Report 5 - Nihal Afsal

Object Detection and Mapping Using a Lidar

Note: Homework must be uploaded as a **single pdf file**, not a zip file. If a problem solution requires a video, add it as a hyperlink in the pdf. The hyperlink should open the video file which is stored on your Google Drive. Any problem that requires Python code must show the entire code as well as a description of how the code works. Duplicate code submissions will result in a zero.

1. In 1969, the Apollo astronauts placed a laser retroreflector on the moon. This 0.5 m^2 reflector can still be used today. Assuming you have aimed laser pulses directly at it from an Earth-based station and observed a return time of 2.55 seconds, what is the Earth-Moon distance? (note that this result will have a precision of better than 10 cm). *(15 pts)*

$$d = \frac{c(t)}{2} = \frac{299,792,458\text{m} \cdot 2.55\text{sec}}{2}$$

$$= \frac{766,902,656.9\text{M}}{2}$$

Round Trip

$$= 382,353,883.95\text{m}$$

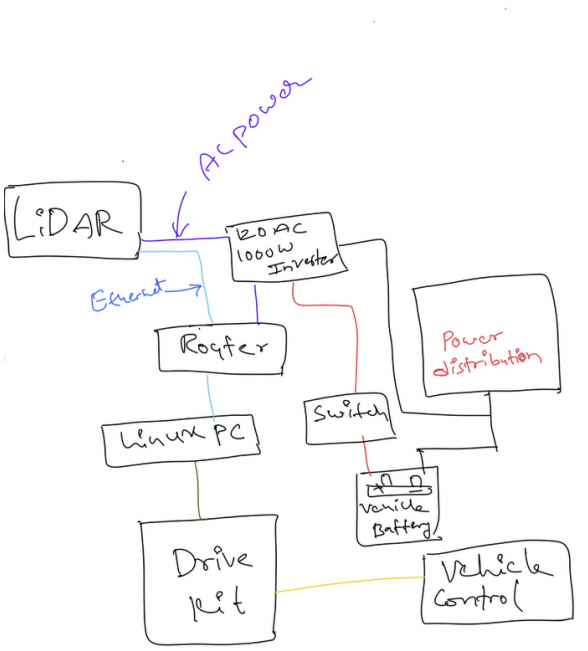
then one way:

$$\frac{382,353,883.95\text{m}}{2}$$

$$= 191,911,727.45\text{m}$$

2. During class we recorded a rosbag using the lidar mounted on our autonomous vehicle development platform. Document the set-up of the lidar on the vehicle by splitting the following tasks with your group. You can all turn in the same thing or have each student turn in their contribution. (*15 pts)*

    a. Create a wiring diagram

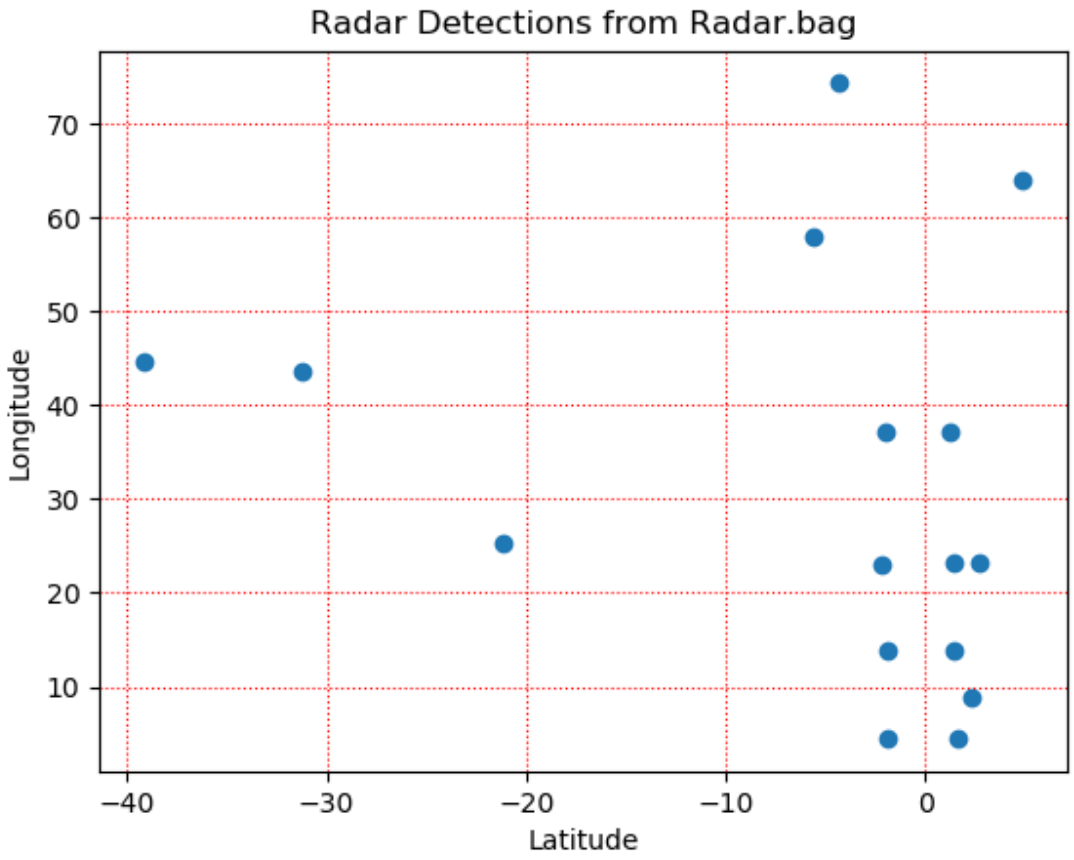


    b. Document with photos how and where the lidar is connected

c. Document and describe how the lidar data was collected

- The lidar data is collected by the lidar sensor mounted to the roof of the vehicle. The data gathered from the sensor are the cartesian coordinates and intensities for each returned laser point. This data is passed via cable to the computer in the trunk that stores it in the point cloud data file format.

3. Using the radar.bag file from Elearning, extract object detection data from a topic that is publishing the appropriate message. Plot the x and y coordinates in Python using a well formatted plot (axis labels, grid, colors, etc.). *(35 pts)*



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