Smart Systems: new opportunities for Europe

Riccardo Groppo
Member of the EPoSS Board

EPoSS - THE EUROPEAN TECHNOLOGY PLATFORM ON SMART SYSTEMS INTEGRATION

Industry-driven policy initiative, defining R&D and innovation needs as well as policy requirements related to Smart Systems Integration and integrated Micro- and Nanosystems

INDUSTRIAL

Smart systems for robots in collaborative environments (Bosch)

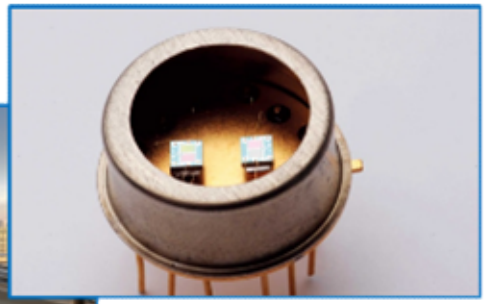
MEDICAL

Intraocular pressure measurement device (Sensimed STM)

AUTOMOTIVE

Advanced driver assistance systems (Bosch)

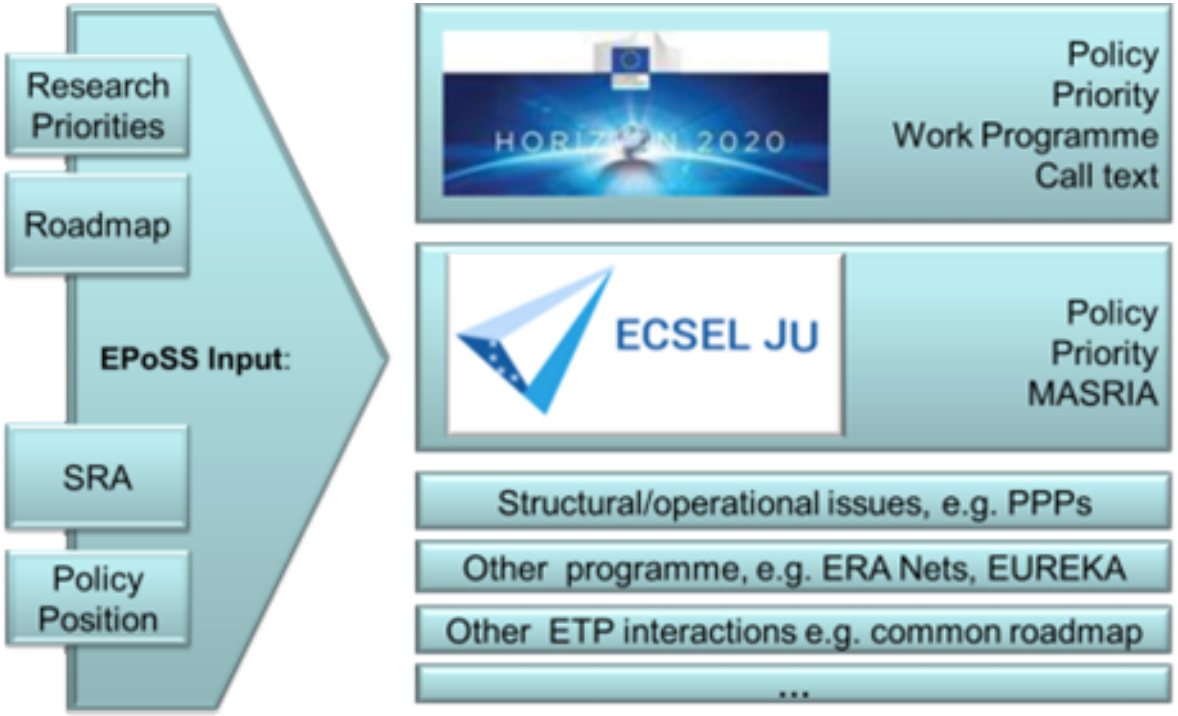
ENVIRONMENTAL



Semiconductor gas sensor (FhG IPM)

EPoSS - THE EUROPEAN TECHNOLOGY PLATFORM ON SMART SYSTEMS INTEGRATION

- Strong community of Smart Systems organisations (Large enterprises, SMEs, clusters, RTOs, academia)
- Partner in ECSEL
- Provider of EPoSS SRA, ECSEL MASRIA chapter, input to Work Programmes,…
- Owner of the Trademark “Smart Systems Integrated”
- Owner of the Smart Systems Knowledge Gateway

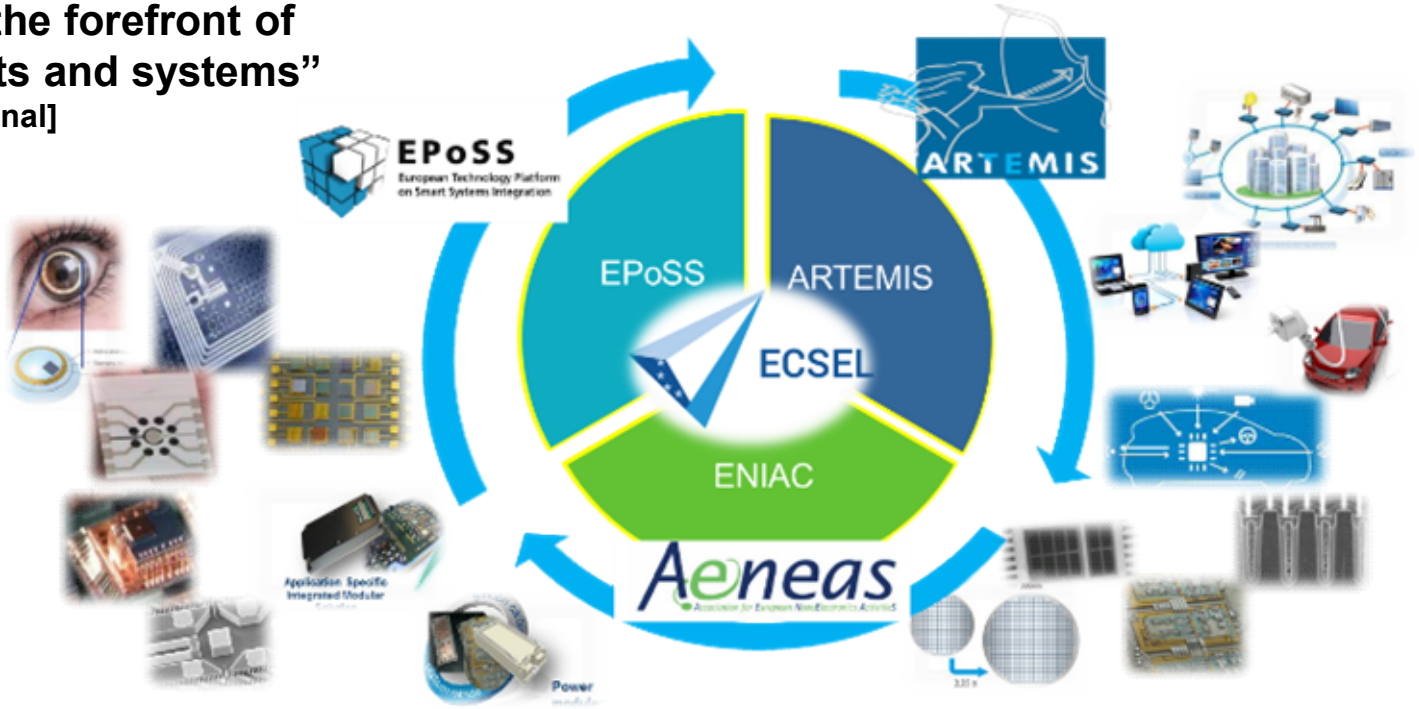


ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

EPoSS

“To keep Europe at the forefront of electronic components and systems”
[10/07/2013 COM(2013) 494 final]

EPoSS, AENEAS and ARTEMIS-IA are private partners in the ECSEL JTI: Electronic Components and Systems for European Leadership Joint Technology Initiative



EPoSS – WORKING GROUPS

Automotive

- Electric Vehicle
- Optimised power trains
- Smart, green & interconnected vehicles
- Weight reduction & energy harvesting
- IoT applications in the vehicle
- Safe, efficient & user-friendly mobility

Healthy Living

- Prevention of disease, and promotion of fitness & healthy lifestyles
- Personal medical devices
- Point of Care diagnostics
- Remote monitoring for chronic disease patients
- Improving the autonomy & integration of disabled and aging people

Manufacturing & Robotics

- Factory automation
- Robo co-w
- Auto dete
- New infor
- Enha
- Redu and r

Communications for Smart Devices

- Internet of Things
  - RFID
  - Sensors/actuators
- Power management
- Machine-to-Machine communication
- Architecture & modelling
- Integration with non-standard substrates

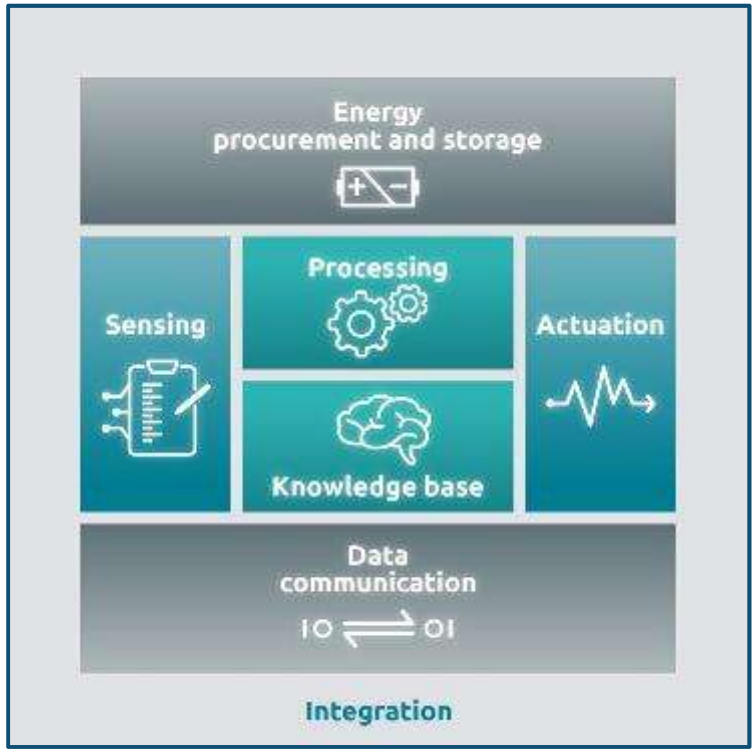
Applied MNBS

- MNBS applications in health, (bio-)medical,environment, food & beverage safety
- Sample preparation & detection in a Lab-on-Chip
- Computer-Brain-Interface & neural systems based on photonic transistors
- Body-worn & implanted Bio-MEMS

Key Technologies

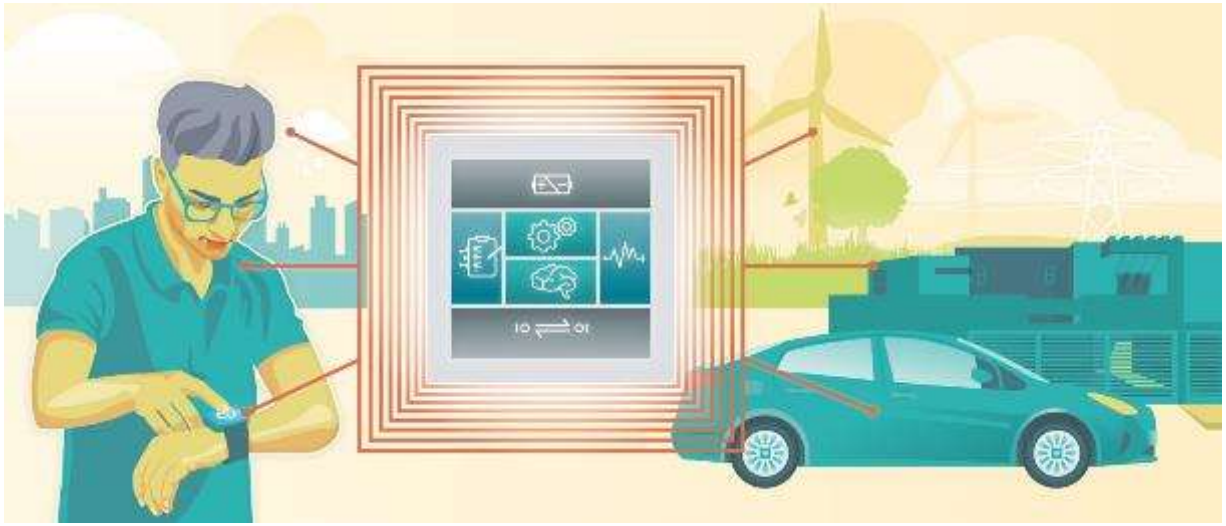
- Materials & processes
- Design methodologies & simulation
- Manufacturing & reliability
- 3D packaging
- MEMS in Smart Systems
- Smart sensor systems
- Technology radar

SMART SYSTEMS …



- Smart Systems combine cognitive functions with sensing, actuation, data communication and energy management in an integrated way
- Smart Systems provide safe and reliable autonomous operation under all relevant circumstances

SMART SYSTEMS …



- Smart Systems are integrated with the (natural, built and social) environment, networks for power and data, other smart systems and the human

- Smart Systems provide (and use) cognitive support to (and from) their surroundings

FUNCTIONALITIES DETERMINE “SMARTNESS”

1st generation

integrate sensing and/or actuation as well as signal processing to enable actions (gyro mouse)

2nd generation

built on multifunctional perception and are predictive and adaptive (continuous glucose monitoring)

3rd generation

perform human-like perception and action, and generate energy (autonomous driving)

SPECTRUM OF SMART SYSTEMS TECHNOLOGIES AND TOPICS

Microfluidic, photonic, micro-optical, and micro-electromechanical components in combination with micro- and nano-electronics

Electronics with novel form factors (e.g. large-area or flexible electronics) or mixed-signal electronics

Smart Systems Technologies, such as Micro-Nano-Bio Systems (MNBS), Microfluidics, MEMS, MOEMS, semiconductors & More-than-Moore, micro-sensors / micro-actuators, combinational sensing, large area sensors and actuators, (multi-)functional materials, energy management, energy harvesting, opto / organic / bio data processing, adaptive surfaces, machine cognition & HMI

Technologies for fabrication and system-level integration and **advanced manufacturing** and new methods to embed such systems in, for example, garments or robots

Materials (metals, ceramics, polymers, semiconductor materials)

Processes such as lithography, chemical and physical etching, LIGA, plasma and vapour deposition, electrochemical plating, chemical functionalisation, atomic layer deposition, (3D-) printing and nanoimprinting, micromachining, forming and handling

Methods and tools for automated design and rapid prototyping

Multi-physics and multi-scale **simulations** as well as **testing and quality inspection**

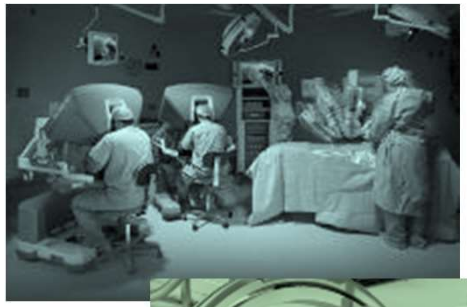
EXAMPLE: SMART DUAL CLUTCH TRANSMISSION …

Courtesy of Continental

Efficient Dual Clutch System

- Efficient Transmission System for improved drivetrain performance (e.g. vehicle dynamic behaviour, comfort) and energy consumption reduction
- Advanced safety mechanisms
- Adaptive control strategies over the product life time.

EXAMPLE: SMART OPERATING ROOM …



Implants

- Predictive & adaptive implants
- Adaptive organ replacement during surgery
- Optimised bioreactors

Minimal invasion

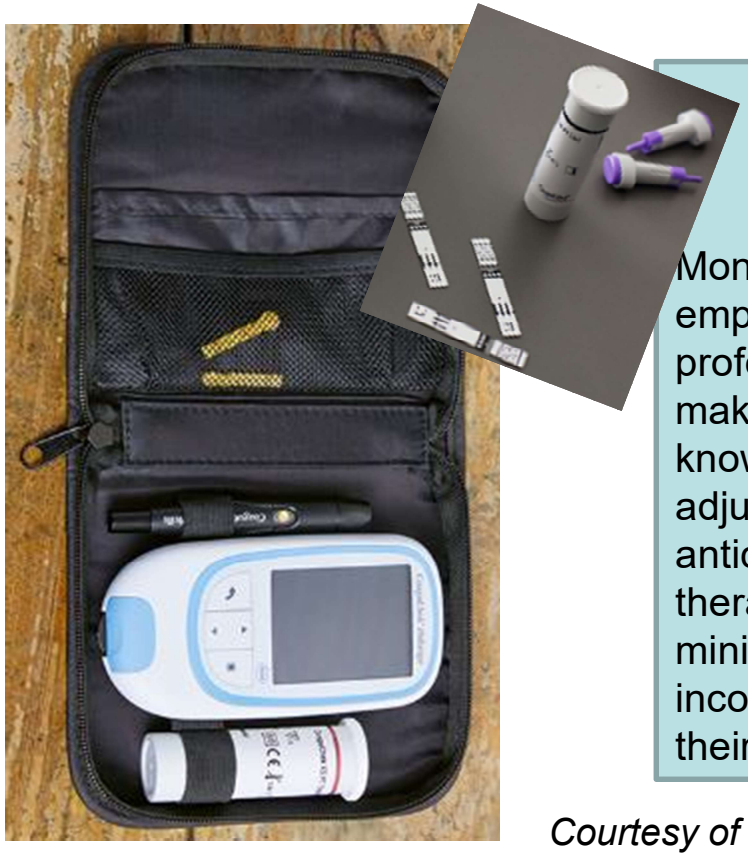
- Smart robots for precision / remote surgery
- Advanced tools combining imaging, diagnostics and therapy (endoscope, smart pills, …)

Assistance

- Functionalised surgery tools (real time analysis, image-guided)
- Interactive access to information (augmented reality, knowledge, monitoring data)

Courtesy of Philips

EXAMPLE: COAGULATION MONITORING …



Advanced monitoring system

Monitoring systems empower healthcare professionals to make immediate, knowledge-based adjustments of anticoagulation therapy with minimum inconvenience to their patients

Testing at the point of care

- CoaguChek® testing at the point of care for:
- Better patient care and quality of life
- Optimised healthcare workflows

Anticoagulation therapy

Anticoagulation therapy for patient subgroups with special conditions

- Patients with severe renal impairment
- Patients with increased risk of bleeding and gastrointestinal side effects
- Patients with mechanical heart valves at high risk of stroke

Courtesy of Roche Diagnostics Deutschland GmbH

EXAMPLE: WINDMILL STRUCTURAL CONDITION MONITORING …

Structural condition monitoring

Condition monitoring, fault diagnosis and structural health monitoring (SHM) are an essential part of predictive maintenance in the windmill industry, as well as to provide early warning of damage.

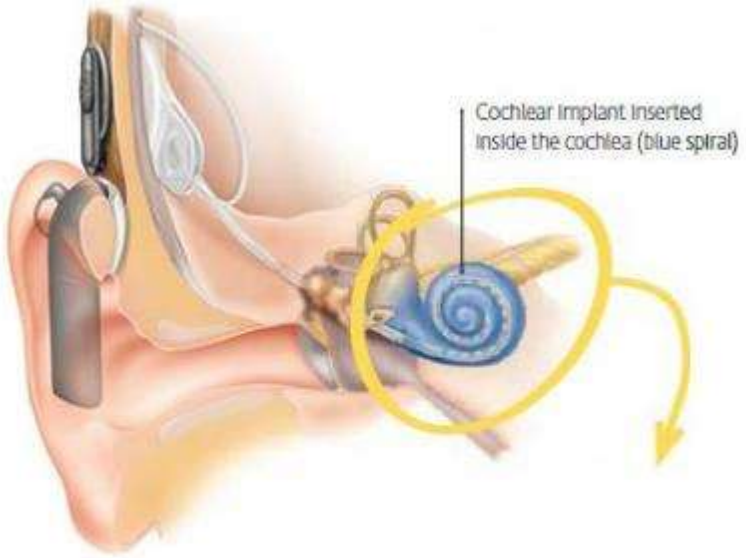
Next generation of wind energy

This is especially true in the next generation of wind energy (e.g.off-shore wind turbines) : there are huge expenses related to the servicing in the sea.
The reliability must be of 25 years for off-shore turbines against 20 years on the ground.

Systems of smart systems

The health monitoring is integrated into the bearing. A system of smart systems is realised: autonomous sensor nodes for temperature, stress and vibration measurements, the wireless operation of the sensor nodes that needs to work in hostile and hard to access environments.

EXAMPLE: IMPLANTABLE HEARING DEVICES …



Cochlear implant

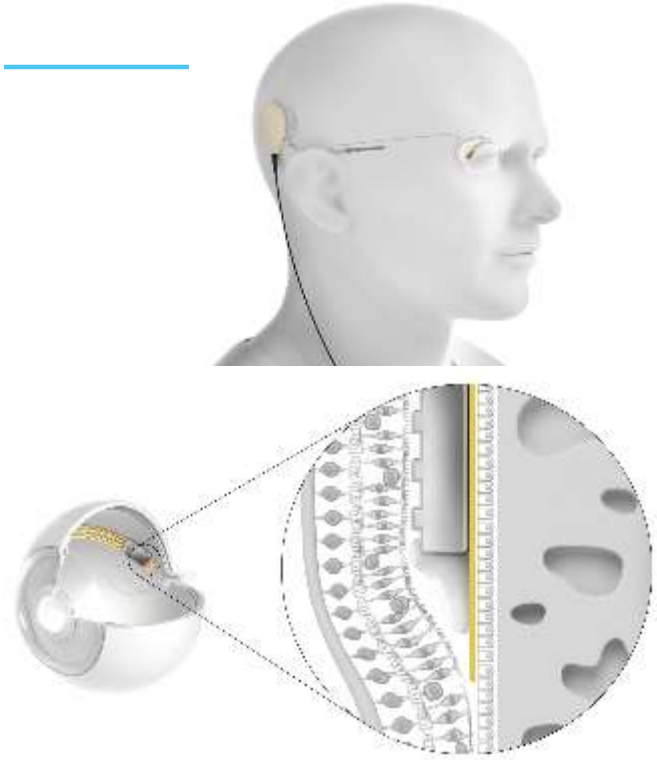
A cochlear implant uses an electrical impulse to stimulate a different set of cells called the spiral ganglion cells.

Minimal invasion

Cochlear's philosophy is to deliver electric stimulation to the spiral ganglion cells located in the hearing zone to achieve optimal hearing performance, and to avoid deeper insertion in order to reduce the risk of apical stimulation or insertion trauma.

Courtesy of Cochlear Ltd

EXAMPLE: SUBRETINAL IMPLANT …



Courtesy of Retina Implant

Subretinal implant

The subretinal implant contains a microchip, similar to a digital camera, which is implanted under the retina. In adult patients whose vision has been affected by retinal degeneration, the system can help to partially restore functional eye sight.

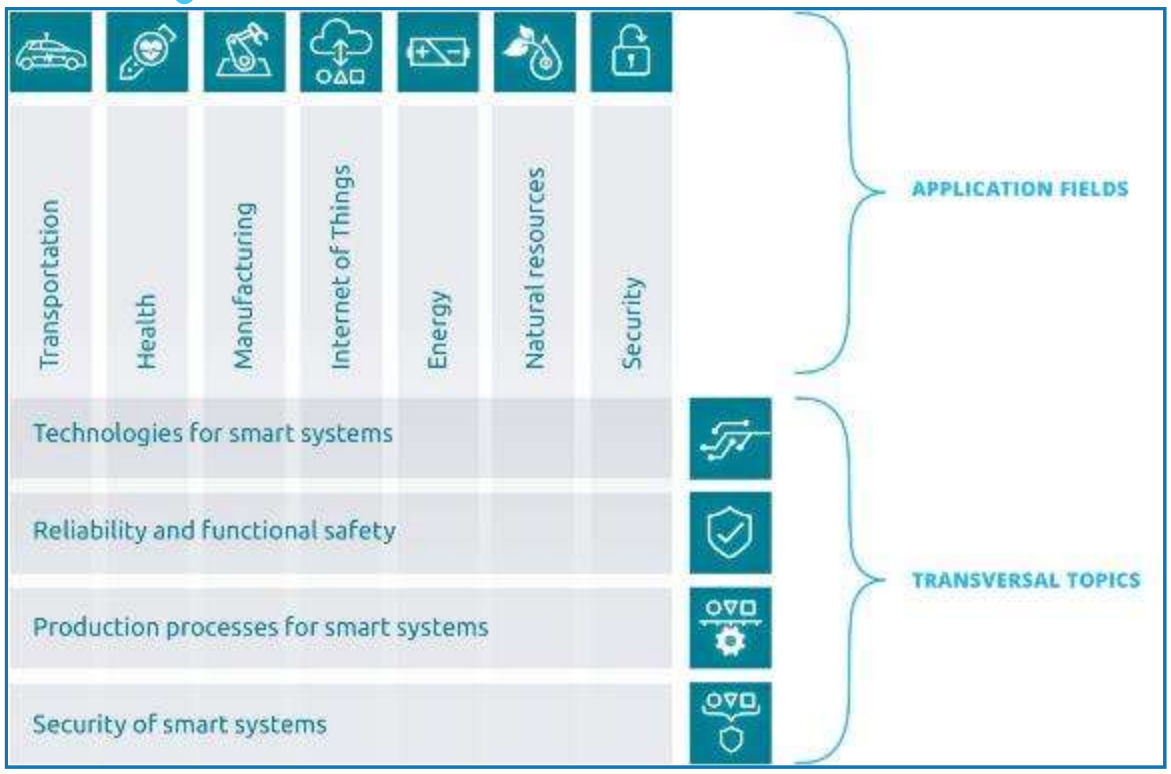
Miniaturisation

The chip is only 3.2 x 4 mm in size with a height of 70 µm. It is equipped with 1600 photodiodes, which convert the incident light into an electrical signal.

Integration

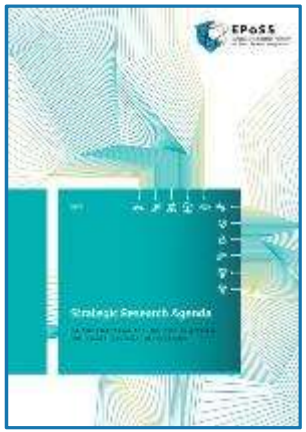
This signal is amplified and relayed via electrodes to the retinal signal processing layers which are still functional. Following the natural optical path, the signal is then transmitted to the brain via the optic nerve.

STRATEGIC RESEARCH AGENDA
7 SECTORS – 4 TRANSVERSAL TOPICS



Focus on

- Objectives
- Strategy
- Impact
- Roadmap



Free download:
www.smart-systems-integration.org/sra-2017

ICT-07-2018: ELECTRONIC SMART SYSTEMS (ESS)

Types of action: *RIA Research and Innovation action (39 Meuro)*
IA Innovation action (8 Meuro)
CSA Coordination and support action (1 Meuro)

Deadline Model: *single-stage*

Deadline: *17 April 2018 h. 17:00:00 (CET)*

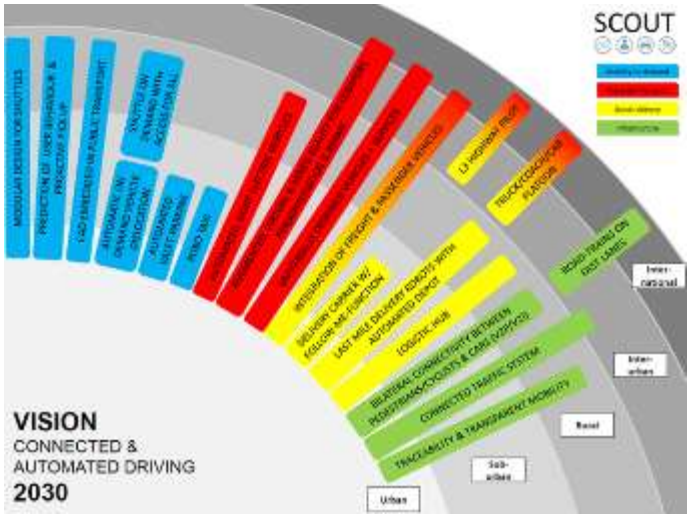
The **challenge** is to **develop and validate a new generation of cost-effective ESS technologies** integrating **hardware technologies across multiple fields** eg, multi-modal sensing, actuating, advanced processing, and secure wireless transmission (to network or local infrastructures).

Access to advanced electronics technologies by SMEs and academia is a complementary challenge supporting digitisation of industry.

FOCUS ON AUTONOMOUS FUNCTIONALITY
3 WORKSHOPS – 3 POSITION PAPERS

EPoSS

Smart Systems for Automated Transport



Smart Systems for the Automated Factory

Smart Systems for the Automated Hospital

inSSIght: in-depth support for innovation and exploitation in Smart Systems Integration ecosystem

- Support and complement R&I activities in Smart Systems Integration
- Support the strategic activities of EPoSS
- Build on and integrate achievements of previous CSAs
- Build a bridge between supply side and demand side
- Rely on information, brokerage, collaboration and project clustering as a tool to strengthen the ecosystem
- Dedicated attention to MNBS

inSSIght

The Coordination and Support Action inSSIght has received funding from the European Community's Programme Horizon 2020 under GA number: 731665
Coordinator: Mrs. Petra Weiler, VDI|VDE Innovation + Technik GmbH

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THANK YOU!

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