# Individual Lab Report #7

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Wholesome Robotics (Team E)

Teammates: Aman Agarwal, Dung Han Lee, John MacDonald, Aaditya Saraiya

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## Individual Progress

In the past few weeks I have worked primarily on the visualizer tool for the monitoring pipeline. A key part of our deliverables is a tool for the farmers to understand the data that we collect and generate. To properly accomplish this, I conducted field interviews with the entire growing staff at Rivendale Farms. I showed them the existing visualizer as an example and asked them to list features that they felt would make the tool as powerful as possible. A number of interesting points were raised and many of the requested feature are within the realm of possibility to include in our mvp. Specifically, based on our conversations we will be adding an option to add notes about a particular image and have it saved into the dataset as well as grouping multiple images into single datapoints. These features are seen as the having the greatest value to effort ratio. Other features, such as datapoint filtering (via human tagging of type of pest/disease), and timescaling are considered stretch goals as they require much more effort and are not strictly necessary, albeit still being valuable.

The visualizer tool is built in matplotlib. It plots the geographical location tagged on each image, using the health value (currently a binary metric) reported by the classification network to chose the color of the point. The main feature of this plotter is an interactive gui, that allows the farmer to change the value of any image by clicking on it and classifying the image itself. In the past two weeks we worked on integrating the visualizer so that it could run on real data. This meant adapting the visualizer to accept the datatypes passed by the other parts of the pipeline. The pipeline consists of a parser that selects the data (in rosbag format) and arranges it into a python dictionary which the inference classifier edits and then sends to the visualizer. The main work involved discussing and deciding on the data structures and flow, and then debugging many compatibility errors. Specifically, ROS1 insists on using the python-ros libraries in Python 2, though the visualizer was written in Python 3. To remedy that I converted the visualizer code to Python 2 by manually debugging and replacing libraries and code incompatibilities line by line. The inference code is currently tied in by saving the data to a csv in between steps in the pipeline, and running each script seperately from a bash script.

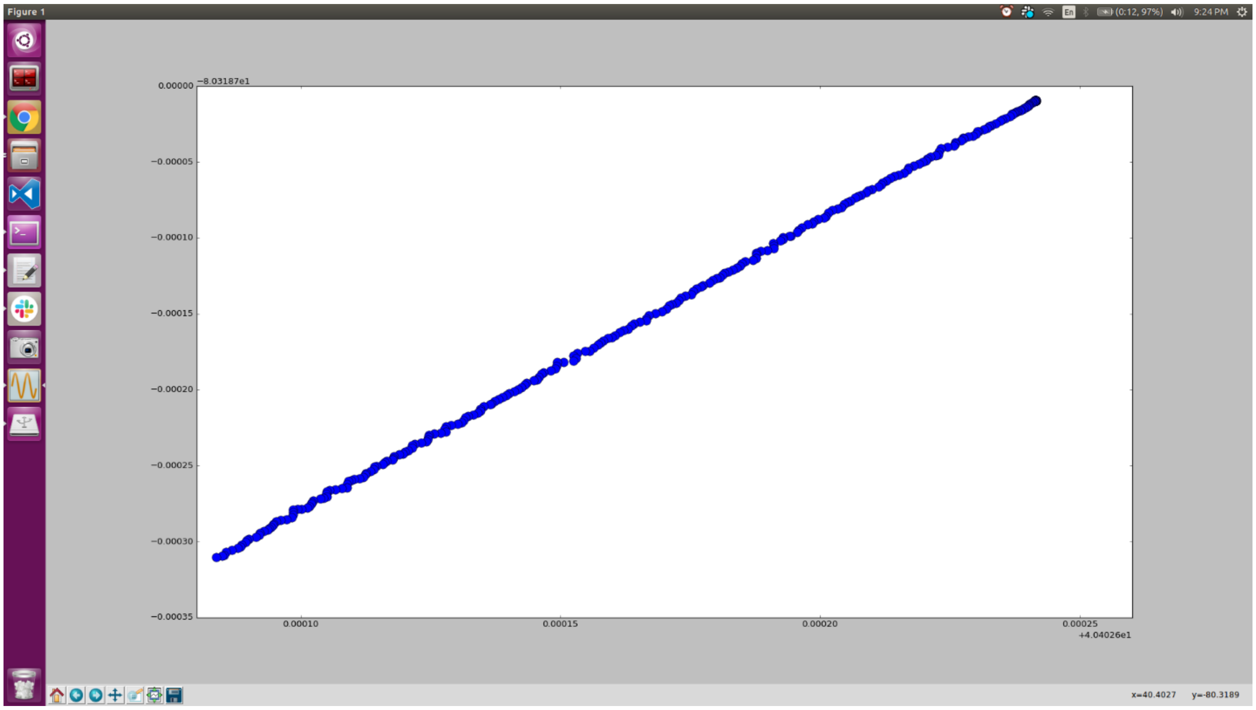


*Figure 1* Visualizer running on real positional data

We also had a field visit this week. I participated in the prep for the visit, which was more intensive than usual, since we had to convert the robot back to the configuration we use it for (that meant tracking down, and installing the linear slide that raises and lowers the camera, as well as the camera, lidar, and gps receiver). The lidar's power cable was lost in the reconfiguration and so I needed to create a new one, by finding the appropriate connectors (we did not have time to order them online) and soldering them to the correct cables. The field visit itself was actually incredibly unsuccesful and the issues it created filled the rest of my time for this week. Specifically, the RTK GPS malfunctioned initially by dropping the data link to the robot, but then the base station's master (the computing unit of the base station) began to malfunction itself (it would turn on and immediately turn off). As a result I have spent time sourcing spare cables for the RTK (some of which are custom cables that I will need to assemble myself) and looking into wired alternatives for the data link (such as spring loaded cable reels with 200ft cables). More notably, a few minutes into the actual data collection, the robot began sparking, which caused us to end the test and begin troubleshooting. I was responsible for dissassembling the robot's exterior paneling and tracing the cables to find any shorts. I ended up finding a rip in the battery's positive lead cable, which could explain the sparking. After wrapping the tear in electrical tape, I replicated the failure mode seen in the field by driving the robot in a similar fashion (at an incline, while reversing directions quickly) and did not experience any recurrence of the issue.

*Figure 2* The tear I identified on the battery cable

Finally, I participated in lab cleanup for George Kantor's area in the FRC Highbay.

## Team Progress

We spent a lot of our time preparing for and recovering from the field visit. This involved a lot of risk management and communication. We also worked on our test plans and schedule for the semester. Through our risk management discussions and standups, we have identified these tasks well, and we have even been able to reprioritize other parts of our project as needed.

# Challenges

The biggest challenge for this progress review was the issues we faced with the robot platform. The challenges with the RTK GPS (both the data link failing and the base station ceasing to work) has been on our risk management Kanban board since last semester. We have begun to enact many of our risk mitigation strategies, and even have 2 worst case scenarios prepared. The battery challenge was only a problem in that it was an incredible time drain. No equipment seems to be damaged, but we lost a day's worth of data collecting opportunities and we spent hours on troubleshooting.

The Python incompatibility problem also posed a big problem, particularly because it was during an integration task, meaning that three people (and consequently more than 3 different computer environments) were involved. This meant sorting out the integration bugs from the compatibility bugs, but through a few short meetings, and constant Slack conversation, we were able to find a serviceable workaround.

# Teamwork

**Aman** has worked on map building and managing the robot platform.

**Aaditya** has been working on visualizer integration and researching auto-exposure methods for the camera.

**Dung Han** has been working on visualizer integration and generalization and evaluation of the plant health perception

**John** has been working on the localization and navigation nodes.

# Future Plans

## Wholesome Robotics

In the coming weeks my plan is to begin to add features to the visualizer, based on the requests from the farmers. Most notably I will be looking into grouping multiple images into a single datapoint.

I will also begin to design plant guards to cover the robot's wheels. This will protect plant leaves from damage if the robot veers slightly off course. This was originally scheduled for this progress review, however in light of the robot platform issues, this task was deprioritized to the next sprint.