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# One control unit, two functions for failsafe, highly automated driving

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REFERENCE-STORY

AutoKonf
Automatische Rekonfiguration

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

## AutoKonf, a publicly funded initiative, developed a redundant steering and braking control unit.

**ITK supported AutoKonf by:**

- Eliciting system requirements with vehicle simulations
- Developing a model-based, practicable system architecture
- Conducting hazard, risk and fault-tree analyses, and developing a functional safety concept

### The challenge

**Design a redundant system without duplicating all the components**

Hands off the wheel? Yes, but only if the systems' safety is assured. This challenge places new demands on automated cars' safety features. New functions call for redundant vehicular systems. Doubling the component count is not the best technical or most economical option, which is why the AutoKonf project set out to develop an innovative E/E architecture. AutoKonf is shorthand for automatically reconfigurable actuator controls for failsafe automated driving functions.

The BMW Group's Research, New Technologies, Innovations unit, the Fraunhofer Research Institution for Microsystems and Solid State Technologies (EMFT), Hella, intedis, and ITK Engineering teamed up in an automotive industry consortium to tackle this project funded by the German Federal Ministry of Education and Research.

### The solution

**A redundant braking and steering control unit**

Engineers developed a redundant control unit prototype to facilitate efforts to design fault-tolerant functions for automated driving. This unit can control either the braking or steering system's actuators. Simulations showed that the vehicle was able to respond to errors within 60 ms or less. The system disconnects the defective control unit from the actuators and connects the redundant control unit within the specified response time. In addition to the standard-issue braking and steering control unit, the prototype comprises a redundant control unit and a switching unit that can handle the high actuator currents (~100A). A controller determines the sequence of switching operations. The diagnostic protocol specifies an availability check for these switches.

## ITK's deliverables

**The go-to partner for system requirements, system architecture and the security concept**

ITK Engineering's role in the AutoKonf project was to elicit the system's requirements, design the architecture and draft a safety concept using systems engineering methods.

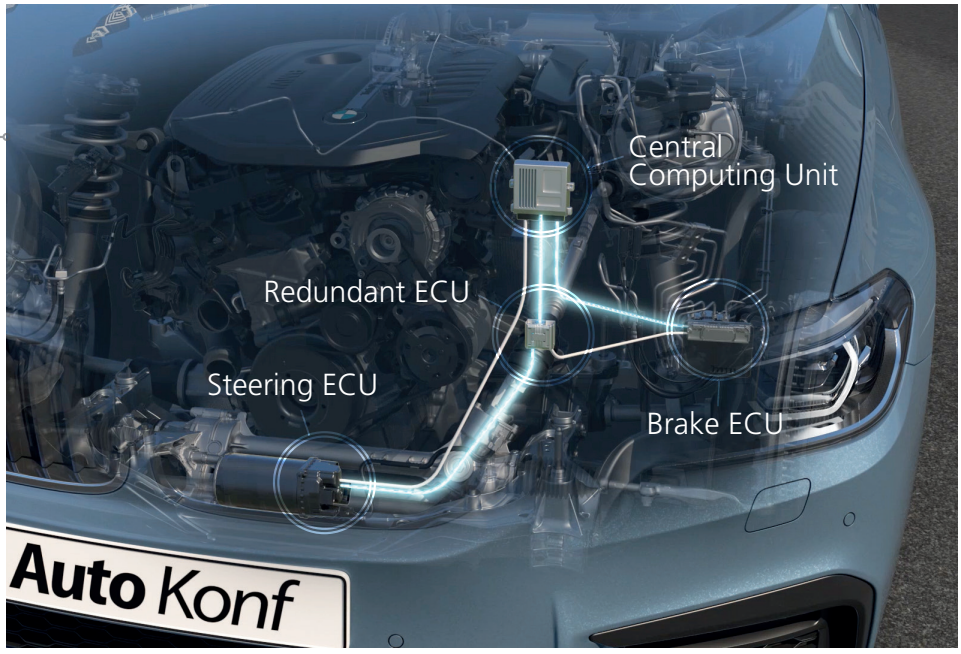
The Volere framework served to elaborate the system requirements. ITK then simulated the vehicle's response to determine the key requirement – the braking and steering response time in the event of an error. ITK Engineering also designed the system architecture using a model-based method supported by SysML activity diagrams. The team ran through all relevant scenarios with a virtual prototype and then allocated functions to the system's components. Extrapolating insights from these trial runs and allocations, it drew up a block diagram for the system's structure and followed an assessment protocol to select the best architecture among the various options. ITK also analyzed the hazards and risks to ascertain the safety goals for this project. These goals and the system architecture were the object of a fault tree analysis that served to develop a functional safety concept.

## The outcome

**A failsafe reconfigurable network of control units**

The reconfigurable combination of three control units – a regular brake and steering control unit and a redundant unit for both functions – ensures safety in the highly automated vehicle. It also reduces the system's complexity. And the reconfigurable network costs less and has a smaller footprint than a solution with four control units.

AutoKonf is a publicly funded project involving various research partners.
To learn more, visit www.autokonf.de




itk ENGINEERING

**ITK Engineering GmbH**
**Headquarters Ruelzheim**
Im Speyerer Tal 6
76761 Ruelzheim, Germany

T: +49 (0)7272 7703-0
F: +49 (0)7272 7703-100
info@itk-engineering.com

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