Master thesis proposal

Logical correctness of Autonomous Driving software systems

About Zenuity

ZENUITY is a pure software company with the mission of elevating people’s lives by making self-driving cars real. Being a joint venture between Volvo Cars and Autoliv from April 2017 we are a truly modern start-up with high energy, dedication and passion. Zenuity uses a disruptive, never-before-seen before, business model to produce world-leading competence in key technology areas. Delivering leading advanced driver assistance, highly automated driving, and cloud based Automotive software, we are dedicated to transforming the automotive industry and catapulting into the future of transportation. With 500+ employees, worldwide and with a unique growth rate we are recruiting top talent to our sites in Gothenburg, Detroit, Munich and Linköping.

Problem description

With the recent developments in Autonomous Driving, the automotive industry has become increasingly dependent on computer and software systems. Autonomous features and control functions are distributed over several units and are responsible for numerous safety critical actions. An unintended software behavior / control action in such complex software can threaten the safety of all road users. One of the biggest challenges in making autonomous driving scalable is to develop a reliable software that fulfills safety requirements in all kinds of complex driving scenarios. A significant step in that direction is to provide formal models, techniques and tools that can guarantee correct function of complex software. The work in this project is focused on developing a mathematical model of specific safety critical software components used in autonomous driving to be able to formally verify correctness.

Purpose and goals

Based on existing safety standards, the purpose of the thesis work is to develop a mathematical model for the use of formal techniques in autonomous driving software systems and use the model to verify safety requirements. The thesis requires you to accomplish the following goals
A literature study on the existing state of the art methods for formal modelling and model checking for autonomous driving software systems.

Define an appropriate practical framework.

Develop a formal model of specific software components, (e.g. decision logic) used in autonomous driving.

Formally verify the correctness of the developed model to fulfill safety requirements.

Develop a method to automatically extract the verification results for use in the existing simulation environment.

Document and present the results for future research.

What we are looking for

- Two highly motivated students with background in control engineering and/or computer science.
- Good analytical and programming skills with interest in mathematics, system modelling and logical reasoning.
- The ideal candidate has interest in both theoretical and applied aspects of the problem.
- Effective communication skills in English, both verbal and written.

What you will gain

- Competences on
  - Automotive safety standards
  - System modelling and model checking for autonomous driving software
  - Firsthand experience in research and development of safety critical systems
- Industrial experience from autonomous systems aimed for the automotive market

Further information and contacts

For questions regarding the project, please contact

Yuvaraj Selvaraj (yuvaraj.selvaraj@zenuity.com)