ILR04

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Individual Progress

Sending Robotanist Parts for Manufacturing

The custom parts for the new version of Robotanist have been sent out for manufacturing. Initial timeline assumed that these components are already manufactured, and we just have to assemble them. This has delayed the timeline and we have thus discussed the contingency plan of using the current Robotanist with our sponsor George Kantor. Further, to get back on our initial timeline by next semester we discussed having an extra set of hands over the summer to help us with the assembly process.

Designing ZED Mount

The ZED camera has been tested separately and we are able to receive the 3D point cloud data along with the POSE of the ZED camera for Visual Odometry. Further, we are able to recognize AR Tags via the ZED camera which will help the localization process during Row Switching and detecting end of row. To integrate it with the remaining sub-systems and test it on the current Robotanist, the camera is required to be mounted on the Robotanist.

The camera comes with a single screw mounting point, commonly seen in commercial cameras. Since, our application can have minor vibration which might cause the camera to rotate and become loose, we needed to mount it such that such rotations are restricted. So, a mount was designed as seen in Figure 1 to mount the camera on the front end of the Robotanist.

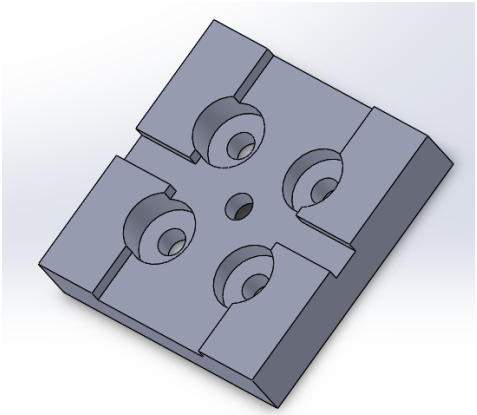

Figure 1 CAD model of ZED mount for Robotanist

The designed component was 3D printed using the Ultimaker 3 platform and does not seem to have any visible issues.

After some effort in correcting the slot width, the ZED camera fits on the mount as seen in Figure 2 and the mounting holes align well with the mounting location on the Robotanist as seen in Figure 3.

Figure 2 ZED camera fits in the 3D printed mount

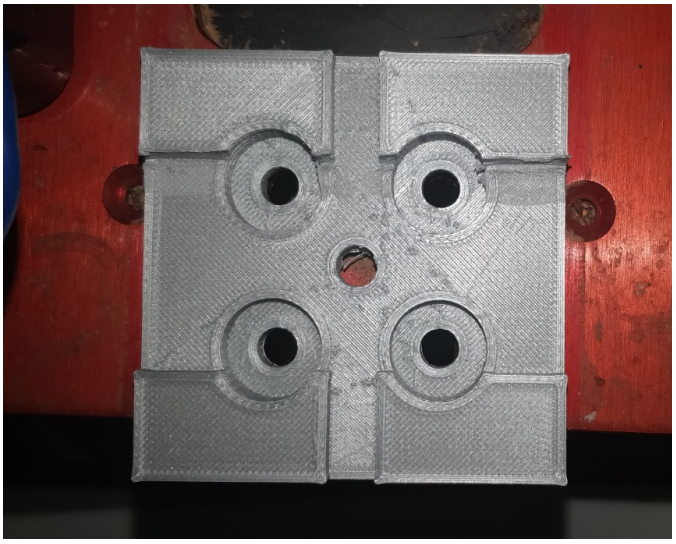

Figure 3 Mount aligns well with mounting holes on the Robotanist

Coverage Path Planning

The robot being developed should start from a designated starting point, enter the first row and then switch rows to next and then continue this process till the entire area of interest is covered.

Requirements for the planner:

Cover entire Area:

The robot should cover the entire area of interest

Traverse each row in both direction:

Since the stereo camera is mounted on only one side of the platform, the robot needs to traverse each row in both directions so that the plants on each side of the row are captured.

Account for Turning Radius:

The robot utilizes a skid-steer mechanism and has a large wheel base. Hence it has a large turning radius. The planner should account for this while making the plan.

Thus, the order in which rows are traversed becomes important. Given a map, the robot should automatically figure out the order in which rows will be traversed. A simple planner was written to create a route satisfying the above requirements, the current planner provides an order for the rows if it switching to the next row does not violate the turning radius constraint. However,

it fails to cover the entire area if the robot is forced to skip a row while switching to satisfy the turning radius constraint

Challenges

Sending Robotanist Parts for Manufacturing

The robotanist cad model has interdependencies on previous versions of the assembly files which did not allow making changes to the design or make CAD drawings of the components. After extensive digging into the previous versions of the Solidworks file, the major issues were corrected, and CAD drawings were generated which have been sent for assembly.

Designing ZED Mount

The mount was designed based on the CAD model sent by the manufacturer. However, after 3D printing the slot for the camera was about an mm less in width and thus had to be increased using a Dremel tool allowing the camera to fit snugly into the mount.

Teamwork

Aaditya:
Interfaced the ZED camera with the computing unit and implemented AR tag detection with it.

Dung-han Lee:
Changed the evaluation metric for hole and disease detection. Implementing new metric and measuring changes in performance.

Hillel:
Identified missing components in the electronic subsystem and designed the cooling fan PCB.

John:
Created the navigation pipeline and assigned sub-tasks to different members of the team.

Future Plans

Team:

- Label the test data with farmers at severity level
- Transfer monitoring system to onboard computing unit and run a test for full pipeline
- Develop and.test first version of sensor fusion algorithm
- Order and start to assemble the electronic subsystem

Individual:

- Mount ZED on Robotanist
- Generate coverage path given a map file