SENSKIN

THE SENSKIN PROJECT

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Structural Health Monitoring

"the process by which the safe use and serviceability of a structure is assessed using information provided, principally, by instruments (sensors) attached to the structure."

- Structure inspection and assessment
- Level of damage
- When is an action necessary
- What is the required action

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Structural Health monitoring in transport infrastructure

- *"Structural Health Monitoring (SHM) has a predominant role in the management of transport infrastructure"*
  - Continuously aging infrastructure requires constant inspection and assessment
  - Critical infrastructure demand top level efficient inspection and assessment to ensure high reliability of operation and safety towards citizens
- SHM systems contribute to a:
  - Safer
  - Smarter
  - More efficient
- network of building, transportation infrastructures and energy structures

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Benefits of improved inspection

- Decrease cost of monitoring and damage assessment compared to traditional methods by:
  - Speedy inspection reducing cost by minimizing the need to close sectors of the infrastructure
    - Single pass through in tunnels using advanced navigation algorithms
    - Aerial inspection on bridges and highways using high resolution cameras, laser scanners and ultrasonic
    - Reduction of necessary personnel
- Detailed information collected and reported automatically

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Project Challenge

- Current SHM methods rely on the **use of point sensors**
- **Dense network of sensors** is required to monitor a structure, which is costly (and impractical)
- **Conventional sensors fail at relatively low strains**
- **Sensor communication systems are unreliable in extreme service conditions** (no foolproof alarm of an imminent structural collapse)
- **Data obtained from sensors not employed routinely** to define the most cost-effective and environmentally acceptable intervention

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SENSKIN – Project Information

"**SEN**sing **SKIN**' for Monitoring-Based Maintenance of the Transport Infrastructure"

"*SENSKIN*"

- H2020 – MG8.1a-2014 (MOBILITY for GROWTH 2014-2015) – Smarter design, construction and maintenance
- Type of action: Research and Innovation
- Funding: 3.8 MEuro

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Consortium

- 9 RTD partners:
  - Institute of Communication and Computer Systems (ICCS, Greece)
  - University of Potsdam (UP, Germany)
  - RISA Sicherheitsanalysen GmbH (RISA, Germany)
  - TECNIC S.p.A. (TECNIC, Italy)
  - Mistras Group Hellas A.B.E.E. (MGH, Greece)
  - University of Stuttgart (USTUTT, Germany)
  - TRL Limited (TRL, UK)
  - Teletronic Rossendorf GmbH (TTronic, Germany)
  - Environmental Reliability and RISK Analysis (ERRA, Greece)

- 2 Road Administrations:
  - State Enterprise State Road Scientific Research Institute (DNDI, Ukraine)
  - Forum Des Laboratoires Nationaux Europeens De Recherche Routiere (FEHRL, Belgium)
- 2 Highway/Bridge Operators
  - Egnatia Motorway (EOAE, Greece)
  - Turkish General Directorate of Highways (KGM, Turkey)
- 2 Associated Partners:
  - Federal Highway Administration (FHWA)
  - Wacker Chemie AG

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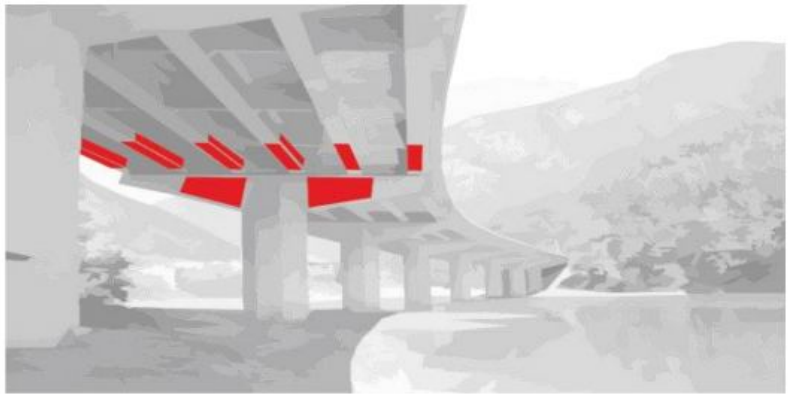
What is SENSKIN

- SENSKIN is an integrated system comprising of:

- **a dielectric-elastomer and micro-electronics-based skin-like sensing solution** for the structural monitoring of the transport infrastructure
  - spatial sensing of repeated strains in the range of 0.012% to more than 10%
  - low operation power
  - easy to install on an irregular surface
  - low cost (compared to existing sensors)
  - allows simple signal processing
  - self-monitoring and self-reporting



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What is SENSKIN

use a **Delay Tolerant Network** to

- secure strain measurements acquired will reach the base station even under extreme environmental conditions and natural disasters

develop a **Decision-Support-System** for

- proactive condition-based structural intervention under operating loads and intervention after extreme events
- accurate structural assessment based on input from the strain sensors

Implement the above in the case of bridges and test, refine, evaluate and benchmark the monitoring system on **actual bridges**

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SENSKIN Objectives

1. Develop a next generation 'sensing skin
   - Innovative stacked architecture with self-sensing functionality
   - Optimized material compositions and processing/measuring technologies

2. Develop a reliable DTN communication system that can guarantee the delivery, availability and integrity of the sensor data even during hostile communication conditions
   - Redundant communication technologies on the nodes (mobile, wireless networking and wireless sensor)
   - Seamless integration and transparency of the different communication technologies

3. Integrate the novel strain sensors and communication system in into a zero power wireless sensor platform
   - Integration into an Ingress Protection (IP) -66 enclosure for protecting against harsh weather conditions

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Project Status

- Running of small and large scale tests
- Finished with the 1st pilot installation in Bosporus bridge
  - Sensor testing following operational conditions
  - Integrated system (node) testing
- System validation at operational environment
  - Results validation over time and comparison with COTS system
- Preparation for 2nd Pilot in Krystalopigi Bridge, Metsovo, Greece
  - Long duration
  - Large number of sensors
  - Comparison with Conventional monitoring system

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Overall Impact

- Extension of life span of ageing infrastructure
- Reduction of CO2 pollutants and noise emissions by reduction
- Transition towards zero traffic disruption from inspection and maintenance
- Boost the overall performance of the EU transport infrastructure by developing new construction and maintenance techniques.

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What is next?

- There has been interest from stakeholder for certain aspects of the system
- Continue further research on specific areas and technologies
- Actively looking for further research projects related to SHM and sensors

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The End

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www.senskin.eu

THANK YOU! ANY QUESTIONS?

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