Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

FFG
Promoting Innovation.

Digital Technologies

Ready for the Future: Smart, Green and Visionary.

Project Highlights of the Years 2016 to 2021

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Introduction

Leonore Gewessler
Federal Minister
for Climate Action,
Environment, Energy,
Mobility, Innovation and
Technology

Eelectronics-based systems, robotics, automated driving, a trustworthy Internet of Things, big data and artificial intelligence – this publication takes a look at projects that have been successfully implemented in digital technologies in recent years. The initiatives presented show the commitment and broad range of expertise of the various stakeholders involved. They have enabled technological progress and shed significant light on the different interactions between technology, people, society and environmental protection. The implementation of digital solutions plays a crucial role in efforts to use resources more efficiently and reduce our environmental footprint.

The Ministry for Climate Action has supported companies and researchers in launching pioneering projects in these very areas over the past two decades. The success of the project calls in the area of digital technologies is reflected in the technological excellence provided, as well as in the creation of a dynamic network of experts who have worked together on forward-thinking projects. I am delighted that our initiatives have had a sustainable impact on the digital landscape in Austria.

The high degree of participation from the EU Framework Research Programme shows that the results achieved are also receiving the recognition that they deserve at the European level. The close collaboration within the scope of this initiative has not only produced innovative technologies, but has also created the basis for future developments. The findings and experiences gained will be used as a creative source for future developments, and therefore lay the foundation for future innovations.

Thank you very much for this.

Leonore Gewessler
Federal Minister
Federal Ministry for Climate Action, Environment, Energy,
Mobility, Innovation and Technology (BMK)

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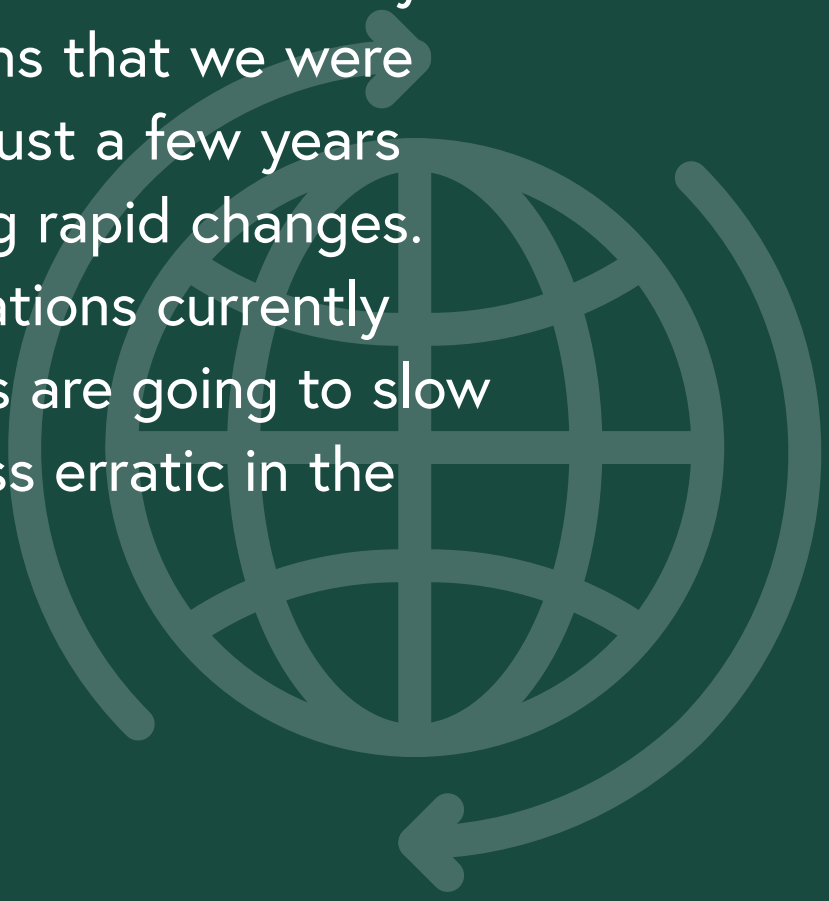
A changing world

Recent years have been characterised by various upheavals that have affected the whole of society. The living conditions that we were familiar with until just a few years ago are undergoing rapid changes. There are no indications currently that these changes are going to slow down or be any less erratic in the future.



Funding initiatives by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) are helping to actively shape selected challenges and thereby exploit the opportunities associated with them for Austria. There have been some specific challenges affecting digital technologies in recent years, the main ones of which are mentioned here:

- digital transformation processes are multifaceted. They include both technological measures which are provided in the form of new digital products and services, as well as social measures which involve everything from forming networks and building expertise to intentionally changing our behaviour. Different methods can be used to achieve the goals, including those based on interdisciplinary integration. Digital technologies can play a part here in various different ways, including evaluating our achievement of the objectives.
- Europe constantly has to prove anew that it can compete in the area of electronic components and systems in the face of global competition. Co-operation at the European level can help to create potential synergy effects in order to be able to compete more effectively globally.
- Demographic ageing is a global phenomenon and represents a major challenge in society. The goal set was to enable people to live independently as long as possible in their own home, including in a broader sense. Digital technologies can play a part in this.

Digital technologies now permeate virtually every aspect of our daily lives, affecting work and leisure times, and how we interact with our surroundings. From a discipline once only used in specific niches, digital technologies have now become a fundamental and integral part of our lives, driving interconnection between various fields in science and the economy. This has given rise to new areas of application and disciplines at the respective interfaces, including providing links between production or energy supply and IT (Industry 4.0, Smart Grid), demographic challenges and IT (AAL), automotive engineering and IT (autonomous driving), as well as medicine, biology and IT (bioinformatics), to name just a few examples.

The process for the future commissioned by the BMK entitled "Scenario Process NGI - The Internet for People 2040"[1] formulated the following mission statement: Digital technologies will shape the opportunities and limitations for society in future. They will accompany people everywhere, all the time. Research institutions and companies are in the process of preparing these technologies over the next few years.

Digital technologies can make a significant contribution to national technology sovereignty and play an important role as critical technologies that not only generate huge markets themselves, but are also essential for virtually all industrial and service sectors, in particular to secure their energy supply, sustainability and social aspects.

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1 iktderzukunft.at/resources/pdf/scenario-report-ngi-the-internet-for-people-2040.pdf

2
Selected project highlights

The projects presented in this brochure cover various objectives that are intended to be achieved through research and development in the area of digital technologies. All projects were funded by the "ICT of the Future" funding programme (now completed). Selected project highlights in various categories are presented here in more detail, demonstrating the broad range of projects that were funded.

These categories are:

A Climate protection and/or the environment

B Energy and/or mobility

C Innovation and technology

D People in the digital world

The UN's Sustainable Development Goals (SDGs) provide an external view of the national projects. The project highlights listed are examples of how the following four global goals have been addressed in particular:

- Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation (SDG no. 9)
- Make cities and human settlements inclusive, safe, resilient, and sustainable (SDG no. 11)
- Ensure sustainable consumption and production patterns (SDG no. 12)
- Take urgent action to combat climate change and its impacts (SDG no. 13)

A HIGHLIGHTS FROM CLIMATE PROTECTION AND/OR THE ENVIRONMENT

The green transformation is a relevant topic. This is why funded projects have addressed this. Integrated solutions for digital technologies play a role in mastering the complex, systematic and interdependent challenges related to sustainability. This has taken place e.g. through the provision of data and through developments that save resources and energy. The project highlights listed here are focussed on the recycling process and different improvements in mobility.

- **OBARIS – Ontology-Based ARtifical Intelligence in the Environmental Sector**
- **SmartDis – Smart Disassembly with a Knowledge-based Automation System**
- **dTS – Data-driven Tourism for Sustainability**

B HIGHLIGHTS FROM ENERGY AND/OR MOBILITY

Energy and mobility issues are closely linked with environmental thinking and with innovations. These topics make use of digital technologies, so ICT of the Future also funded projects in these areas. The project highlights for this category show how mobility participation can be made easier for older and disabled people or how electronic semiconductor components contribute to energy efficiency.

- **SINUS – Sensor INtegration for Urban riSk prediction (cooperative R&D project)**
- **UltimateGaN - Research for GaN technologies, devices and applications to address the challenges of the future GaN roadmap (European ECSEL project)**
- **iLIDS4SAM – Integrated LiDAR Sensors for Safe & Smart Automated Mobility (flagship project)**

HIGHLIGHTS FROM INNOVATION AND TECHNOLOGY

C

The project highlights presented here address different areas of application. These include e.g. securing supply chains and workplaces or the working environment itself. Many different solutions are offered for these challenges, from an infrastructure for data trading, the creation of data ecosystems, the pooling of expertise along the value chain to the reliable networking of existing technical solutions. The projects make use of or establish national and/or international ecosystems in order to achieve digital innovations and competences more effectively.

- **Cooperation with a signal effect**
  - **DMA – Data Market Austria**
  - **IoT4CPS – Trustworthy IoT for Cyber-Physical-Systems**
- **European projects with an Austrian character**
  - **Semi40 - Power Semiconductor and Electronics Manufacturing 4.0**
  - **ENABLE-S3 - European Initiative to Enable Validation for Highly Automated Safe and Secure Systems**
- **Exploring future research**
  - **SWIS – Sophisticated Web Information Service**
  - **ICT4snow – Exploring ICT solutions for a common snow and avalanche platform**

HIGHLIGHTS FROM PEOPLE IN THE DIGITAL WORLD

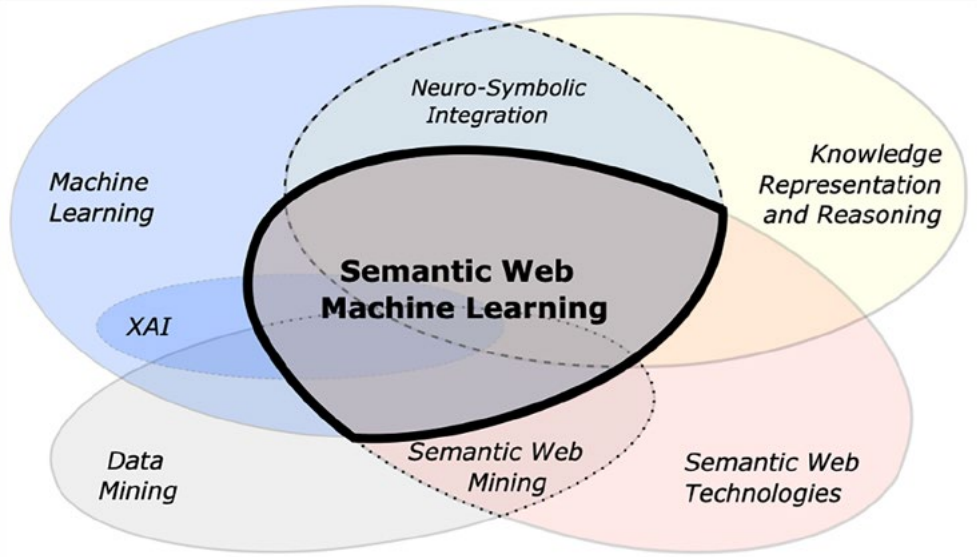
D

This category presents project highlights that specifically address people in the technology environment. They take social and ethical challenges into account in this process. One social challenge is demographic change, another is ensuring digital sovereignty. The development of innovation and the use of digital technologies needs to be fair and inclusive. The selected project highlights address the topics of ethics and trustworthy artificial intelligence as well as the sustainability of digital solutions for all. They look at both the private and the working environment.

- **LICA – Linked Care – Continuous information provision in mobile care and assistance (flagship project)**
- **TeleCareHub – Platform for technology-assisted care and support for people with dementia living at home (flagship project)**
- **EyeControl – Eye-Controlled Machines (collaborative R&D project)**
- **AI@Work – Human Centered AI in Digitized Working Environments (exploratory project)**

OBARIS

Ontology-Based Artificial Intelligence in Environmental Sector



Embedding of "Semantic Web Machine Learning" and the relationship with other divisions; Image: Anna Breit

The OBARIS project aims to advance the status quo in auditable semantic artificial intelligence systems (SAIS) by investigating both conceptual aspects of these systems as well as the development of a technology stack that transfers these system types into concrete settings.

OBARIS covers a range of innovative aspects:

The first aspect is to improve the understanding of the different types of semantic AI systems (SAIS) on a conceptual level. We further refined the concept of SAIS into Semantic Web and Machine Learning System (SWeMLS). One important outcome is a systematically derived taxonomic characterisation of SWeML systems and their patterns based on a large-scale Systematic Mapping Study.

The second aspect was the development of a lifecycle model, which helps identify and guide the development of concrete SWeMLS implementations. Based on this lifecycle model, we devised a concrete technology stack for developing SWeMLS in the OBARIS showcases. To this end, we developed a flexible pipeline architecture that adopted the widely used NLP Interchange Format (NIF). The pipeline communicates with a range of services which ensure that it can be reused and extended.

The third aspect was related to the design and development of an auditability framework for SWeMLS. To this end, we have developed a semantic-based method and models which allow automated capturing of audit traces and machine-actionable descrip-

tion of SWeMLS. We reuse and extend the PROV-O and P-Plan ontologies to represent SWeMLS workflow and to generate corresponding endpoints for system trace acquisition.

These innovative aspects highlight the challenges that we addressed within the scope of the OBARIS project:

- the lack of understanding of the characteristics of SWeMLS
- the need for a generic and practical framework to support the auditability of SWeMLS
- the limited application of SWeMLS in the environmental domain.

We presented the software that we have developed to our project partners in two specific use cases in the environmental sector and evaluated them together. The first showcase deals with machine learning-supported analysis of legal permit information. The second showcase is concerned with the FAIRification of nutrient input and flows of river catchments in Austria, i.e. the collection and integration of heterogeneous measurement data and metadata from different sources in order to increase data transparency.

These innovative aspects and their usage within the specific showcases highlight the contributions made by OBARIS to the SDGs, in particular to Goal 9 "Industry, innovation and infrastructure". First of all, our results contribute to understanding the new wave of semantic AI systems and the auditability aspects of these systems. Secondly, we have developed two proofs-of-concept based on our research results that demonstrate the applicability and further development of these technologies.

Our plan is to develop SWeMLS design patterns further in future and explore their impact on auditability and other system characteristics. We will also continue to develop our software so as to add further functionalities and increase user-friendliness.

PROJECT INFORMATION

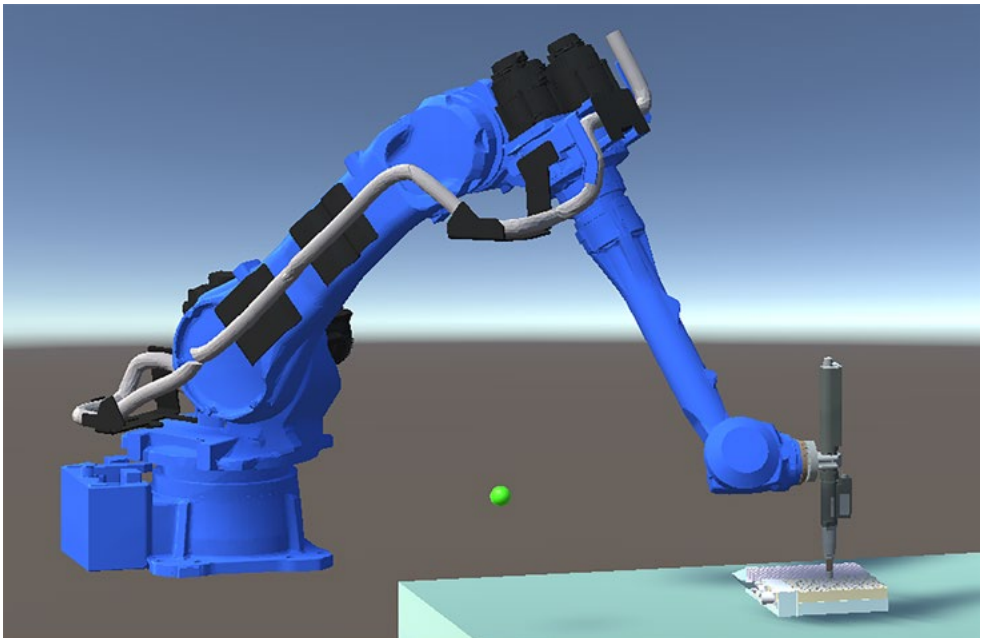
Term: February 2020 – October 2022
Consortium leader: TU Wien, Data Science research unit (194-04)
Project coordinator: Fajar J. Ekaputra
Additional consortium partners: Semantic Web Company (SWC), Environment Agency Austria (UBA)
Project website: obaris.org

A

SmartDis

Smart disassembly with a knowledge-based automation system

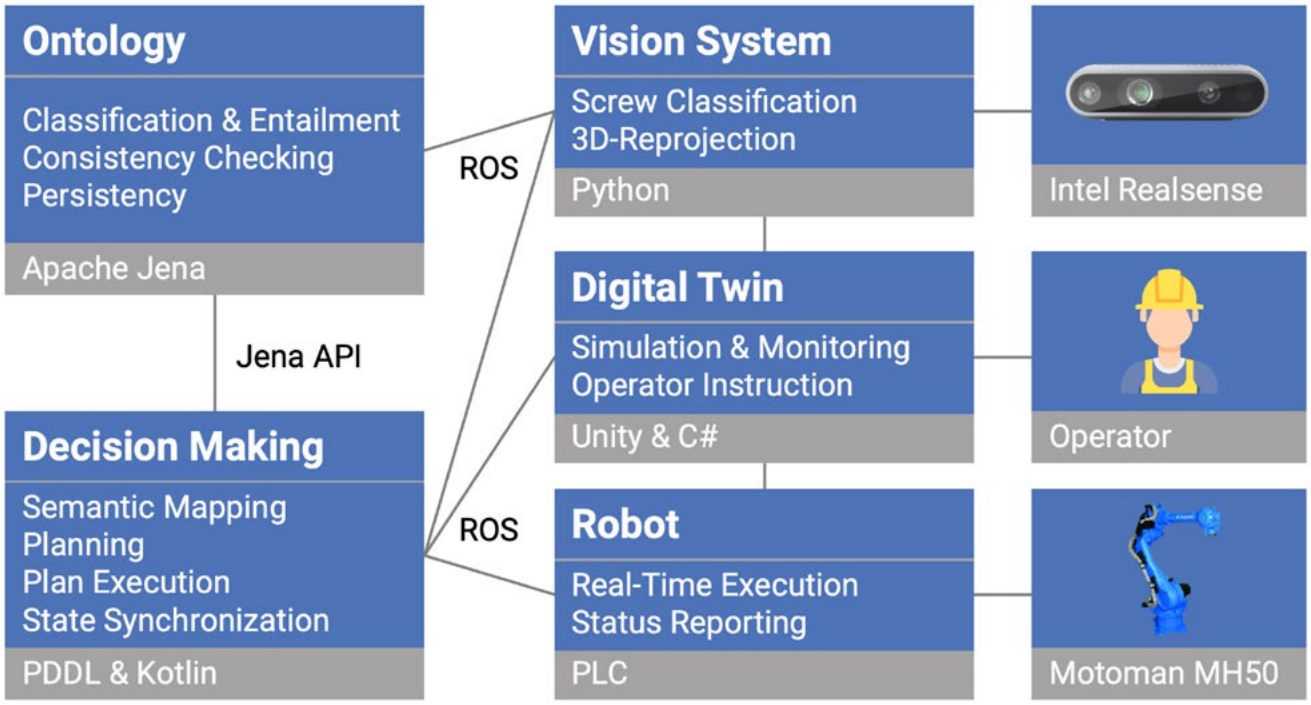
Funding as part of a bilateral call with Germany



Digital twin for the system, copyright: Boxx IT Solutions GmbH

The increasing usage of electronic products is resulting in a growing mountain of scrap electronic equipment on a global level. Disassembling a product into its individual components is considered one of the most important recycling processes in dealing with waste electrical and electronic equipment (WEEE). However, current disassembly processes are primarily performed manually, as the condition of the products provided, which may have damaged or even missing parts, is unpredictable as well as a diversity of product variants in small lot sizes.

The SmartDis research project is focused on developing a knowledge-based, highly autonomous and collaborative robotic system capable of combining non-destructive and destructive disassembly techniques in order to cope with potential process uncertainties. The symbiosis of robotic and human capabilities increases the flexibility of this type of disassembly system. The core components of the system include the decision-making component, the vision system, the digital twin and the execution component, with the latter component being responsible for executing the operations. The decision-making component controls the disassembly process and gradually brings the system from its initial state to the target state (disassembled product). It allocates the disassembly operations to the human or robot, depending on which is most suitable considering time and costs, and it can also create a new disassembly strategy if necessary. The vision system is focused on locating and identifying specific components within the product. Finally, the system status and sensor information is represented by a digital twin in order to support the interaction between the human and the robot, with the human able to use this twin to monitor and support the robotic system, particularly if the robot is unable to complete certain tasks independently. The system's applicability is demonstrated based on a usage case that focuses on the dismantling of antenna amplifiers.



System architecture, copyright: Practical Robotics Institute Austria

The key to efficient recycling lies in the disassembly of products, which allows certain product parts to be removed and materials to be separated out in order to maximise the recycled resources and minimise the potential for pollution and the quantity of remaining product parts. The SmartDis approach enables faster and easier disassembly of the components within the products to be recycled, thereby ensuring greater gains from the recycling processes. The advantage of this type of approach is that the components can be separated with a high degree of integrity and purity, which enables a higher recovery rate in the recycling processes. Our approach will ultimately enable greater automation in the recycling processes, which may lead to larger parts in waste electrical and electronic equipment being recycled this way in the future.

SmartDis utilises the latest advances in image processing and controls over industrial robots to achieve increased automation, improved data integration, greater flexibility and therefore more efficient disassembly processes. We use an ontology-based product model in this project in order to create a link between the product, the planning processes for the disassembly and the required disassembly equipment.

Our approach uses a captured image of the product to draw conclusions regarding its features and parts, and combines the information extracted with the ontology-based product model. This enables the parts to be recognised and their positions and alignments as well as the path planning to be determined. The robotic system's decision-making component is also able to use the recognised parts to extract the required disassembly information and deduce how a product should be disassembled and how its parts should be removed in succession. These mechanisms are well suited to achieving flexible disassembly processes, but are also beneficial in production systems that need to achieve small batch sizes of down to 1.

We ensure greater flexibility by reducing the resources required to disassembling products with respect to the time and expertise required for configuration and programming. SmartDis will also lay the foundations for intelligent automation to be used in areas that were previously not practical to be automated.

PROJECT INFORMATION

Term: March 2021 – August 2023

Consortium leader: Practical Robotics Institute Austria (PRIA)

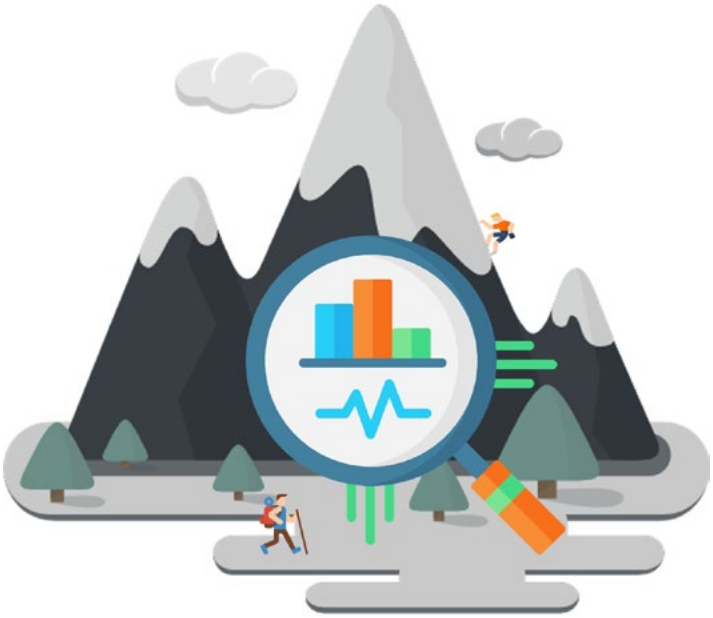
Project coordinator: Munir Merdan
Additional consortium partners: Institute of Mechanical Process Engineering and Mechanics, Karlsruhe Institute of Technology; Automation and Control Institute, Vienna University of Technology; AUGUSTA Buntmetalle GmbH; Ing. Eric Dokulil e.U.; Boxx IT Solutions GmbH; Reichmann SPS – Service GmbH
Project website: smartdis.org

A

dTS

Data-driven Tourism for Sustainability

Logo dTS,
Graphic elements: flaticon.com



Current developments, such as in the area of climate change, have shown how sensitive the tourism ecosystem is in responding to disruptive factors. Sustainable and scalable destination management concepts aimed at improving resilience while protecting vulnerable and marginalised groups are therefore essential. The dTS project therefore addresses the challenges of intelligent data use for the forward-looking development of tourist regions from the perspective of digital sustainability.

The aim is to contribute to resilient and sustainable regional tourism in Austria by combining AI, agent-based simulation and a federal data management platform via the management of visitor flows. This can help to change tourist behaviour on a sustainable basis and lead to a better balance of capacities in the long run. Two use cases were selected in the province of Salzburg in the aim of strengthening the entire region, exploiting mobility resources and working towards climate neutrality. The technical developments are accompanied by a sustainable perspective to ensure their effectiveness and optimal integration into the regional tourism ecosystem, following the principle of privacy by design at all times.

Smaller regions do not yet have the capacity, expertise or infrastructure to collect data on a continuous basis, in a targeted manner and with the appropriate quality. There are also legal obstacles in the area of personal data as well as licensing issues when using data from third-party service providers.

dTS proposes a scalable and portable model for resilient and sustainable tourism by analysing two use cases with differing degrees of technological maturity. The outcome should be a technical demonstration of a scalable data exchange and simulation platform that can also be used as a data space for visitor flows. The authentic movement and behavioural patterns of the target groups will be learned using artificial intelligence and agent-based simulations, making it possible to model "what-if" scenarios and thereby enable sustainable and smooth mobility concepts.

The findings gained from the project in relation to digitalisation, data and AI can be incorporated into tertiary (further) education programmes related to tourism and therefore support initial training as well as lifelong learning.

Developing and expanding data-driven tourism services and establishing tourism-specific data spaces allow sustainable business models to be established and jobs to be created and secured as a result.

The use of fair AI models allows minorities and vulnerable groups to be protected in data-driven tourism applications, such as management of visitor flows.

Intelligent mobility concepts aimed at strengthening the rural tourism infrastructure while reducing the strain on the urban one not only allow the conservation of resources, but also enable reductions in the carbon footprint in the tourism sector.

The project thereby contributes to SDGs 4, 8-11 and 13.

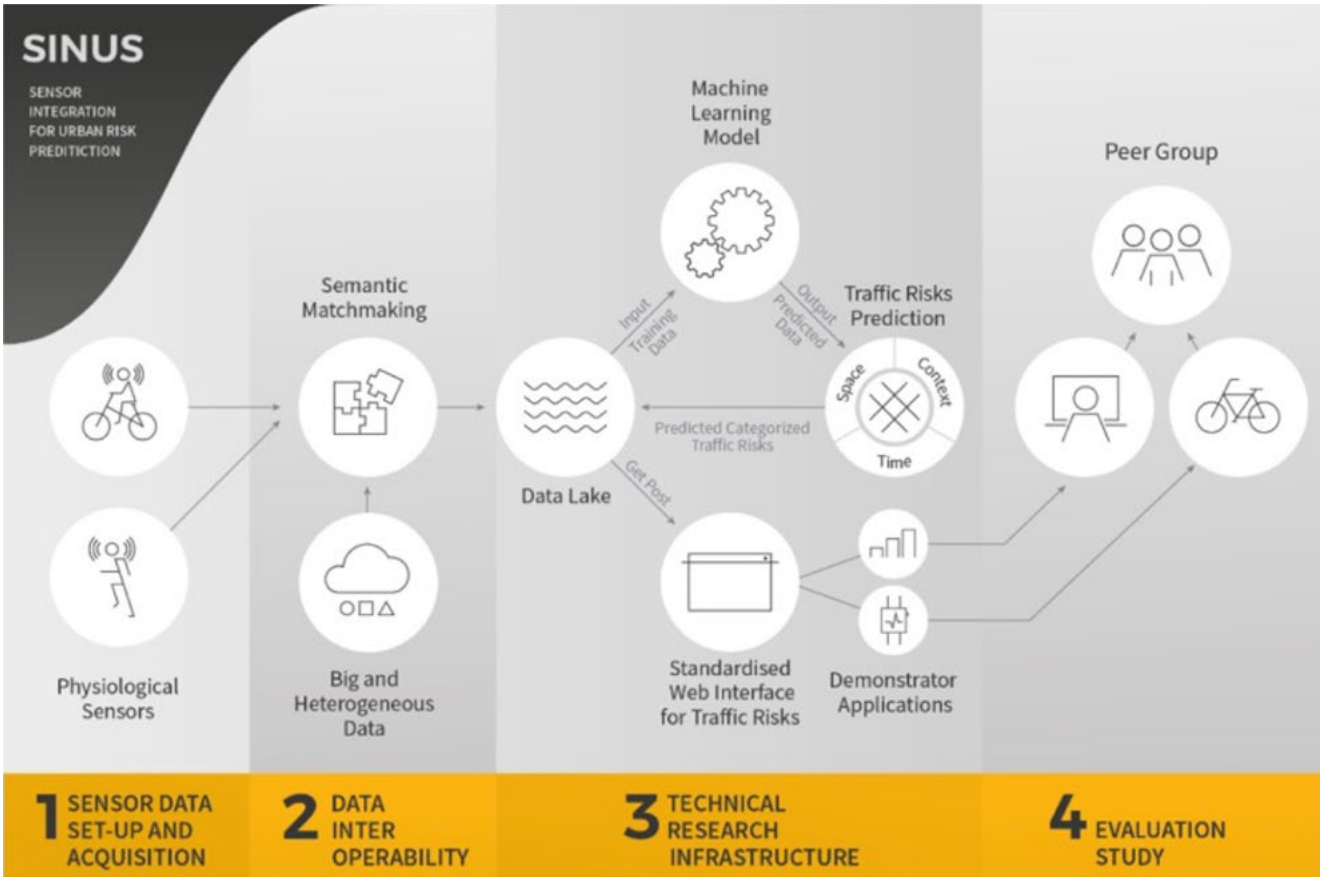
PROJECT INFORMATION

Term: December 2021 – May 2024
Consortium leader: University for Continuing Education Krems
Project coordinator: Thomas J. Lampoltshammer
Additional consortium partners: Fuscher FREGES GmbH, DatenVorsprung GmbH, nexyo GmbH, TSG Tourismus Salzburg GmbH, Vienna University of Technology, Fachhochschule Salzburg GmbH
Project website: project-dts.eu

B

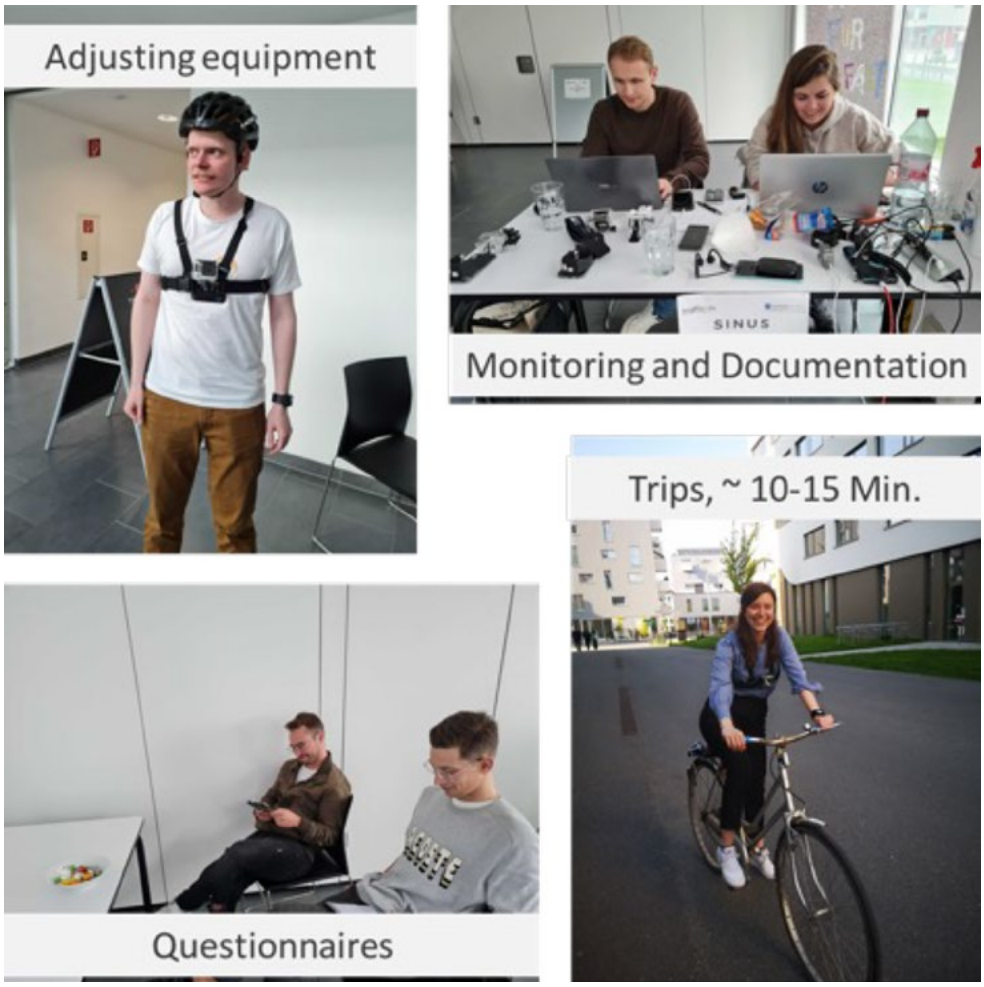
SINUS

Sensor Integration for Urban Risk Prediction



Project overview SINUS; Image: Trafficon

The SINUS project researched the options available for linking mobile human sensor technology with heterogeneous data interfaces of urban data ecosystems in a way that would enable improved forecasts for traffic risks for cyclists and pedestrians in urban road networks. Combining previously isolated data sources in a forecasting model should make it possible for forecasts on traffic risks occurring in trainable, differentiated standard traffic situations with a high degree of geographical and temporal resolution. These types of risk forecasts are intended to help make urban road traffic safer for cyclists and pedestrians.



Implementation of the evaluation study involving 40 cyclists,
photos: Trafficon

In the city of Salzburg, which served as a test bed for the project, stress moments of cyclists were recorded over several months, with these data then used together with accident data, weather data, infrastructure data and a simulation model for cyclists and pedestrians as input parameters for training a risk forecast model. A web service was developed based on this model that provides a risk assessment for a queried time and street edge of a digital road network graph. The model was trained using data from the city of Salzburg and can also be used for cities with similar infrastructures.

After development, the model was tested within the scope of two demonstrators. These were a smart city dashboard, which can be used to view the risk assessments of a road network and in which various planning scenarios and their impact on the forecasted risk can be tested, and a smartphone-based warning application for cyclists, which transmits corresponding warning signals to users when approaching a road section that has a high risk assessment. Different options (haptic, visual, auditory) for signalling cyclists were compared and evaluated in a study involving 14 participants.

This revealed that acoustic warnings achieved the best perceptibility and provided the least distraction for cyclists.

The applicability of the forecasting model developed and the risk warnings derived from this and acceptance of these, as well as their impact on road behaviour, were examined in a final evaluation study involving 40 test subjects. The indications of risk provided generally had very little impact on the test subjects' road behaviour. However, 57% of respondents stated that the warnings increased their situational awareness, while a majority found the warnings helpful (62%) and understandable (67%). There were no negative effects identified with the warning messages during the journey, such as additional uncertainty or increased stress among cyclists.

The SINUS project aims to help identify the potential for ICT-assisted processes to make cycling and walking in the city safer and therefore more appealing. While technical systems have been used to increase road safety in motorised traffic for quite some time, such approaches are rarely used for cycling and pedestrian traffic. Emphasis was placed within the project on not requiring the excessive use of energy-intensive sensor technology, but rather utilising existing data sources in a new application context. This aims to use technological measures to make cycling and walking safer while remaining as energy-efficient as possible.

Cycling and walking will play an increasingly important role in environmental and climate protection initiatives, as well as in the health and quality of life of an increasingly ageing society, particularly in urban areas. Making these sustainable and active forms of mobility safer and therefore more appealing could help to further increase their share in the urban modal split.

PROJECT INFORMATION

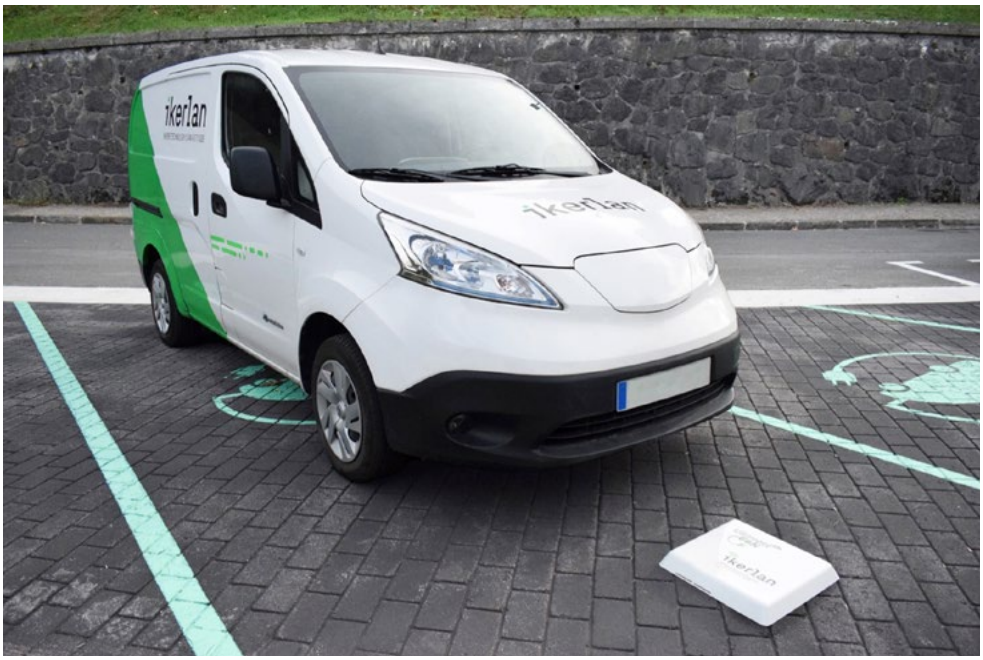
Term: November 2020 – July 2022
Consortium leader: Trafficon – Traffic Consultants GmbH
Project coordinator: Gernot Pucher
Additional consortium partners: Kompetenzzentrum – Das Virtuelle Fahrzeug Forschungsgesellschaft mbH; Know-Center GmbH; Universität Salzburg, Interfakultärer Fachbereich für Geoinformatik – Z_GIS; Spatial Services GmbH
Project website: sinus.trafficon.eu

B

UltimateGaN

Research for GaN technologies, devices and applications to address the challenges of the future GaN roadmap

Funded within the scope of transnational funding as part of ECSEL



The prototype developed for wireless charging of electric cars achieves an efficiency level of 96 per cent with gallium nitride chips, photo: UltimateGaN/Ikerlan

The urgency of the energy transition, the reduction of CO_2 emissions and increasing demand for energy represent challenging issues of our time. Efficiency is more important than ever in this context. Producing, managing and using energy efficiently is a crucial lever when it comes to digitalisation and decarbonisation. Smart technologies and new semiconductor materials such as gallium nitride (GaN) play a key role here. GaN power semiconductors provide more power in a smaller space, save energy and thereby minimise the carbon footprint.

The team from science and industry in the “UltimateGaN” research project set itself the task of utilising the advantages of GaN technology for multiple applications. The results are groundbreaking. With these advancements in material and process technology, it was possible to provide efficient and compact GaN energy-saving chips at globally competitive costs. There are many applications that can benefit from this, from wireless charging for electric cars to the low-loss smooth connection of solar energy to the grid and rapid cost-effective expansion of 5G networks.

The “UltimateGaN research team” at their final meeting, photo: UltimateGaN

In terms of energy efficiency for instance, the prototype developed for wireless charging for electric cars was able to transfer energy with an efficiency level of 96 per cent. By comparison, the systems currently available on the market deliver maximum efficiency levels of 93 per cent. A three per cent improvement in energy efficiency provides the potential of achieving a reduction of around 1.7 megatonnes of CO_2 per year by 2030, which is roughly equivalent to the emissions from around one million cars with combustion engines.

There is major potential in the integration of renewable energy sources, including the integration of solar and wind energy into the power grid. Smart power electronics minimise losses in energy conversion and basically extract more power. The project involved including a modular GaN conversion concept for the integration of microgrids in the smart grid, involving the integration of local sub-grids consisting of photovoltaics, wind and storage technologies. More than 3,000 hours of field tests showed that the GaN components offer the best reliability combined with the highest efficiencies of up to 98.4 per cent and is thereby playing a decisive role in promoting the energy transition.

The research also lays the foundation for GaN amplifier modules and thus for fast transfers of data, e.g. for lightning-fast video streaming or communication in the Internet of Things. A faster, more energy-efficient and climate-friendly 5G rollout is possible because the energy-efficient 5G amplifiers made of GaN are also more cost-effective. The project was also honoured with the Futurezone Award 2019 in the 5G category.

The Austrian partners played a significant role in the success of this European research project. Austria, for example, was responsible for coordinating the overall project as well as managing three of the work packages.

Gallium nitride offers great potential for the efficient integration of renewable energy sources into the power grid, photo: Infineon

The project is enabling greater levels of efficiency in a number of applications (see examples in the project description) and therefore represents an essential component of a sustainable energy system.

The competition for submissions ensures that all of the criteria for SMART projects (Specific, Measurable, Achievable, Relevant and Time-bound) are addressed. This will also be verified in reviews by independent experts as the project progresses.

The research work performed by UltimateGaN has opened up the roadmap for the next generations of gallium nitride semiconductor switches, which will enable even more compact and efficient energy conversion.

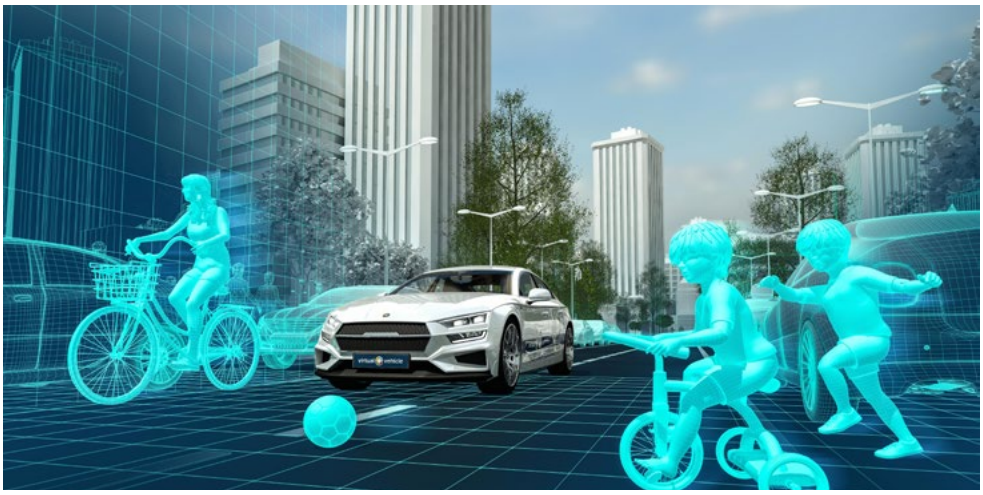
PROJECT INFORMATION

Term: May 2019 – October 2022
Consortium leader: Infineon Technologies Austria AG
Project coordinator: Herbert Pairitsch
Additional consortium partners: Austria: Austria Technologie & Systemtechnik AG, Fronius International GmbH, CTR Carinthian Tech Research AG, Graz University of Technology | Belgium: IMEC | Germany: AIXTRON SE, Infineon Technologies AG, Siltronic AG, Max-Planck-Institut für Eisenforschung GmbH, Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V., Chemnitz University of Technology, NaMLab GmbH | Italy: Università degli studi di Padova, Infineon Technologies Italia, Universita di Milano Bicocca | Norway: Eltek AS | Slovakia: Slovak University of Technology in Bratislava, Nano Design SRO | Switzerland: Ecole Polytechnique Fédérale de Lausanne EPFL, Attolight SA | Spain: IKERLAN, For Optimal Renewable Energy, LEAR | Sweden: RISE Research Institutes of Sweden AB, SweGaN AB
Project website: ultimategan.eu

B

iLIDS4SAM

Integrated LiDAR Sensors for Safe & Smart Automated Mobility



The 3D eye for autonomous driving improves safety and reduces emissions through anticipatory driving, Image: Virtual Vehicle

Flagship project develops sensory organ for safe automated driving

The reliability and safety of autonomous vehicles takes top priority when it comes to mobility of the future. The events occurring in the surrounding environment must be identified comprehensively and quickly. This is particularly challenging in complex urban road and rail traffic. The "iLIDS4SAM" research project is dedicated to precisely this topic.

Eleven Austrian partners from industry and science are pooling their expertise for this purpose. They are working together to research sensors that provide autonomous vehicles on the road or rail with a 3D image of their surroundings and detect hazards in advance. The aim is to develop a powerful and cost-effective laser sensor system with data management based on deep learning. The sensor system will be tested in urban road and rail traffic as well as in agricultural applications in order to demonstrate both integration and practical performance.

It is an innovative showcase project because it covers the entire technology and application chain with hardware and software adjustments as well as laboratory and road-based tests.

Three-dimensional vision for vehicles

The team is working on innovative and compact lidar sensor systems to provide a greater field of vision with high resolution. Using microchip mirrors, a laser beam scans the surroundings with millimetre precision in order to measure the distance and shape of objects. The result is a 3D image of moving vehicles or pedestrians, traffic signs, roadside obstacles and even road markings.

A large field of vision combined with high resolution and a high frame rate result in a very large number of measurements that have to be performed per second. The challenges involve achieving a high measurement rate and thereby also a high data rate, as well as optimising and miniaturising all components, the connection technologies and the mirror design. The system is to be installed e.g. behind the windscreen, in the headlights or in the rear lights.

Learning sensors

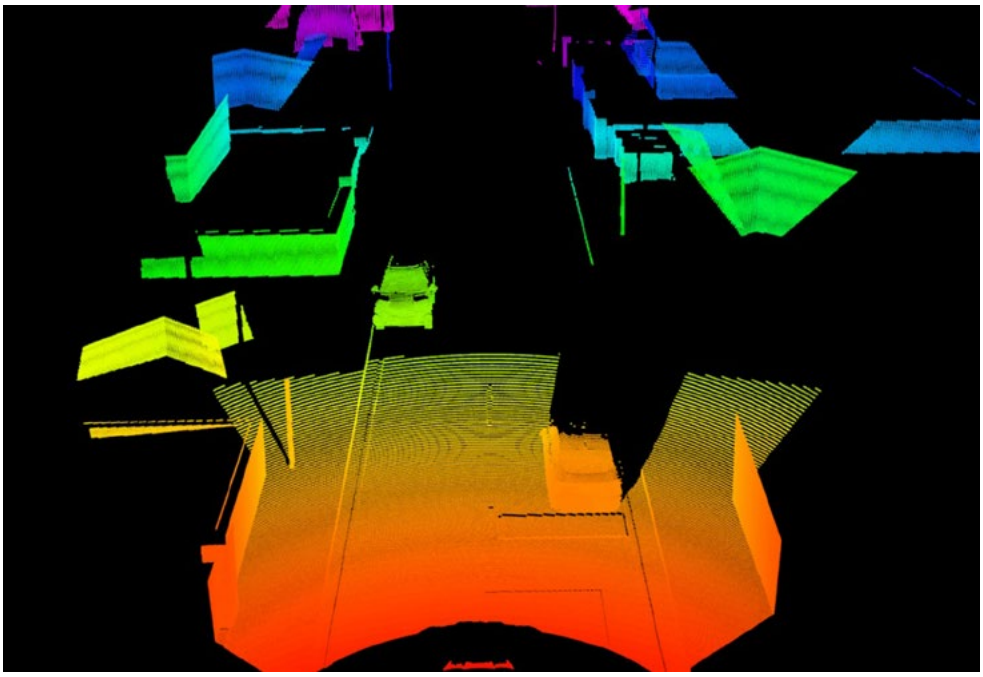
Real test drives with the new LiDAR demonstrator are an important part of the project. The aim is to collect a large amount of real-world data in order to use learning algorithms to predict behaviour and be able to derive a hazard assessment. Big data as well as artificial intelligence are used to improve and optimise the system on a continuous basis.

The project ran until mid-2023. The innovative sensor is also being tested in the laboratory under difficult weather conditions such as fog, with simulations also being carried out. Real tests will follow in urban road and rail traffic as well as in agriculture. The project contributes to the SDGs by promoting the safety of all road users through smart technologies, improving smart and zero-emission mobility in urban and rural areas and strengthening the overall innovation capacity of the partners.

The Austrian "iLIDS4SAM" flagship project involves 11 partners from science and industry researching safe autonomous driving, Image: Infineon

The project contributes to the following Sustainable Development Goals:

SDG 3: health and well-being through accident prevention and increased safety in mobility
SDG 9: it promotes the innovative strength of the project partners from science and industry and enables people to connect with transport networks and the mobility of the future.
SDG 10: it enables access to mobility for road users who previously had no access, such as the elderly or impaired people. They are able to participate in mobility through autonomous and safe driving.
SDG 11: it offers cities and settlements potential for a more sustainable future through resource-efficient and safe mobility concepts
SDG 13: Electrified and automated mobility reduces CO_2 emissions.



The laser sensor system scans the surroundings, Image: Virtual Vehicle

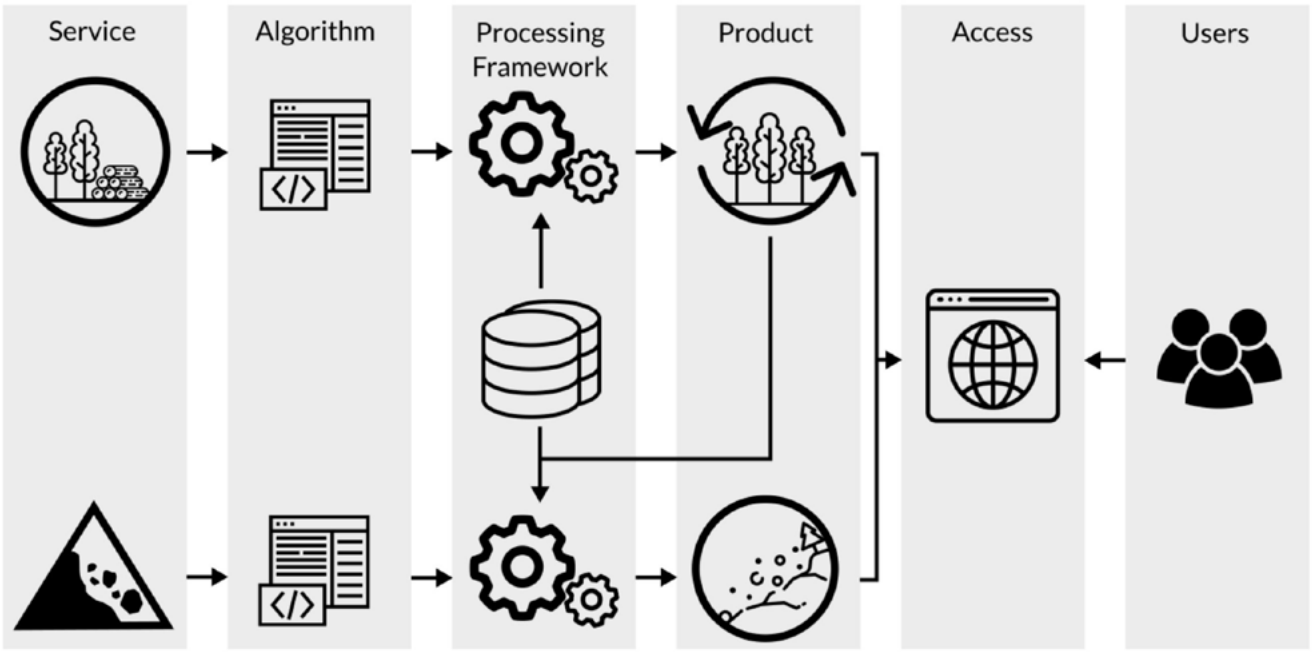
It is a green project because it promotes automated and predictive mobility of cars and rail vehicles, thus helping to avoid unnecessary emissions (e.g. stop-and-go) and at the same time it promotes the safety of road users. It is a smart project because it supports the basic need for mobility through the further development of intelligent technologies and combines the competencies of partners along the entire value chain. It is a forward-looking project because it enables autonomous and safe mobility in the long term and also makes it easier for older and impaired people to participate in mobility.

PROJECT INFORMATION

Term: January 2020 – June 2023
Consortium leader: Infineon Technologies Austria AG
Project coordinator: Marcus Hennecke
Additional consortium partners: AVL List GmbH, ams AG, EV Group E. Thallner GmbH, FH Campus Wien Forschungs- und Entwicklungs-GmbH, Infineon Technologies Austria AG, Peschak Autonome Systeme GmbH, RIEGL Research Forschungsgesellschaft mbH, Silicon Austria Labs GmbH, Graz University of Technology (Institute of Computer Graphics and Vision), TTTech Auto AG, Virtual Vehicle Research GmbH
Project website: ilids4sam.at

DMA

Data Market Austria



Workflow of the prototype for monitoring forest change, Image: Data Market Austria

The aim of the "Data Market Austria" project was to research the conditions required for a functioning data market and to develop a (prototype) platform to create a functioning Austrian data market. Organisations can share, exchange and trade their internal data in this data market. This data trade can be used to develop new types of innovations and create a vibrant data ecosystem. Companies and organisations benefit from this data trade on the one hand through the commercial usability of their data, but on the other hand also through the possibility of expanding their own database with the help of new, external data. This helps to implement innovative utilisations.

The innovative aspect of the DMA lies in the creation of a data infrastructure that enables trustworthy and traceable data trading. One special aspect was data security, which is often expressed as a concern about data trading. There was also a focus here on interoperability, which addresses the problem of data heterogeneity and the multiplicity of interfaces between different organisations.

The four main innovations were in the areas of

- providing an innovative technological basis for data maintenance, data origin and data security (e.g. with the help of distributed ledger technology) and matchmaking between data and services
- establishing an innovative environment for the creation of a data community
- connecting cloud systems
- implementation of the two pilots “Earth observation” and “Mobility”.

Operational challenges consisted of motivating organisations to trade data. Concerns about utility and data security proved to be hurdles that needed to be overcome. The concept of “data circles” was developed as a response to this, in which organisations trade data with one common goal. There were some technical challenges in the areas of data origin, data maintenance and security, which were addressed using appropriate methods, such as the use of distributed ledger technology.

The project was completed in September 2019. The results of the project can be viewed on the project website.

Contribution to the SDGs

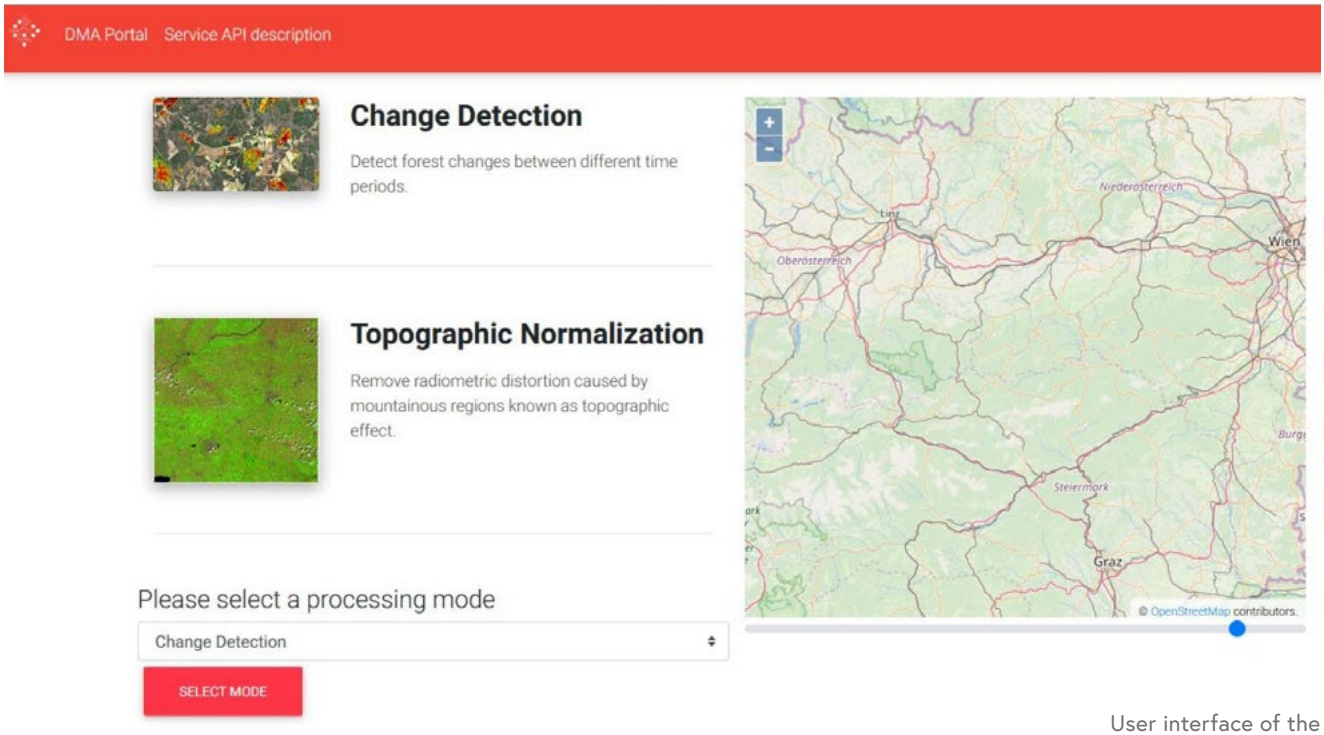
The wide availability of data enables innovators to implement projects that ultimately support a broad range or even all of the 17 SDGs. Specifically however, the DMA contributes to SDG 9 “Industry, Innovation, and Infrastructure” by providing a data infrastructure that can be used to support Austria’s capacities for innovation. This is not just limited to industry, however, and can have a wide range of applications. The two pilots “Earth observation” and “Mobility” were also implemented in DMA. The “Earth observation” pilot contributes to SDG 13 “Climate Action” and SDG 15 “Life on Land”, while the “Mobility” pilot contributes to SDG 11 “Sustainable Cities and Communities” with its “taxi fleet management” aspect.

The “smart” aspect was fulfilled in DMA through its goal of creating an infrastructure for data trading. Organisations often face the problem that they simply lack the data required to implement new and smart innovations. A vibrant data market can help here. Organisations gain access to data that they would otherwise not have had and are able make use of these data, e.g. through innovative digital applications. Conversely, the providers of the data themselves benefit from the sale of their data, which would otherwise have remained unused.

The DMA project is a forward-looking one because it advances the current efforts to create data ecosystems by providing the corresponding infrastructure. The aim was to support national efforts such as data hubs by providing a technical infrastructure. The DMA project also contributes to the European GAIA-X project, which aims to create a pan-European data ecosystem.

DMA was not explicitly focused on “green” methods. Nevertheless, it is able to contribute to this field through spill-over effects and by promoting data-driven innovations, e.g. by increasing the availability of data for climate-related applications.

The two pilots “Earth observation” and “Mobility” make a more specific contribution to the green aspect. The first pilot allows processes to be observed in natural habitats, while the second pilot plays a part in relieving the burden on transport infrastructures and reducing CO_2 emissions from vehicle fleets through its focus on “taxi fleet management”.



User interface of the prototype for earth observation, Image: Data Market Austria

PROJECT INFORMATION

Term: October 2016 – September 2019

Consortium leader: AIT Austrian Institute of Technology GmbH, Cloudflight Austria GmbH (previously Catalysts GmbH), Compass-Verlag GmbH, University for Continuing Education Krems, EODC Earth Observation Data Centre for Water Resources Monitoring GmbH, INiTS Universitäres Gründerservice Wien GmbH, JOANNEUM RESEARCH Forschungsgesellschaft mbH, Know-Center GmbH, Semantic Web Company GmbH, Siemens AG Austria, T-Mobile Austria GmbH, T-Systems Austria GmbH, TDA Trusted Data Analytics GmbH & Co KG, Wikimedia Austria, Central Institute for Meteorology and Geodynamics

Project website: datamarket.at

IoT4CPS

Trustworthy IoT for CPS

IoT4CPS,
Image: Vienna University of Technology

The IoT4CPS flagship project addressed the challenges arising from the use of information and communication technologies (ICT) in real industrial environments. Since in this context, in addition to cybersecurity issues, aspects of availability and (physical) security from the design to the operation of the plant must also be addressed, the project developed methods for a joint consideration of safety and security over the entire life cycle The topic of security was considered on all levels, i.e. from the sensor and communication interfaces through to networked systems.

In order to fully exploit the potential of digitalisation in the field of automated driving and intelligent production, a high degree of trust between the components in the communicating systems must be ensured. In IoT4CPS, methods were therefore developed to strengthen the integrity, authenticity and confidentiality of information, as well as for the sufficient protection of production data. Combined safety & security approaches as well as solutions for comprehensive verification and safety analyses during operation were developed with this. This allows safety to be ensured, including over the long service life of industrial plants.

The greatest implementation-related challenges lay in the complexity of the overall systems being considered. In order to ensure the functional reliability of components in automated vehicles for instance, the integrity of the vehicle as well as in assembly and production must be ensured.

The IoT4CPS project was completed successfully in December 2020. The comprehensive project results are now available to Austrian business for use in future Industry 4.0 applications and for developments in the field of autonomous driving. All results are available on the website.

IoT4CPS is a "smart" and a "future-oriented" project, as it involved developing methods for holistic analysis and modelling of security aspects in complex application and production environments. Intelligent linking across the entire production process enables effective, flexible and efficient management of security risks across supply chains and system levels. At the same time, it is possible to adapt safety strategies on an ongoing basis by analysing risks that only arise during operation. The concepts developed in the project thereby form the basis for responsible and sustainable digitalisation and therefore for products that are fit for the future.

IoT4CPS has made a significant contribution to sustainable technology development in industry in line with SDG 9. This was achieved by strengthening distributed production structures as well as by increasing the competitiveness of domestic industries as a whole. IoT4CPS also played a part in increasing product lifespan and therefore to strengthening sustainable production methods in line with SDG 12 thanks to its holistic approach.

PROJECT INFORMATION

Term: December 2017 – December 2020
Consortium leader: AIT Austrian Institute of Technology GmbH
Project coordinator: Mario Drobics
Additional consortium partners: AVL List GmbH, University for Continuing Education Krems, Infineon Technologies Austria AG, Johannes Kepler University Linz/Institute of Pervasive Computing, Joanneum Research Forschungsgesellschaft mbH, Nokia Solutions and Networks Österreich GmbH, NXP Semiconductors Austria GmbH, SBA Research GmbH, Salzburg Research Forschungsgesellschaft, Software Competence Center Hagenberg GmbH, Siemens AG Austria, TTTech Auto AG, TTTech Computertechnik AG, Graz University of Technology/Institute for Applied Information Processing and Communications, Graz University of Technology/Institute for Technical Informatics, Vienna University of Technology/Institute of Computer Engineering, XNET – X-Net Services GmbH
Project website: iot4cps.at

Semi40

Power Semiconductor and Electronics Manufacturing 4.0

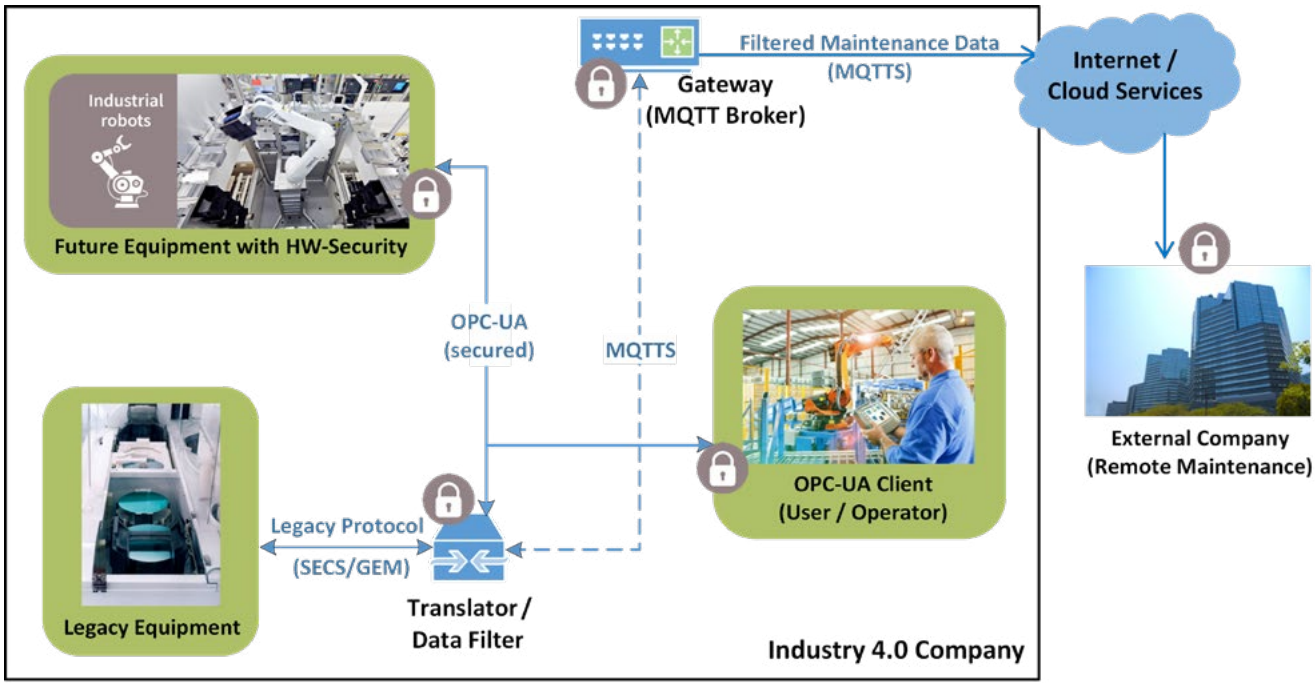
Funded within the scope of transnational funding as part of ECSEL

Simulation models with two proposed layouts for evaluation of the tool and the layout of the transport system; Image: Infineon Technologies Dresden GmbH

Smart factories are made possible by innovative production technologies with end-to-end networked information and communication infrastructures that are capable of sensing, collecting and processing large volumes of data in real time. This creates added value in the production process in terms of availability, flexibility and traceability while at the same time ensuring safety of all assets. The SemI40 project implemented these types of technical solutions in pilot lines of the industry partners. Selected use cases representing real supply chains were also evaluated to assess their technical, social and economic impact, future working conditions and the expertise required.

Hardware-based solutions for secure connections of legacy devices were developed, combined with translation systems and integrated into new approaches such as digital twins, in order to create a balance between system security and production flexibility. A statistical process control was implemented as a prototype in one specific supply chain process to evaluate and improve the customer ordering behaviour and increase information transparency between the individual company divisions and the enterprise resource planning system.

Customised algorithmic approaches were also developed. These algorithms were implemented into demonstrators related to topics like auto-calibration for improved process stability and automated decision mechanism in semiconductor manufacturing. A hybrid automated production handling system for a 300 mm wafer factory and innovative, self-navigating robotic systems were developed to improve capacities and cycle



Concept for HW-based Industry 4.0 communication; Image: Infineon Technologies Austria AG

times in the context of factory digitalisation and virtualisation. The implementation of a simulation model to map all transport systems in a factory enables real-time tracking of traffic and immediate failure analysis.

An energy data system with different dashboards was also implemented in a wafer factory. Visualisation of the flow of energy and resources made it possible to gain a better understanding, identify potential savings and increase energy and resource efficiency. Digitalisation methods were employed to enhance the cooling management in the heating, ventilation, and air conditioning system at the wafer factory, with the aim of vastly reducing energy consumption related to heating and cooling.

Hybrid transport system; photo: Infineon Technologies AG

The results from SemI40 clearly contribute to SDG 9 “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation” through its innovations for industry. SemI40 also supports SDG 4 “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” with its findings from the evaluation of selected use cases in terms of social impact, future working conditions and the expertise required.

Semi 40 logo

The aim of SemI40 was to contribute to the competitiveness of manufacturing “Made in Europe”. The activities were carried out by SMEs, research institutes and academic partners. In particular, the cutting-edge research by the academic partners that took part has further advanced manufacturing science in Europe and thereby created a solid foundation for further progress towards Industry 4.0. Innovative power semiconductor manufacturers have provided significant support for the development of the European manufacturing industry as it moves towards Industry 4.0.

The focus was also on training the younger generation and on efficient use of natural resources such as energy and materials. By implementing Industry 4.0 and enabling networked manufacturing, the Semi40 project secured highly skilled and demanding jobs within the European manufacturing industry and played a part in maintaining the competitiveness of European industry and research in a European cooperative consortium.

Improving the capabilities of European stakeholders throughout the entire supply chain by the leading semiconductor suppliers for power semiconductors helped to support fulfilment of the European Commission’s microelectronics strategy.

Semi 40 consortium; photo: Infineon Technologies Austria AG

PROJECT INFORMATION

Term: May 2016 – April 2019

Consortium leader: Infineon Technologies Austria AG

Project coordinator: Johann Massoner / Christina de Luca

Additional consortium partners: Kompetenzzentrum Automobil- und Industrieelektronik GmbH, KNOW Center GmbH, Infineon Technologies IT-Services GmbH, AT&S Austria Technologie & Systemtechnik AG, Fraunhofer Austria Research GmbH, Vienna University of Technology, Plansee SE, AVL List GmbH, University of Klagenfurt, Kompetenzzentrum Das Virtuelle Fahrzeug Forschungsgesellschaft mbH, Austrian Institute of Technology GmbH, Fachhochschule Burgenland GmbH, Materials Center Leoben Forschung GmbH, Infineon Technologies Dresden, Infineon Technologies AG, Institute für Automation und Kommunication E.V. Magdeburg, Semikron Elektronik GmbH & Co. KG, Dresden University of TechnologyDresden, Robert Bosch GmbH, Systema Systementwicklung GmbH, Plasmetrex GmbH, Zentren für neue Technologien GmbH, Fabmatics GmbH, Roth & Rau Ortner GmbH, Metralabs GmbH, Hochschule Mittweida, Elmos Semiconductor AG, Universita degli studi di Pavia, L.P.E. SPA, Ion Beam Services, Critical Manufacturing SA, Amkor Technology Portugal SA, Insituto de Telecomunicacoes, Universidade de Aveiro, Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung E.V., Schiller Automatisierungstechnik GmbH, Politecnico di Milano

Project website: semi40.eu

ENABLE-S3

European Initiative to Enable Validation for Highly Automated Safe and Secure Systems

Funded within the scope of transnational funding as part of ECSEL

Closing event for ENABLE-S3 in Graz, photo: photoworkers.at

The aim of the ENABLE-S3 project was to provide the resources required but which had not been available previously for Verification & Validation (V&V) of Automated Cyber-Physical Systems (ACPS). In terms of automated driving, Winner et.al. [2] and Wachenfeld et.al. [3] predict that more than 100 million road kilometres would be required as statistical evidence that an automated vehicle is just as safe as one driven manually. This means that "proven-in-use" certification, which mainly involves testing on the road, is simply not feasible. Similar statements also apply to other application domains. One possible solution involves identifying relevant test scenarios and using virtual validation. In ENABLE-S3, industry and research partners from various application domains (automotive, aerospace, rail, shipping, healthcare and agriculture) joined forces to develop the technology bricks required for virtual V&V of automated cyber-physical systems.

The ENABLE-S3 partners agreed on a virtual approach to verification and validation based on different scenarios. This means that the main test effort is largely shifted to a virtual environment represented by models. This has multiple advantages: tests can be carried out at a much earlier stage and in a more cost-effective and more reliable and reproducible manner. Tests are described in scenarios. The following definition (across all application domains) was formulated within the project:

> "A scenario class is a formalized description of the multi-actor process, including its static environment, its dynamic environment and environmental conditions. In a scenario class, the parameters are described and may have parameter ranges or distributions. A scenario class may include activities, events, goals of the activity and decisions of actors."

The project does not aim for a common, generic software solution due to the large number of project partners and application domains involved. The focus instead was on developing a common methodology, a basic validation tool chain architecture and a series of reusable technology bricks (tools, methods, models, etc.) that can be used for building a test environment for a specific use case.

It was split into two parts due to the wide scope and complexity of the problem. The validation methods specify the steps and analyses necessary for data collection and storage and for selecting scenarios and metrics as well as test generation methods. Scenarios are an integral aspect of the scenario-based approach to validation. There are a large number of possible scenarios that can either be extracted from the data that are recorded or that are generated synthetically (e.g. based on safety analyses). The reality is characterised by a large number of scenario variations (e.g. for different weather conditions, cultural differences, etc.). This results in a huge number of test cases. The aim therefore must be to provide smart methods that ensure sufficient test coverage with the smallest possible number of test cases and to decide which test cases should be executed in which test environment.

The validation platform, on the other hand, focuses on reusable validation technology bricks (tools and models) that can support different development and test environments seamlessly (model-in-the-loop, hardware-in-the-loop, system-in-the-loop such as vehicle-in-the-loop, as well as real-world testing).

Project meeting for EN-ABLE-S3 in Dublin organised by IBM Ireland, photo: AVL

By combining both parts and their respective technology bricks, the aim is to achieve a significant reduction in the test effort required in order to make tests realistically feasible in the first place.

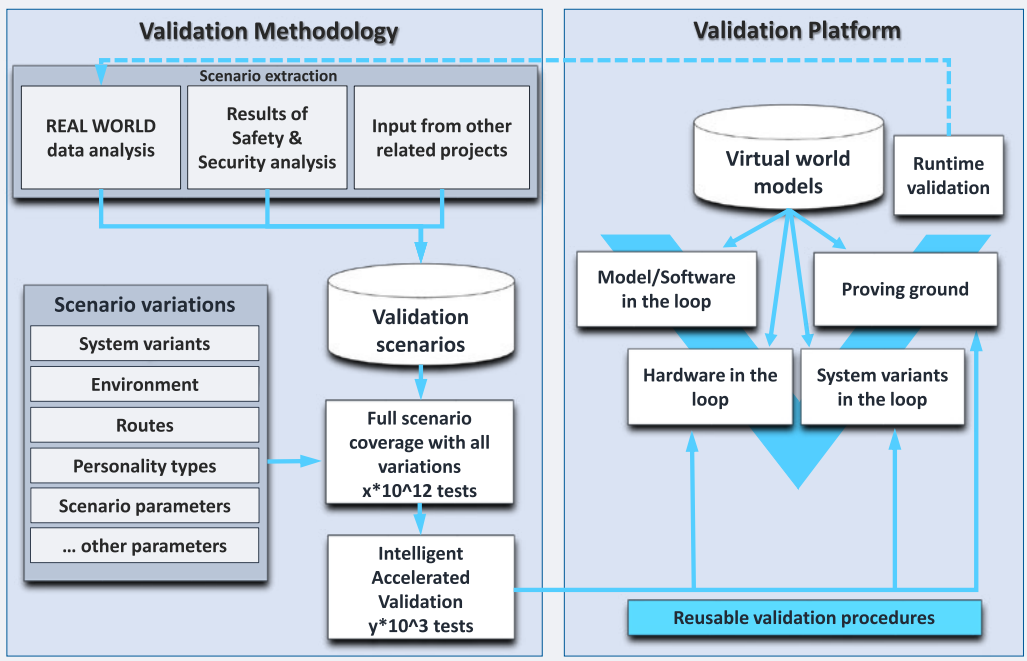
PROJECT INFORMATION

Term: May 2016 – May 2019
Consortium leader: AVL List GmbH
Project coordinator: Andrea Leitner
Additional consortium partners: Aalborg University, AIRBUS GROUP INNOVATIONS, Austrian Institute of Technology GmbH, AVL Deutschland GmbH, AVL Software & Functions GmbH, BTC Embedded Systems AG, Cavotec Germany GmbH, Creanex Oy, Czech Technical University, Deutsches Zentrum für Luft- und Raumfahrt e.V., DENSO Automotive Deutschland GmbH, Dr Steffan Datentechnik GmbH, Danmarks Tekniske Universitet DTU Denmark, EVIDENCE SRL, FZI Research Center for Information Technology, GMV Aerospace and Defense S.A.U., GMVIS SKYSOFT S.A., Politechnika Gdańska ul. Narutowicza, HELLA Aglaia Mobile Vision GmbH, IBM Ireland Limited, imec, INRIA, INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO, Instituto Tecnologico de Informatica, IXION Industry and Aerospace SL, Johannes Kepler University Linz, Linz Center of Mechatronics GmbH, MAGILLEM DESIGN SERVICES SAS, Magneti Marelli S.p.a, Microelectronica MASER S.L., Apsys, Model Engineering Solutions GmbH, Magna Steyr Engineering AG & Co KG, Nabto ApS, Navtor AS, NM robotic GmbH, NXP Semiconductors Germany GmbH, OFFIS e.V., Philips Medical Systems Nederland B.V., Rohde & Schwarz GmbH & Co. KG, Reden B.V., Renault S.A.S., Rugged Tooling Oy, Serva Transport Systems GmbH, Siemens Industry Software NV, University of Southampton, SafeTRANS e.V., Thales Alenia Space Espana S.A., Fundación Tecnalia Research & Innovation, THALES Austria GmbH, Thatcham Research, TOYOTA MOTOR EUROPE, TNO, TTControl GmbH, TTTech Computertechnik AG, Eindhoven University of Technology, Technische Universität Darmstadt, Graz University of Technology, TWT GMBH SCIENCE & INNOVATION, University College Dublin, Universidad de Las Palmas de Gran Canaria, University of Modena, Universidad Politécnica de Madrid, Valeo Autoklimatizace k.s., VALEO Schalter und Sensoren GMBH, Virtual Vehicle Research Center mbH, VIRES Simulationstechnologie GmbH, VTT Technical Research Centre of Finland, Tieto Finland Oy, University of Zilin
Project website:
tugraz.at/institute/ihf/forschung/abgeschlossene-projekte/enable-s3/

European Initiative to Enable Validation for Highly Automated Safe and Secure Systems

Proposal for the modular validation framework through the ENABLE-S3 project, Image: AVL

Automotive | Aerospace | Rail | Maritime | Health | Farming



ENABLE-S3 is an industry-driven EU-project with 71 partners in 16 countries that aspires to substitute today's cost-intensive validation and verification efforts for highly automated and autonomous systems by more advanced and efficient methods. The project's aim is to develop novel testing methodologies and technologies that will be applicable across 6 industrial domains (Automotive, Aerospace, Rail, Maritime, Health, Farming).

- 71 Partners
- 16 Countries
- Consortium combining experts from six different domains with academia
- € 68M Project Budget
- € 32M Total Funding

SWIS

Sophisticated Web Information Service

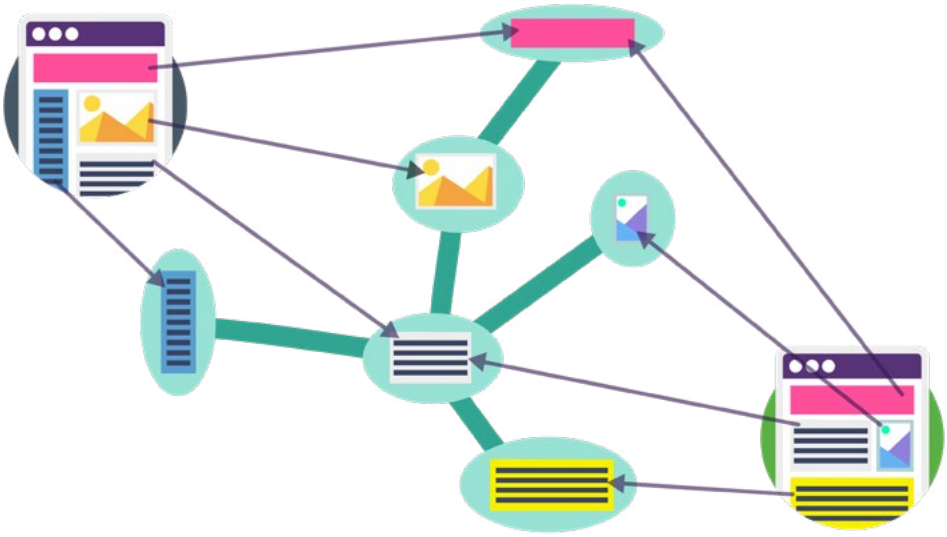


Illustration by SWIS Graphs, Image: LuxActive

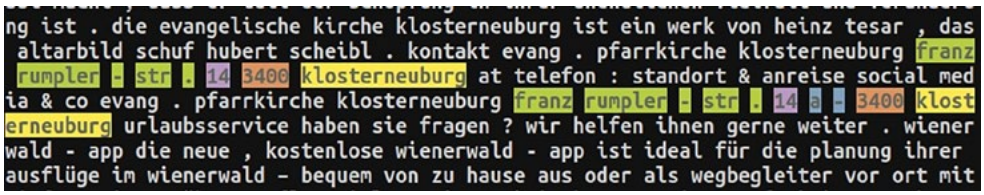
Data have become a valuable raw material these days for many industries, as their availability and quality often give companies a competitive advantage over their competitors.

The scraper and crawler from LuxActive was expanded and developed through the SWIS project. SWIS scours the World Wide Web using state of the art machine and deep learning methods, originally for the purposes of extracting tourism data from websites and documents. The extracted data are enriched with geo-positions, descriptive texts, categories and opening hours and saved in the form of a knowledge graph. The described data and other services are now accessible to third parties for the first time through LuxActive. In addition to the data extracted and processed from the World Wide Web, the project also provides services that have been developed as part of the scraper and crawler and are used within it.

Specifically, this means:

1. The scraper and crawler has been improved significantly in terms of performance and now processes 400 to 800 million new data records per day and per server.
2. Individual services such as address extraction, opening hours extraction or geocoding can now be purchased and used separately from the scraper and crawler by third parties.
3. The scraper and crawler architecture has been extended to include a loosely coupled extraction service. This is built around a database similar to a multilayered data warehouse. The bottom layer contains the SWIS graph with all of the raw and extraction data. The enrichment and analysis take place in the layer located above this in order to create the target data sets for a wide range of use cases (e.g. a list of doctors or shops). For example, it can be used to identify all shops within a certain sector (e.g. sports shops) and within a radius of 50 kilometres, which makes it much easier for a chain of sports shops to plan locations for new sites, as it provides a comprehensive picture of competitors.
4. All SWIS services use a rate limit as well as a payment and billing service, so that these services can also be used by third parties.
5. All APIs and services are prepared in such a way that they can be easily integrated into a data market (such as Data Market Austria), but can still be acquired and used in parallel without a data market.

The following is an example of a text clearing and address extraction service from transmitted text. In the text, different parts of the address are displayed in different colours. These address parts can now be identified by transmitting preferred texts via API service and are therefore easily accessible to third parties.



Address extraction from example text, Image: LuxActive

PROJECT INFORMATION

Term: October 2018 – December 2019

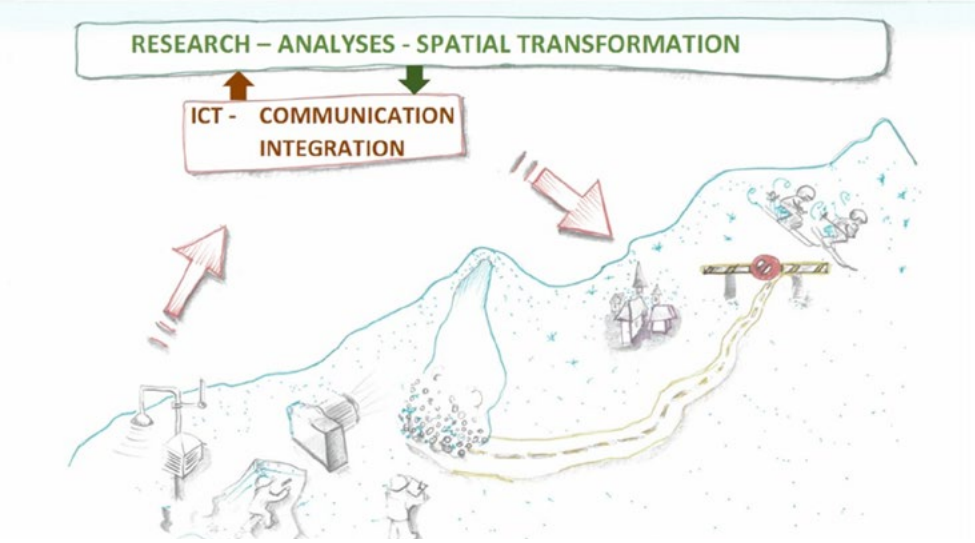
Project management: LuxActive KG

Project website: swisdma.jimdofree.com

Company website SWISDATA GmbH (the company grew out of the project): swisdata.com

ICT4snow

Information and communication technology - New solutions for assessing snow and avalanches



Regional perspective on the topic of snow and avalanches - conceptual framework of the ICT4snow project, Image: Federal Research and Training Centre for Forests (BFW), Kleemayr, 2017

The demand for the up-to-date information on snow conditions and avalanches for decision-making processes in the context of risk management is steadily increasing and was the motivation for the ICT4snow exploratory project. This project involved testing for possible technical implementation of a web-based real-time snow and avalanche platform.

The information platform developed over the course of the project records, analyses and visualises both the stability of the snowpack and current snow conditions. This is based on different (heterogeneous) data sources that have been integrated dynamically into this platform and made available to users in the form of customised information packages. In addition to developing these technical implementation options, this pilot project also involved recording and assessing the potential added value of these types of data for the end user.

Developing the ICT4snow platform

The objective was to establish a platform that can incorporate existing data systems directly via interfaces. This type of data transfer allows familiar and tried-and-tested systems to continue to be used and does not require any additional effort on the part of the institutions/persons providing the data. The expanded basis for the data means that information can be exchanged more quickly and in a more targeted way. However, this 1:1 integration of different data sources placed high demands on ICT4snow's technological infrastructure. This included for instance the need to process data in different formats,

Field tests of various measurement routines for determining snow hardness, photo: Federal Research Centre for Forests (BFW), Zechling, 2017

snowpack and avalanche information had to be analysed and forecast in real time and the results had to be quickly returned to the end users in processed form.

Integrated data sources

- Actual snow and avalanche situation (avalanche danger level, observations of drift snow, etc.) recorded and documented by mountain and ski guides and managed in a database and information system of the Lech Alpine Centre
- Combination of numerical weather forecast models with terrain data in high temporal and spatial resolution
- Real-time weather data collected by mobile mini-sensors in the field
- Stability assessments of the snow cover from traditional manual hardness profiles and innovative probes that digitally record and store the penetration resistance
- Recordings from time-lapse cameras for documenting ski tracks
- Images from thermal smartphone cameras to detect people buried in an avalanche
- High-resolution optical satellite data (Sentinel 2), which are made available to users in a prompt and user-friendly manner via a new web application developed by ICT4snow.

Data from various sources were successfully integrated and a smart real-time information flow made possible based on a stable server structure and newly created interfaces. This was subjected to intensive practical testing in a ski resort in close co-operation between IT technicians, practitioners and researchers.

PROJECT INFORMATION

Term: July 2016 – June 2017
Consortium leader: Austrian Federal Research and Training Centre for Forests (BFW) – Institute for Natural Hazards
Project coordinator Antonia Zeidler (BFW)
Additional consortium partners: Snow sports school Omeshorn – Alpincenter Lech GmbH
Project website: not published

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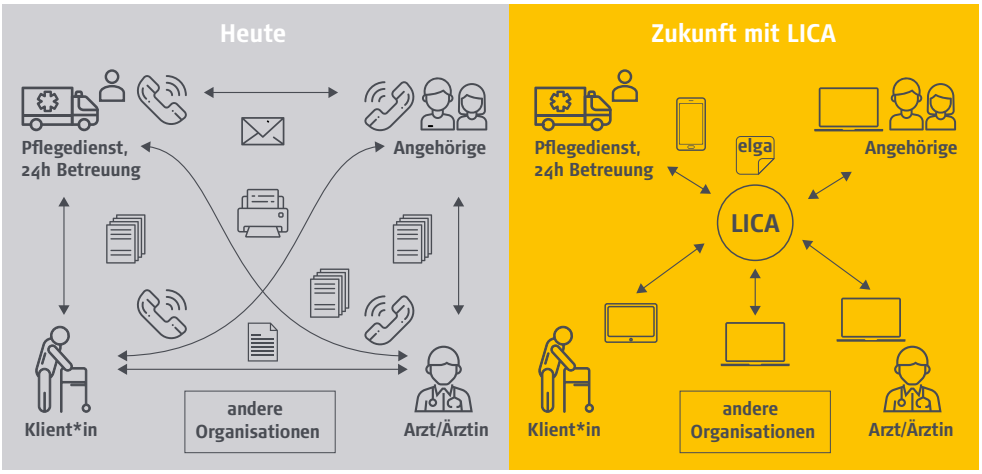
LICA

Linked Care – Continuous information provision in mobile care



Linked Care project graphic, Image: Linked Care project

The aim of the four-year Austrian Linked Care project is to ensure the continuous provision of information in mobile care and support through development of a comprehensive digital system. Involving nurses, caregivers, therapists and doctors as well as people in need of care and their relatives in the development of a documentation and communication platform allows all of the people and organisations involved in the care process to be linked together.

The interfaces of the innovative digital system with ELGA, as well as medical and pharmacy software, help to avoid multiple health-related client data records. The elaboration of standards and the involvement of all relevant target groups based on a user-centred design approach enable practical IT tools to be developed for standardised networking. The result will be an affordable and easy-to-use IT system for the team around the client. This can be operated via a mobile device, PC or tablet.

The intention is for Linked Care to use a digital platform throughout the whole of Austria to map indicators of the current state of health, a description of the scope of services (e.g. the need for nursing and care) and a description of current changes in an interdisciplinary manner. Network-building measures are aimed at initiating the necessary cooperation between all of the stakeholders involved, establishing this in practice and making it a stable process through structured forms of cooperation.

Complex everyday procedures, processes and challenges in mobile care and assistance were visualised through a comprehensive needs assessment and environment analysis. The identified requirements for a digital system provide the basis for the further development of Linked Care. Thereby, the challenge of meeting the heterogeneous needs of the different target groups is accepted.

The main focus for the evaluation phase of the project will be on demonstrating a clear improvement in comprehensive communication in the mobile nursing and care setting and between all stakeholders involved in the care process.

The efficient interdisciplinary exchange of information enables high-quality care and support for people in their own homes and therefore makes a valuable contribution to the well-being of all those affected as well as their relatives and people close to them. The open source solution will support access to information and communication technologies for everyone involved in the care process. As such, Linked Care particularly addresses the Sustainable Development Goals 3 “Good health and well-being” and 9 “Industry, innovation and infrastructure”.

PROJECT INFORMATION

Term: April 2021 – March 2025
Consortium leader: FH Campus Wien Forschungs- und Entwicklungs GmbH (F&E GmbH)
Project coordinator: Elisabeth Haslinger-Baumann
Additional consortium partners: myneva Austria GmbH, Loidl-Consulting & IT Services GmbH, HCS Health Communication Services GmbH, Österreichische Apotheker-Verlagsgesellschaft m.b.H., CompuGroup Medical CGM, Steszgal Informationstechnologie GmbH, Academy for Ageing Research at the “Haus der Barmherzigkeit”, Volkshilfe Gesundheits- und Soziale Dienste GmbH, Wiener Rotes Kreuz- Rettungs-, Krankentransport-, Pflege- und Betreuungsgesellschaft m.b.H., Volkshilfe Wien gemeinnützige Betriebs-GmbH, Johanniter Österreich Ausbildung und Forschung gem. GmbH, University of Applied Sciences Technikum Vienna, University of Vienna, Institute for Ethics and Law in Medicine
Project website: fh-campuswien.ac.at/forschung/projekte-und-aktivitaeten/linked-care-durchgehende-informationsversorgung-in-der-mobilen-pflege-und-betreuung.html
linkedcare.at/en

D

TeleCareHub

Platform for technology-assisted care and support for people with dementia living at home

"Customers Journey" workshop July 2022 in Vorarlberg with representatives of nursing, assistance and healthcare service providers from Vorarlberg, photo: Karin Trommelschläger

Connected technology for a good life with dementia

The TeleCareHub project identifies the potential for relief provided by remote care and offers web-based solutions for care at home: the Telecare app aims to identify needs at an early stage and provide support with daily activities.

Identify challenges, offer user-oriented help

Many of those active in Austria's healthcare landscape are doing good work. There is a wide range of services on offer aimed at relieving the strain of caring for people with dementia. Nevertheless, not all sections of the population are making adequate use of the help and support at an early stage. This is due to a lack of knowledge about analogue and digital services, uncertainty about the quality of digital services, as well as language barriers that make it more difficult to access support services.

The TeleCareHub meets these challenges with technology-enhanced services that are focused around the user, evidence-based and culturally sensitive: remote systems should be clear, understandable and easier to use for everyone in Austria. Add-on modules are also being considered for other providers of remote care systems, such as early diagnosis based on daily structural data and intelligent decision-making algorithms for interventions.

Digital support for care at home,
photo: IBH/Hannes Thalmann

A multi-centre study was launched in December 2022 in the federal states of Tyrol, Salzburg, Carinthia and Vorarlberg, with the aim of recording the care and stress-related factors as well as the options for technical support from the perspective of people with incipient dementia and their carers as well as from the perspective of professionals. Recommendations for relieving the strain on informal carers and care providers as well as recommendations for reducing distrust towards ICT solutions are derived from the findings from care research.

Telecare solutions aim to help reduce the strain on informal carers and care providers and improve their health-related quality of life. For people living with dementia, the aim is to reduce their abnormal behaviours as a dimension of their quality of life and to prolong the time until full inpatient care is required. A two-year field study aims to demonstrate the impact on the health and quality of life of those affected.

A certified “app on prescription”

Looking to the future, the goal for telecare in Austria is to achieve a certified “app on prescription”. The consortium is in the process of developing a digital health application and preparing it for certification as a medical device: the app integrates existing telecare systems (e.g. video consultation, reminder and call systems) and supplements them on the level of the user interface to include features aimed at end-users, such as transmitting information to target groups and demonstrations of efficacy for clients.

Digital services reduce unnecessary travel times and journeys to care providers.

Connecting existing high-quality technical solutions such as sensors, actuator technology and web platforms ensures that clients can enjoy a comfortable and safe life at home for as long as possible.

The TeleCareHub project aims to ensure that digital health applications that provide proof of effectiveness should be prescribed by healthcare providers and refinanced by health insurance funds. This will make sustainable digital solutions affordable and accessible for all on a permanent basis.

PROJECT INFORMATION

Term: March 2022 – February 2026
Consortium leader: FHV Vorarlberg University of Applied Sciences
Project coordinator: Katrin Paldán
Additional consortium partners: connexia – Gesellschaft für Gesundheit und Pflege gem. GmbH, Diakonie de La Tour gemeinnützige Betriebsgesellschaft m.b.H., ESD – Evaluation Software Development GmbH, Carinthia University of Applied Sciences – private non-profit foundation, FAWO GmbH, Intefox GmbH, Salzburg Research Forschungsgesellschaft m.b.H., Tirol Kliniken GmbH, University of Innsbruck, Institute of Psychology, Centre for Migrants in Tyrol (ZeMit)
Project website: telecarehub.at

TeleCareHub booth at the "Innovation in der Pflege – gewusst wie!" (Innovation in care – knowing how!) conference on 20 September 2022 in Dornbirn, Vorarlberg, photo: Karin Trommelschläger

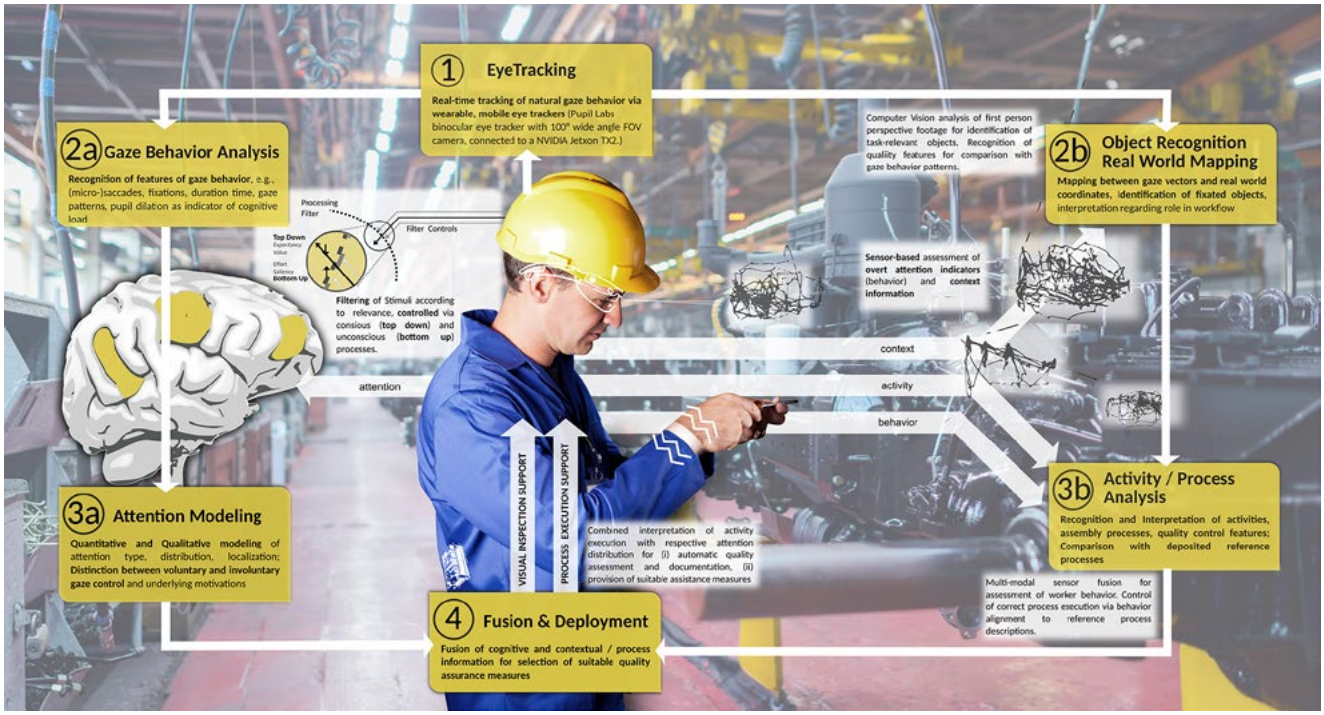
EyeControl

Eye-Controlled Machines

Enabling efficient interaction with future cognition-aware systems requires innovative interaction modalities which are suited to the increasing need for fast, seamless integration of information processing into everyday life and interactions. One challenge associated with the digital transformation is the increasing fusion of the digital with the physical world. In terms of the interaction between humans and machines, this challenge is being met with augmented reality, mixed reality and virtual reality solutions. This increasingly requires methods of interaction that go beyond traditional input media (mouse, keyboard, voice input).

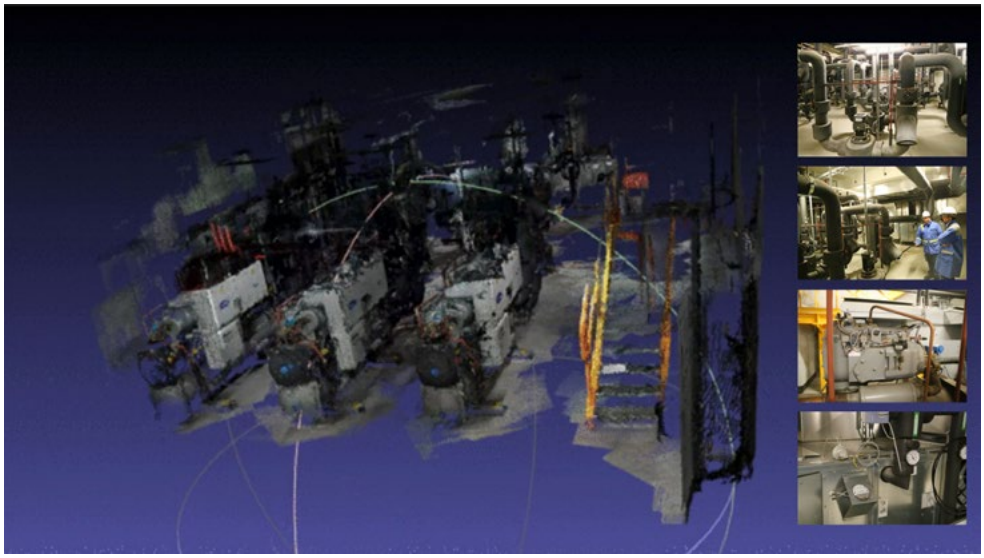
The EyeControl project pursued an unconventional but highly promising (input) device-free approach to explicit and implicit interactions between humans and machines, based on the use of the human gaze as the method of human interaction that comes closest to perception, information processing and thereby also cognition. The human gaze is particularly suitable as a method for implementing fast, efficient and convenient user interaction, as

- it is the main information perception sensor,
- (ii) services based on eye gaze are directly exploiting natural user behaviour for true user-centred design and
- are more versatile than device-based methods of interaction. Furthermore, gaze-based interaction is
- free from wear-and-tear, maintenance-free and
- is hygienic, enables
- remote access and interaction at a distance, which increases convenience and safety, provides
- deep insights into the user's activities and keeps
- hands free for manual activities to be carried out at the same time.



The EyeControl project created a natural and intuitive system for gaze control that is based on the evaluation and interpretation of gaze behaviour with regard to underlying attention and intention mechanisms. The aim of this was not to replace conventional pointing and selection methods and devices, but rather to create new possibilities for interaction based on cognition and perception.

Perception-Action Control Loop,
Image: Institute of Pervasive Computing, JKU

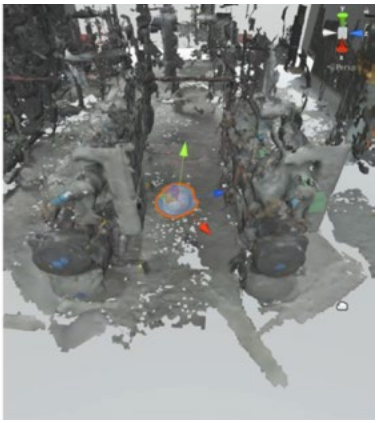


Cooling systems at voestalpine Steel Division,
Image: Institute of Pervasive Computing, JKU

The EyeControl project

- used mobile eye-tracking sensors to reduce technological overload
- identified characteristic gaze features (gaze behaviour, somatic indicators, gaze modelling) in order to achieve an independent gaze control system
- supplemented conventional technical approaches with findings from cognitive psychology and HCI in order to distinguish between conscious and unconscious processing and perception so as to overcome the Midas touch problem
- developed a general eye-gaze-based control tool kit, adaptable to various fields of application

Working with voestalpine, the EyeControl system was used in two use cases in the field of quality assurance for cyber-physical systems (visual inspection and complex workflow support). The technologies developed were transferred from initial implementations in the laboratory via iterative on-site field studies to a final on-site installation and evaluation of the developed system.



Guide at the repair point, Image: Institute for Pervasive Computing

PROJECT INFORMATION

Term: September 2016 – February 2020

Consortium leader: Johannes Kepler University Linz/Institute of Pervasive Computing

Project coordinator Institute of Pervasive Computing

Additional consortium partners: Research Studios Austria FG – Pervasive Computing Applications, voestalpine Stahl GmbH, voestalpine Automotive Components Schwäbisch Gmünd GmbH & Co KG

Project website: jku.at/institut-fuer-pervasive-computing/research/projects/2020- 2016-eyecontrol

D

AI@Work

Human Centered AI in Digitized Working Environments

Consortium meeting of the AI@Work successor project "TEAMING.AI" in Hagenberg im Mühlkreis (Upper Austria) in June 2022, photo: Software Competence Center Hagenberg GmbH, Lisa Meisinger

The aim of this exploratory project with a budget of approx. EUR 200,000 was to develop a technical concept for teamwork between humans and AI systems, including requirements from different areas of the digitalised working environment. In contrast to the paradigm of 100% automation, AI@Work is based on the opposing view that greater efficiency and effectiveness can only be achieved through coordinated teamwork between AI and humans.

The methodological approach is based initially on analysing the strengths and weaknesses of AI systems compared with human operators and/or engineers. AI systems have a particular strength when it comes to scaling up, i.e. scalable processing of data for the purposes of prediction, optimisation, etc.; however, current AI systems lack the flexibility in dealing with changing underlying conditions or a lack of data. It is precisely the opposite case with humans and it makes sense therefore to combine the respective weaknesses and strengths in line with the idea of teamwork. However, team intelligence is a new category and challenge in AI research. In order for a team to work well, it needs above all to know who is responsible for what, in what context, to what extent and in what role. Flexibility is required in implementation, even if this distribution of roles has been defined in advance. Team intelligence is characterised by precisely this type of flexibility. In order to make this flexibility possible, communication between the actors is needed and above all a common ground to avoid misunderstandings. One important outcome of this project was the technical concept using knowledge graphs and use of these for (relational) machine learning. This concept was the starting point for the European "TEAMING.AI" project (teamingai-project.eu) which was subsequently

successfully submitted and was led by the SCCH with a project volume of EUR 5.7 million. TEAMING.AI is specifically tailored to address teamwork in production but also covers issues involving auditability, ergonomics and safety. As one international study shows, it is precisely the aspect of dynamics in teamwork that represents one of the greatest challenges. The AI@Work or TEAMING.AI approach demonstrates a significant technical innovation for solving the dynamics problem, with a new method for rapid updates to knowledge graphs and corresponding embedding within machine learning algorithms.

This project is a contribution to the human-centred, ethically acceptable and transparent integration of humans and artificial intelligence in the working environment. This concept gives skilled workers an additional more valuable role in monitoring and improving these types of systems, thereby enabling a greater degree of flexibility in a rapidly changing working environment with increasing demands for small batch sizes and personalised products.

This is a "smart" project in that it uses the latest methods of digitalisation and AI and integrates them into work processes. However, this project is above all "future-oriented" as it addresses important issues of ethics and trustworthy AI.

PROJECT INFORMATION

Term: October 2019 – December 2020
Consortium leader: Software Competence Center Hagenberg GmbH (SCCH)
Project coordinator: Bernhard A. Moser (SCCH)
Additional consortium partners: Industrie 4.0 Austria – the platform for intelligent production, Institute of Labor Research and Labor Policy at Johannes Kepler University, APOLLO.AI GmbH, Vienna University of Economics and Business, PROFACTOR GmbH
Project website: teamingai-project.eu

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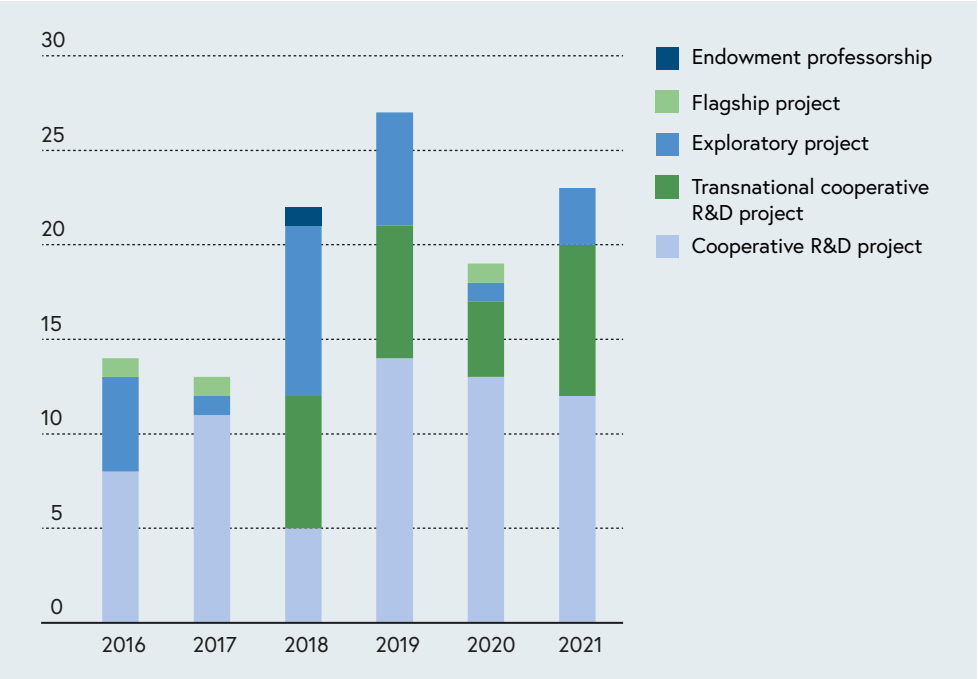
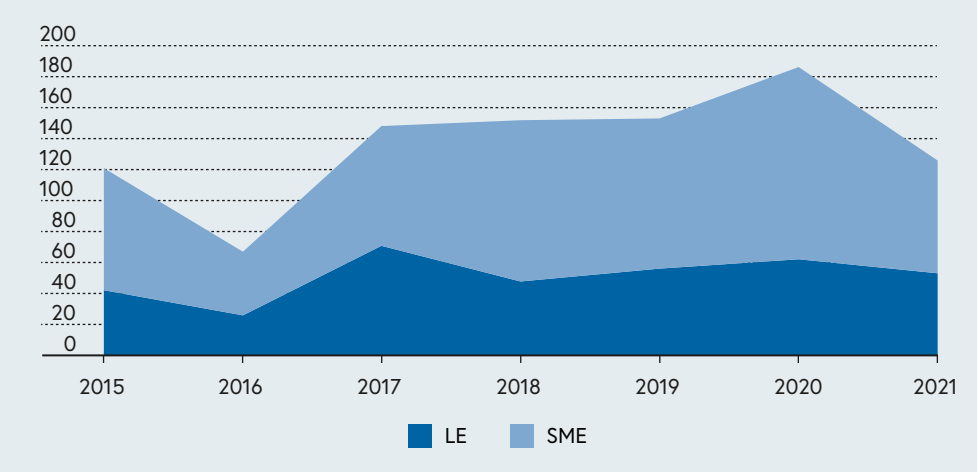
Evaluations

Unless otherwise stated, the evaluations presented here refer to projects sponsored by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) in the field of digital technologies with start dates between 2016-2021.



Number of projects launched in the years indicated broken down by funding instrument
Source: Austrian Research Promotion Agency (FFG) funding statistics 2022



Company submissions for calls for proposals between 2015-2021 categorised by company size
Source: Austrian Research Promotion Agency (FFG) funding statistics 2022

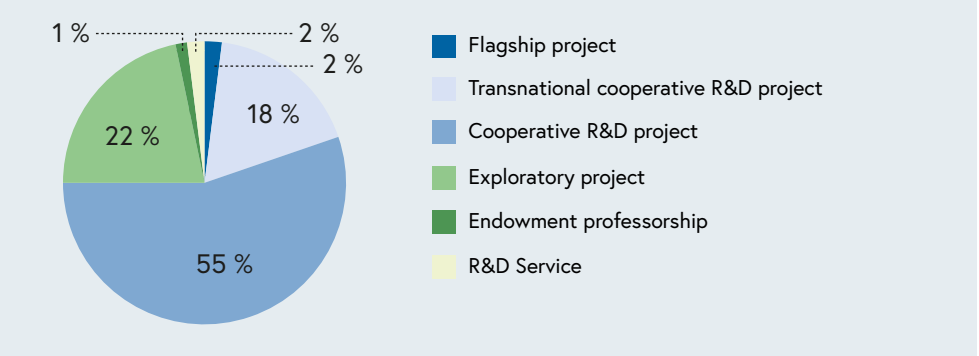


Image: Allocation of funding instruments among the funded projects from 2015-2021
Source: Austrian Research Promotion Agency (FFG) funding statistics 2022

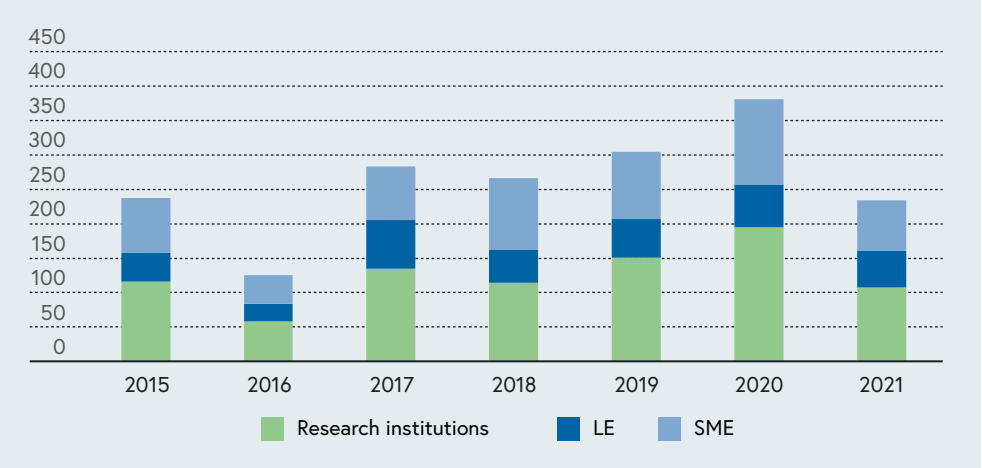


Image: Number of project participations by organisational form of the submitting party, divided into small and medium-sized enterprises (SMEs), large enterprises and research institutions (universities, universities of applied sciences, non-university research institutions); the year indicates the launch year of the call for proposals.
Source: Austrian Research Promotion Agency (FFG) funding statistics 2022

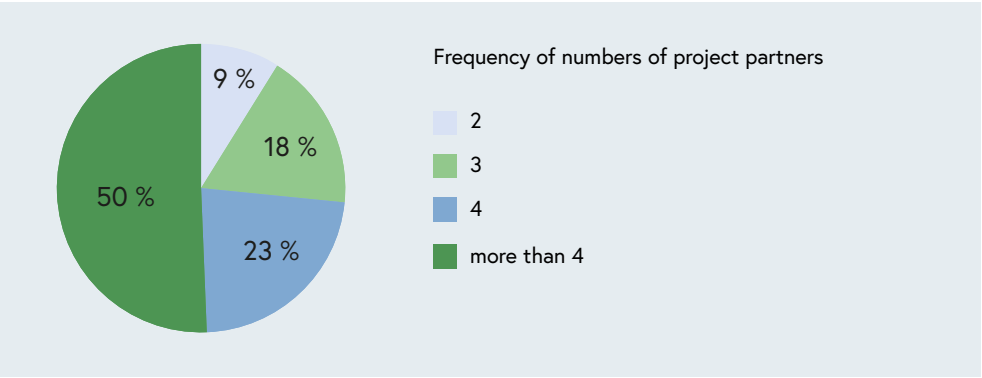


Image: Size of the consortiums for the cooperative R&D projects funded in the calls for proposals between 2015-2021
Source: Austrian Research Promotion Agency (FFG) funding statistics 2022

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