Model-Based Adaptation for Embedded Systems

Background

In the recent years, model-based solution for the development of complex embedded real-time systems have been introduced successfully in many industry scenarios. While model-based solutions today provide a multitude of concepts, methods and tools for coping with functional properties of embedded systems, such solutions rarely exist for supporting also non-functional or timing properties. The situation is even worse when dealing with systems that exhibit flexible behavior at runtime, e.g., when different systems or subsystems can take different roles or when the architecture of such systems needs to be changed (e.g., to react on context changes or failures).

Description

Within this master project, we will investigate how to extend model-based solutions from the field of automotive systems to develop reliable embedded real-time systems that support flexible behavior with adaptation. Based on the capabilities provided by the existing solutions and the existing tool chain the students will investigate how to reflect non-functional and timing properties also at the model-level and how to preserve these properties within the implementation. Furthermore, different modeling concepts of adapting the behavior at runtime should be evaluated.

As an application example three Robotino robots will be used where the robots can take different roles and have to be able to react on changes of their context. Each robot has to fulfill several non-functional as well as timing constraints (e.g., avoid collisions with other robots).

The master project will consist of the following concrete elements: (1) An extension of an existing development tool chain that support also non-functional aspects, (2) a runtime framework realizing the higher-level concepts present in the models, and (3) a demonstrator where the software for the robots have been developed with the extended development tool chain on top of the runtime framework.

References

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