Smart Wireless Solutions

EU-wide “DEWI” project delivers innovations for a wireless future of automobiles, trains, aircraft and infrastructure

For three years, under the leadership of VIRTUAL VEHICLE 58 European partners from industry and research across 11 countries conducted research aimed to strengthen Europe’s leading position in the field of embedded systems and the Internet of Things. The results from the Dependable Embedded Wireless Infrastructure (DEWI) project were presented today in Graz. The wide variety of applications for a wireless sensor network and wireless communication included a research rocket, demonstrators for building, vehicle and rail technologies, and a fully networked truck.

Graz, 27 April 2017 – What just a few short years ago seemed like science fiction has already become a reality in some senses and will become a normal part of everyday life in the future. Wireless systems embedded in buildings, machines, automobiles, trains and aircraft will significantly alter and improve our lives.

DEWI: Dependable Embedded Wireless Infrastructure

The fundamental goal of DEWI is to create a reliable, intelligent, and connected environment to support individuals in their private lives and occupations. Our world is equipped with sensors, actuators, controllers, displays and computer-based elements. Functionally, all of these elements are closely interlinked and integrated in common, everyday objects. However, many current wireless solutions are not yet so advanced that they can replace their wired equivalents on the market. Therefore, DEWI focused mainly on the needs of industry and users.

Over the last 36 months, more than 500 researchers have developed wireless sensor networks and applications for professional and private users. The research partners held a project completion conference and several open house events in Graz to introduce their innovations and concrete applications from more than 20 industry-driven use cases in the automotive, rail, aerospace and building construction/infrastructure fields.

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New applications: From street and rail right up to space

A modern automobile contains between 70 and 80 electric control units. The DEWI project developed strategies and solutions that enable a wireless software update of such units both in and out of the garage (e.g. when the vehicle is parked), which are resistant to the typical problems facing wireless transfers (e.g. bad reception, security threats) and require no owner intervention.

In addition, trucks, in particular, currently require up to 100 kg of cables, which leads to increased weight and fuel consumption and diminished flexibility. The DEWI project developed a suitable platform to wirelessly integrate sensors and actuators.

The automatic detection of how rail vehicles (e.g. locomotives, wagons) are connected has often been rather difficult. Thanks to DEWI, wireless sensors installed independently on the individual wagons make this task significantly easier than it was with older wired solutions. These sensors “speak” with each other and automatically make available to the rail operator detailed static information (e.g. total length, number of axles, weight), as well as safety-relevant dynamic information (e.g. braking behavior).

The EU is the global market leader in the civil aviation sector. The industry is growing fast and is hoping to benefit greatly from the use of wireless technologies. These benefits are particularly significant with flights into space: for the transmission of measured values, the telemetry system of a space rocket consists of about 600 to 800 sensors and thousands of cables, which are spread throughout the rocket. Seventy percent of the weight of the avionics (i.e. all electrical and electronic devices on board) comes from cables. As part of DEWI, for the first time a research rocket was equipped with a comprehensive wireless system, which not only significantly reduces weight and fuel consumption, but also ultimately significantly increases the cargo load. At the same time, DEWI offers solutions to achieve increased reliability with regard to both electromagnetic interferences and failure-proof data transmission.

Another typical application for wireless sensor networks can be found in the area of building safety. Using DEWI, various types of information from different data sources within a building complex are collected, analyzed, and consolidated, in order to obtain an accurate picture during safety-critical situations (e.g. chemical accidents, fire). In the event of extreme crisis situation (e.g. terrorist attacks), measures such as facial recognition methods and drone swarms can be deployed.

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In addition, innovative algorithms for comprehensive wireless networks with several hundred or even several thousand points of light were developed in DEWI. These algorithms enable reliable, centralized, energy-efficient control and operation.

Convincing project outcomes

*Dr. Jost Bernasch – CEO / **VIRTUAL VEHICLE Research Center**:*
"DEWI is the largest EU project so far at the VIRTUAL VEHICLE research center that is centrally controlled by us from Graz. As the overall coordinator of this 40 million EUR project, we are the central node of an international network consisting of 58 industry and research partners. This testifies to the work done over the past years and the excellent reputation of the research center and its employees."

*Dr. Werner Rom, DEWI Project Coordinator / **VIRTUAL VEHICLE Research Center***:
"The present project results have by far exceeded our already high expectations. Through numerous demonstrators, we managed to show the many benefits of intelligent wireless systems, including low weight, simple and inexpensive system updates, increased flexibility and re-configurability, and reduced installation costs, to name but a few examples. We achieved a significantly higher reliability and operational safety in all applications, which is a key factor for the market acceptance of wireless systems. The DEWI solution offers its users more options for individual control and design, which represents an essential step towards making the daily and professional environment more stress-free, simpler and more efficient." And further: "Nevertheless, much remains to be done: the upcoming follow-up project 'SCOTT' – also led by VIRTUAL VEHICLE – will focus in particular on cyber-security, data protection and increasing faith in wireless solutions, in order to overcome the last hurdle to the market and to ensure a broad field of application.

Statements by international project partners:

*Michael Jerne, External Relations, **NXP***:
"The project, with its challenging application cases, was an exciting opportunity for NXP to further develop and evaluate new technologies in the field of secure communication and localization. The perfect combination of our corporate goal 'Secure Connections for a Smarter World' with the focus of DEWI on a reliable, embedded, wireless infrastructure – coupled with a professional project management and efficient cooperation between highly qualified partners along the entire value chain – has made the DEWI project a great success from our perspective. We look forward to integrating the DEWI results soon into

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new applications in the automotive sector, but also other industries in which secure wireless solutions increase the efficiency or user-friendliness for the end customer."

Peter Priller, ITS Research and Technology, ***AVL List GmbH****:*
"The European automotive industry represents over 12 million jobs, and with more than 400 million EUR in annual tax payments, it contributes significantly to Europe's prosperity and growth. This is why DEWI attracted enormous interest and participation from automakers and suppliers. For the first time, DEWI enabled the collaboration of such an outstanding consortium, which facilitated research into wireless embedded systems. In doing so, the project managed by VIRTUAL VEHICLE united top universities and European research centers, highly innovative small-scale enterprises and industry market leaders. The result is a wealth of new knowledge, new technologies and application ideas. In the very near future, these innovative products for reliable wireless systems will contribute to a sustainable and safe mobility."
And further: "The multitude of successful research results in the automotive field demonstrate the huge commitment. Newly developed sensor systems, for example, offer significantly improved validation in the development and production process of the powertrain and the complete vehicle. For developers and quality assurance, autonomous, smart sensors facilitate a flexible and quick instrumentation, which was proven on the AVL testbeds."

Dhasarathy Parthasarathy, Principal Research Engineer, ***Volvo Trucks****:*
"Several hundred meters of different cables are built into modern trucks. For an annual production of around 100,000 trucks, replacing cables with wireless systems can save around 5,000 kilometers of cables, depending on the size of the trucks. That's a grand total of 18 tons of copper and 33 tons of plastic. Wireless sensor networks facilitate the installation in production lines, eliminate mechanical sources of error and are easier to maintain. Overall, we can say that the use of wireless networks significantly increases the quality of electrical systems."

Prof. Dirk Pesch, Head of the Nimbus Centre for Embedded Systems Research,
Cork Institute of Technology*:*
"Together with the Irish SME EpiSensor, Philipps Lighting and the Technical University Eindhoven, our research focus within the DEWI project was on reliable wireless networks for the control of light systems. One of the fundamental results was the development of an innovative, robust, scalable and reliable protocol family for the interaction of terminal devices in wireless light control networks."

Dr. Willem van Driel, Research Director, ***Philips Lighting****:*
"The rapidly expanding digitalization and connectivity of light systems is paramount for our industry. Intelligent networking with varying technical environments, users and

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requirements goes hand-in-hand with energy-saving wireless networks and LED technology. Through the shared research with the DEWI partners, we managed to substantially increase the capabilities of our light systems.
One further outcome of the DEWI project is a reliable forecast model for product development, as well as the development of wireless networking of complex light systems in professional applications, such as public buildings. It was possible to quickly and efficiently apply the DEWI research results to new developments and applications. The collaboration with VIRTUAL VEHICLE, the project coordinator, as well as all project partners was extremely satisfactory. This is why we also decided to participate in SCOTT, a large follow-up research project.

Rafael C. Socorro Hernández, Technology & Innovation, ***ACCIONA Construcción S.A.***
"Subway construction requires a precise and effective deployment of resources (e.g. workers, building materials, tools) and special machines in order to meet the primary goal of optimized efficiency and safety in the best possible way. As part of DEWI, we managed to successfully develop a wireless prototype for the management of transport trains in the construction site area, in order to prevent accidents and catastrophes during construction and maintenance work in large subway areas. This was achieved by precisely capturing the detailed physical parameters of trailer trains and their loads."

Impetus for Austria

The DEWI project once more highlights the pioneering role in innovation played by Austria, and in particular Styria, with its capital city of Graz. The close collaboration with leading international facilities and companies, such as Volvo, Siemens, Valeo, Philips, Indra, Airbus, Thales, and many more, sustainably strengthens the position of VIRUTAL VEHICLE, AVL, and NXP in the European research and technology landscape.

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The DEWI Consortium: 58 partners from 11 countries

Acknowledgement

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www.dewiproject.eu

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VIRTUAL VEHICLE

The VIRTUAL VEHICLE Research Center (Graz/Austria) is an international center for research and development in the area of road and rail vehicles.

Under the motto “Smart Mobility”, around 200 researchers devote their energies to the vehicles of tomorrow, which should not only be safer and more environmentally friendly, but should also feature increasing connection with the environment. In order to meet these requirements, VIRTUAL VEHICLE offers up-to-date research and technology development. In this effort, the essential elements of expertise include linking numerical simulation and experimental verification, as well as comprehensive system simulation right up to the complete vehicle.

The solid network of the research center consists of:

- More than 80 international industry partners (among them vehicle manufacturers, tier-1 and tier-2 suppliers, and software providers)
- More than 45 international scientific institutions
- More than 200 researchers in Graz

VIRTUAL VEHICLE is a research center of the Austrian COMET K2 program. In addition, the center is strongly committed to EU projects (30 ongoing, and over 20 completed) and offers a broad portfolio of contract research and services.

www.v2c2.at

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AVL List GmbH

AVL is the world's largest independent company for the development, simulation and testing technology of powertrain systems (internal combustion engines, transmission, electric drives, hybrid systems, batteries and software) for passenger cars, trucks and large engines.
AVL was founded in Graz more than 65 years ago, and more than 8,600 employees are currently working in the three areas of Powertrain Engineering (PTE), Instrumentation and Test Systems (ITS), and Advanced Simulation Technologies (AST); approximately 3,600 of them work in the Graz headquarters, while the others are employed at over 45 AVL affiliates around the world. The R&D quota is currently over 10 percent, while the export quota is at 96 percent.

AVL develops and improves all kinds of powertrain systems and is a competent partner of the engine and automotive industry. Products from the ITS area include devices, systems and the software which is necessary to test powertrain systems and vehicles.

The three areas of AVL continually invest in research and development in order to remain one of the world leaders in powertrain system development. This includes a particularly active role in the Austrian research landscape, as well as in European research initiatives, such as ECSEL, EARPA (European Automotive Research Partners Association), EUCAR (automotive manufacturers), CONCAWE (fuel industry) and CLEPA (automotive supply industry).

In the invention ranking of the Austrian Patent Office, AVL has been named Austria's most innovative company several times, including in 2016 with 137 new patent applications.

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NXP Semiconductors Austria

NXP Semiconductors N.V. (NASDAQ: NXPI) develops solutions that create secure connections for a smarter world. Based on its expertise in the high-performance mixed-signal area, NXP drives innovation in the application areas of the Connected Car, Cyber-Security, Portable & Wearable, and the Internet of Things. The company, which operates worldwide, has branch offices in more than 30 countries and in 2016 generated a revenue of $9.5 billion.

Within NXP, NXP Semiconductors Austria GmbH is the global competence center for secure contactless identification systems. More than 500 highly qualified employees are working at the Gratkorn headquarters on innovative solutions in the area of secure connection technologies and infrastructure. NXP Gratkorn is engaged in research and development activities that include national and Europe-wide collaborative projects, as well as having global market responsibility for many products.

The competence center offers a wide range of solutions for a number of applications in the security area, for transport and logistics and in the automotive sector. NXP Gratkorn develops a full range of wireless-based semiconductors for RFID (Radio Frequency Identification), Smart Labels/Tags, Smart Cards, Near Field Communication, MIFARE and Tagging. To name but a few application areas, the products are deployed in (contactless and contact-based) Smart Cards for cashless transactions, for electronic ticketing in public transportation, for access control systems, for electronic passports, for toll payments, in intelligent labels for logistics and manufacturing automation, in automated libraries and for the identification of livestock.

In addition, almost all leading automotive manufacturers deploy the chip technology made in Styria. Applications include the electronic immobilizer, remote keys which open and close the car with the push of a button, as well as completely keyless unlocking and locking of the car.

www.nxp.com

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Illustrations

20140822_DEWI-Bubble_3000px.jpg

The central idea in DEWI is the so-called sensor & communications bubble. This bubble is defined by fast, simple, and spatially limited wireless access, secure wireless communication, as well as flexible self-organization and adaptability.

Source: VIRTUAL VEHICLE

20170425_DEWI-Final-Week_Aerospace-Flow-Control_IMG_9366-2500.jpg

Review of the Active Flow Control for Aerospace Operations by Means of a Dense Wireless Sensor and Actuator Network - Increasing Fuel Efficiency by Reducing Aircraft Skin Drag.

Source: VIRTUAL VEHICLE

20170425_DEWI-Final-Week_Candle2-Rocket_IMG_9298-2500.jpg

The CANDLE2 Sounding Rocket integrated with Wireless Sensor Network, Multi-Telemetry Logger and Radio-Frequency Tracking Module Subsystems. Due to the massive weight reduction, Wireless Sensor Networks can be of great value for space vehicles such as the Ariane 5.

Source: VIRTUAL VEHICLE

20170425_DEWI-Final-Week_Candle2-Rocket_IMG_9370-2500.jpg

Review of the CANDLE2 Sounding Rocket integrated with Wireless Sensor Network, Multi-Telemetry Logger and Radio-Frequency Tracking Module Subsystems. Due to the massive weight reduction, Wireless Sensor Networks can be of great value for space vehicles such as the Ariane 5.

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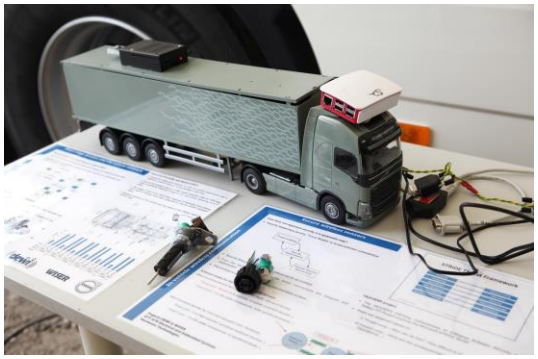


20170425_DEWI-Final-Week_WSN-Volvo-Truck_IMG_9333-2500.jpg

Today's heavy-duty vehicles are equipped with a large number of sensors that typically require extensive wiring – the so-called wiring harness. Replacing wired sensors with wireless alternatives has several benefits, such as increased uptime, reduced service costs, less weight, a reduced number of required unique harness variants, and many more.

Source: VIRTUAL VEHICLE

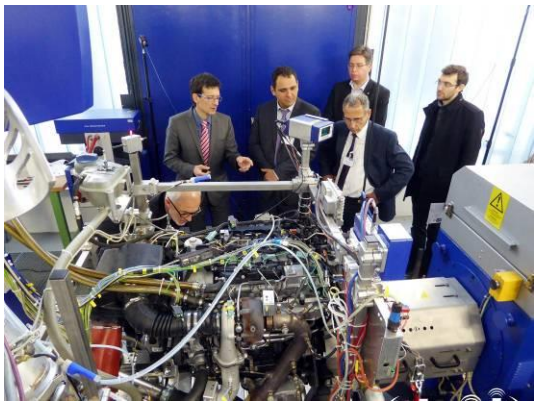
20170425_DEWI-Final-Week_WSN-Volvo-Truck_IMG_9331-2500.jpg

Today's heavy-duty vehicles are equipped with a large number of sensors that typically require extensive wiring – the so-called wiring harness. Replacing wired sensors with wireless alternatives has several benefits, such as increased uptime, reduced service costs, less weight, a reduced number of required unique harness variants, and many more.

Source: VIRTUAL VEHICLE

20170425_DEWI-Final-Week_Partners_IMG_9329-3000.jpg

For three years, under the leadership of VIRTUAL VEHICLE 58 European partners from industry and research across 11 countries conducted research aimed to strengthen Europe's leading position in the field of embedded systems and the Internet of Things. The results from the Dependable Embedded Wireless Infrastructure (DEWI) project were presented on April 27 2017 during a "Public Day" at the "Seifenfabrik" in Graz.



20170426_ViF-DEWI-AVL-Review_P1200318bD-3000.jpg

DEWI Review at the AVL test bed: Newly developed sensor systems offer significantly improved validation in the development and production process of the powertrain and the complete vehicle. For developers and quality assurance, autonomous, smart sensors facilitate a flexible and quick instrumentation, which was proven on the AVL testbeds.

Source: VIRTUAL VEHICLE

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