

PROJECT PROFILE

20006



TRUST-E [Trustable (sensor-driven) electronics – for Automotive, Aviation and Industrial Applications]

With the emergence of autonomous vehicles and smart mobility, transport and road travel are undergoing a transformation. New technologies are paving the way towards easier, more efficient journeys and the goal of zero traffic fatalities. As critical tasks are increasingly transferred to vehicles and machines, it is vital to have trust that they will operate safely and reliably at all times. This, in turn, implies that the electronic components and systems in these vehicles and machines must be completely 'trustable' (trustworthy). Safety and reliability are non-negotiable requirements. The TRUST-E project is addressing these needs through the development of methodologies and processes for trustable electronic components, modules, and systems that can be used in automotive and aviation applications, and in industrial settings. It will prove their effectiveness by means of three 'Digital Eye' demonstrators, covering each of the three application areas.

Trustworthiness at every level from components to system integration

Electronic systems for future vehicles and industrial machines must not only function flawlessly in harsh conditions but also have a long lifetime, which might be up to 30 years in some cases. Yet today, many of the necessary technologies still have critical limitations. Smart sensors, which 'see' their environment, provide signals that still are too fragmented and incompletely fused into information to be directly usable for decision-making and acting in real-time. In addition, usual methods for assessing which existing consumer components could be used in automotive and industrial applications cover only hardware not software. Moreover, there are no certification schemes for electronic systems that simultaneously assess both hardware and software. Consequently, smart approaches to functional safety for safe operation – such as predictive 'health management' for fault detection and AI algorithms tailored to local computing capabilities within vehicles or machines – are required.

Given these needs, TRUST-E is targeting a significantly increased trustworthiness of complex systems, focusing on advanced sensor systems across the whole chain from single components, via modules, to system integration. It will deliver innovations in hardware reliability, safety, health / lifetime monitoring, and the use of embedded AI techniques for highly demanding applications in sensing and Edge computing for mobility. These applications are, for example, autonomous vehicles and semi-automated wheelchairs, as well as aviation guidance systems, and collaborative

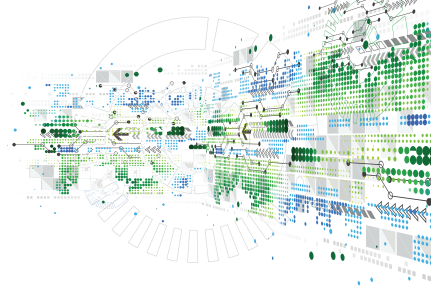
industrial machines. The envisaged demonstrators will provide a holistic view of novel capabilities, with a focus on trustworthiness and AI that ensures the dependability of real-time responsiveness, fault tolerance, risk management and Automotive Safety Integrity Level (ASIL) conformity in resource- and energy-constrained embedded distributed systems and applications as mentioned above.

Among the many TRUST-E innovations will be: advanced components in 7 nm semiconductor technology; techniques for building trustable systems including simulation tools and testing; complete reliable and trustable sensor-based systems including deep-edge smartness or 'AI in a die' and computational empowerment of a sensor node; and embedded AI techniques for health information from sensor nodes based on data-driven models to complement physics-of-failure models, thereby enabling real-time health- and reliability assessments.

The demonstrators will incorporate TRUST-E innovations such as a high precision 6-D inertial measurement unit (IMU) and a combined Radar/LiDAR based sensor fusion automotive system in complex Digital Eye applications for seeing/perceiving the system's condition and environment:

— Automotive Digital Eye: Environment Perception

- Safety relevant, high precision 6D (+ optional pressure) IMU for GPS-independent calculation of emergency brake trajectories (e.g. for tunnels)



KEY APPLICATION AREAS



Transport and Smart Mobility



Digital Industry

ESSENTIAL CAPABILITIES



Systems & Components: Architecture, Design and Integration



Safety & Reliability

PARTNERS

Aptiv Contract Services
 Berliner Nanotest und Design GmbH
 CWM - Chemnitzer Werkstoffmechanik GmbH
 edacentrum e.V.
 Fraunhofer Institute IIS / EAS
 Fraunhofer Institute for Electronic Nano Systems
 FRT GmbH
 imec
 KTH Royal Institute of Technology
 Mercedes-Benz AG
 Nexperia Germany
 Qamcom Research & Technology AB
 RISE IVF AB
 Robert Bosch GmbH
 Saab AB
 SABCA
 scalable minds GmbH
 Siemens AG
 Synective Labs AB
 University of Siegen
 Volkswagen AG
 XenomatiX

COUNTRIES INVOLVED



Belgium



Germany



Sweden

PROJECT LEADER

Kai Kriegel
 Siemens AG

KEY PROJECT DATES

Start: 1 April 2021
 End: 31 March 2024

- _ Vulnerable road-user detection with LiDAR system to improve detection confidence

Industry Digital Eye: Trustable system of systems

- _ Innovative sensors for electrically driven vehicles for all relevant markets
- _ Smart power module for condition monitoring of industrial drives (power + sensor + monitoring, i.e. sensing motor vibrations)
- _ Sensor network for condition monitoring of and around industrial drives

Alternative Mobility Digital Eye: Assistive autonomous electric wheelchair for healthcare applications

- _ Improvement of the quality of life for the users by increasing their freedom to move by trustable electronics.
- _ New autonomous functions with self-diagnosis using AI.
- _ Certification process by experienced partners.

Beyond these specific goals, the project aims to deliver outcomes applicable in standardization, assessment, and certification across the value chain. It will develop common methods, innovative testing methodologies using AI, and guidelines for the design and self-diagnosis of trustworthy components, modules and full system integration, including AI-based optimization. A sensor framework for increased reliability of smart systems will also be developed.

Consortium covering technology knowledge to OEM requirements

Collaboration across the value chain is key for delivering the TRUST-E goals. Thus, the project partners range from

(i) OEMs, (ii) system, module, and component suppliers to (iii) Research & Technology Organisations, representing a cross section of European industry in this field. Together they have the necessary market positions and knowledge to effectively and efficiently solve the problems along the way from first product ideas to fully reliable and functional safety solutions with embedded AI.

Strengthening Europe competitiveness

TRUST-E will strengthen the strategic alliance among semiconductor companies, equipment manufacturers, packaging service companies, module-/system-integrators, and leading European research institutes, thus providing new AI-based methods, tools, and trustable value chains from component to system integration. It will also enable many of the partners to reduce time-to-market and to offer better products or services. This will increase their competitiveness and market share, and reinforce Europe's leading positions in automotive, transport, and industrial applications from semiconductor- to system-level.

Among the numerous market opportunities, the global sensor market is expected to grow to USD 241 billion by 2022, registering a CAGR of 11.3% during the forecast period 2016 – 2022. Moreover, electromobility and ADAS are the two electronic segments with the highest growth rates in the semiconductor market, with the ADAS market expected to reach a volume of USD 16.307 million in 2026.

In addition, TRUST-E is a key technology enabler for Industry 4.0, offering solutions for competitive manufacturing in regions with relatively high labour costs such as the EU. The technological advances in sensors and sensor networks will also have a large impact on medical / healthcare mobility, offering both improved quality of life for large numbers of people and further opportunities for European industry to serve social as well as economic needs.

¹ <https://www.alliedmarketresearch.com/sensor-market>

² HIS Automotive Semiconductro Market Tracker, 2020-04

