GPS Simulation Project

ECE 495/595 Lecture Slides

Winter 2017

Instructor: Micho Radovnikovich

Summary and Quick Links

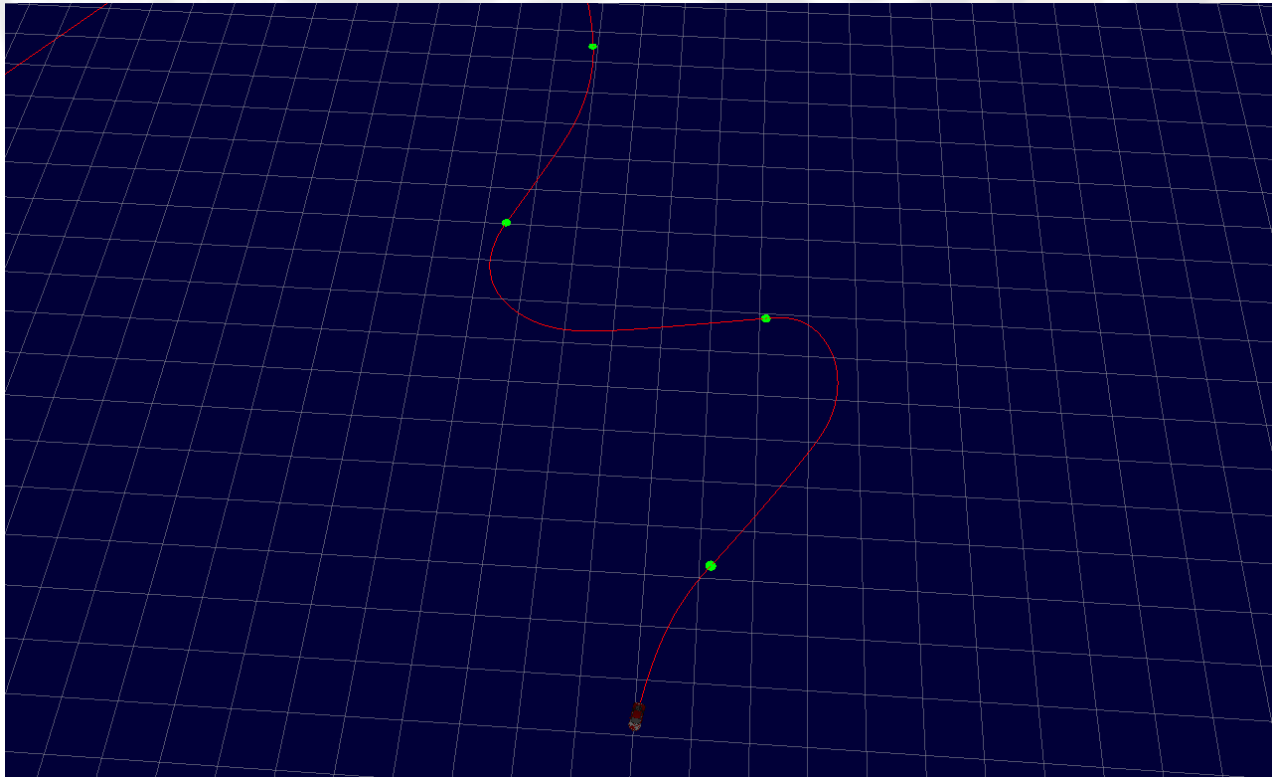
These slides contain the following concepts:

Introduction

- Control Audibot to navigate to 8 GPS waypoints in order.
- Pass within 1 meter of each waypoint.
- Complete the waypoints within a particular time.

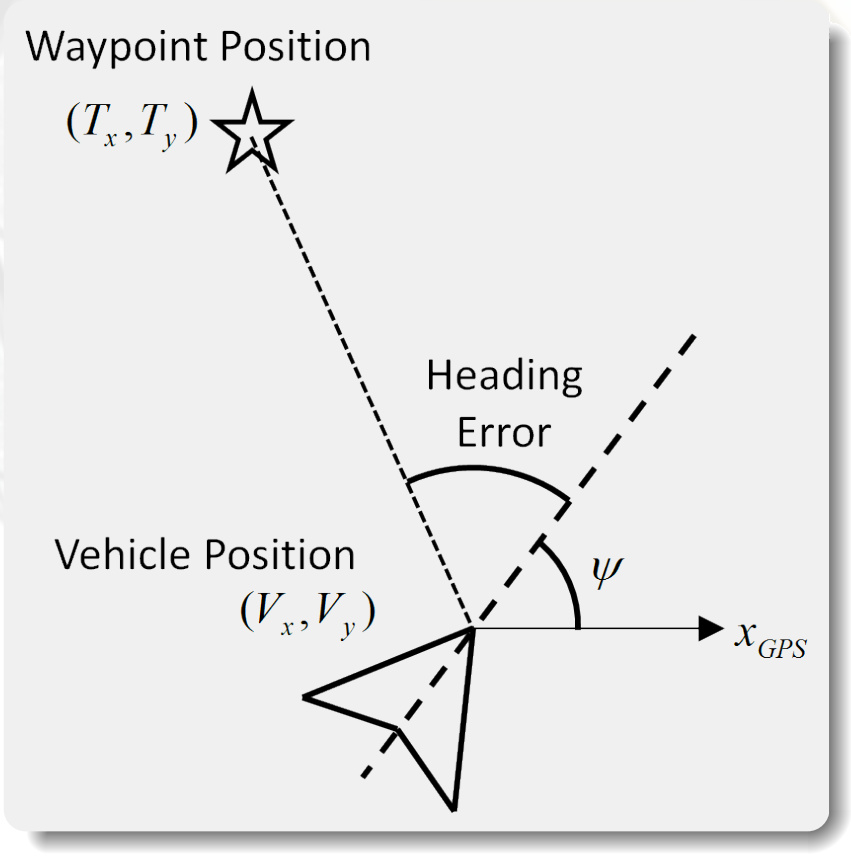
Introduction

- Display waypoint locations using markers.
- Display robot model.
- Display path of the vehicle.



Simple Steering Control Method

- One method of waypoint navigation involves simply controlling the steering to drive heading error to zero.



Simple Steering Control Method

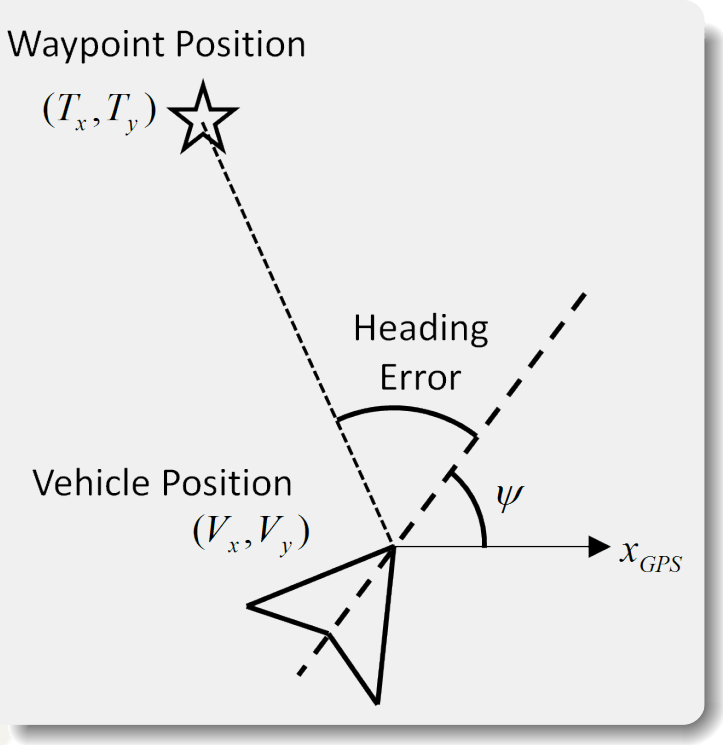
- Compute angle to waypoint in GPS frame:

$$\theta = \text{atan2}(T_y - V_y,\ T_x - V_x)$$

- Heading error is the difference between angle to waypoint and current vehicle heading:

$$\epsilon = \theta - \psi$$

- Apply common sense at discontinuities!



UTM Coordinates

- The Gazebo **world** frame is aligned with a UTM frame, so it is highly recommended to use UTM in your code as well.
- However, the heading is reported like a real GPS receiver, which is relative to True North.
- Therefore, you will have to account for convergence angle.

Convergence Angle

$$\gamma = \tan^{-1}\left[\tan(\lambda - \lambda_0)\sin\phi\right]$$

Heading Correction

$$\psi_{UTM} = \psi_{ENU} + \gamma$$

UTM Coordinates

- To get the central meridian of the UTM zone (λ_0), you can use the **getCentralMeridian()** method of the UTMCoords class.
- To see all the details of the classes and functions defined in **gps_conv.h**, refer to the documentation in **ugv_course_libs_doc.pdf**
- This pdf can be found in the **ugv_course_libs** package.