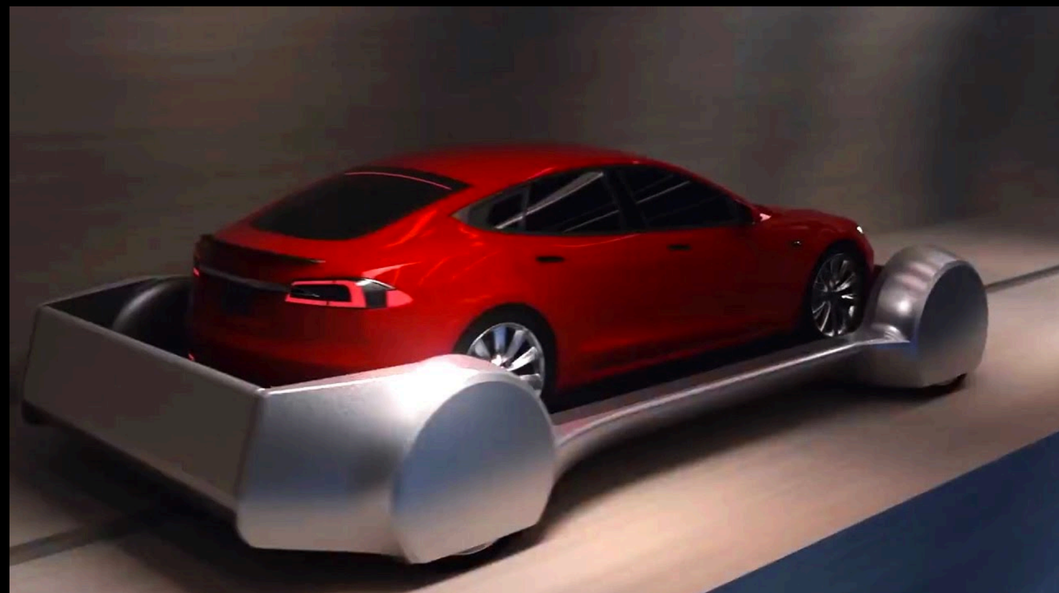
Tunnel Navigation

EECE-5698



Project Goal

Track vehicle position through tunnels and areas of low GPS reception in order to give users accurate turn-by-turn directions

Implementation

- NU autonomous car will be utilized for easy programatic access to integrated sensors via ROS
  - GPS (1Hz)
  - IMU (100Hz)
  - Encoder (for calculating wheel rpm) (100Hz)

- As GPS RSSI (received signal strength indicator) drops and falls below predefined threshold for acceptable SNR (signal to noise ratio), navigation will switch from GPS-based to IMU-based. As encoder data is not consumer-accessible on most vehicles, this data will be used as ground truth of IMU data.

Project Milestones

1. Read GPS position from NU autonomous car
2. Implement Google Maps API calls to overlay GPS data on Google Maps
3. Write script for checking GPS RSSI and determine threshold at which SNR is insufficient to receive accurate data.
4. Read IMU and Encoder data from autonomous car
5. Implement filtering algorithms on raw IMU data to minimize integration error. Used corrected IMU data to double integrate and generate position data. Pass position data back to Google Maps API and plot updated position on map overlay in real time.

Project Milestones (cont'd)

6. Using encoder data to read wheel rotations, plot this position on Google Maps as ground truth data and compare to IMU-generated position.

7. Using positions generated from IMU data, send user updates on distance to exit

8. Use MATLAB to plot data via all three sensors on map view and analyze error.

Stretch Goal: implement this position-tracking algorithm on a smartphone device (like Google Tango) for use in any vehicle.