

ILR02

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Team E: Wholesome Robotics

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ILR02

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Individual Progress

Designing Plant Guards

During field testing with the Robotanist Platform (as seen in Figure 2) last semester, the team encountered the challenge of plants going under the wheels. The problem was more significant with plants which had a high spread. To reduce this challenge, we decided to make guards/cow catcher to push away the plants.

The factors considered while designing the plant guards were:

Stiffness and Durability: The guards should survive frequent collisions with small plants.

Weight: The guards should not add major payload to the Robot

Width: Since the walking area between the crop rows is quite narrow, the guards should not drastically increase the robot width as it will lead to increased damage to the plants.

Mounting points: Attempt was made to mitigate adding more holes to the original design. Thus, the mounting location was chosen near already present holes near strong load taking members.

Not affect functionality: The guards should not affect the functionality of the robot platform

Easy to manufacture: The design should be easy to manufacture

The plant guards as seen in Figure 1 were designed keeping the above factors in mind. The following design decisions were made for the plant guards.

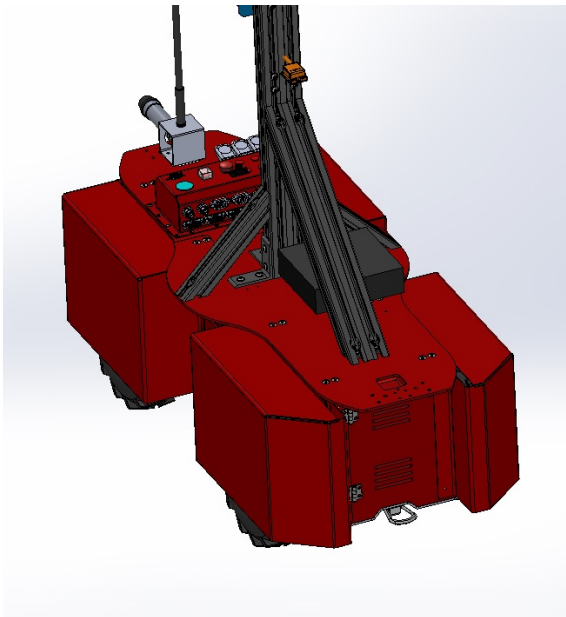


Figure 1: Robotanist with plant guards

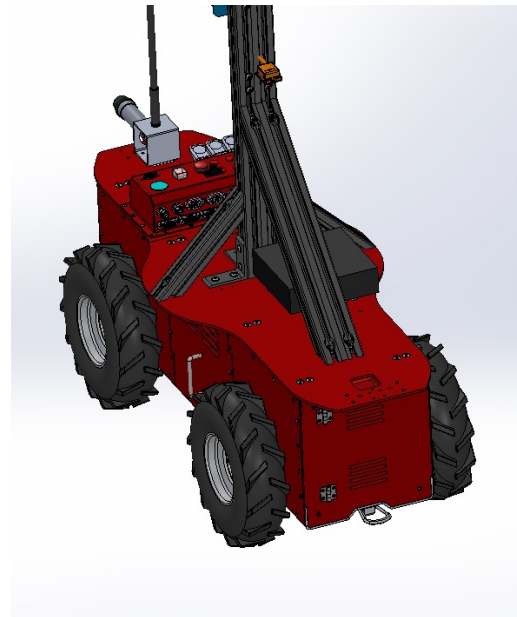


Figure 2 Robotanist without plant Guards

Material:

Aluminum 5051-H32, Sheet metal 2mm thickness

The current paneling already takes similar impact loads and is subject to similar mechanical loading. Thus, the same material was chosen for the plant guards. This further allows easy integration into the current manufacturing pipeline.

Hinge and Latch mechanism:

The plant guards on one side of the Robotanist are not permanently mounted as they obstruct the battery panel as discussed in the challenges section of ILR02. To tackle this challenge, the guards are mounted via hinge, and secured using a drawbar as seen in Figure 3 and 4.

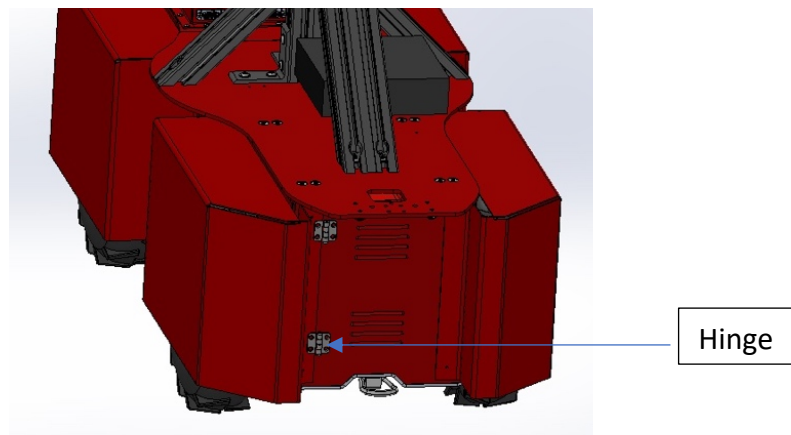


Figure 3 Plant Guard with Hinge

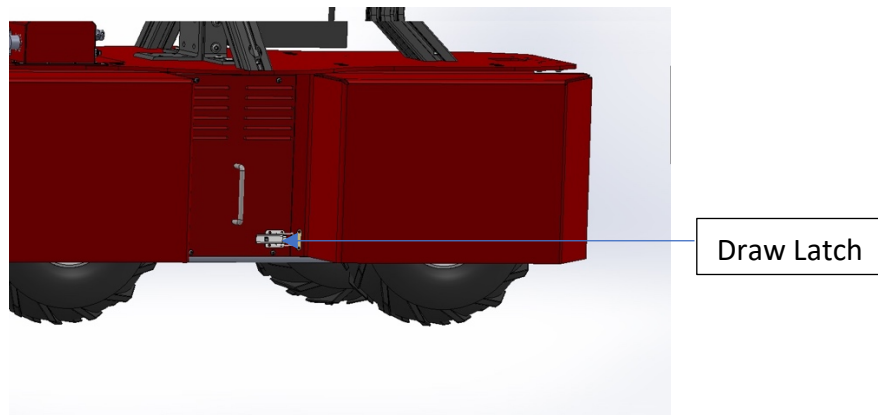


Figure 4 Plant guard secured using draw latch

Latch Selection:

A drawbar latch with a secondary catch (Southwest TL-40-111-52) was selected to securely hold the plant guard and prevent accidental opening during operation.

Challenges

One side of the Robotanist has a battery panel as seen in Figure 5 which is frequently removed to access the battery. The plant guard thus cannot be permanently mounted on the battery panel.



Figure 5 Battery Panel

Also, designing with sheet metal imposes restrictions on the design of the plant guards. Lack of knowledge about design guidelines for sheet-metal parts increased the time spent for designing the plant guards.

Teamwork

Aaditya: Worked on interfacing with the Velodyne puck and implemented LOAM pipeline

Dung-han Lee: Worked on segmenting holes and diseases in the image data available.

Hillel: Ordered parts and handled purchasing

John: Implemented particle filter, automated part of the labeling process

Future Plans

- Automate quantitative analysis for identifying holes and diseases
- Evaluating scenarios where LOAM fails
- Implement Visual Odometry with ZED camera
- Evaluate the accuracy of Particle Filter Localisation by comparing to ground truth
- Begin manufacturing of cultivator after raw-materials arrive
- Integrating Plant Guards into the assembly
- Designing Sensor Mounts
- Make drawing of remaining base structural components [Desired]