Exploring in-vehicle Time-Sensitive Network scheduling based on formal requirements

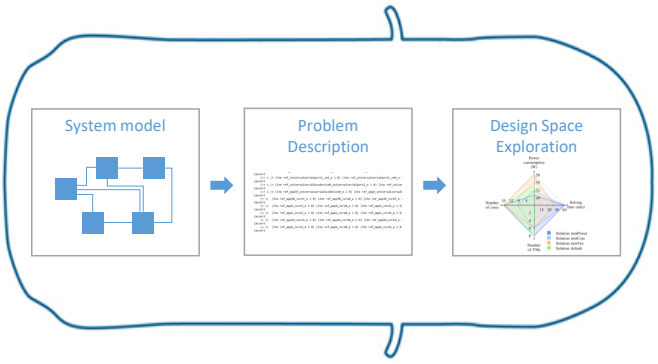
Description

With the increasing number of automotive software and evolving hardware architecture, the design of modern automotive systems has become increasingly complex. To tackle this complexity, the automotive industry is turning to model-based system engineering, which employs formally described system information to enable automated system analysis, including verification and validation.

This study focuses on exploring design alternatives of Time-Sensitive Network (TSN) scheduling based on formal requirements. Solving the scheduling problem is a challenging task involving various system properties and requirements. Currently, engineers encode such problem manually and use state-of-the-art solvers to identify design alternatives. However, the process of writing mathematical formulations is complex and prone to errors. In our previous work, we propose an automated approach to solve the resource allocation problem by generating mathematical formulations from formal system model descriptions, enabling engineers to explore design alternatives in a more efficient and accurate way. In this study, we shall extend this approach for TSN scheduling [1].

Tasks

- Literature review on TSN and current methods.
- Design models to describe TSN scheduling problem.
- Select proper language to formally express TSN-related requirements.
- Implement transformations from formal requirements to optimization models.
- Select and integrate state-of-the-art solvers.
- Design realistic TSN scenarios for the demonstration.



References

[1] Morteza Hashemi Farzaneh and Alois Knoll. Model-based schedule synthesis in time-sensitive networks. In Jochen Langheim, editor, *Electronic Components and Systems for Automotive Applications*, pages 197–203, Cham, 2019. Springer International Publishing.

Technische Universität München

TUM School of Computation, Information and Technology

Lehrstuhl für Robotik, Künstliche Intelligenz und Echtzeitsysteme

---

Supervisor:
Prof. Dr.-Ing. Alois Knoll

Advisor:
Fengjunjie PAN, M.Sc.

Research project:
MANNHEIM-CeCaS

Type:
MA

Research area:
System engineering, optimization, scheduling

Programming language:
Java

Required skills:
Object-oriented programming with Java; Experience with Z3/Gurobi solver and Eclipse EMF environment; Knowledge of real time scheduling.

Language:
English

For more information please contact us:

E-Mail: f.pan@tum.de

Internet: www.ce.cit.tum.de/air