Interfacing CompSOC platform with Advanced Driver Assistance Systems Testbed

Description

EMC² – 'Embedded Multi-Core systems for Mixed Criticality applications in dynamic and changeable real-time environments' is an ARTEMIS Joint Undertaking project started in 2013. The objective of EMC² is to establish Multi-Core technology in all relevant Embedded Systems domains. Within the EMC² project, one domain of interest is Advanced Driver Assistance Systems (ADAS) for next generation vehicles. To this end, a testbed for ADAS is being developed by Technolution (www.technolution.eu). The idea of this master project is to build up an interface between ADAS testbed and CompSOC platform from TU/e and investigate various architectural and algorithmic design aspects.

ADAS Testbed

Technolution is a Systems Integration house based in Gouda. Established some 28 years ago, it now comprises some 180 highly qualified staff working across transport, medical and high-tech industry sectors. Over the past year it has developed quite some interest in Autonomous Vehicles and has created a set of model vehicles which can work within an 'Arena' to demonstrate and test various Advanced Driver Assistance Services (ADAS) and Autonomous Driving (AD).

The 3D printed model vehicle is a 4 wheel drive, 4 wheel steering system with a small (LPC11C24) CPU on each wheel assembly. These are connected, over a CAN bus interface, to a 'Low Level Board' where the basic control software runs. In the current implementation a High Level Board (HLB) based on a NVidia Tegra K1 connects to the LLB over Ethernet and provides the high level control functionality (reasoning, world view etc.). The HLB communicates with a 'Mission Control' system over a 868MHz wireless link.

In this configuration the system is fully functional and was successfully demonstrated at the ITS World Congress in Bordeaux in October 2015. A paper outlining the functionality of that demonstrator can be downloaded from goo.gl/1fb7BX.

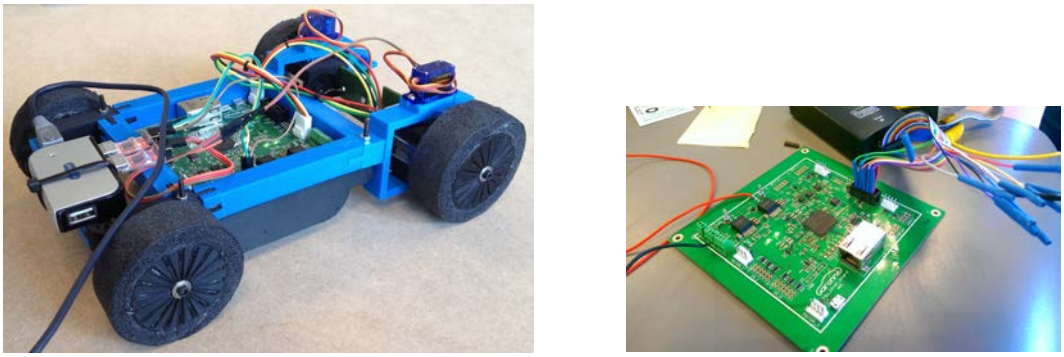

Figure1: A partially assembled ADAS testbed and the Low Level Board (LLB)

CompSOC Platform

Electronics Systems group has developed a real-time multi-processor system on chip (MPSoC) (www.CompSOC.eu). This platform leverages several techniques like composability and predictability to reduce the complexity and verification of executing multiple applications on a single system. These

techniques combined with fact that the platform provides guarantees on timing and correctness of functionality make it very suitable for applications where safety is critical. For already 15 years the CompSOC platform is used as a platform for academic research into, but not limited to, composable and predictable memory controllers, distributed power management, dynamic loading, unloading and reconfiguration of applications in safety critical systems.

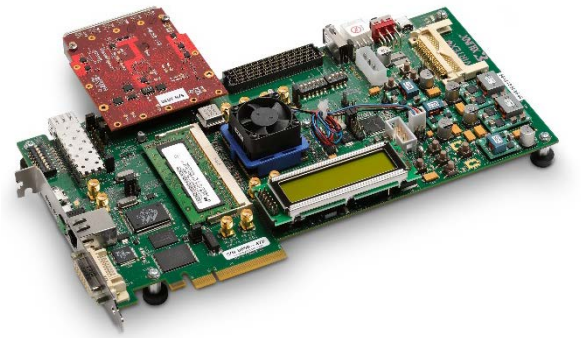

Figure2: Xilinx ML-605 FPGA Prototype Board

The graduation assignment

The intention of the assignment is to replace the current NVidia based HLB with the CompSOC. The first step in the assignment is to make a link between the Low Level Board of the ADAS testbed and a CompSOC instance running on an ml-605 FPGA prototype board. The CompSOC platform will be used to run the high level decision making algorithms and the fault-tolerant algorithms. The second step will be more open and the idea is to evaluate performance of some of the decision making algorithms.

Background requirements: Programming basic, embedded systems, basic electronics

Deliverables

The student is expected to use state-of-the-art engineering practices, which means a proper design of the system and its components is made before implementation. The implementation itself must be properly documented and conform to development rules that will be discussed. We expect the student to consider things like:

- The high-level architectural design that shows how all components work together
- An analysis of the requirements and constraints that the interconnect between the CompSOC platform and the Low Level Board it should satisfies.
- An exploration of the available interfaces, what are their specifications, analyzability and if they meet the given requirements.
- The impact of the different solutions on both the demo vehicle and the CompSOC platform.
- The impact of the different solutions on the used algorithms.

At the beginning of the project a list of deliverables will be agreed upon that describes the work that is expected from the student.

More information

The work is a part of the EMC^2 project. The major part of this master project will be performed at Technolution, Gouda. Depending on the requirement of the project, the student might need to spend certain time at TU/e in the Electronic Systems (ES) group, Electrical Engineering department.

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