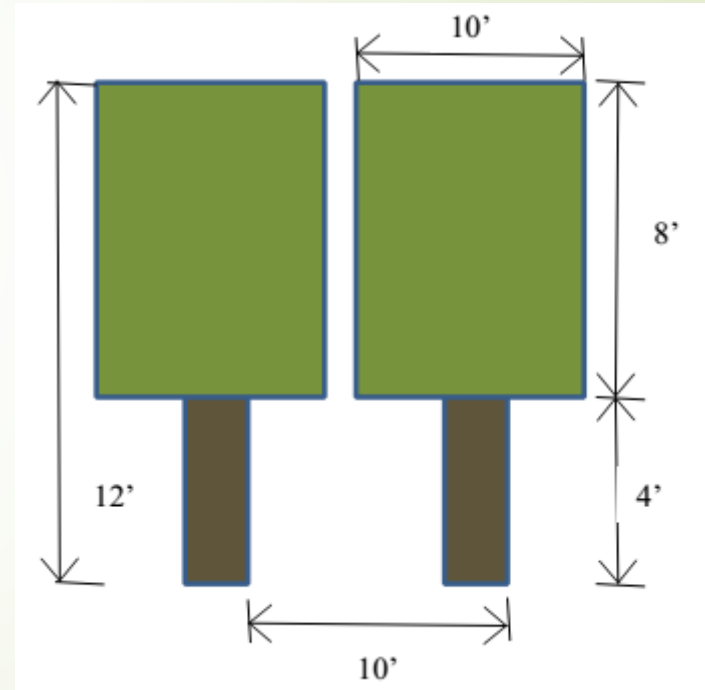
Scale Model Plans




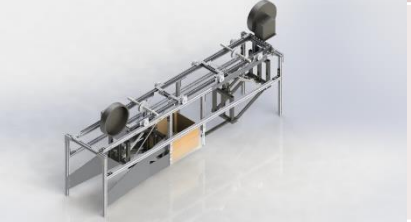
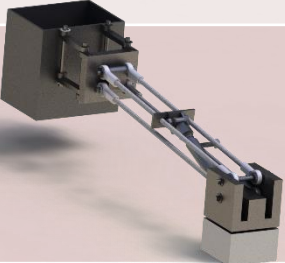


- Due to budget constraints, a full-scale prototype will not be made
- 1:10 scale model orchard and machine will be fabricated to demonstrate the abilities of the machine
- A 1:4 scale model of the bin management system will be built separately due to its complexity
- The models will be hand operated due to budget constraints

Design Parameters

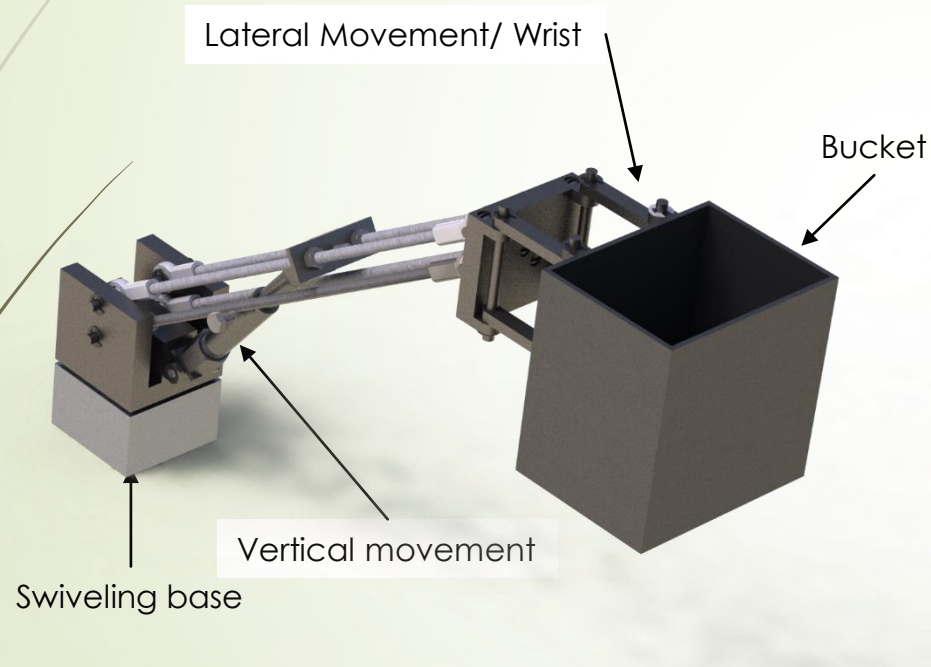
- ▶ Fit between rows of apple/pear trees (16 feet)
- ▶ Allow a single worker easy access to all sides of the tree down single row
- ▶ Automatically deposit the fruit in standard bins for collection
- ▶ Travel safely on sloped ground (20-30%)
- ▶ 10-foot vertical range of motion
- ▶ 3-foot horizontal range of motion into tree



Morphological Chart

Subsystem/ Problem	Solution	
Chassis		Corner leveling
Bin Management		
Boom		Double Beam
Lateral Movement of Platform		
Fruit Transport to Bin		Conveyor

Boom System



- Will allow a single worker easy access to one half of a tree
- Minimal movement of machine itself while harvesting
- Worker can access and control all functions of the machine from the bucket
- Vertical as well as lateral movement, using wrist and swiveling base

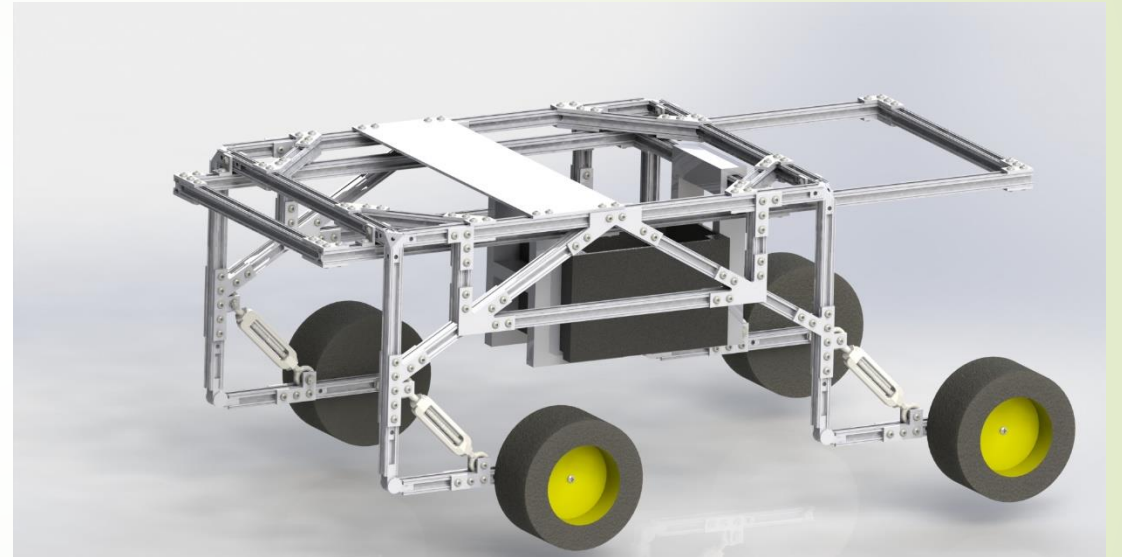


Final products:

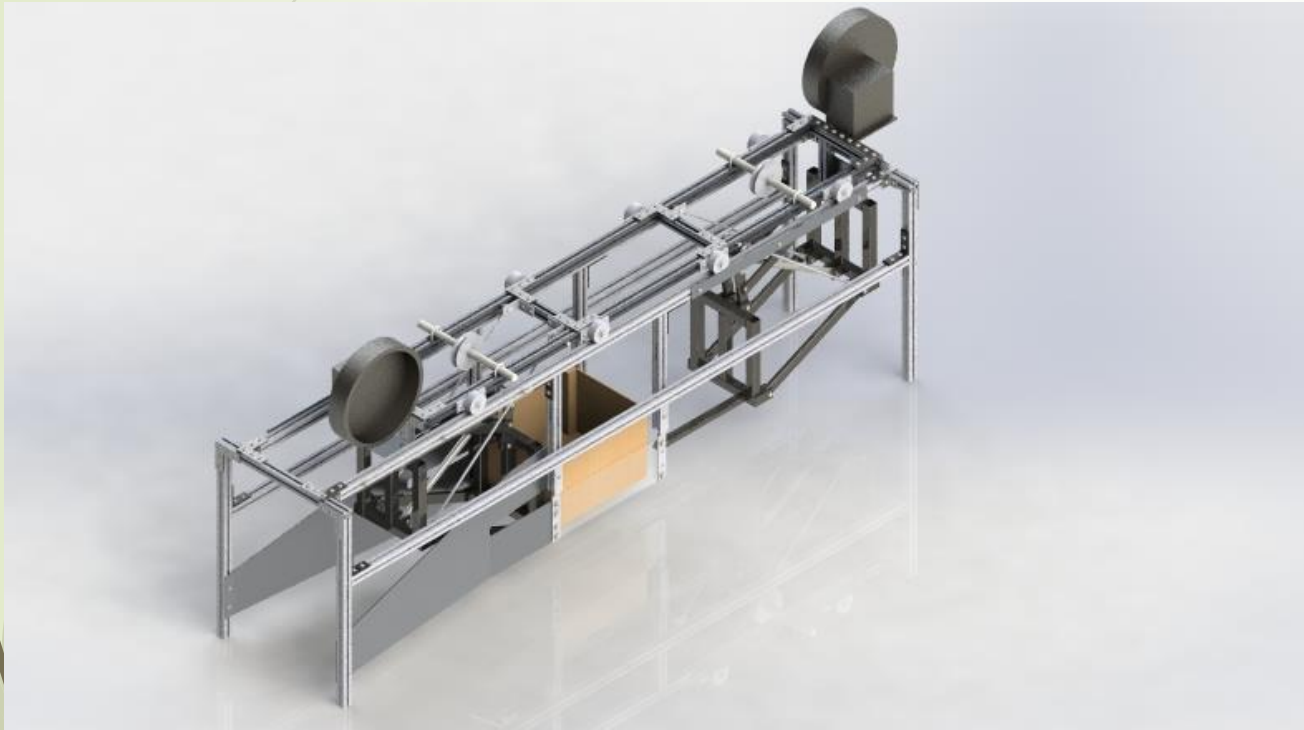
- 1/4 scale bin loading mechanism (top)
- 1/10 scale frame and boom (bottom)

Leveling System

- ▶ Allows the machine to safely traverse slopes of up to 30%
- ▶ Keeps the operator's bucket level
- ▶ Large, high-traction wheels
- ▶ Independent vertical movement of each wheel allows leveling over uneven terrain

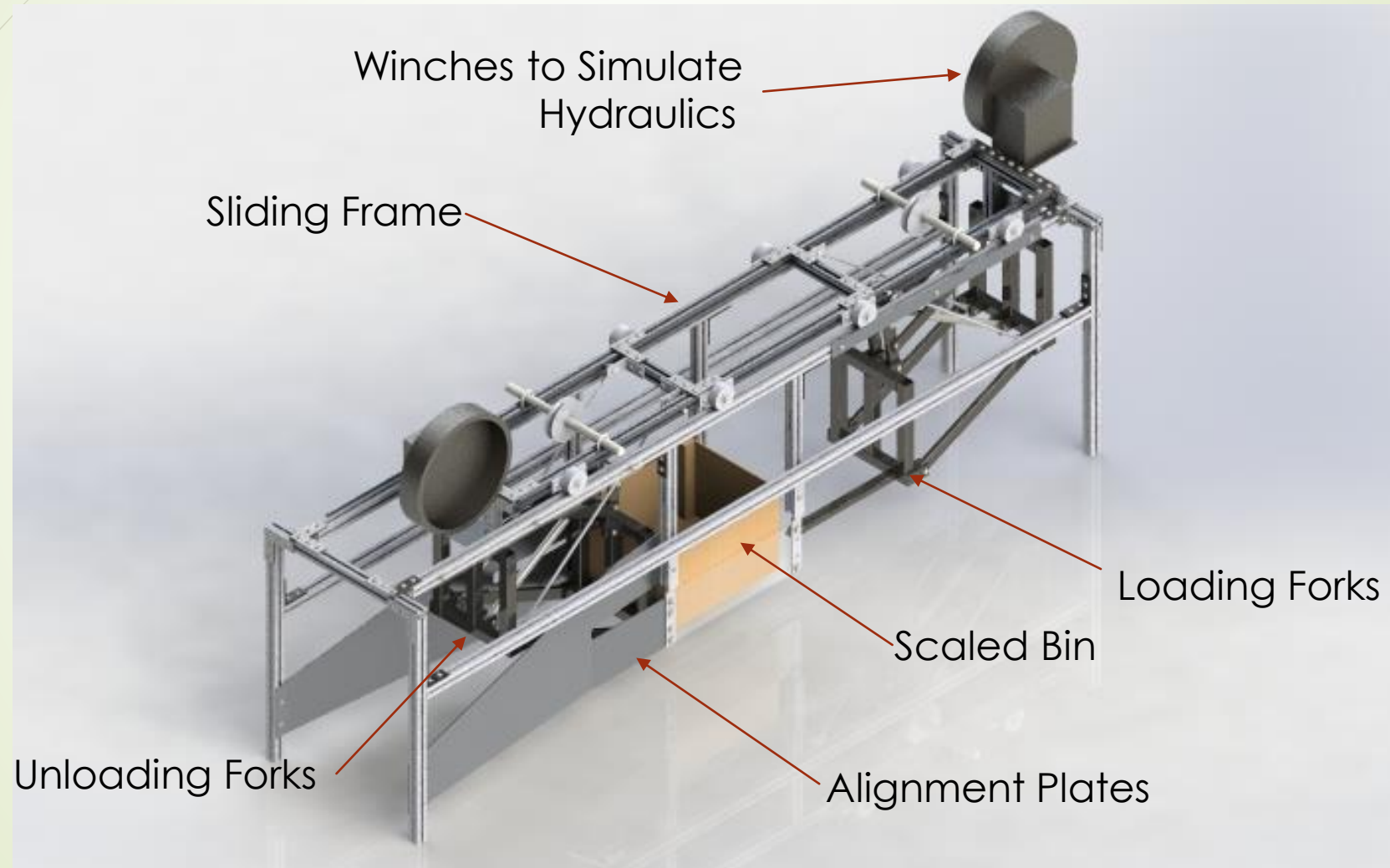


Bin Loading and Unloading

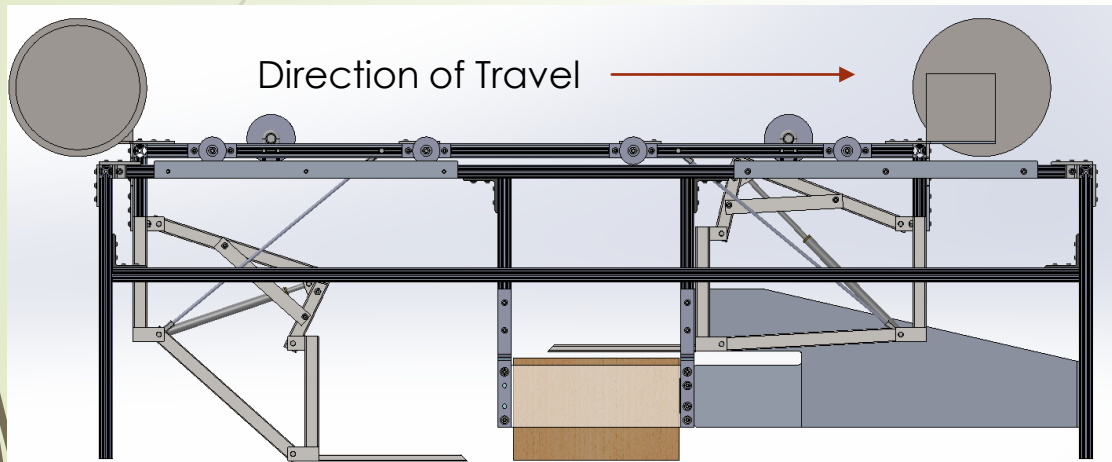


- Fruit will be deposited into standard bins (48"x48"x30")
- Machine will pick up bins laid along the rows and carry them as they are filled with fruit
- When full, bins will be left behind for pick-up
- Scale bin dimensions: 12"x12"x7½"

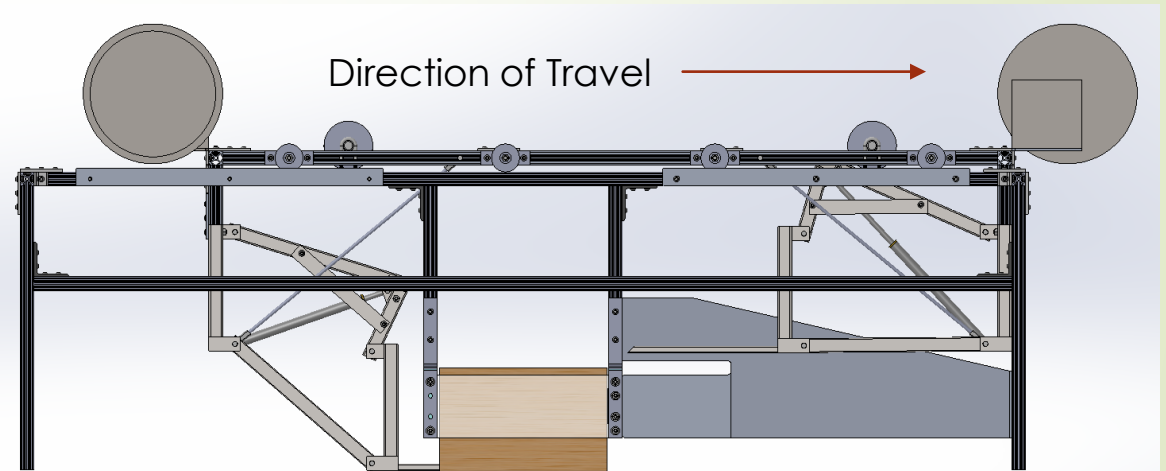
Bin Management Overview



Bin Loading/Unloading Process (Step 1+2)

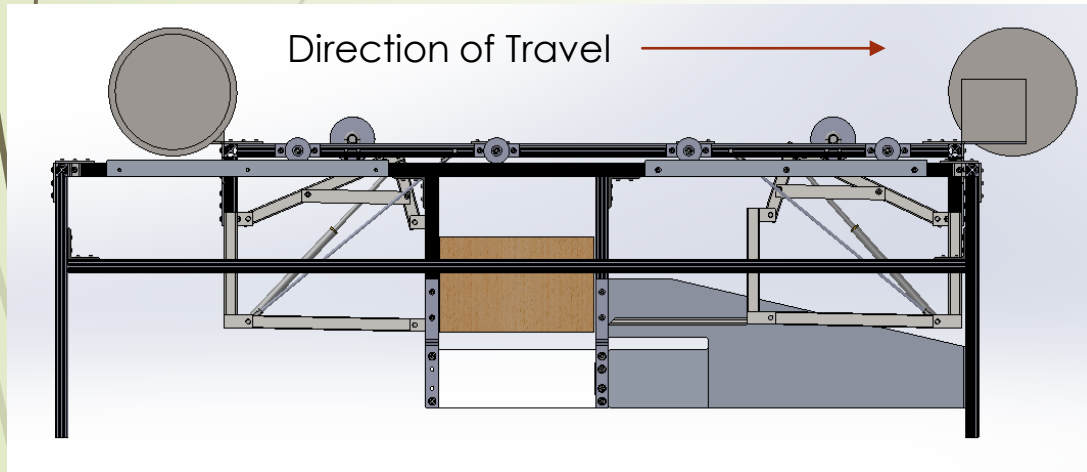


Step 1: Machine approaches the bin with non load bearing forks down, simulating a traditional tractor

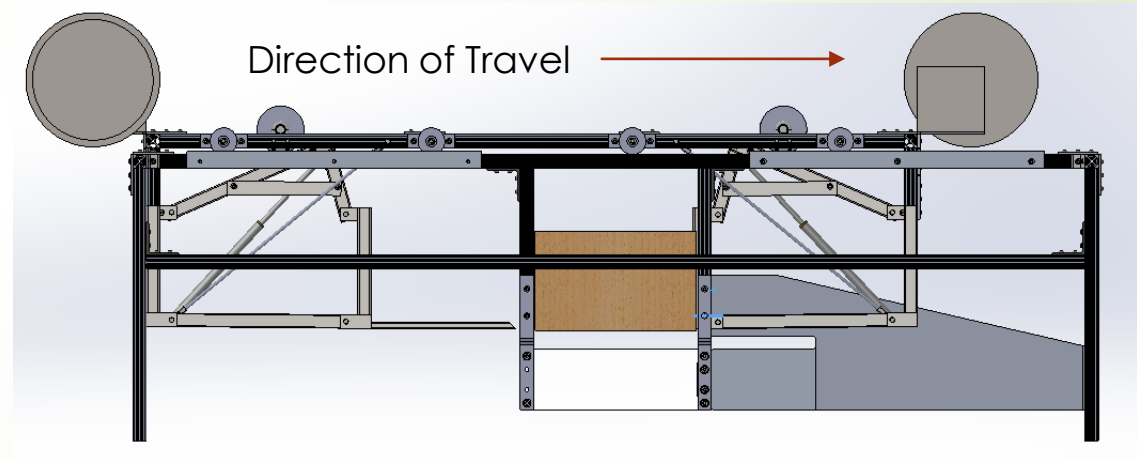


Step 2: Non load bearing forks have engaged with bin

Bin Loading/Unloading Process (Step 3+4)

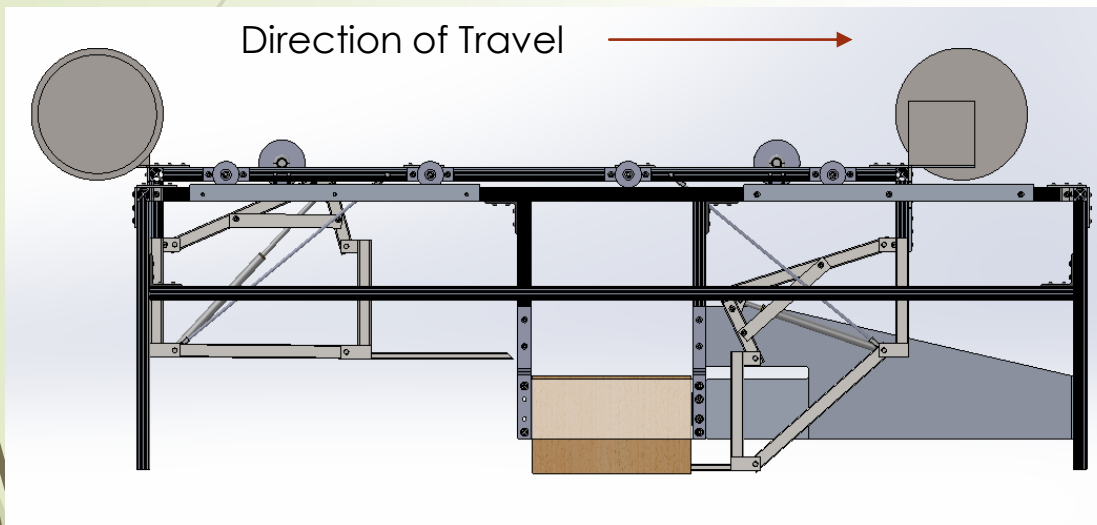


Step 3: Non load bearing forks have lifted bin into cradle. The bin is now centered in the frame.

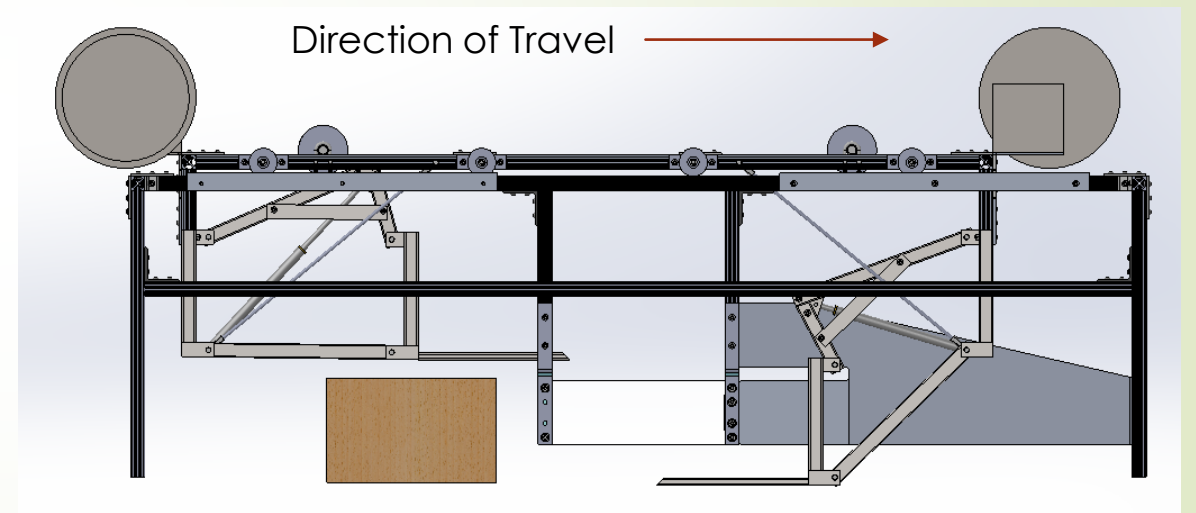


Step 4: The Sliding Frame has moved laterally to let load bearing forks take the place of the non load bearing forks while fruit is loaded.

Bin Loading/Unloading Process (Step 5+6)



Step 5: Once bin is loaded, the load bearing forks extend down to the ground.



Step 6: Bin makes contact with the ground. Machine pulls forward releasing itself from bin, ready to pick up next bin.

Fruit Transport

- ▶ Moves the fruit from the bucket to the bin
- ▶ Allows the worker to harvest 1100 pounds of fruit without leaving the bucket
- ▶ Designed to not cause damage to the fruit
- ▶ Time and budget constraints have not allowed us to implement into our models
- ▶ Existing systems we would incorporate would be similar to the Whooshh where a flexible delivery system would get fruit from picker to bin.





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Dillon Turnbull, Zachary Howard, Dhari Aldehani, Vince Schwartz

Project Wiki Page: [http://mindworks.shoutwiki.com/wiki/Orchard Harvesting and Pruning Platform](http://mindworks.shoutwiki.com/wiki/Orchard_Harvesting_and_Pruning_Platform)