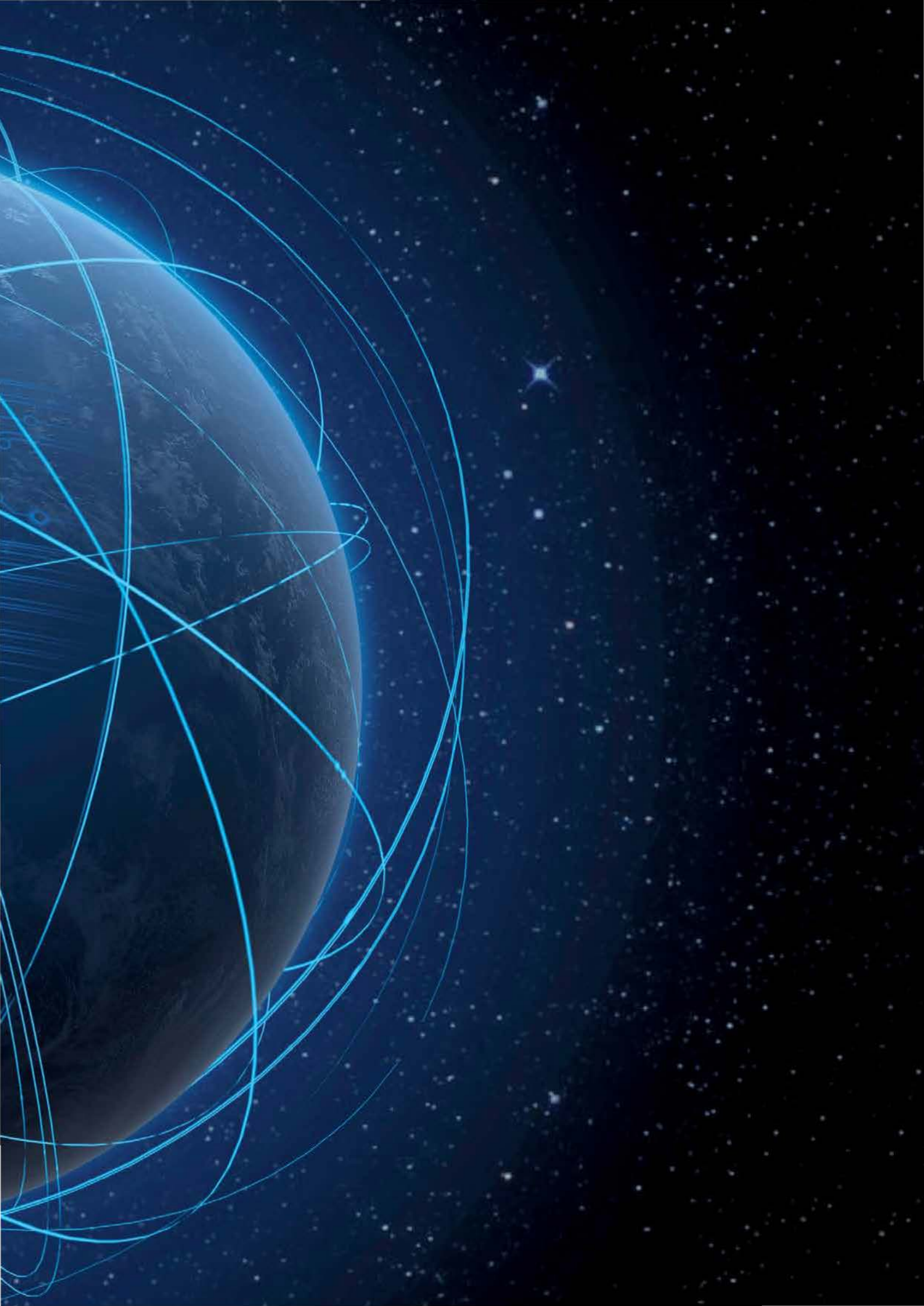# ICT **of the Future**

Time for Great Ideas
Project Examples 2012 – 2015

The Austrian Funding Initiative for Innovative
Information and Communications Technology

bmvit

The Funding Initiative
ICT of the Future

Over recent years, information and communication technology (ICT) has had a huge impact and brought many changes to all our lives and there is currently no indication that further changes to come in the future will be any slower or less disruptive. ICT permeates just about all areas of everyday life, be it work, leisure time or our interaction with the world around us.

Having started out as a niche discipline, ICT has become a fundamental and integral part of our lives and is now essential in linking the most diverse fields of science and business. This leads to the emergence of new application areas and disciplines at the relevant interfaces such as, for example, links between products or energy supply and informatics (Industry 4.0, smart grids), demographic challenges and informatics (AAL), automotive engineering and informatics (autonomous driving) or medicine, biology and informatics (bioinformatics) to name but a few examples.

Indeed, it is the increasing links between information (usually in the form of data) and communication in particular that are creating new challenges, opportunities and areas of application.

Effective applied research funding monitors and influences such developments and thus provides Austria's enterprises and research institutions with targeted support in their ICT research efforts.

The funding initiative "ICT of the Future" was launched by the Federal Ministry for Transport, Innovation and Technology (bmvit) in 2012 and offers a range of different programmes:

- The national funding programme "ICT of the Future", positioned as newly refocused successor to the "FIT-IT" funding programme, aims to give due consideration to the changing demands to be met by ICT research.
- The EU co-funded programmes "ARTEMIS" and "ENIAC", which were merged into the ECSEL initiative in 2014.
- The transnational funding programme "AAL" and the national funding programme "benefit", which both focus on ways in which ICT can contribute to improving quality of life (particularly for older people).

This brochure highlights the wide range of topics related to "ICT of the Future" by showcasing specific funded projects with a focus on the national funding programme of the same name.

Following a brief overview of the funding initiative, 27 selected Cooperative Projects are presented, which in their technical diversity offer an impression of the broad scope and complexity covered by the programme. Of these, 22 projects are from the national programme "ICT of the Future" and two projects are from the "benefit" programme. In addition, one project carried out under Austrian consortium management will be presented from each of the EU co-funded programmes AAL, ENIAC and Artemis, which are also run under the umbrella of the "ICT of the Future" initiative. Each of the featured projects indeed clearly demonstrates the active role played by Austrian ICT enterprises and research institutions in cooperation at international level. For the purposes of providing a clearer structure, the projects described in this brochure are assigned to three categories according to a common thematic focus:

Think, which includes data-intensive projects and projects involving simulation or analysis,

Create, which includes all projects relating to manufacturing, robotics and manufacturing processes, and last but not least

Live, the category for projects with a focus on day-to-day living, health and transport as well as earth observation.

In their entirety, the selected projects should serve to illustrate the overall framework within which ICT research takes place as part of "ICT of the Future" initiative and arouse interest and curiosity about what ICT of the future holds in store.
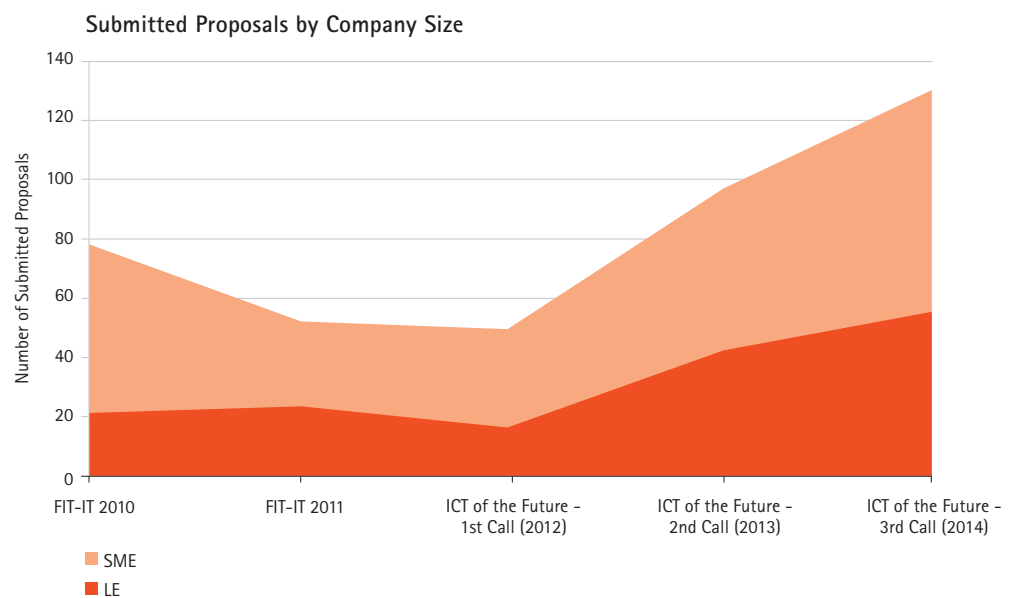
Submitted Proposals by Company Size

Figure 1: Number of project proposals submitted by companies in the last two years of "FIT–IT" and the first 3 years of "ICT of the Future", categorised by company size

Source: FFG funding statistics 2016

The national programme ICT of the Future – targeted research funding

"ICT of the Future" is the funding programme of the Federal Ministry for Transport, Innovation and Technology (bmvit) for the promotion of high-quality research, development and innovation in information and communication technology, interlinked with application areas and societal challenges. The programme supports ICT innovation in a comprehensive manner and aims to contribute towards the goal of the federal government to lead Austria from the group of Innovation Followers to the group of Innovation Leaders, making it one of the most innovative countries in the EU. With its focus on generic ICT research and development, the programme pursues the following goals aimed at increasing innovative strength in this sector:

• Develop lead technologies
• Achieve lead positions in competitive markets
• Establish and extend Austria's lead position as a research location
• Train and attract top scientists and research staff

In order to reach these goals, the programme focuses on four technological topic areas, several cross-cutting topics as well as particular application areas, in which these topics are of key relevance. This clearly reflects the interlinking of today's ICT research, where ICT topics are addressed in the context of concrete fields of application.

Facts:
3 calls (2012 – 2014)
216 project submissions
349 participating organizations
Funding granted: EUR 27,000,000
Total cost: EUR 118,000,000

This structure allows both for a high degree of flexibility as well as a broad range of topics while also enabling targeted goals and priorities to be set.
The topic areas defined in the programme and supplemented in the individual calls with relevant application domains are

• A) Mastering Complex ICT Solutions: Systems of Systems
• B) Justifying Trust: Safe and Secure Systems
• C) Conquering Data: Intelligent Systems
• D) Ensuring Interoperability: Interfaces of Systems

Funding Instruments
ICT of the Future 2012 – 2014

■ R&D Service
■ Exploratory Project
■ Cooperative Research Project IR
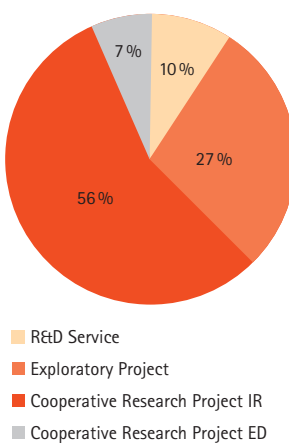■ Cooperative Research Project ED

Figure 2: Distribution of projects funded under the ICT of the Future programme between the funding instruments in the period from 2012 to 2014
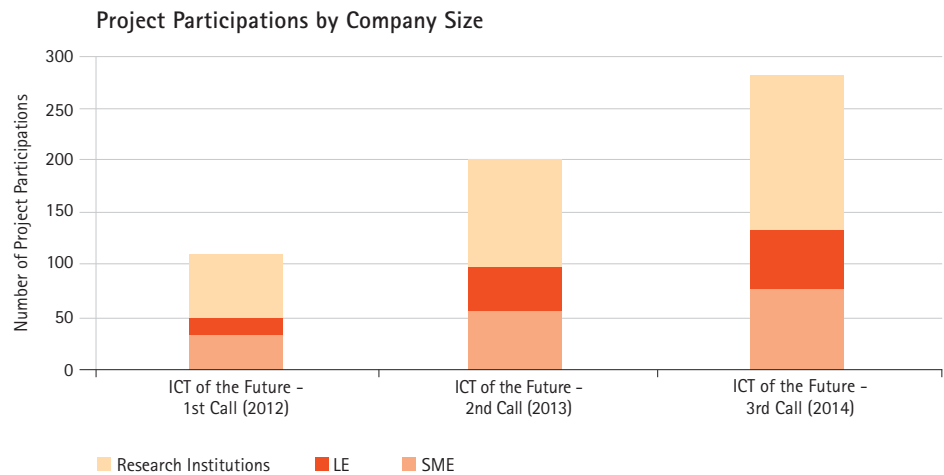
Source: FFG funding statistics 2016

A total of 349 companies and research institutions submitted 216 project proposals to the past 3 calls of the ICT of the Future programme, either as single applicants or as a member of a consortium. The total cost of the projects was 118 million euros, the level of funding applied for was almost 86 million euros.

Cooperative Projects of Experimental Development (ED) and Industrial Research (IR) are the most widely used funding instrument in the ICT of the Future programme. Under this funding scheme several project partners (companies and research institutions) collaborate on a single project, each contributing their expertise and requirements. The funding instruments provided in the past 3 calls also included Exploratory Projects (preliminary studies for preparing and examining the viability of a planned research project) and R&D Services (investigation of a topic specified by bmvit, e.g. roadmap studies). Endowed Professorships were introduced into the funding portfolio of the ICT of the Future programme for the first time in 2015.

Figure 2 shows how the funded projects are distributed between the individual funding instruments.

Project Participations by Company Size

Figure 3: Number of project participations submitted, broken down into small and medium-sized enterprises (SME), large enterprises (LE) and research institutions (universities, universities of applied sciences, non-university research institutions).

Source: FFG funding statistics 2016

Figure 3 shows the number of participations in Cooperative Projects submitted in the individual calls, broken down into large enterprises (LE, over 250 employees), small and medium-sized enterprises (SME, fewer than 250 employees) and research institutions (universities, universities of applied sciences, non-university research institutions).

The medium-term goal of the programme is to disburse at least 30% of the funding available to Austrian SMEs. The continuous increase in submissions from project consortia involving small and medium-sized enterprises (SME) is therefore considered to be a positive trend. This development also becomes evident when comparing the results with the number of projects submitted by companies in the last two years of the national predecessor programme „FIT-IT", see Figure 1.

Figure 4 illustrates the distribution of the Cooperative Projects funded under the 3 calls from 2012 to 2014 between the individual application areas. The Open Application Area is designed for projects addressing at least one of the 4 topic areas, but which cannot be assigned explicitly to one of the application areas specified in the relevant call.

Figure 5 shows how the projects are distributed between the 4 topic areas of the ICT of the Future programme, based on the priority topic specified in the proposal. This evaluation reveals a clear focus on data processing, transformation and interpretation, which is inherent in ICT, and also indicates strong relationships to the other topic areas of the programme.

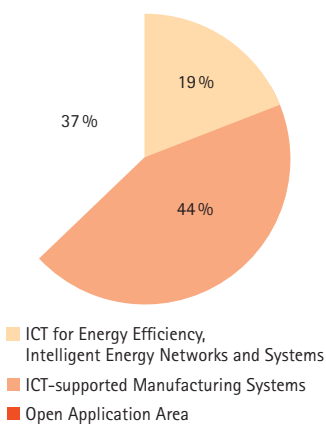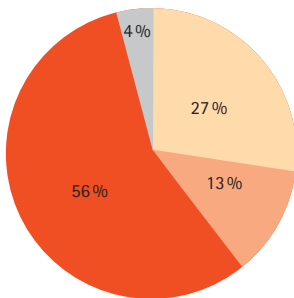## Funded Cooperative Projects by Application Area

Figure 4: Distribution of funded Cooperative Projects between the individual application areas for the calls 2012 – 2014

Source: FFG funding statistics 2016

Funded projects 2012 – 2014

A total of 48 Cooperative Projects, 20 Exploratory Projects and 3 R&D Services received funding under the 3 national calls of the ICT of the Future programme from 2012 to 2014.

Funded Cooperative Projects by Priority Topic Area

- □ A) Mastering Complex ICT Solutions: Systems of Systems
- □ B) Justifying Trust: Safe and Secure Systems
- □ C) Conquering Data: Intelligent Systems
- □ D) Ensuring Interoperability: Interfaces of Systems

Figure 5: Distribution of funded Cooperative Projects between the individual topic areas for the calls 2012 – 2014, based on their specified priority topic.

Source: FFG funding statistics 2016

Figure 7 shows the sizes of the consortia for the Cooperative Projects funded under the 3 calls. At least one SME was involved in over 50% of the project consortia; close to 20% of the consortia even involved two or more SMEs.

The average funding sum applied for increased continuously over the 3 calls from 360,000 euros in the 1st call in 2012 to 560,000 euros in the 3rd call in 2014.

The Cooperative Projects submitted address the 4 topic areas and 3 application areas as illustrated in **Figure 4** and **Figure 5** above. The funding applied for in the relevant application areas and priority topics is shown in **Figure 6**. Of special note is the relevance of „Ensuring Interoperability" in the application area "Manufacturing Systems" and the large proportion of projects with the priority topic "Conquering Data".

Almost two thirds (65%) of the funded Cooperative Projects address only one topic area, almost a third (31%) cover two areas and the remaining projects address three topic areas.

Projects addressing more than one topic area are primarily found in categories C) "Conquering Data" and D) "Ensuring Interoperability".

Figure 8 shows the result for the individual application areas taking into account the content actually covered in the relevant projects. The tag cloud visualises the words occurring in the titles of the funded Cooperative Projects weighted according to their frequency.

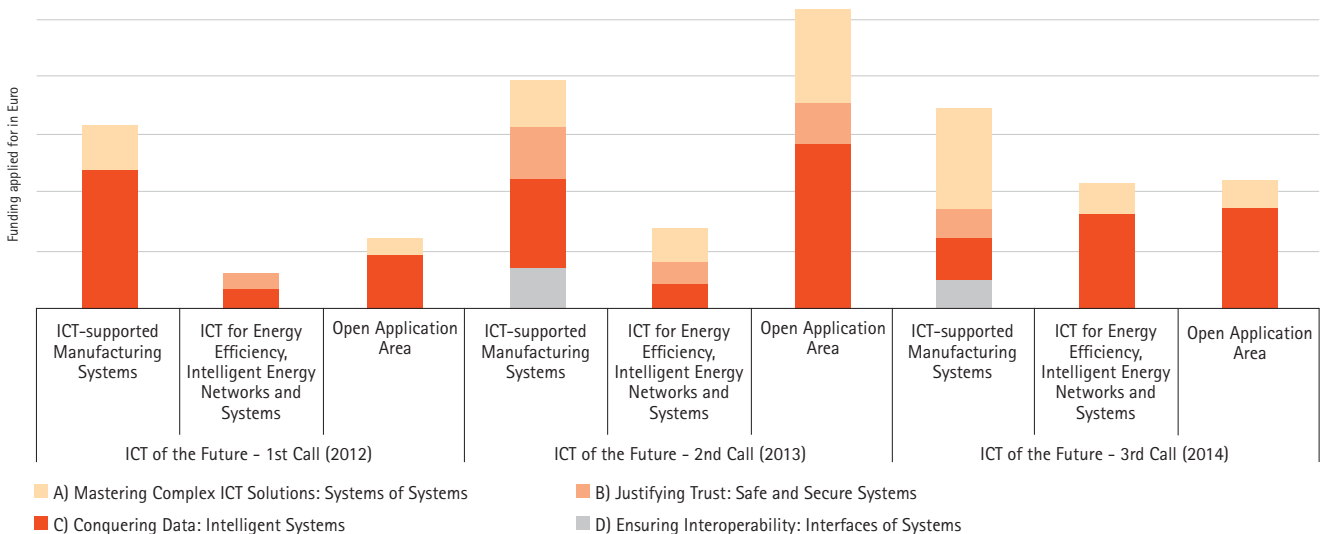## Funding applied for by Topic and Application Area

Figure 6: Funding applied for by priority topic area and application area for the Cooperative Projects funded under the 3 calls since 2012.

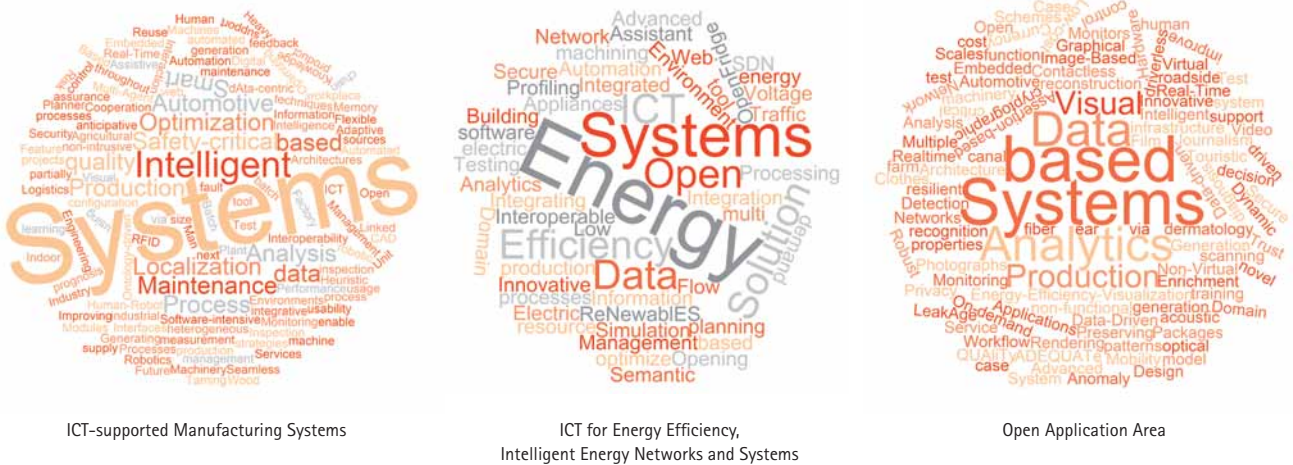Source: FFG funding statistics 2016

ICT-supported Manufacturing Systems

ICT for Energy Efficiency,
Intelligent Energy Networks and Systems

Open Application Area

Figure 8: Tag clouds for the application areas, created from the titles of
the Cooperative Projects funded under the ICT of the Future programme from **2012 – 2014**

Projects addressing the manufacturing sector focus on topics of maintenance and
process optimisation, while projects in the field of energy primarily cover the topics
of open data and buildings. The projects in the open application area naturally
present the highest degree of diversification with a focus on visualisation and data
analysis.

Leaving aside the application and topic areas specified by the programme and consi-
dering the overall portfolio (Cooperative Projects and Exploratory Projects) in the first
three calls of the "ICT of the Future" programme, the following research clusters are
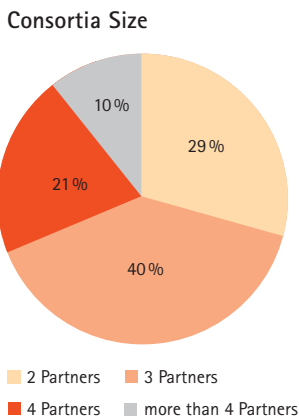represented by more than one project:

Data analysis (12 projects): The development of new data analysis methods allows
the solution of complex problems. The funded research projects address special
challenges of large and complex data domains, e.g. network data in the transport
sector, telecommunications or building management, and the real-time requirements
of applications.

Data interoperability (9 projects): The increasing complexity of networked systems
in different application areas requires new communication and data architectures to
monitor and control these systems. The projects investigate issues relevant to these
new architectures, such as configuration tools, system visualisation and the use of
open linked data portals.

Energy interoperability (9 projects): The application area "Intelligent Energy Net-
works and Systems" includes a range of projects specifically aimed at enabling smart
energy grids. These systems require new ICT approaches for modelling, data acquisiti-
on and energy-efficient control.

Visual computing (8 projects): The projects in this cluster focus on various topics of
visual computing, a special field of expertise in Austrian ICT research. Topics range
from 3D modelling under difficult conditions through to workflow tools and machine
vision in industrial environments.

Consortia Size

- 2 Partners
- 3 Partners
- 4 Partners
- more than 4 Partners

Figure 7: Consortia sizes for
Cooperative Projects funded
under the calls 2012 – 2014

Source: FFG funding statistics 2016

Flexible production (6 projects): The projects covering the application area "ICT-supported Manufacturing Systems" seek to develop approaches to enhance the flexibility and efficiency of production facilities based on data analysis and interoperable interfaces.

Modelling (4 projects): One of the core tasks of ICT is the modelling of ever more complex systems and processes in software. This allows access at a more abstract level based on a formal description of the project domain.

Robotics integration (3 projects): Robotics opens up a range of topics in the application area "ICT-supported Manufacturing Systems", e.g. human-robot collaboration.

Security concepts (3 projects): These projects focus on novel ICT security approaches for sensitive application domains, for example the industrial Internet.

Integrated systems (3 projects): There are numerous research questions surrounding "invisible" integrated and often networked hardware systems in various application areas.

The clusters of predictive maintenance of **production facilities** and design of **open data interfaces** include two projects each.

The present brochure presents project examples from each of the above clusters.

The ARTEMIS and ENIAC programmes – the European dimension of ICT research

www.ffg.at/en/ecsel-programme
www.ffg.at/en/benefit
www.ffg.at/aal
www.ictprofiles.at

The bmvit, via the Austrian Research Promotion Agency (FFG), also supports Austrian companies and research institutions in the field of ICT research at European level.

The European technology initiatives ARTEMIS (Advanced Research and Technology for Embedded Intelligence and Systems) and ENIAC (European Nanoelectronics Initiative) enabled the implementation of large-scale industry-driven research projects in the fields of embedded systems and nanoelectronics on a European scale.

Both initiatives primarily provided funding for market-oriented research creating prototypes and demonstrators that are characterised by cross-domain applicability and thus make an important contribution to major social objectives. This was the first time that European industry itself acted as a key driver of research funding: calls for cooperative research projects were issued on the basis of a multi-year work programme coordinated with the European Commission and Member States.

In 2014, the two initiatives were merged into ECSEL (Electronic Components and Systems for European Leadership), which is also managed by FFG as part of the ICT of the Future initiative at national level. From the start of ICT of the Future in 2012 until 2014, funding totalling 17 million euros was granted to Austrian companies and research institutions under the ARTEMIS and ENIAC initiatives, matched by funding from the European Union under the Horizon 2020 framework programme.

The benefit and AAL programmes – putting people at the centre

The national funding programme "benefit – demographic change as an opportunity" promotes the research and development of ICT-based products, services and systems aimed at maintaining and improving the quality of life for older people enabling them to enjoy a long and independent life in their own homes. A consistent focus in this programme is placed on tangible benefits for the end users. The same applies to the European AAL programme, where national funding is matched by funds from the European Union (through the research funding programme Horizon 2020). The programme also promotes the investigation of innovative solutions for older people based on information and communication technologies.

Both programmes place special emphasis on closely involving the end users from an early stage of research in order to ensure broad acceptance of the solutions developed. Interdisciplinary approaches and ethical aspects also play a more prominent role than in traditional ICT projects. National funding totalling almost 14 million euros was made available for these two programmes between 2012 and 2014. EU co-financing for Austrian AAL project participations, which was also managed by FFG, amounted to some 5 million euros over the same period.

Insight into
Digital Currencies

Virtual currency systems such as Bitcoin are becoming increasingly popular. Austrian researchers are working on algorithmic solutions that should help to understand and detect anomalies in such systems.

The raise of digital currencies such as Bitcoin is an indicator for the ongoing digital transformation in financial technologies. Currency units are being generated decentralized and can be transferred globally within minutes and with minimal transaction costs. In contrast to existing currency systems, virtual currencies are operating without central control (e.g., national banks) and bypass established payment processors (e.g., banks). All transactions, which have ever been executed with Bitcoin, are anonymous and accessible in the publicly visible blockchain and can therefore be accessed for analytics tasks.

The GraphSense project aims at developing algorithmic solutions for real-time analytics of virtual currency transactions, which should provide insight into functionality and transaction processes. A special focus lies on anomaly detection, which should identify transactions and transaction patterns that deviate from typical structures. This could, for instance, help in identifying and tracing fraudulent activities.

Real-time analytics of large network structures
The specific characteristic and scientific challenge of the GraphSense project lies in the structure and volume of the transaction data to be analyzed. More than 100M atomic transactions form a network in which bitcoin addresses and transactions are represented by hundreds of millions nodes and edges. Anomaly detection algorithms operating on such structures must be built for horizontally scalable infrastructures (e.g., Apache Spark) and tested for their applicability.

Generic Applicability
Technologies developed within the GraphSense project should, besides the use case "Anomaly detection in virtual currencies", also be applicable for other application areas (e.g., fault detection in manufacturing processes, anomaly detection in energy networks). All developed components will therefore be published as open source software.

Mastering the
Information Overload

Processing complex data is essential for quality in data-driven journalism. This research project combines data and visual analytics, with a focus on journalistic needs.
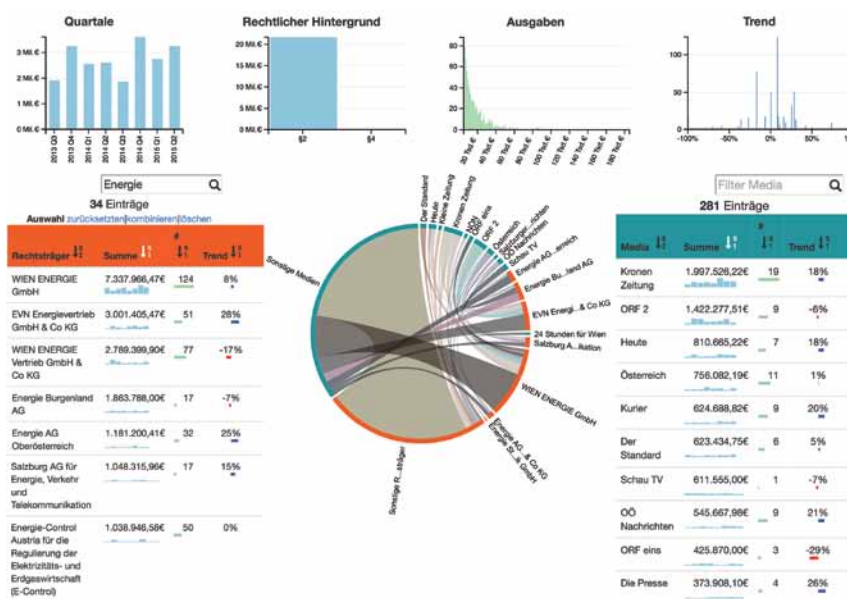
We live in a world in which it is increasingly important to understand complex socio-economical and ecological phenomena to facilitate well-informed decisions. Traditionally, journalists play an important role in this endeavor by uncovering hidden patterns and relationships to inform, enlighten, and entertain. With the ever-growing amount and availability of data, it becomes crucial for journalists to use elements of data analysis and visualization in their work. This trend led to the advent of the emerging field of Data-Driven Journalism (DDJ), which involves computer-supported data-based reasoning as well as interactive visualization.

Combine human skills and computer processing

The project VALiD combines Data Journalism and Visual Analytics. The core principle of Visual Analytics is the integration of the outstanding visual perception and reasoning capabilities of humans with the strengths of automated data analysis of computers. Thus it aims to make large and complex data more comprehensible and facilitate new insights.

Although news organizations such as the New York Times or the Guardian apply data journalism, the majority of journalists still face significant obstacles hampering the utilization of data for their work. Often, newsroom workflows do not cover data journalistic processes, available tools require advanced technical expertise, or dealing with complex, heterogeneous data is not supported.

Mitigating these obstacles is the main goal of the VALiD project: Following a user-centered and problem-driven research process, the involved researchers design techniques to support data journalists in dealing with complex heterogeneous data, and develop a set of guidelines and best practices for data journalism workflows. Because heterogeneous data is a large field with many different facets, we are focusing specifically on two types: First, textual data over time, such as transcripts of parliament debates, are investigated. Second, we analyze dynamic networks combined with quantitative flows, as for example data on governmental advertisement in media.

Improved Data create Added Value

Innovative approaches for increasing the quality of open data.

The ADEQUATe project will identify the requirements for the quality of open data management in Austria and evaluate the mechanisms needed to monitor, evaluate and solve the identified data quality issues on open data portals and beyond. Building on these findings, the project will develop data quality mechanisms in 3 areas: automated machine-driven mechanisms, data linkage, and crowd-sourcing approaches, combining these results into the (Open) Data Quality Monitoring and Evaluation Framework. This Framework will be deployed in 2 real world use cases, pertaining to the major open data portals in Austria: data.gv.at and opendataportal.at. It will be evaluated and refined in several iterations to follow an agile software development process along user needs (user-driven & data-driven development).

An ever increasing amount of Open Data becomes available as an important resource for emerging businesses. The integration of such open, freely re-usable data sources into organisations' data warehouse and data management systems will be a key success factor for a competitive advantage in a data-driven economy.

The crucial issues to be tackled for fully exploiting the value of open data and the efficient integration with other data sources are:
1. overall quality issues with meta data and the data itself and
2. the lack of interoperability between data sources

The crucial part is that these issues need to be already addressed when open data is provided by either governmental organisations or other stakeholders publishing open data.

Data Quality becomes a major issue
Data quality in Open Data Publishing was not addressed as a major issue in the open data movement so far, but becomes crucial these days as the re-use of open data is immensely increasing.

The consortium will research and develop novel automated and community-driven data quality improvement techniques which will be integrated into existing Open Data portals, thereby increasing the overall value for consumers; interlinking will contribute to the potential of reusing data sources by creating a network of interconnected Open Data that can be easily integrated. A quality assessment & monitoring framework in combination with questionnaires will continuously evaluate and demonstrate the impact of the ADEQUATe solutions.

Project Title
ADEQUATe - Analytics & Data Enrichment to improve the QUAliTy of Open Data
Programme
ICT of the Future
Application Area
Open Application Area
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
Semantic Web Company GmbH
www.semantic-web.at
Project Coordinator
Martin Kaltenböck
m.kaltenboeck@semantic-web.at
**Further Project Partners**
Donau-Universität Krems
Wirtschaftsuniversität Wien
Project Duration
2015 – 2018

Anticipate Faults
before they occur

Knowledge and data-based approaches improve fault prognosis models to enable the development of anticipative maintenance strategies, thereby optimizing operational availability and resource efficiency of manufacturing processes.
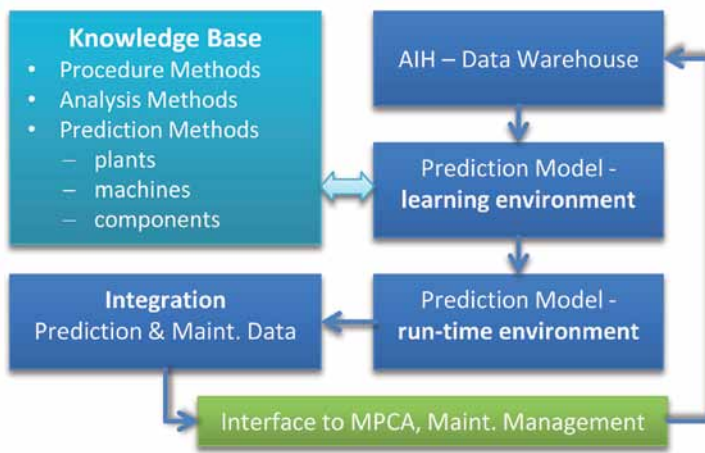
Anticipative maintenance strategies bear various benefits: An increased plant availability, as the early identification of faults can reduce down-times; a reduction of material and energy costs, since maintenance activities are no longer carried out on pre-defined schedules but only when necessary; and an easier planning of maintenance procedures, due to continuous condition monitoring.

Despite this huge optimization potential and the availability of more and more condition-relevant process and sensor data, anticipative maintenance strategies are only rarely found in industrial applications. Reasons for this are the growing complexity of production plants and the increased diversity of used components. These pose one of the major challenges to the development of a strategic maintenance management.

Combining knowledge and data

The project PROSAM, however, rises to this challenge and aims to solve it via the development of novel conceptual as well as methodological foundations, where the combination of expert knowledge and data based fault prediction models is considered as the key factor to success and therefore strongly pursued by consortium leader SCCH. Within this process, it is crucial to incorporate all critical aspects from data integration and processing, over feature extraction, model building, knowledge representation and problem oriented system analysis up to the optimal integration of developed techniques within the maintenance management. As an expert on condition monitoring, project partner Messfeld GmbH provides the know-how required to generalize component-oriented monitoring approaches to plant-wide strategies. H&H Systems, the third consortium member and producer of a maintenance management tool, plays a key role in developing a methodology to integrate prognosis models, which are naturally subject to a certain amount of uncertainty, inside a comprehensive maintenance plan. This step is particularly challenging with respect to the actual practical applicability, as various constraints regarding economical as well as operational planning aspects need to be taken into account.
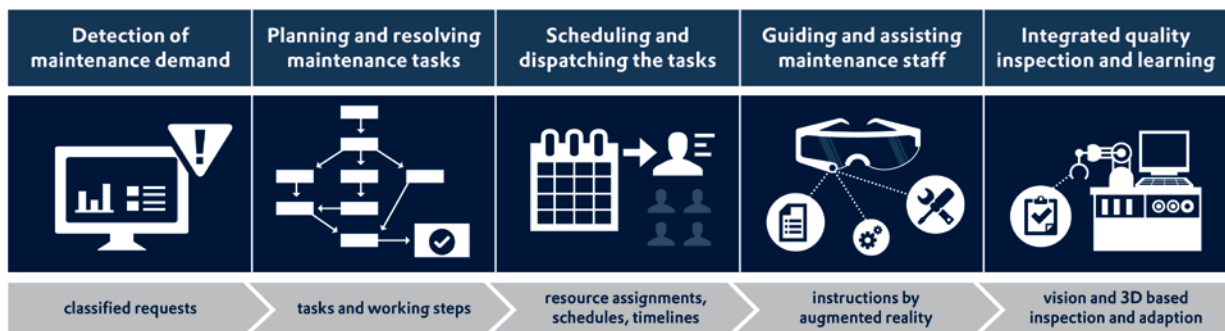

Project Title
Intelligent Fault Prognosis Systems for Anticipative Maintenance Strategies (PROSAM)
Programme
ICT of the Future
Application Area
ICT-supported Manufacturing Systems
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
Software Competence Center Hagenberg
www.scch.at
Project Coordinator
Thomas Natschläger
thomas.natschlaeger@scch.at
Further Project Partners
H&H Systems Software GmbH
Messfeld GmbH
Project Duration
2014 – 2017

Intelligent Maintenance
saves Costs

Efficient planning and running of industrial maintenance saves costs and conserves resources. The required information normally already exists. It just needs to be used.

Detection of maintenance demand	Planning and resolving maintenance tasks	Scheduling and dispatching the tasks	Guiding and assisting maintenance staff	Integrated quality inspection and learning
classified requests	tasks and working steps	resource assignments, schedules, timelines	instructions by augmented reality	vision and 3D based inspection and adaption

Intelligent maintenance cycles and error-free maintenance performance are increasingly becoming the key to commercial success. Many machines and equipment are however still subject to set maintenance intervals. They are therefore rarely serviced at the optimum time. Important information is often absent too. How should which component be changed? Which resources are required? Which experiences were already made? The result: higher costs.

In a joint project COPA-DATA, an HMI/SCADA specialist, the Salzburg University of Applied Sciences and the research company PROFACTOR developed a self-learning tool for intelligent planning and maintenance of equipment and machines. It collects information from various sources, interprets them and triggers the necessary steps. Each new service procedure increases empirical values and makes predictions more precise.

5 clear steps for every maintenance process

1. Identifying: Maintenance demand is detected by the system. Initially on the basis of specifications, then increasingly via condition monitoring by means of analysis of machine and operating data as well as from feedback from previous maintenance tasks.
2. Planning tasks: The tool creates specific maintenance instructions and defines the optimal timing as well as the required resources. The plans include target times, which increase in accuracy with each maintenance task.
3. Time planning and dispatch: Using its database and the linked shift schedules the tool chooses the best qualified employee to carry out the task and informs them automatically. Production and maintenance tasks for time control are considered and optimized together.
4. Guided performance: During operation the technician is given detailed information per augmented reality. The component to be replaced as well as its position in the machine is displayed and technical instructions are incorporated. In the case of deviations, feedback is given to the planning component.
5. Learning: Finally, the maintenance task is qualitatively assessed. Newly gathered data and experience is adopted and used as a data basis for the next cycle. Companies can thereby optimize running times of their machines, plan their maintenance cycles more precisely and thereby make optimal use of resources.

Machines learn from Production Data

Quality control is a crucial factor in multi-stage production processes. Adaptive data analysis recognizes problems and provides a competitive advantage.

During quality control large quantities of data are generated, that today mainly aim at detecting defects and identifying parts to reject. However, in the long run the goal of quality control is to prevent the manufacturing of reject parts. In today's production environments the necessary data analysis is only rarely done, because of the time and effort that are required. Short-term reaction to quality problems is thus not possible. Through a combination of product, process and quality data, knowledge about the production process can be automatically acquired and process improvements can be automatically deduced.

The project aims at the development of data analysis methods that accumulate knowledge about the process and enable its use in several situations: During re-starting of the process after a break the rate of reject parts is temporarily increased. Data analysis will allow a targeted modification of the process parameters to reduce the reject-rate during that time period.

Currently, modifications to the process are only possible after reject parts show up during end-of-line quality control. Inline data analysis will allow a quick reaction and prevent the manufacturing of reject parts. Process improvements that are targeted at avoiding occasional defects are currently very difficult to identify, because of a lack of analysis tools. The project aims at providing exactly such tools.

Merge data and combine tasks
To provide a solution for these situations, the project aims at the development of data-driven machine learning models that merge data from many different and heterogeneous sources. The models will cover the whole multi-stage process and merge process-, design- and quality data over the different stages to discover causal relationships. Technologically this requires research in fields such as time-series prediction, incremental learning, drift analysis and process optimization. A key challenge is the optimization of the prediction time horizon, making robust distinctions between intended and un-intended changes and automatically obtaining proposals for adjustments of the process.

The results of the project will allow manufacturing companies to perform an automatic and very detailed analysis of production data. It will be specifically beneficial for manufacturing of small lot sizes or high number of product variants.

From Cloudy to Bright

Innovative artificial intelligence automatically detects clouds in satellite images.
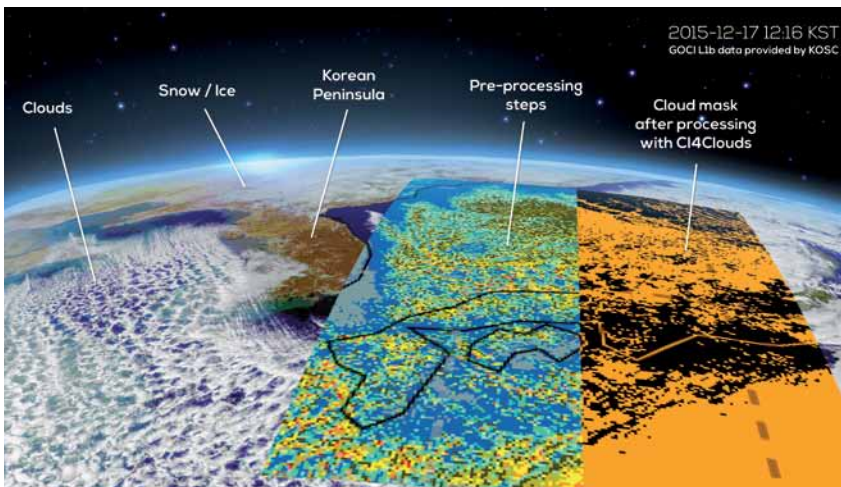
Numerous satellites orbit the Earth, permanently producing observational data from various instruments. One example for such instruments is the group of optical sensors.

Optical sensors measure the sunlight reflected by the Earth, recording images in the spectral range from near-UV to near-IR. Clouds present a problem when observations of the surface or clear air are required. Thus, measurements have to be classified according to whether clouds are present or not – a cloud mask.

A typical application of satellites involves the derivation of geophysical parameters. An example is the Geostationary Ocean Color Imager (GOCI). It observes the region of Korea, Japan, and East-China in the visible spectral region. Its main purpose is to recognize different properties of the ocean surface (algal blooms, gelbstoff, and other particles), and is thus not ideal for detecting clouds. Another example is the Sentinel-4 instrument of the Copernicus program, which will be started in 2019 to measure the air quality over Europe.

Computers are trained to recognize clouds
In the CI4Clouds project, the latest Machine Learning algorithms will be evaluated in their ability to produce a reliable cloud mask based on GOCI data. Models for the cloud mask will be trained and their pre- and post-processing steps optimized. The results will be compared to those acquired from instruments specialized in cloud detection. The objective is to obtain comparable results despite GOCI not being designed for cloud detection.

Every Machine Learning approach relies heavily on a set of representative training data describing all relevant scenarios. In the given domain the data must cover different types of clouds and landscape, times of day and year, intensity of light, or translucence of clouds. For the training phase, powerful parallel hardware will be available to handle the huge amounts of data efficiently.

An outcome of this project will be an improved cloud mask for those satellites which only use optical sensors. This product shall then be integrated into existing products, such as for aerosol or surface recognition, and be offered to the scientific community and for forecasting purposes.

Project Title
CI4Clouds – Computational Intelligence for Cloud Masking
Programme
ICT of the Future
Application Area
ICT for Earth Observation
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
Catalysts GmbH
www.catalysts.cc
Project Coordinator
Bernhard Niedermayer
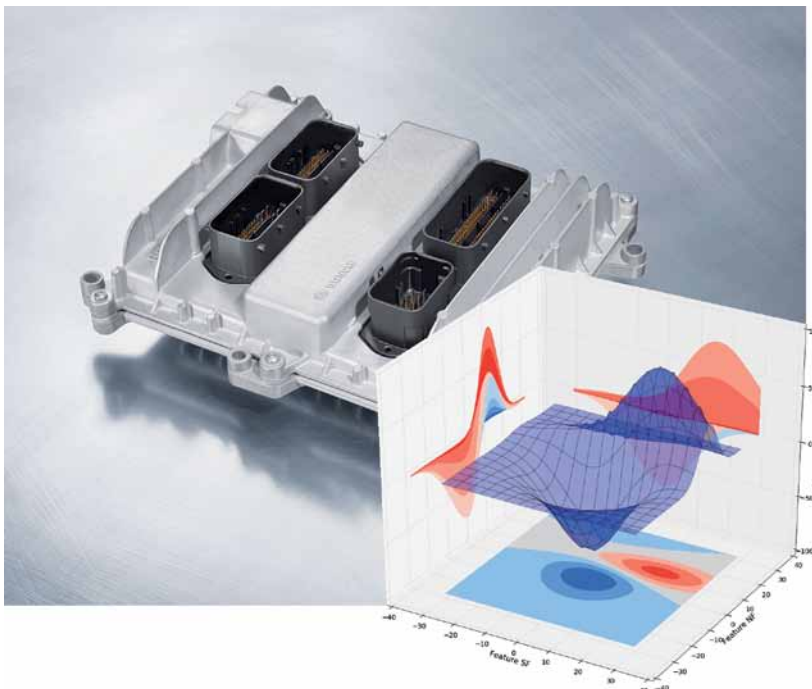bernhard.niedermayer@catalysts.cc
Further Project Partners
Zentralanstalt für Meterologie und Geodynamik (ZAMG)
Project Duration
2015 – 2016

Smart Software improves our Cars

The TU Wien researches feature interaction in state-of-the-art automotive systems. For less CO² emissions and more safety.

Automotive systems are safety-critical, and in most European countries it is socially unacceptable if they are not safe and do not have high reliability. Especially CO2 emissions are recognized as a major threat to the environment, to which automotive systems contribute considerably.

Meanwhile, automotive systems have become software-intensive systems. They are equipped with powerful control units, allowing them to provide increasing numbers of features, i.e., characteristics or stakeholder-visible units of behavior. This trend will continue in the foreseeable future, but such features are not independent from each other. This leads to feature interaction (FI), i.e., when the interplay of two or more features gives rise to an overall system behavior that is not easily deducible from the individual behaviors of the features involved, and often unexpected.

Undesired FI in automotive systems can be safety-critical. But FI can also be desired, where the cooperation of features can be optimized, e.g., to minimize (CO2) emissions. Technically, an objective function is being optimized (in this case minimized).

Improving feature interaction
The new research for this project includes
- defining and using new coupling metrics and feature clusters based on structural dependencies as new attempts to detect undesired FI already at design-time and with less effort than with model checking or testing, which will be better focused based on the new results; and
- research on novel machine learning and product line methods for optimizing system properties in cyber-physical systems for addressing the combinatorics of FI, which traditional optimization approaches cannot satisfactorily deal with.

In effect, the interplay of features in such software-intensive systems should be improved, which we expect to result in safer automotive systems, in spite of the ever increasing number of features with potentially more and more interaction.
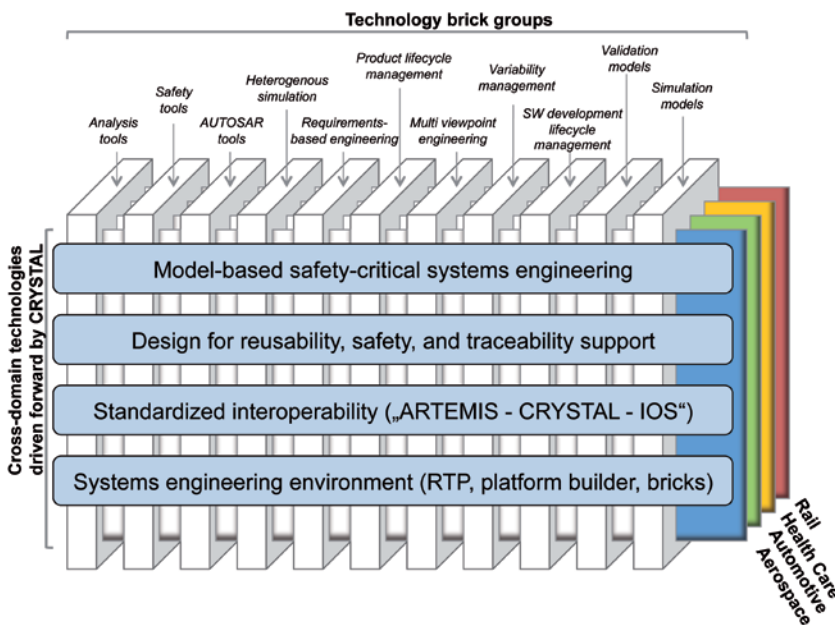
Better Together: Coordinated Collaboration for the Future

CRYSTAL enables seamless collaboration throughout the product life cycle towards a common target, via the standardized and open integration of engineering tools.

Openness as the key

The processes of developing, deploying, governing, operating and maintaining modern safety-critical embedded systems is highly complex and requires specialized tools supporting different activities throughout the entire product life cycle. Therefore, original equipment manufacturers (OEMs) and suppliers are typically operating a large set of tools from different vendors often complemented by custom in-house solutions. The overall process can only be effective and efficient if it supports collaboration among all stakeholders and consequently interoperability between the tools they are using. Considering the ongoing outsourcing and globalization activities, interoperability and openness is becoming even more crucial. In addition, the demand for supporting a large number of product variants further increases the complexity to be handled.

Today, tool integration is often done in an ad-hoc manner by creating proprietary bridges between each pair of tools. Such an approach does not scale, since the number of required bridges grows exponentially with the number of employed tools. Moreover, the resulting tool chain becomes extremely vulnerable to common changes like version upgrades from tool vendors, and the efforts for maintaining a large set of bridges is sooner or later not acceptable anymore. The main technical challenge in addressing this problem is the provision of open and common interoperability technologies supported by the different tools that generate and provide access to data covering the entire product lifecycle.

CRYSTAL establishes standards

The project CRYSTAL (CRitical sYSTem engineering AcceLeration) has identified this need and takes up the challenge to establish and push forward an Interoperability Specification (IOS) as an open European standard for the development of safety-critical embedded systems in the automotive, aerospace, rail and health care domain. This standard will allow loosely coupled tools to share and interlink their data based on standardized and open Web technologies that enable common interoperability among various life cycle domains. This reduces the complexity of the entire integration process significantly.

CRYSTAL is strongly industry-oriented and will provide ready-to-use integrated tool chains having a mature technology-readiness-level (up to TRL 7). In order to achieve this goal, CRYSTAL is driven by real-world industrial use cases from the automotive, aerospace, rail and health sector and builds on the results of successful predecessor projects like CESAR, SAFE, iFEST, MBAT on European and national level.

CRYSTAL reaches the critical Mass
Creating and establishing a new standard on a large scale in an already consolidated market cannot be achieved by small individual organizations. With a budget of more than 82 million Euro and 68 partners from 10 different European countries, CRYSTAL has the critical mass to accomplish this endeavor. The project consortium is made up of participants from all relevant stakeholders, including OEMs, suppliers, tool vendors and academia.

Throughout the entire project, CRYSTAL will stay in close exchange with standardization organizations like ASAM, ProSTEP iViP, OASIS, OMG, CENELEC and others in order to build up on existing achievements and to join forces through collaboration in the standardization process.

Objectives and market relevance
The aims of CRYSTAL are ambitious and the expected results will have significant economical and societal impacts.

OEMs will benefit from better supplier collaboration and reduced system design costs due to the improved and smart integration of system analysis, safety analysis, and system exploration tools. In addition, the CRYSTAL IOS will increase the flexibility for all stakeholders and has the potential to deeply impact the market on a global level. OEMs can easily combine tools from different vendors, and tool vendors will be able to find new market opportunities in an open and extensible environment.

Project Title
CRYSTAL - Critical System Engineering Acceleration
Programme
ECSEL (ARTEMIS)
Consortium Manager
AVL List GmbH
www.avl.com
Technical & Strategic Project Coordination
Dr. Christian El Salloum (christian.elsalloum@avl.com)
Administrative Project Coordination
Annemarie Hamedler (annemarie.hamedler@avl.com)
Further Austrian Project Partners
AIT Austrian Institute of Technology GmbH
Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH
Technische Universität Graz
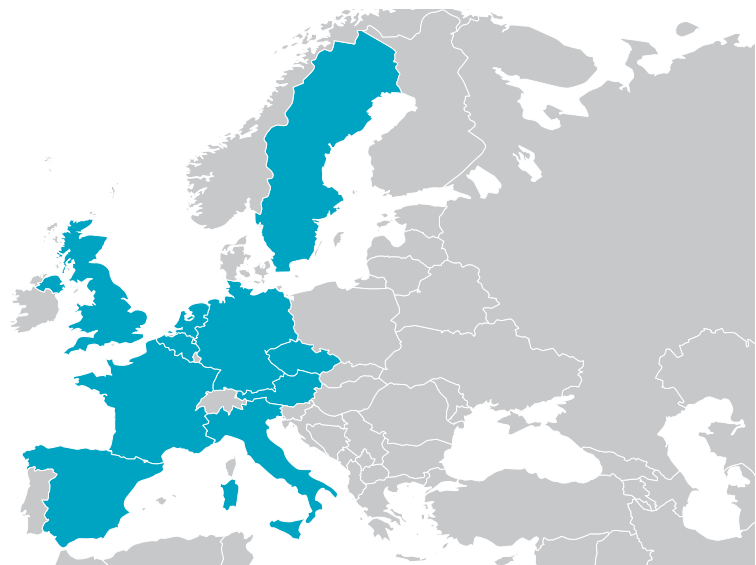Thales Austria GmbH
TTTech Computertechnik AG
Associated Countries
Austria, Belgium, Czech Republic, France, Germany, Italy,
The Netherlands, Spain, Sweden, United Kingdom
Project Duration
2013 – 2017

create

Localization
of UHF RFID-Tags

With billions of deployed units, Radio Frequency Identification (RFID) tags dominate the item identification market. A novel method now allows determining the position of these low priced tags as well.

Radio frequency identification is often seen as the successor of barcodes. RFID tags work without batteries, can store large amounts of data, are rewriteable, and need not be in line of sight of a reader to be detected. The dominating tags on the market, Electronic Product Code (EPC) tags, operate at 868/915 MHz and enable reading ranges of several meters.

While the focus of industrial processes was on identification a few years ago, the localization of a tag gains more and more importance nowadays. Applications include the detection of item order on a conveyor belt, the localization of hand tools, or the determination of a tag's movement direction.

Existing localization techniques are too inaccurate
The project REFlex investigates a new approach of measuring the distance between RFID reader and tag. The method is applicable to existing tags and circumvents accuracy limitations of existing systems by using time-of-flight based measurements. The ranging is implemented by superimposing an extremely low power broadband spread-spectrum signal onto the reader's interrogation signal. This ensures that neither the RFID communication is influenced nor radio standards are violated. The ranging method then separates the echo of the RFID tag from all other echoes of the environment by a novel algorithm, allowing for a direct measurement of the reader to tag distance. REFlex's consortium investigates the applied methods with respect to their physical limits, required calibration techniques, and performance increase by using multiple antennas.

The research on distance measurement is complemented by investigating and modeling industrial processes which use RFID localization. This allows to determine accuracy requirements for the localization algorithms as well as to establish a feedback from industry to research.

To pave the way for a successful industrial deployment of the localization technique, the consortium is also active in standardization bodies in parallel to research activities. Furthermore, the team of REFlex studies social and ethical aspects of possible consequences of the ranging technology, like indirect tracking of individuals, to achieve "responsible innovation".

Project Title
REFlex - RFID Real-Time Localization
for Flexible Production Environments
Programme
ICT of the Future
Application Area
ICT-supported Manufacturing Systems
Topic Area
Ensuring Interoperability: Interfaces of Systems
Konsortialführer
Technische Universität Wien, Institute of Electro-
dynamics, Microwave and Circuit Engineering
www.emce.tuwien.ac.at/mw
Consortium Manager
Ass.Prof. Dipl.-Ing. Dr. Holger Arthaber
holger.arthaber@tuwien.ac.at
Further Project Partners
TU Graz, Institut für Signalverarbeitung und
Sprachkommunikation
Universität Wien, Institut für Wissenschafts- und
Technikforschung
NXP Semiconductors Austria GmbH
Enso Detego GmbH
CISC Semiconductor GmbH
Project Duration
2014 – 2017

Simple and Versatile:
the new Robotic Co-Worker

This new generation of robots assists with assembly and inspection, carrying out new tasks with ease.

Usually one would expect a robot to carry out its programmed tasks in a reliable, albeit quite rigid way. As soon as the nature of the task changes, an elaborate reprogramming process has to be performed, conflicting with the goal of a flexible production. PROFACTOR develops systems that are easily – that is, by the operators themselves - configurable for a multitude of different tasks.

Two robotic use cases

1. The robot assists manually, for example with a screwing task. The robot functions as a „third hand" by securing the component, such that a worker can perform the required task (tightening the screw) with just one hand. No precise positioning of the component on the workbench is required. The system is equipped with 3D-scanners and object recognition software developed by PROFACTOR. Additionally, it supports gesture recognition by utilizing a "Leap-Motion" sensor. The worker is able to indicate the start of a new task with a simple finger movement.

2. The robot is responsible for inspection tasks. In this use-case the robot assists during the final inspection of electric scooters prior to their delivery. Completeness as well as fitting of components like brake levers is examined. Furthermore, Stickers and labels are inspected by utilizing PROFACTOR's long-standing experience in 2D and 3D-quality control.

The robot combines the inspection of the individual scooters with the scan of their respective serial numbers. In the case of subsequent complaints, this allows proving the proper configuration of the workpiece at the time of inspection.

And again: even a non-expert is able to independently adapt and configure the „inspection-recipe" for other models or tasks. This is an important step towards flexible production. The project supports the "ICT of the Future" programme with the development of ICT-supported production systems. The collaboration with "GW St.Pölten Integrative Betriebe GmbH" (one of the biggest inclusive workshops in Austria) also shows how these cooperative robotic designs allow for a simple upgrade of existing industrial work places.

Sensitive Machines cooperate with Plant Personnel

Attention-aware Machines adapt to the human's performance and constitute the production systems of the future.

Future ICT-based manufacturing systems aim at a radical individualization of products (Lot-size 1) under the pre-condition of highly flexible mass production environments.

A key challenge towards such systems is the implementation of confluent collaborative cooperation between humans and machines. The Attentive Machines project aims at attention-aware self-adaptive machines pacing the interaction with human workers based on observed user attention and task performance and up-to-the minute adaption of the level of assistive support provided to human workers during the manufacturing, semi-manual assembly process.

This project will realize attentive machines based on (i) formal models of human attention, (ii) multisensory recognition architectures based on machine learning and pattern recognition approaches and (iii) realization of embedded subtle assistive support mechanisms in real-world production systems.

Perfect collaboration between man and machine
The developed system will be empirically evaluated in the scope of two cases of Austrian manufacturing excellence to significantly improve product quality assurance (Fischer Sports GmbH) and to significantly advance worker safety in heavy duty metallic manufacturing processes (Aumayr GmbH).

Based on the fusion of multi-sensor data (eye tracking, behavior analysis via motion tracking, capturing of somatic and psycho-physiologic attention indicators), activity, cognitive workload as well as orientation and quality of attention are supposed to be detected and modeled to provide suitable assistance feedback (visual, acoustic, haptic) to support the correct execution of the respective collaborative task.

The explicit goal of this project is not to replace workers via extended automation of production systems, but to optimize the collaborative cooperation between humans and machines via an encompassing automatic perception of the human being, its intentions and attention distributions.
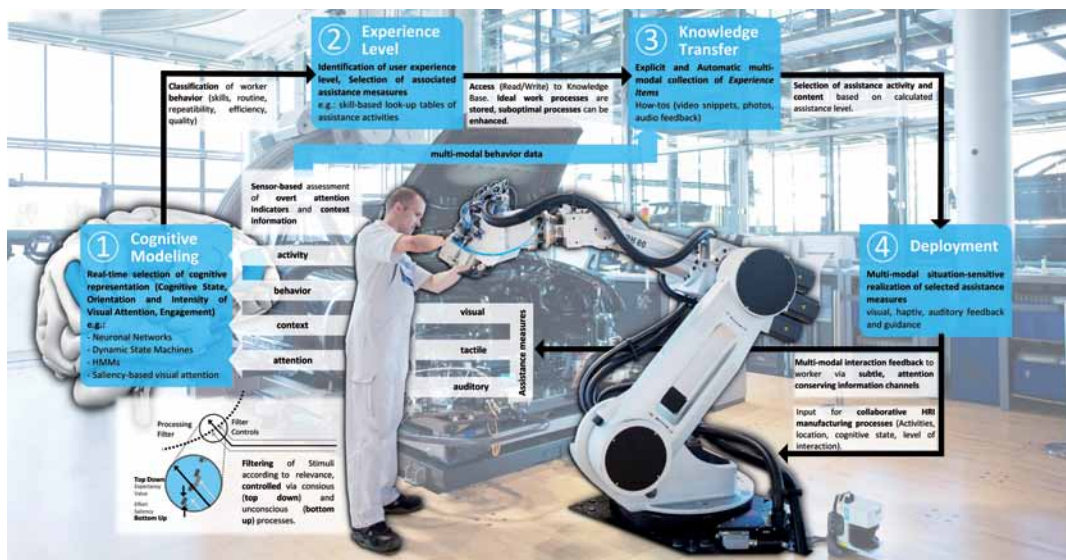
Project Title
AttentiveMachines - Man and Machines in ICT based Production Systems of the Future
Programme
ICT of the Future
Application Area
ICT-supported Manufacturing Systems
Topic Area
Mastering Complex ICT Solutions: Systems of Systems
Consortium Manager
Institut für Pervasive Computing, JKU Linz
www.pervasive.jku.at
Project Coordinator
Univ.-Prof. Mag. Dr. Alois Ferscha
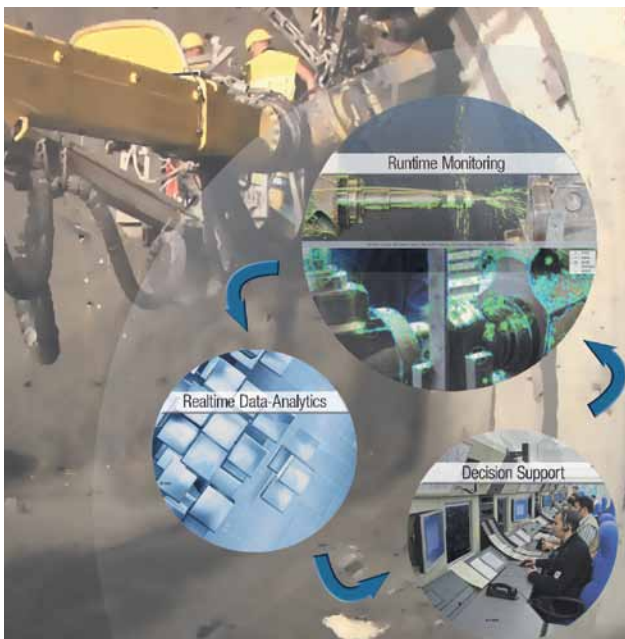alois.ferscha@jku.at
Further Project Partners
Research Studios Austria FG, PCA
Fischer Sports GmbH
Aumayr GmbH
Project Duration
2015 – 2017

The Contact-free Informant

Optimizing heavy machines' performance is demanded by the industry. In addition to this, an innovative sensor system controls the production process.

Heavy machinery, such as rig equipment, cranes, heavy-duty vehicles and cut-off and grinding machines are in use around the world in diverse industries. Therefore operational as well as maintenance costs play substantial roles. Hence the maximization of operational performance and efficiency are inevitable.

Heavy machinery of any type is typically equipped with a large number of sensors for surveillance, machinery control, or sub-component control purposes. However, there is a lack of sensors for monitoring machine efficiency and performance. Moreover, an integration of additional sensors and measurement technologies is difficult or even impossible in most cases due to technical, economical, or even legal issues.

Contact-less sensor system captures performance indicators
In order to avoid these problems, TDE GmbH, a company in the field of rig monitoring, is - in collaboration with JOANNEUM Research – developing a non-invasive measurement system, consisting of optical sensors, acoustic sensors, thermal sensors, and current/voltage sensors, as well as appropriate analysis and evaluation algorithms for determining relevant machinery "Key Performance Indicators" (KPIs).

The non-invasive character as well as the compact and autonomous design of the measurement system thereby allows for the acquisition of time synchronized data streams of heavy machinery, as well as for the direct efficiency and performance analysis.

In terms of machine state detection, novel and innovative machine learning and pattern recognition methods and algorithms are developed and applied, allowing for an automatic determination of the relevant machinery KPIs. The core innovations of the "MAHMAMT" project are given by the fusion of different measurement modalities. Especially the fusion and combination of modality specific properties and features, e.g. audio frequencies, image based features, or power consumption tolerances, will be utilized for detection of different machine states.

The tracked and monitored KPIs are finally presented to a corresponding operator through a customized graphical user interface. In this way essential information on the current status of the machine, as well as assistance for decision making in terms of machine efficiency and production process control are provided.

Project Title
MAHMAMT - Monitoring and Analysis of Heavy Machinery using non-intrusive Measurement Techniques
Programme
ICT of the Future
Application Area
ICT-supported Manufacturing Systems
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
TDE Thonhauser Data Engineering GmbH
www.tde-group.com
Project Coordinator
Dr. Gerhard Thonhauser
gerhard.thonhauser@tde-group.com
Further Project Partners
JOANNEUM Research
Forschungsgesellschaft mbH
Project Duration
2014 – 2017

Self-learning Software for Mechanical Engineering

Self-learning software aims to shorten the manufacturing time on mechanical engineering and creates cost advantages for customers.

Engineering   Assembly   Machine setup

The project for developing a software called SIAM (Seamless Interoperability of Assistive Modules in the Digital Factory) is conducted by Anger Machining GmbH, together with the University of Applied Sciences Wels and the research institutes Profactor & RISC. The software will eventually be integrated into ANGERs IT landscape and will support every process step in mechanical engineering, starting with the engineering up to the assembly and the calibration process.

Engineering: The software supports the mechanical engineer by specifying how accurately / precisely the machine has to be designed for the specific workpiece. For this, information from the workpiece drawing, machine accuracies and data from the machine capability study of past projects are analyzed. The machine will be designed only as accurately as necessary, thus production costs can be lowered already during the engineering phase.

Assembly: During the machine assembly the software records, for example, all work steps via a camera. Also, the assembler can use the software to add installation instructions. With this kind of documentation future assemblers will gain valuable knowledge from their predecessors. Data glasses or tablet PCs could further speed up the installation process in the future.

Machine setup: For calibration the software uses a kinematic model of the machine. The commissioning engineer will receive instructions where to do fine adjustments (in the NC program or directly on the spindle). Thus, efficiency will be increased and setup lead time will be shortened.

An intelligent assistance module
A fundamental difference to other assistance models is the fact that it does not involve passive tools, but it provides certain intelligence. Through this - continuously learning - information tool the process complexity will be reduced and the manageability of this elaborate technology will be made controllable.

Efficient Safety Planning

Planning safety-critical infrastructure error-free is a complex challenge. A new tool makes this possible – tested in the railway domain.

Planning large infrastructure systems and their development processes is a complex task. This is especially true for systems that must comply with strict safety regulations, such as for example railway safety systems. The problem of planning and monitoring such processes is addressed by the project SHAPE (Safety-critical Human- and dAta-centric Process management in Engineering projects) - a collaboration between the Vienna University of Economics and Business, and Siemens AG Österreich.

Who is the employee best suited to solve a specific task? When will the required test laboratory space be available? Have all the safety-critical requirements been met? Taking into consideration all these aspects and coordinating the individual steps manually is a challenging endeavor. A new planning and monitoring tool developed within this project should provide valuable future support.

Good documentation decreases sources of error
The developed solution shall enable the automatic execution of the development processes for large projects as well as the formalization and automated verification of compliance with business rules and regulations. The better the utilized data and tools are documented, the more efficient planning is possible, minimizing overall risks for the successful execution of infrastructure projects.

Methods belonging to the fields of process management, semantic technologies and constraint-based, automatic configuration are combined in the project. A novelty of the system is that it shall consider both structured (e.g., spreadsheet files with the required information) and unstructured data (e.g., normative documents in natural language). Unstructured data is analyzed, transformed and integrated into a semantic model. As a consequence, this shall enable the transfer of experiences from one development project to similar follow-up projects. Moreover, the users of the system can derive the optimal order in which certain process steps should be executed.

The main focus of the resulting system is to simplify the work of the involved project personnel by seamlessly integrating with existing tools and not interrupting standard workflows. The result is a simplified development process which allows for a more efficient resource-utilization whilst simultaneously guaranteeing a high level of service.

Securing Memory in Manufacturing Systems

Valuable production data is often not adequately protected. An intelligent firmware protection mechanism is developed to prevent manipulations.

Program code and configuration data are significant assets in modern ICT-based manufacturing systems. The effort for the development of firmware/software is often in the range of dozens of person years. Also stored and processed configuration and production data are typically trade secrets and a loss would lead to a significant commercial impact. Although the value of the assets is high, the protection of both data and code in today's manufacturing systems is often very limited.

The situation in the area of monitoring and controlling of supply infrastructures (e.g., water, gas, district heating) is similar. The secure interconnection of distributed ICT-based measurement and control systems is essential to ensure the undisturbed operation of these public supply grids.

Secure data is a valuable asset
MEMSEC addresses this pressing security problem. The focus is on the protection of software and data in memory against local attackers. Furthermore, strong authentication mechanisms and secure communication between systems and service personnel are considered.

The use cases considered in MEMSEC are automotive test systems, which are a typical example of an ICT-based manufacturing system. Like in many systems, the existing software has mostly been written without considering security. The goal of MEMSEC is to research a hardware memory security unit which enables reuse of existing software. This unit can be integrated between the CPU and the memory of the system and serves as security anchor of the system. The following security features are targeted:

- Transparent protection of code and data using low-latency hardware encryption
- Strong external authentication and isolation mechanisms for privileged and non-privileged code and data
- Securing the communication link

The novel approach of such a unit combines properties of an encryption engine, of a trusted platform module (TPM), and of a memory management unit (MMU). Goal of the research project is to determine the full potential of this combination. Finally, the unit will be integrated into a prototype.

Energy as an Important Production Factor

Consideration of energy demand and energy costs in the planning phase of production enables optimized resource and cost management.

Growing product variety and shortened product lifecycles require a new dimension of flexibility and adaptability in modern production facilities, while the cost pressure continuously increases. To face these challenges successfully, unutilized optimization potential has to be identified and transformed to competitive advantages. Resources like personnel, material, and machine availability or adherence to delivery dates are considered as restrictive factors in the production planning process for quite a long time now, whereas the resource "Energy" is mostly neglected. Several studies estimate the energy cost reduction potential in the producing industry to 20-30%.

Energy costs are a production resource

Hence, the research project PLAN-E focused on the integration of energy demand and energy costs into the production planning and control process. In the course of the project, a number of concepts were developed to implement energy management functionalities into the Manufacturing Execution System (MES) cronetwork of the project partner Industrie Informatik GmbH. Amongst other concepts a newly developed energy demand function enables the MES platform to include energy demand and energy costs of machines and production lines as planning parameters in the detailed planning process. Furthermore, the acquisition of actual energy consumption data can be automatically performed by Machine Data Collection (MDC). Another innovation is the possibility to define energy pools similar to other resource pools in cronetwork. Thus, energy generated at a production site (e.g. wind or photovoltaic based energy generation) can be considered separately from the externally supplied energy. It is also possible to arrange machines or machine groups in energy consumption pools. The established key performance indicators (KPIs) allow quantitative analysis of energy consumption and energy costs.

The automatic actual energy data acquisition via MDC, the visualization of energy pools in a so-called planning table and the evaluation of energy related KPIs are already available in cronetwork, the implementation of further functions is planned. The integrated energy management in cronetwork enables production facilities to take control of their production energy consumption and costs. A new dimension "energy" is added to the optimization intentions in the planning process and raises the planning quality to the next level. At the end of the day, energy consumption and energy cost savings not only benefit the production company but also help to protect the environment.

Boosting Energy Efficiency through New Power Electronics

The common goal of the 31 partners in this European project is to boost the next generation of energy-efficient chips.

The main goal of the project „Enhanced Power Pilot Line" (EPPL) is to enhance the leading position of power semiconductors "Made in Europe" and its forward-looking manufacturing methods. Europe is a worldwide leader in the field of power electronics. Nowhere else worldwide power electronics chips based on silicon wafers are manufactured using 300-millimeter diameter wafer technology which in addition are thinner as a sheet of paper. This lead can be strengthened with substantial effort and expense in research and development. With EPPL, Europe intends to further expand this advantage while paving the way for further high-technology product innovations.

The EPPL partners stem from six European countries: Germany, France, Italy, the Netherlands, Austria and Portugal. The project is led by Infineon Technologies Austria AG.

Manufacturing industry in Europe
Main focus of the EPPL project is to boost Advanced Manufacturing Systems in the European semiconductor industry. In particular the segment of power semiconductors technologies will be addressed, which plays a key role in solving the grand societal challenges related to energy efficiency and mobility. The expected innovations address technical challenges in the 300-millimeter manufacturing technologies as well as basic research and development for establishing the next generation power semiconductors based on 300-millimeter wafers and setting up the latest technologies as a pilot line. The EPPL consortium brings together leading institutions from science and industry representing the entire value chain of 300-millimeter power semiconductor - from manufacturing to applications. The work includes the silicon material research, the semiconductor development involving 3D-integration technologies and the further development of logistics and automation technologies.

Power semiconductors for cars and solar power
Due to the occurring high voltages and currents, power semiconductors are required for example in cars, photovoltaic systems, LED lighting or medical equipment. The project EPPL will demonstrate the market readiness of 300-millimeter-wafer technologies enabling manufacturing excellence and cost competitiveness.

The Consortium will thus develop new silicon dopings, transfer the novel process technologies to other semiconductor segments, further automate the production energy-efficiently, but also refine the associated transistor manufacturing methods for implementation into practical applications. Overall the project EPPL will not only innovate technology but also boost the commercial competitiveness of energy efficient applications. . Until September 2016, first pilot lines and demonstrator applications will emerge and pave the way for a variety of product innovations. The following applications are in the focus of EPPL:

• Domain renewable solar: improve the whole PV - inverter system.
• Domain automotive: generate a body control module which increases the overall use of power semiconductors and new solutions for LED lighting.
• Domain healthcare: deliver smarter and more powerful medical diagnostic appliances.

Impact on grand societal challenges
Electronic components are a key enabler for smart systems to master the grand societal challenges. Innovative technologies and smart manufacturing act as the source for innovation in many fields of our daily life. Innovative cars, smart production equipment, efficient use of energy, assisted living, and modern communication, just to name a few, are enabled by power electronic components.

EPPL will contribute significantly to this technological progress by providing enhanced pan-European collaboration, securing and creating highly skilled jobs and providing relevant contributions for the "Europe 2020" initiative. The semiconductor industry, the related manufacturing science, the automotive industry and industrial electronic industry of Europe will benefit greatly from the Intellectual Property generated. In its „Europe 2020" initiative, the European Commission has set ambitious targets for the reduction of greenhouse gas emissions, energy efficiency and towards electro-mobility. In achieving these goals, power semiconductors designed and manufactured in sufficient quantities and at competitive cost in Europe, will be key enablers. The project EPPL will contribute significantly to these goals and strengthen Europe´s expertise in a long term.

Project Title
EPPL - Enhanced Power Pilot Line
www.eppl-project.eu
Programme
ECSEL (ENIAC)
Consortium Manager
Infineon Technologies Austria AG
www.infineon.com
Project Coordinator
Johann Massoner
johann.massoner@infineon.com
Project Manager
Dr. Cristina De Luca
**Further Austrian Project Partners**
ams AG
CEST Kompetenzzentrum für elektrochemische Oberflächentechnologie GmbH
CTR Carinthian Tech Research AG
EV Group E. Thallner GmbH
Fronius International GmbH
KAI Kompetenzzentrum Automobil- und Industrieelektronik GmbH
Montanuniversität Leoben
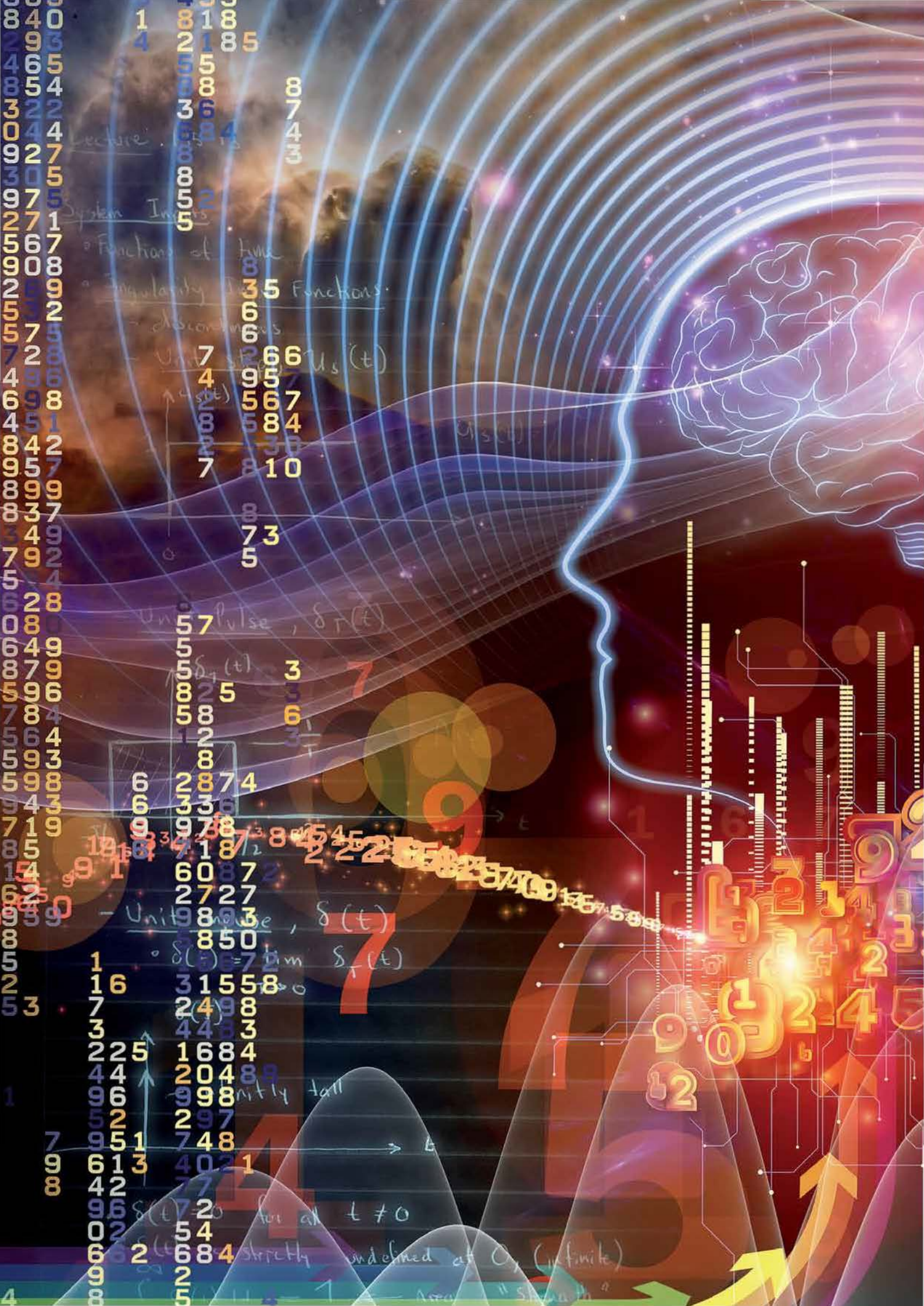Plansee SE
Technische Universität Graz
Associated Countries
Austria, France, Germany, Italy, The Netherlands, Portugal
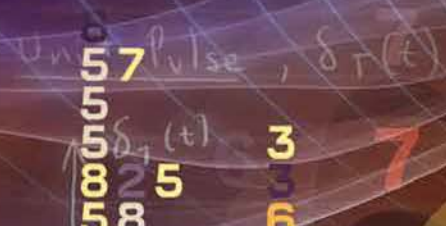**Project Duration**
2013 – 2016
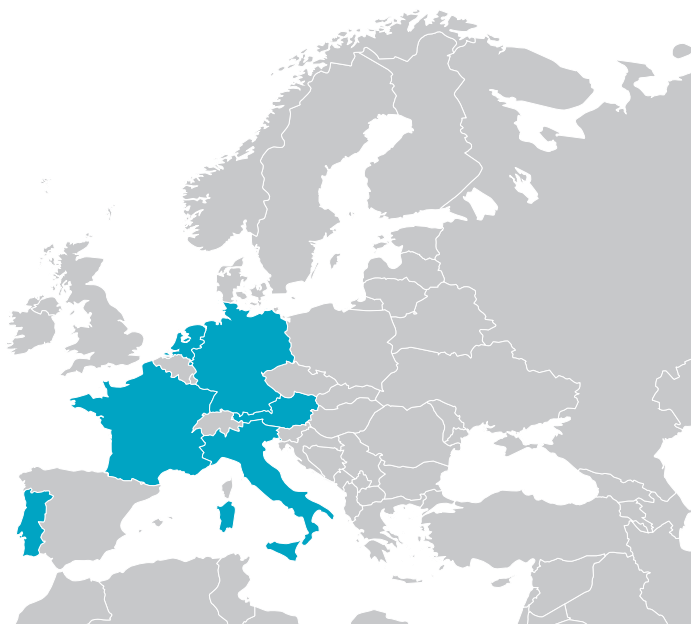
live

The Virtual Dressing Room

IBROC merges the real and the virtual world. For the first time it is possible to simulate the correct fit of clothes when shopping online. An important step – not only for fashion marketing.

Online retailers have already tried different methods for virtual try-on. However, all of them require 3D models of the clothes or a specialized studio photography process to work. Both requirements are labor intensive and therefore prohibitively expensive in the fast moving fashion industry. Fashion photos from social networks or photographed by the users can not be used for try-on, either.

Virtual try-on also from blemished originals
IBROC is a new intelligent system that enables users to try on clothes from just an image. Fashion photos as they are common in catalogs, webshops or social networks can be used. Such photos can either show a model wearing the piece, the piece draped on a mannequin or hanging on a hanger. Such photos are subject to a number of defects including occlusions (e.g. hands cover parts of the piece), unrealistic deformations (e.g. the garment lies on the floor and looks flat) and weak lighting situations.

IBROC uses visual computing methods to solve these problems. To extract 3D information from a set of fashion photographs, a template (shape prior) is needed. In this project, a template database of fashion images with associated 3D models will be created. Based on that database, our matching and machine learning methods compute a new 3D model for a desired piece of clothing. Occluded regions can be filled automatically by texture synthesis and projection of multiple fashion images. The resulting models can be used to simulate how a user would look when wearing the clothes.

The proposed method does not need manual 3D modeling or specialized photography methods. Therefore, it is particularly scalable and can be deployed as a mobile app or website right away. Such an application would collect an extensive data collection of fashion preferences linked with social network accounts. The data collection enables a new form of native advertising. Clothes can be advertised with the user as the model. Personalized ads can adapt to the user's taste and wardrobe and only propose relevant items.

Project Title
IBROC - 3D Image-Based Rendering
of Clothes from Photographs
Programme
ICT of the Future
Application Area
Open Application Area
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
Prof. Dieter Schmalstieg, TU Graz
www.icg.tugraz.at
Project Coordinator
Dr. Stefan Hauswiesner
www.reactivereality.com
Further Project Partners
–
Project Duration
2015 – 2018

Smart Grids become sustainable

Integrating the growing amount of renewable energy into the electrical grid requires an open and interoperable solution like OpenNES.

Source: Fronius International GmbH

The massive deployment of distributed generators from renewable sources in recent years has led to a fundamental paradigm change in terms of planning and operation of the electric power system. Smart Grids are one of the most promising solutions to use the existing grid infrastructure in a more efficient way, thus allowing higher penetration levels of renewables.

To leverage the benefits of such intelligent power grids, it will be necessary to develop new information and communication solutions, automation architectures and control strategies. However, a common and formal modelling concept for energy applications used in Smart Grids and distributed energy resources is still missing. Moreover, the scalability and openness of today's utility automation systems needs to be improved due to the lack of common and open interfaces, as well as the usage of a multitude of different protocols.

ICT solutions for integrating renewable energy sources
OpenNES addresses these shortcomings through the development of an open and interoperable information and automation solution for the integration of distributed energy resources in the Smart Grid context. The OpenNES approach therefore comprises remote programmable device functions, an appropriate modelling method for distributed energy resources, and a generic and open communication infrastructure. One important result of the OpenNES project is the validation of the overall approach in the partners' laboratory environments. With this proof-of-concept, an evaluation of the OpenNES approach can be performed, and the main benefits of this highly innovative approach can be shown.

The OpenNES demonstrator will make a flexible and adaptable automation system available that is able to fulfil future requirements of the Smart Grid.

Project Title
OpenNES - Open and Interoperable
ICT Solution for Integration of ReNewablES
Programme
ICT of the Future
Application Area
ICT for Energy Efficiency, Intelligent Energy
Networks and Systems
Topic Area
Mastering Complex ICT Solutions:
Systems of Systems
Consortium Manager
AIT Austrian Institute of Technology GmbH
www.ait.ac.at
Project Coordinator
Thomas Strasser
thomas.strasser@ait.ac.at
Further Project Partners
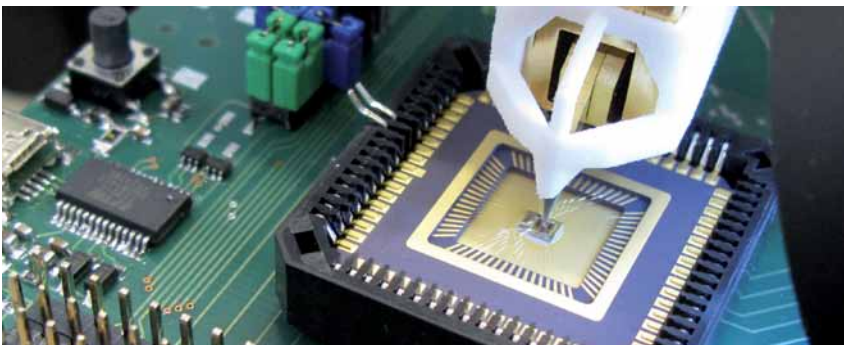Fronius International GmbH
Fachhochschule Salzburg GmbH
Project Duration
2014 – 2017

High Security for the Smallest

Millions of tiny microchips are used in door openers, ticketing and payment systems. A new approach allows to significantly increase the security of these chips, without substantially changing the cost of manufacturing.

Currently there are hundreds of millions of low cost contactless devices out in the field, for ticketing or micro-payment applications, having been sold under the assumption that they would help to protect assets like access to public transport or mass rallies, cars or payment credentials. Weaknesses in those systems suffering from pricing pressure had been assumed a while ago, but it was only in 2008 when two prominent and widely spread systems got broken. Successful attacks on proprietary protocols are ongoing, as shown in recent publications on digital locking systems. Besides reverse engineering, attackers are making use of the well-known methods Side Channel Analysis (SCA) and Fault Attacks (FA).

On the other hand high security products with certification levels EAL5+ and even higher have been developed for government ID and banking applications; the ever increasing complexity of countermeasures employed in these products - like encrypted calculation and dual-CPU architectures for data integrity checking at runtime – is bringing them price-wise out of reach for the low cost application areas with their need for cost-efficient security.

Recently upcoming research on leakage-resilient protocols started to justify hope that the gap between ever-rising security requirements and the costs for countermeasures may for the first time after a long period get smaller, thus enabling use of extremely optimized countermeasures against wide spread attacks, even in low-cost applications. This is where the SCALAS project comes in: it will bring together first class researchers from academia and industry to fit the missing mosaic stones to the so far incomplete puzzle picture of low-cost security systems.

Low-cost security for microchips
The goals of the SCALAS project are to improve analysis techniques and measurement setups to an extent that - together with theoretical research - the quantization of secrecy leakage for any individual attack trial may be characterized.

It further aims to research optimized low-cost SCA countermeasures, based on accurate knowledge of secrecy leakage each time a protocol is performed, and design them explicitly with a focus on small critical portions of the newly improved protocols. Finally, new leakage-resilient protocols and new protection mechanisms for key derivation functions as well as dedicated control-flow protection mechanisms supported by corresponding tools are proposed. Since stronger SCA-countermeasures always focus attacks to the "source of secrecy", an additional goal is to provide novel least-cost high quality True Random Number Generator (TRNG) concepts for key generation and other security mechanisms.

Simulated Traffic
with real Implications

Simulated vehicles improve real traffic's safety.
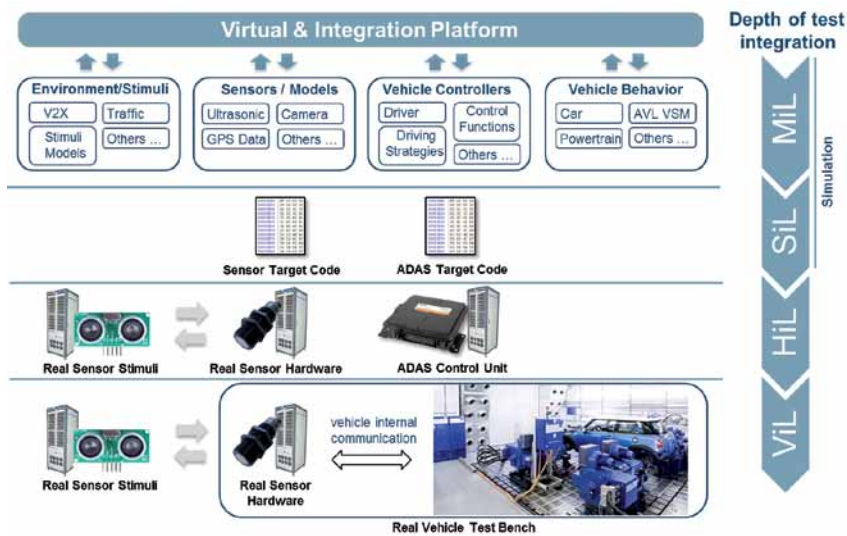
Advanced Driver Assistance functionalities (ADAS) are an increasingly important selling point for vehicles as they improve both safety & convenience when driving in traffic. Besides data from vehicle sensors like radar and camera, information received from the infrastructure will become very important in the future.

For safety reasons ADAS functionalities should not be initially tested and optimized on public roads. An additional reason for usage of simulation technology is the reproducibility of the tested scenarios.
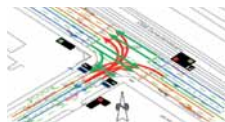
Simulating driver assistance functions
TASTE will show how ADAS functionalities can be developed and optimized using an integrated development environment before they are tested at the test-bed and validated on the road. In this project a CACC-function (Cooperative Adaptive Cruise Control) in combination with a TLA (Traffic Light Assist) will be implemented in a test vehicle. The velocity of the vehicle will be optimized utilizing information from the infrastructure. The result will be reduced energy consumption and in some cases also reduced travel times. Additionally, the integrated simulation environment will enable evaluation of feedback to the overall traffic.

The particular challenge in this project is to combine development- and test-tools from different domains (V2X and ADAS) into an integrated environment, incorporating the results of the individual development teams. Ideally, the simulation and test-bench environments should only differ in the components used (i.e. replace vehicle model by the real vehicle). This requires, besides good tools for co-simulation, a considerate choice of the interfaces between the components (design for testing).

TASTE interconnects Information Technology (simulation and vehicle electronics) with communication-technologies (V2X communicating in real time traffic light signal phase and timing). This enables the implementation and validation of ADAS functionality in simulation as well as in reality.

Sharpening Diagnostic Skills

In many areas of the world dermatologists are not the primary medical contact for patients with skin diseases. A medical decision support system can assist non-specialized physicians in diagnosing dermatologic conditions and can serve as a training platform.
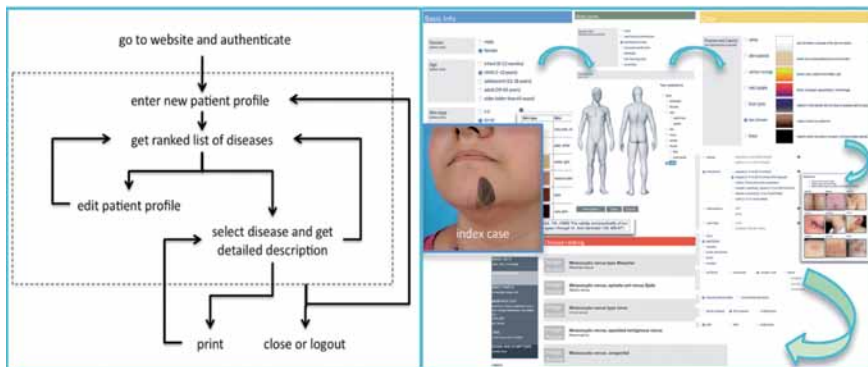
The increasing incidence of skin diseases, most prominently skin cancer, poses a significant burden on patients and on the public health system, underscoring the need for early recognition and treatment. In many areas of the world dermatology specialists are rare, and general practitioners, i.e. non-specialists, are responsible for diagnosing skin diseases. Moreover, within Europe, training programs for dermatologists vary substantially between countries. Dermtrainer was developed as a computer-assisted medical expert system for the diagnosis of skin diseases. The aim of this project is to develop a prototype to improve the diagnostic accuracy of general practitioners in daily clinic and to provide a training platform for dermatologists in training. Currently existing diagnostic decision support tools for dermatology amount to simple data retrieval without a reasoning component, frequently yield poor results, and lack scientific validation.

A diagnostic system with an international knowledge base

The key components of Dermtrainer are a comprehensive dermatological knowledge base, a clinical algorithm for diagnosing skin diseases, and a reasoning component based on recent advances in computational logic. Innovative aspects are the underlying clinical algorithm as well as the stepwise process that was applied to validate the expert system. First, we performed user tests with trained dermatologists. In the second stage dermatologists in training validated Dermtrainer using virtual patients. The final and most critical stage in regard to future marketing options was a clinical validation study with physicians from various disciplines that was performed at the Mount Sinai Hospital, New York.

Overall, Dermtrainer retrieved the correct diagnosis out of a database containing over 600 diagnoses in 94% of the cases among the displayed diseases, either as primary diagnosis or as one of six differential diagnoses. The results from these studies that were performed at a national and an international academic institution confirmed the concept of Dermtrainer that is based on a clinical expert algorithm, and lay the foundations for a stable product that we expect to become a widely accepted tool that will help to retrieve dermatologic knowledge and to assign clinical signs to specific skin diseases.

Contactless Ear Canal Measurement

Measuring the ear canal is the first step in all audiological applications. A new, non-contact, optical 3D measuring system is set to revolutionise this process.

Hearing aids and sophisticated ear protectors are always adapted to fit the ear for which they are intended. This requires the hearing aid audiologist to first take a mechanical impression of the ear canal using a modelling mass which is injected into the external auditory canal. A new non-contact, optical measuring system is set to revolutionise this unpleasant and laborious procedure by providing a complete 3D model of the ear canal and outer ear.

The Digital Safety & Security Department at the AIT Austrian Institute of Technology has been researching innovative optical 3D measurement systems for many years. Precisely measuring objects in 3D is a prerequisite for many technical applications, for example in the industrial sector. The optical sensors and algorithms developed by AIT allow objects of all sizes to be measured with great precision, down to the micrometre level. The real-time measurement systems enable complex manufacturing techniques to be automated, and assist in realising customised and more flexible production concepts.

3D-model replaces imprint
As part of the 3D-EarScan project, run in cooperation with the hearing aid acoustics company Neuroth, the experts at AIT are researching into computer vision based strategies and methods for quick, precise and contactless 3D measurement and 3D surface reconstruction of very small openings and canals. The results of this research are needed to develop a new, reliable and real-time 3D measuring system, particularly for taking 3D measurements of human ear canals. In the course of the project the designs and methods will be demonstrated and evaluated within a laboratory set up.
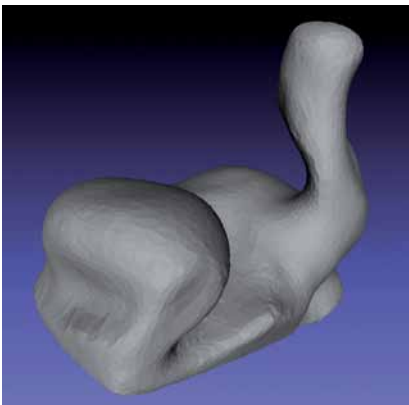
For application within the ear canal the measuring system needs to be strongly miniaturised and adapted to suit the special conditions in the ear. The manually operated system may not be larger than 3mm in diameter, enabling it to be inserted almost as far as the eardrum. The measuring system must record the whole length of the ear canal. The measurement involves slowly inserting the system into the ear where it scans the entire surface of the ear canal. The 3D data is used to create a complete 3D model of the ear in real-time.

Project Title
3D-EarScan - Video based 3D scanning and reconstruction of the human ear canal
Programme
ICT of the Future
Application Area
Open Application Area
Topic Area
Conquering Data: Intelligent Systems
Consortium Manager
AIT Austrian Institute of Technology GmbH
www.ait.ac.at
Project Coordinator
Christoph Nowak
christoph.nowak@ait.ac.at
Further Project Partners
Neuroth Medical Division GmbH
Schindler Endoskopie Technologie GmbH
(associated partner)
Project Duration
2014 – 2016

Age Appropriate Living – Hands-On

Innovative – individual – practical: a large-scale test region pioneering in novel combinations of technologies and services in the living-environment of older people.

The aim of the AAL Testregion West (West-AAL) is to support elderly people with modern technologies in their independent and secure living in their familiar environment. Innovative and affordable combinations of services and technologies aim to illustrate new ways in the field of Active and Assisted Living (AAL). The core added values are the introduction of AAL-technologies and services that already exist in the market as well as those that have been newly developed within research and development projects. Above that, technologies which are already established in the market (e.g. Smart-Home-solutions) are put into a new context, as West-AAL aims to transfer them into the field of AAL. The innovative value of this approach manifests itself in the intelligent combination of Smart-Home-Systems with AAL-technologies.

Multi-dimensional solutions in 74 test-households
The individual AAL-solution packages are tested in a total of 74 test-households, which are distributed over 6 different social institutions of Tyrol and Vorarlberg. This allows a distinction of different geographical and organizational settings. Overall, the 12 consortium-partners realize a multidimensional approach to the topic AAL in practice: They represent assisted living homes, private households, solution- and technology-providers, as well as research institutions. The identified solutions aim to represent the different end-user-needs as well as to incorporate the important technological, economical and ethical aspects. West-AAL also maintains demo-flats, showcasing AAL-solutions to a broad audience and different target-groups. In these flats solutions are installed, which are also tested in several test-households.

Altogether, the characteristics of West-AAL are versatile: The project is designed to meet the individual needs of the test-persons and the organizational requests of the care institutions. At the same time, the effects on the entire value chain and interest groups are incorporated in the evaluation.

Project Title
West-AAL - AAL Testregion West
www.west-aal.at
Programme
benefit
Consortium Manager
Universität Innsbruck
www.uibk.ac.at/smt
Project Coordinator
Mag. Nesrin Ates
nesrin.ates@uibk.ac.at
Further Project Partners
AIT Austrian Institute of Technology
FH Vorarlberg
Private Universität f. Gesundheitswiss.
Innsbrucker Soziale Dienste GmbH
St. Anna Hilfe Nütziders
Sozialdienste Götzis
SGS St. Josef in Grins
Pflegeheime der Stadt Hall in Tirol
Residenz Veldidenapark Innsbruck
Gekko it-solutions GmbH
FAWO GmbH
Project Duration
2014 – 2016

Electronic Aid for Nighttime Care

Rooms equipped with a smart sensor system increase safety in residential care settings.

signAAL Data Collector + signAAL Examination

Movement Sensor   Bed Sensor

Door Sensor

Apartment

Nurses' Room

Alarm App + Care Documentation

SignAAL

Has someone fallen in the dark or is otherwise in need of help? Older adults who live in residential care settings often ask night staff to perform regular checks in their rooms during the night. In the signAAL research project, led by TU Wien, technical solutions have been developed which can provide automatic night-time safety support. An intelligent room can help prevent accidents and alert help in case of an emergency. Regular check-ups at night are time consuming for staff and intrusive to residents' privacy. Typically a staff member has to quietly enter the residents' rooms to find out whether nothing unusual is going on and to check that the residents are in bed. For the residents it is important to know that someone checks up on them regularly and that they are quickly found in case of an emergency (i.e. in case of a fall when visiting the restroom). In case of persons with dementia increased nighttime activity is common and therefore challenges in nighttime care may increase upon the onset of a dementing illness.

Sensors detect dangerous situations
The signAAL research project developed and evaluated a modular technical assistive system which increases the objectively and subjectively perceived safety of old persons during nighttime and reduces the workload for night-time care (in institutional settings or at home).

The system consists of sensors placed unobtrusively in residents' rooms or apartments along with a central data collection unit and algorithms that - based on individually configurable rules - detect unusual or possibly dangerous events and convey them to the mobile devices carried by the care staff. The events are automatically recorded in a linked care documentation system.

The main goal is to diminish the burden caused by the regular check-ups by innovative real-time alarming while at the same time reducing the time for help to arrive in case of an emergency.

Extensive tests in settings of sheltered homes with independently living older adults and residential care for persons with dementia who are at risk of falling demonstrated the potential of the system. The quick alarms from the system were even able to help prevent falls in some cases. Socio-legal and ethical aspects related to the system are important in the context of signAAL. For this reason socio-legal and ethics questions were continuously addressed in the work of the multi-disciplinary project consortium and guidelines and checklists for product design and product evaluation were prepared.

Digital Assistance against Forgetfulness

A mobility assistance system for people with dementia has been developed. The European project has been awarded two AAL awards.

In close collaboration with research and care institutions, CONFIDENCE has developed and tested a mobility assistance service for people with dementia. The system combines personal assistance with state-of-the-art technology and helps those living with dementia to remain mobile and active for longer. Ten partner organisations from Austria, Switzerland, Romania and the Netherlands were involved.

Primary users of the mobility assistance service are older people displaying the first signs of cognitive impairment or incipient dementia, as well as those with mild to moderate dementia. Secondary users are family caregivers, professional carers and volunteers.

All stakeholders were intensively involved in each stage of the project. To ensure that their wishes and requirements could be met, workshops were organised in Austria, Switzerland and Romania. Based on the results of these workshops, the following issues were taken into account when developing the assistance system: Support with everyday tasks and in emergencies, disorientation and forgetfulness, social inclusion and reducing the burden on carers.

App, web portal and community
Two smartphone applications have been developed – one for primary and one for secondary users – as well as a web portal for managing the „Confidence Community", which provides additional support. The following Confidence functions have been implemented:

- Support: In the event of problems, the user can contact a trusted person at any time by video or voice call with the help of a clear and user-friendly address book.

- Emergency: In the case of an emergency, the user simply has to press an emergency button on the device. The system automatically informs the relevant carer, who can then locate the user.

- Calendar and reminders: The user or the carer can add dates and important tasks. The system then automatically sends the user a visual and acoustic reminder at the defined point in time.

- Navigation: In the case of orientation problems, the map function assists the user in finding their way home by showing the route and distance to the destination on an easy-to-read map.

- Surroundings: The latest weather conditions, along with tips for suitable clothing, are presented in a user-friendly way.

In addition to the technical system, the „Confidence Community" has been established, the aim of which is to reduce the burden on caregivers by integrating all people involved in the care process (as well as other volunteers) and coordinating the responsibilities and tasks via the Confidence web portal.

Field test
The system was tested under real conditions in two six-week field tests involving approximately 450 primary and secondary end-users in Austria, Switzerland and Romania. After using the system, 51% of primary users stated that Confidence had a positive effect on their lives (32% said Confidence had no effect, and 5% said the system had a negative effect; 12% did not comment). The most common reasons were: a heightened sense of security (38%), more communication with others (45%) and less forgetfulness (40%). The field tests provided valuable insights into how the system could be enhanced and improved.

Outlook
The Confidence project was completed in June 2015. The product is now being prepared for series production. Its main USPs are: combination of ICT and personal support, different service levels, option to develop and integrate care networks, developed in collaboration with „real" end users. The plan is for Confidence to be sold by aid organisations and to charge a monthly user fee.
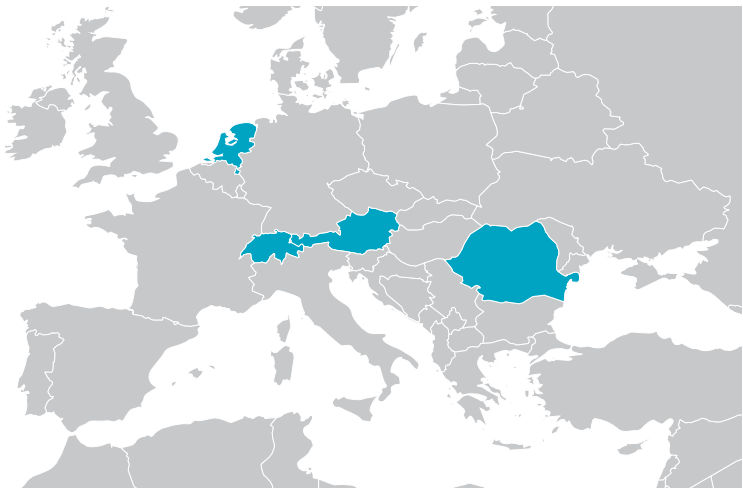
Contacts

Program Owner
Federal Ministry for Transport, Innovation and Technology (bmvit)
Department III/I 5 - Information and Industrial Technologies, Space Travel
1030 Vienna, Radetzkystraße 2
www.bmvit.gv.at

Contacts
Mag. Michael Wiesmüller
Tel.: +43/1/71162-653501
michael.wiesmueller@bmvit.gv.at

Mag^a. Lisbeth Mosnik
Tel.: +43/1/71162-653414
lisbeth.mosnik@bmvit.gv.at

Program Management
Austrian Research Promotion Agency (FFG)
Area Thematic Programmes
1090 Vienna, Sensengasse 1

Contacts
DI Georg Niklfeld MSc (ICT of the Future group of programmes)
Tel.: +43/5/7755-5020
georg.niklfeld@ffg.at

DI Dr. Peter Kerschl (ICT of the Future)
Tel.: +43/5/7755-5022
peter.kerschl@ffg.at

Mag^a. Dr^{in}. Gerda Geyer (benefit, AAL)
Tel.: +43/5/7755-4205
gerda.geyer@ffg.at

Mag^a. Doris Vierbauch (ARTEMIS, ENIAC, ECSEL)
Tel.: +43/5/7755-5024
doris.vierbauch@ffg.at