David Perez
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CSCE 460

Lab 4 Part 1 - Reactive Method

The approach I took to implementing the follow the gap algorithm closely resembles the implementation mentioned in the f1tenth presentation and pdf documents. The first step in that process was removing lidar readings that were plus or minus 100 degrees from the center reading. This was then followed by setting distances that were greater than 2 meters (or 4 meters for the Berlin map), and infinity distances to nan values. With this preprocessed data the closest index was set to zero along with the 10 index on both sides of it (bubble radius of 80 was used for the Berlin map). The max gap was then used to find the largest amount of indexes that didn't contain zero values. The 'best point' was then chosen to be the reading that contained the largest distance. This index that contained the largest value was then fed into the PD controller that determines the steering angle and speed to set the vehicle.

The error that was generated for the PD controller was the angle from the center index of the lidar readings to the index containing the largest value. The steering angle thus became a proportional constant 'kp' multiplied by the angle of the largest distance from the center plus a constant 'kd' multiplied by current max distance angle minus the previous max distance angle from the center. The tuning of the PD controller mostly involved setting the constant's to a value that would fall within the range of available angles (max and min steering angles for the vehicle are +- 0.3 radians). All things considered, the bulk of the 'tuning' came from the bubble radius and the max distance. Since it's necessary to use a large array of lidar values, in order to direct the vehicle away from obstacles early the max distance and bubble radius were crucial in creating enough space for the vehicle to avoid obstacles.