PROJECT RESULTS

CT217 | Reliability and adaptivity essential for building resilient integrated electronic systems for automotive and avionics [RESIST]

Focusing primarily on reliability and adaptivity of electronic systems for the automotive and avionics industries, the RESIST project developed design methods and solutions that will be dependable and resilient to intrinsic and extrinsic failures in future process technologies.

An increasing sophistication and complexity of systems found in vehicles (including electric cars), airplanes and satellites, as well as, their high-performance, light-weight and compact-size requirements, are all placing greater demands on their electronic components. For example, ever-higher integration is pushing the limits of reliability – and thus their operating life – of current devices, particularly in the harsh operating conditions of automotive and avionics applications. This calls for safety-centric, robust systems based on advanced electronics, which can actively and in real-time handle problems, such as system-performance degradation and errors, before they actually cause failures.

Beyond the traditional hardware-design paradigm

The RESIST project developed new design methods for semiconductors and electronic components which are vital for next-generation electronic systems for avionics and automotive applications, with ever-higher demands on reliability, cost-effectiveness and quality of semiconductor devices. Crucially, RESIST looks beyond the traditional hardware-design paradigm of embedded semiconductor-based devices, which assumes that no device will degrade or operate incorrectly during the lifetime of the device.

RESIST's objectives were to:

- Enhance the lifetime of embedded devices, from today's 10-15 years, to tomorrow's 25 years for automotive, and 35 years for avionics, with a reliability indicator of maximum 10 failures-in-time (FIT) for avionics;
- Enable an innovative 'design for resilience' approach for embedded devices that is at least twice as cost-effective as conventional redundancy practices for the same level of system reliability;
- Increase by at least 20%, the number of integrated components, or integration density of such components, for integrated electronics systems in cars and airplanes for the same, or higher, level of system reliability;
- Reduce reliability-testing costs by 25%, and reduce the qualification time by 30% for integrated electronic-components;
- Develop an early-warning system which monitors the condition of critical components in safety-critical applications.

On target, RESIST achieved all nine milestones and 23 deliverables according to plan.

Among the deliverables were proof-of-concept demonstrators for automotive and avionic applications, where key features and benefits are:

- Highly efficient and a reliable driver for electro-motors usable in electrical vehicles or safety-critical applications, like electrical steering;
- Self-healing and self-regulating processors exploiting time redundancy;
- Resilience and 'health'-monitoring of safety-critical automotive networking applications;
- Good average testing tool that cleverly identifies good circuits for aerospace applications.

Other notable achievements

RESIST designed and developed state-of-the-art IPs, models and tools at a component and system level. All of this was achieved by co-operating vertically with the entire value chain, and across country borders. The consortium also helped promote the project and its deliverables, and disseminate the knowledge it gained, through some 130 contributions to conferences, papers, workshops and the like, including nine talks, and 13 PhD and 11 Master theses. RESIST also (actively) supported standards through its involvement

PROJECT CONTRIBUTES TO

- Automotive and transport
- Safety and security
- Design technology

PARTNERS

NXP-NL (project leader)
ATMEL Nantes SAS
BOSCH
Airbus
Nexperia
Heliox
Infineon
IROC
MunEDA
NXP-D
ST-FR-CRO
Volkswagen AG
CEA-LIST
Fraunhofer IIS/EAS
Institut Polytechnique de Grenoble
ISEN Toulon
Reutlingen University
Technical University Delft
Technical University Eindhoven
Technical University Munich
University of Bremen

COUNTRIES INVOLVED

- The Netherlands
- France
- Germany

PROJECT LEADER

Pierre-Marie Dell'Accio
NXP

www. resist-catreneproject.eu/homepage

KEY PROJECT DATES

01 September 2014 - 31 December 2017

in four standardisation working groups (ISO26262), as well as its collaboration with the CMC, AEC and JEDEC standardisation organisations.

Targeting European automotive and avionics markets

Importantly, European automotive and avionics industries rely on the performance, reliability and longevity of electronic systems for their success and to ensure the quality of their products and solutions. The automotive and avionics markets were estimated in 2016 at € 289 billion and € 320 billion, respectively. However, ia growing penetration in electric vehicles (EVs) and hybrid vehicles (HEVs) is expected to increase automotive electronic-component demand. Important application segments include safety, advanced driver-assistance systems (ADAS) and powertrains, as well as, infotainment and body electronics.

Crucially, in order to curb the number of fatalities from road accidents, regulatory boards in several countries have taken steps to install safety devices in vehicles. Trends suggest that the greatest growth through 2020 will occur within the safety segment. By 2025, 6.2m vehicles are expected to have automated features. Most OEMs are focused on offering semi-automated features in their cars by 2016 and highly-automated driving by 2021. Within the safety category, collision-warning systems are expected to have a compound annual growth rate (CAGR) of 22% between 2015 and 2020, when sales will reach US$4.1 billion. Looking at long-term developments after 2020, continued growth in the engine-control segment is expected. This will include e-motors and power electronics, as well as, growth in integrated systems and solutions, such as engine-control units (ECUs) for fusion sensors and integrated-control systems that will enable level 4 autonomous driving.

RESIST's work in reliability and resiliency – key enablers in the automotive and avionics industries – will further increase the chance of success for European automotive suppliers and manufacturers. This is because RESIST's developments demonstrate fail-safe technologies that not only contribute to reducing the number of (road) accidents; but also in securing European leadership in an extremely competitive sector, where recalls are a constant threat to car manufacturers. Of course, there is still room for improvement and advancement. Further R&D work in the form of follow-up projects and industrial collaboration is just what is now needed.

CATRENE Office
44 rue Cambronne
F-75015 Paris - France
Tel. +33 1 40 64 45 60
Fax +33 1 40 64 45 89
Email catrene@catrene.org
www.catrene.org