Exercise 4: GPS Scribbling

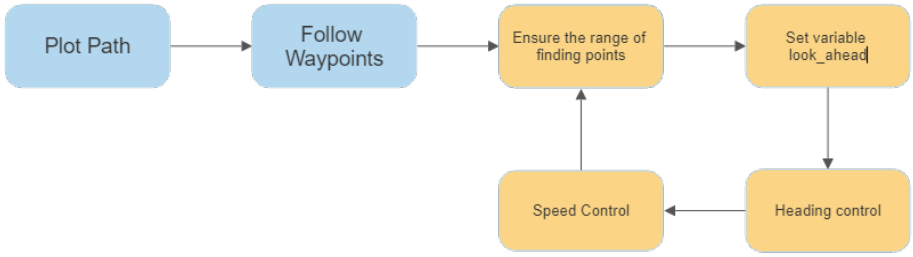
Hongqing Liu, Weichen Liu, Jingwei Bao

University of Illinois Urbana Champaign,
hl85, wl45, jb52

Purpose

The primary goal of this exercise is to cause the vehicle to follow a figure 8 path on the outdoor track. The waypoints used in this exercise was recorded by GPS.

Method



Plot Path: The given 8-path waypoints have some issues: certain parts of the route are too close to the edge of the field, and due to GPS offset, the vehicle tends to drive onto the grass when actually driving. Therefore, in this exercise, we have re-recorded a new set of 8-path waypoints. During the specific recording process, GNSS was used to gain the latitude, longtitude, and azimuth of the vehicle and show these information in a highbay map as x, y coordinate and orientation.

Follow Waypoints: Control the vehicle to sequentially follow each way points of the plotted path.

Ensure the range of finding points: Force the system was only able to find waypoints in next 100 waypoints of current one.

Set variable look_ahead: The reason to set this variable is to deal with the problem of system delay. Since subscribing and publishing messages through ROS takes time, the system can only track points behind the vehicle when path planning is done. So look_ahead is designed to predict a brief position of vehicle when system processings are done, and it will search for waypoints within a radius of 0.3 meters around that position.

Heading control: Calculate the angle value between the current location and the planned next way point, and call the variable f_delta_deg. There are three situations: f_delta_deg > 30 ,f_delta_deg < -30, or f_delta_deg between -30 and 30, we sequentially give command 2 (turn left), 0 (turn right), and 1 (stay current direction).

Speed Control: Control both acceleration and desired speed to make sure the velocity of the vehicle is relatively low.

Solved Problem

There was a problem that the vehicle followed wrong points during the cross part of the 8 path, it might decide to follow a previously travelled path. The solution to this problem is the step "Ensure the range of finding points"mentioned in previous part.

Video Link

Outside view: https://www.youtube.com/watch?v=DW96HV-QaW8list=PL5IM62rCQfXrOYlQUh9B-AyZ2Xzz-sQe6index=7exercise 4 vision 1
In-car view: https://www.youtube.com/watch?v=uGqsXzaHD5slist=PL5IM62rCQfXrOYlQUh9B-AyZ2Xzz-sQe6index=8exercise 4 vision 2