ILR06

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Team E: Wholesome Robotics
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Individual Progress

Weeding Timeline Analysis and Descoping

I worked with Hillel over the summer to analyze the optimal weeding method. This was done as the mechanical weeding method selected previously was causing difficulty in manipulator selection. Mechanical Weeding methods require higher mechanical force than non-contact methods, this required the manipulators to have a high arm torque, increasing their price exponentially. Further, achieving precision weeding using a mechanical cultivator seemed difficult to achieve during the Fall semester. Thus, we switched to non-contact based weeding methods. After analyzing various weeding methods like Steam, Oil sprinkling, high intensity light etc. We decided to go ahead with "Nature Zapp DE" which a commercial off the shelf weeding device which makes use of high intensity light to kill the weeds. Further, a Hebi robotics-based arm was selected for the application. We created a timeline for this configuration of the robot and realized that if we spend most of our time on weeding then we might be able to finish it by mid-November.

However, after discussion with the team, we decided that we preferred a robust system with lesser features over an unreliable system with multiple features. The work scope had always been a major risk for our project, and after spending considerable man-hours in redesigning a new robot but descoping it later. We were further behind our timeline than expected. Thus, we decided to descope weeding completely instead of trying the non-contact based weeding method which had high scheduling risk. We communicated this to our sponsors and they agreed to the modification in the project scope.

Further, we decided that we wanted to have at least a bare minimum version of the project working. So, we decided to change our strategy to development, where we will focus on developing a minimum viable product (MVP) first before attempting high risk sub-systems.

Navigation

During the Spring semester we focused on the navigation sub-system and had the entire pipeline working during Fall. The system made use of Visual Odometry using a ZED camera and further used a Lidar Point Cloud based model to localize itself. This was tested and adapted to the fake row of plants we had access to during Spring. However, during the field test with early stage plants the localization failed to perform appropriately. The localization was especially bad when the system was out of the row and did not have enough visual features to localize itself. Therefore, the current localization method was put on hold and we decided to go ahead with a low-risk RTK GPS based localization method first and attempt the visual localization method once we have the MVP working. My focus would be on getting the RTK GPS based navigation node up and running

On the planning and controls front, the system continues to use the same global coverage planner developed in fall and uses a pure pursuit-based controller for traversing the developed global plan.

Cleaning and Productizing Planning and Control Code

The planner and control ROS nodes were developed in a short timeline during spring. Since I had never worked on developing code for big teams, the focus was only on performance and not the readability and structure of code. The final code at the end of spring constituted of multiple separate python scripts running different nodes which had to be started separately on the terminal.
This semester the focus is on more professional code development and we have formalized code reviews into the development cycle. Further, we have a commonly agreed standard of linting so that basic readability of code is maintained.
I cleaned and commented the current code and ensured the linting standard being followed is adhered to. However, to change the nodes into a single ROS packet, a major overhaul of the structure of the code is required. I went through ROS tutorials for rospy and only revamping the structure of the current code is left to be done before converting it into a single ROS packet.

Challenges

Unavailability of Robotanist
The Robotanist is the robot which will be used for the remaining portion of the project. Currently its unavailable as its being used by another team for some testing. Access to the robot has been delayed in the wake of the recent hurricane. This has delayed the development of the RTK GPS based navigation node by a week.

Teamwork

Aaditya:
Binded time stamps between GPS and Visual data. Planned pipeline to connect prediction data to visualizer.

Dung-han Lee:
Cleaned labelling code. Focused on binary labeling and training for binary classification

Hillel:
Developed the user interface for visualizing plant health in the field

John:
Reviewed labelling code coordinated robot access & field visits. Planned RTK localization and integration.

Future Plans

Team:

- Develop map builder
- Clean, productize and review all code.
- Complete integration of visualizer in the monitoring pipeline
- Evaluate model on all 4 plants