Chair for Computation in Engineering and MathWorks
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Automated Driving Systems – Co-Simulating Autoware with Simulink

Software Lab Project 2019

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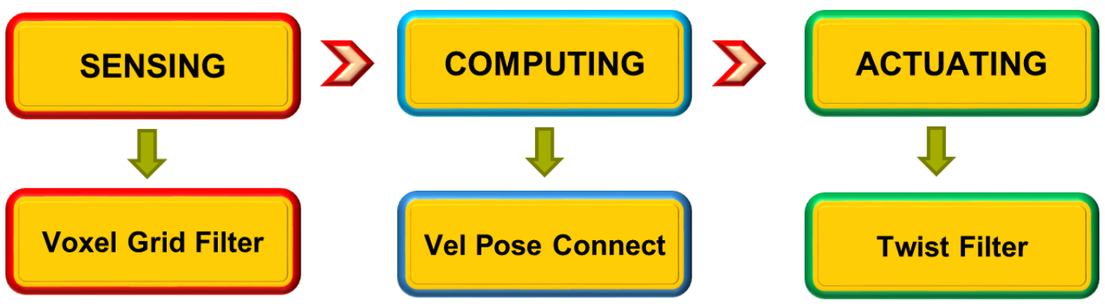
Abstract

This project presents methods to demonstrate interconnectivity between Autoware and MATLAB using Robotics Operating System (ROS). This also aims to provide an example of automated driving co-simulation.

Motivation

Autoware, an open-source platform, is a ROS-based automated driving stack. It is widely used in the research and development for autonomous driving. Co-Simulation between Autoware and MATLAB/Simulink will allow the users to develop autonomous vehicle functions directly from their preferred environment; hence, the amount of time and effort that would be required for ROS programming is reduced. The final goal of the project is to form a closed loop system for autonomous driving vehicles by performing modules from each of the basic functionalities of self-driving cars: sensing, computing, and actuating.



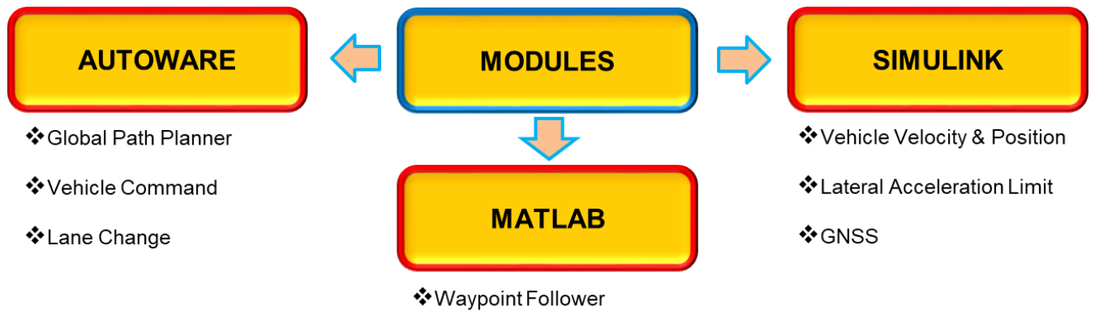
Achievements

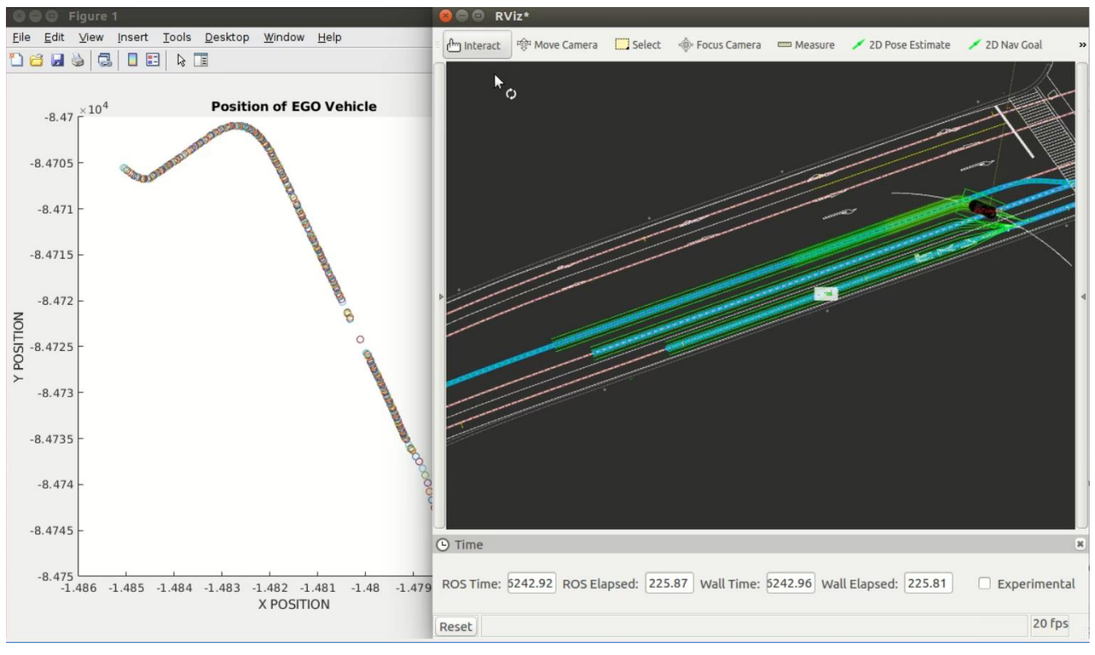
The achievements can be summarized as:

- *A Closed loop system:* Forming a closed loop system consisting of sensing, computing and actuating functionalities.

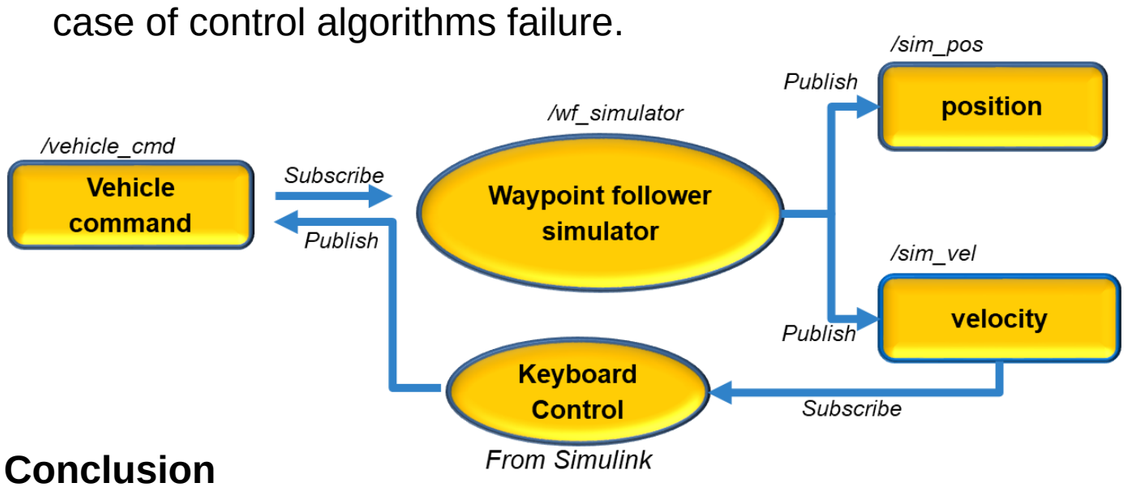
- *Automated Script:* Setting up simulation model in Autoware is a time-consuming process, so in order to speed up the procedure, an automated script has been created which populates the field of Autoware GUI almost three times faster.

- *Lane Change with Obstacle:* A Simulink model was implemented which consists of the three modules running together with Autoware so that ego vehicle can avoid suddenly appearing obstacles by changing lanes.





- *Manually controlling the vehicle:* A manual mode was implemented to control the ego vehicle via a keyboard in case of control algorithms failure.



Conclusion

This project provides a path to an individual who is interested in pursuing the field of autonomous driving. The solutions to the problems faced during installation phase have been well-documented which is believed to provide adequate assistance to the users.

The automated script which can further be extended would provide a friendly experience to the users who can easily populate the required field in Autoware GUI, leading to a much faster process of simulation in Autoware. Additionally, a user has a possibility to try other examples of his/her choice belonging to each of the functionalities of Autoware, by following the same procedures outlined in the documentation.

References

[1] Maruyama, Y., (2018). Autoware on board: Enabling autonomous vehicles with embedded systems.

[2] Tokunaga, S., (2019). IDF – Autoware: Integrated development framework for ROS-Based self-driving systems using MATLAB/Simulink

[3] Software Lab – Co-Simulation of Autoware with MATLAB & Simulink, Git Repository available at:
https://gitlab.lrz.de/ge73xoh/software-lab---autoware.git