



The RESCAR 2.0 research project helps to improve reliability and resilience of electronic systems in vehicles, in particular in electric ones. The project, led by chipmaker Infineon and concluded recently, also helps car manufacturers to align increasingly fast design cycles with rising complexity of the electronics landscape in vehicles.

In powertrain, electronic control units (ECUs) or in the car's body and comfort electronics, the number of the electronic components is rising as well as their complexity. Today's medium sized cars have about 70 ECUs; experts believe that in five years from now this number will be about 100 units. These networked computers, comprising some 4000 to 8000 integrated circuits, have to collaborate without any errors under all driving circumstances.

Electrically-driven cars demand particularly resistant, reliable and durable ECUs. In addition to driving operations, the electronic components and chips installed in them are also under stress during downtimes ; for example, in the battery management when quick-charging or charging overnight. Here, the electronic systems must be designed to last more than 30,000 operating hours - almost four times longer than today's average of about 8,000 operating hours in vehicles with conventional combustion engines. Hitherto, ECUs of electric cars have been improved through elaborate specific manual work to master these challenges.

The task for RESCAR 2.0 was to devise methods and procedures for development processes to be used across the entire automotive value chain that take into account the increasing vehicle complexity as well as the tougher reliability requirements. Hitherto, the standard practice was to optimise existing solutions which had been developed separately and without much coordination. The result of the RESCAR research is a cross-industry solution that enables upgrading of the ECUs in a considerably more efficient way.

The five research partners involved in the project - carmaker Audi, electronics supplier Bosch, the FZI research centre and chipmakers Elmos and Infineon - developed processes and methods that are standardized across the automotive value chain from the semiconductor provider to the system supplier and the automobile manufacturer. These processes can be applied by all participants already in very early stages of their development activities. For example, special robustness analyses have been devised. They help to check and confirm the suitability of planned ECUs or chips for the intended field of application as early as during their development phase. Also, they help to report the results to the automobile manufacturer. Therefore, already in the design phase of an ECU and of the chips the requirements of the automobile manufacturer, its requirement profiles, are now considered.

A requirement profile, as a fixed component of the technical specifications for the ECU, includes all relevant data for a vehicle. Among these are the stress factors based on environmental conditions such as temperature, humidity, supply voltage, the specific conditions of the driving operation, key data on transport, storage, processing and continuous operation for the respective application. The RESCAR partners have broken down this data to the required level of detail within their respective value stage, and have standardized them in such a way that the data can be used consistently.

As a result of the research project, the development of ECUs that meet the new, more demanding standards in terms of robustness and durability is now tightly linked along the entire automotive value chain. ECUs in electrical cars can, for example, meet the much higher requirements for reliability and robustness. Also in the changeover of central automotive ECUs, such as for steering and braking from mechanical and hydraulic to mechatronic systems, the RESCAR results help meeting the highest safety standards. Safety aspects, numerous different interactions between components and their interdependencies can now already be taken into account during the development of ECUs and chips. Also, they can be geared towards the requirements of the respective application.

RESCAR stands for "Robust Design of New Electronic Components for Applications in Electromobility". Over the course of the project, about € 13.3 million were invested. The project 2.0 was funded in part by the German Federal Department of Education and Research (BMBF).

More information about RESCAR: <https://www.edacentrum.de/rescar>