Microelectronics News

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The thinnest loudspeaker in the world



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From the institutes

Watching the computer think

It used to be difficult to sort photos on a computer. Now you can just click on facial recognition, and the desired selection appears instantly. Thanks to neuronal networks, computers are good at analyzing large quantities of data. The particularly interesting thing is finding out how these networks work.

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They save space and energy while producing a new sound quality: MEMS-based loudspeakers were developed by an Austrian startup company in cooperation with Fraunhofer researchers. The devices, which are only between two and twelve millimeters thick, offer great potential for use in smartphones, headphones, or even hearing aids. **»» page 3**



Almost real: the Holodeck makes it possible to experience and even walk through winter landscapes. © Fraunhofer IIS / Kurt Fuchs » page 7

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Intelligent energy management with high-tech electricity meters

With new types of electricity meters and smart algorithms, Fraunhofer researchers intend to revolutionize future energy management. The scientists and their partners have succeeded in itemizing overall power consumption down to every appliance. All it takes is a single high-tech power meter.

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RFID sensor transponders can even be attached in difficult-to-reach areas or to rotating machine parts. © Fraunhofer IPMS **» page 10**

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Events



Date	Event / WWW	Location	Group institutes involved
05/08 – 05/12	5GMan 2017 www.5gman.org	Lisbon, Portugal	FOKUS
05/09 – 05/11	INC12 www.incnano.org	Indianapolis, USA	
05/09 – 05/12	Control 2017 www.control-messe.de/en/control	Stuttgart, Germany	Group Institutes
05/14 – 05/18	Compound Semiconductor Week 2017 www.csw2017.org	Berlin, Germany	HHI, IAF
05/16 – 05/18	PCIM Europe 2017 www.mesago.de/en/PCIM/home.htm	Nuremberg, Germany	Group Institutes
05/30 – 06/01	Sensor + Test 2017 www.sensor-test.de/welcome-to-the-measurement-fair-sensor-test-2017/	Nuremberg, Germany	Group Institutes
05/30 – 06/02	ECTC 2017 www.ectc.net	Florida, USA	IZM
06/06 – 06/09	The Internet of Things Week 2017 www.iot-week.eu	Geneva, Switzerland	FOKUS
06/14 – 06/15	Vision, Robotics & Motion 2017 www.vision-robotics.nl/home-en-us/	Veldhoven, Netherlands	IMS
06/19 – 06/22	ITS European Congress 2017 http://strasbourg2017.itsineurope.com/	Strasbourg, France	ESK
06/26 – 06/29	Laser World of Photonics www.world-of-photonics.com/index-2.html	Munich, Germany	Group Institutes
06/27 – 06/29	Sensors Expo & Conference www.sensorsexpo.com	San Jose, USA	IPMS
06/27 – 06/29	International Conference on DC Microgrids www.icdcm.co	Nuremberg, Germany	IISB
07/03 – 07/04	Workshop: The promising future of sensors in the Internet of Things www.emft.fraunhofer.de/en/events.html	Munich, Germany	EMFT
07/04 – 07/07	EFCF 2017 www.efcf.com	Lucerne, Switzerland	IKTS
07/11 – 07/13	SEMICON West www.semiconwest.org	San Francisco, USA	
07/18 – 07/19	Workshop: ECPE Tutorial Thermal Engineering of Power Electronic Systems www.iisb.fraunhofer.de/en/events/ecpe-tutorial-2017.html	Erlangen, Germany	IISB

While every care is taken to ensure that this information is correct, no liability can be accepted for omissions or inaccuracies.

Title



At 5 \times 7 \times 2 mm³, the world's smallest loudspeaker could give smartphones a whole new sound quality. Its frequency ranges from 2 to 15 kHz. © USound

The thinnest loudspeaker in the world

They save space and energy while producing a new sound quality: MEMSbased loudspeakers were developed by an Austrian startup company in co-operation with Fraunhofer researchers. The devices, which are only between two and twelve millimeters thick, offer great potential for use in smartphones, headphones, or even hearing aids.

MEMS – microelectromechanical systems that can process both mechanical and electrical information – are found in a number of products used every day. As acceleration sensors, for example in activity trackers they count the user's steps; as tilt sensors in smartphones, they prompt the screen image to rotate whenever we turn the phone.

MEMS microphones have also been a market success for some years now. Loudspeakers, however, still work according to the principle patented by Werner von Siemens in 1877: an electrodynamic impulse causes the membrane to oscillate. The electrical signal is converted into an oscillating motion through the interaction of a coil and a magnet. The disadvantages are that both coil and magnet need a lot of space and energy.

A big step into modern technology

The Austrian startup USound would now like to be the first to implement MEMS technology into loudspeakers, and thus bring them into the 21st century. There are some convincing arguments in favor of doing that: MEMS loudspeakers only require half the space their more traditional counterparts consume, and allow energy savings of up to 80 % due to a dense packing of its components. They also sound better than the current commercially available models. In order to meet these ambitious targets, USound has called on the ser-

tious targets, USound has ca vices of several Fraunhofer institutes: the Fraunhofer Institute for Digital Media Technology IDMT, for example, applied its expertise to evaluating the acoustic power of USound's loudspeakers. The Fraunhofer Institute for Silicon Technology ISIT developed the MEMS chips with powerful drives. The sound is now produced piezoelectrically instead of electromagneti-

cally. The Fraunhofer Institute for Integrated Circuits IIS, for its part, was in charge of the energy-saving actuating chip, which is capable of recuperating energy stored in the MEMS chip. This complex but effective circuitry allows for very low actuation power during operation of the new MEMS loudspeaker. The Fraunhofer Institute for Reliability and Microintegration IZM was in charge of the new generation loudspeaker's structure. At $5 \times 7 \times 2$ mm³, the loudspeaker is the thinnest in the world. Drops of adhesive with the diameter of a hair were applied to the components in order to position them precisely on top of one another. Since even small deviances from specifications lead to extreme distortions of the sound signals being transmitted, meaning that the sound quality is significantly impaired, extremely high fabrication margins in scale production have to be met. After five months, the production concept was complete, and USound is now refining it and getting it ready for the market.

Market launch planned for 2018

In 2017, the first MEMS in-ear headphones and MEMS loudspeakers – which are now being developed as a final product – are slated for series production. In early 2018, a new generation of loudspeakers based on semiconductor technology is expected on the market, giving mobile communication devices a powerful innovative boost.



Saves space and energy: this type of loudspeaker is particularly suited to headphones and hearing aids. © USound

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From the institutes

Watching the computer think

It used to be difficult to sort photos on a computer. Now you can just click on facial recognition, and the desired selection appears instantly. Thanks to neuronal networks, computers are good at analyzing large quantities of data. The particularly interesting thing is finding out how these networks work. A research team at Fraunhofer HHI has now developed a software program that can do just that.

We do not yet know how neuronal networks work or how they arrive at this or that result. They are a sort of "black box," a computer program into which one feeds values and that then reliably produces results. If you want to teach a neuronal network to recognize cats, say, you need to feed it thousands of pictures of cats. "In many cases, however, researchers are less interested in the result than in what the neuronal network actually does," says Dr. Wojciech Samek, head of the Machine Learning research group at the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI. For this reason, Samek and his research group - together with a team from the Technical University of Berlin developed a method that can be used to watch a neuronal network "thinking."

Machine learning offers tailor-made diagnostics

That is important for the detection of illnesses, for example. It is already possible to feed computers or neuronal networks with data about a patient's genetic material. The network then analyzes the probability that the patient has a given genetic disease. "It would be much more interesting, however, if we knew what features the program bases its decision on," says Samek. That could be the starting point for individually tailored treatments.

Neuronal networks in reverse

The researchers' method allows them to run the neuronal networks' work in reverse. They start with the result value and work backwards through the program. "We can see exactly at what point a certain group of neurons made a certain decision and how much of an effect this had on the result," says Samek. The researchers have already proved more than once that the process works. They compared two programs, both of which are available to the public on the Internet and both of which can recognize horses in pictures. The result was astonishing. The first program was really able to recognize horses' bodies. The second one, however, used the copyright symbols on the photos for orientation. The symbols contained references to forums for horse enthusiasts or riding and breeding clubs, meaning that the program achieved a high hit rate although it had never learned what horses look like.

Big Data: a potential application field

The findings can be used, for example, when optimizing production processes. "We could imagine reading the operating data of a complex production system in order to determine what parameters affect the quality of a product or lead to fluctuations in that quality," says Samek. During the CeBIT trade fair in Hanover, the research team showed how they use their software to analyze the black boxes of neuronal networks.



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The method developed by Fraunhofer HHI and TU Berlin visualizes the analyzation of the black box algorythm



Li-Fi is competing with WLAN in an industrial setting. © Fraunhofer IPMS

From the institutes

High-speed challenger with a data reception guarantee – Li-Fi is giving WLAN a run for its money

Li-Fi technology, which uses light to exchange very large quantities of data, could soon supplement or even replace the established cable-based and radio-based transmission technologies currently in use in highly automated production environments. Researchers at Fraunhofer IPMS are convinced of that, as they have developed the first prototypes for Li-Fi communication over short and medium distances.

Wireless connections – essential component of modern Industry 4.0 infrastructures

Whether it is in logistics, in production environments, or within maintenance - in the age of Industrie 4.0, wireless networking of devices used in industrial production is becoming interesting for more and more users. Not only can laying cables in difficultto-reach areas be complicated, but the use of plug connections for wired field bus or Ethernet systems is subject to wear and tear. Gains in mobility and cost savings due to more flexibility during data transmission between machines are clear incentives to replace fixed-location cable connections, if possible. As a result, tried-and-tested radiobased systems, particularly wireless LAN, have become a constant in the consumer division

For time-critical communication needs, WLAN is reaching its limitations

Because of the limited bandwidth of WLAN, data rates and communication cycle times deteriorate as the number of users and the data transmission volume increase. The area of control and sensor / actuator level requires cycle synchronicity with data transmission cycle times of under a millisecond; WLAN technology quickly reaches its limitations and doesn't meet the demand.

Punctual data reception guaranteed

These problems have been solved by the new optical data transmission solution Li-Fi GigaDock. "Our GigaDock uses the light spectrum, which is unregulated around the world, meaning that there is no interference from radio-based systems," explains project manager Dr. Alexander Noack. "The available bandwidths of up to 12.5 Gbit/s are ten times faster than those of available WLAN radio solutions. We have, for example, been able to achieve very good realtime properties at distances of up to 50 mm, with latency times of less than one millisecond. This means that our technology offers a guarantee that the data will be received at the desired point in time." For larger distances, there is the "Li-Fi Hotspot." This hotspot allows simultaneous data exchange with several users in an area of approximately 5 \times 5 m², at speeds of up to 100 Mbit/s. The driverless transmit / receive modules combine an optical transceiver and a protocol controller with a gigabit Ethernet interface, meaning that they can easily be incorporated into systems that are commonly used in industry. In order to test the Li-Fi technology in a wide range of application fields, the Dresden-based research institute offers its customers various Customer Evaluation Kits



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Li-Fi-GigaDock. © Fraunhofer IPMS

From the institutes

Intelligent energy management with high-tech electricity meters

With new types of electricity meters and smart algorithms, Fraunhofer researchers intend to revolutionize future energy management. The scientists and their partners have succeeded in itemizing overall power consumption down to every appliance. All it takes is a single high-tech power meter.

Saving energy is no longer just a trend; it has become a matter of necessity. Until now, however, there has not been much more one could do other than switching off devices or enabling the energy-saving mode. This could now change, thanks to a technology called NILM (Nonintrusive Load Monitoring), previously invented by the MIT in Boston and now adopted as part of a project of the same name at the Fraunhofer Institute for Microelectronic Circuits and Systems IMS. The technology is based on a simple principle: every appliance exhibits a particular pattern while it is consuming electricity. This leaves a type of signature or fingerprint in the power grid. Using machine learning algorithms being developed at Fraunhofer IMS in Duisburg, this signature can be detected within the overall electricity consumption, enabling the consumption of an individual appliance to be calculated. All that is required is a single measuring device offering threephase current and voltage measurement.

Diverse application possibilities

Software is used to visualize the data, broken down by consumer, and to view power consumption in real time. This lets the user work out when the espresso machine is switched on, the washing machine is on the spin cycle, or a lamp has been switched off. It can also tell if an appliance is defective, as this changes its typical signature within the power consumption figures. A faulty seal on a fridge, for example, becomes apparent due to increased energy consumption. In the areas of industry, commerce, trade, and services, NILM can offer savings of more than 12%. Companies can analyze the electricity consumed in manufacturing and determine, for example, which component of a product requires a particularly large quantity of electricity for its production. This also allows peak loads in the grid to be registered and avoided. NILM is thus an ideal complement to Industry 4.0, as appliancespecific measurement of electricity consumption means that a company can target the optimization of its energy management.

Sampling rate of up to 1 megasample per second

In order to be able to feed the algorithms with enough data, the high-tech meter measures energy consumption with a sampling rate of up to 1 megasample per second. The meter can register such data as the noise consumers transmit within the power grid (interference voltage). This noise occurs at different frequencies, which allows conclusions to be drawn about the appliance generating it. EasyMeter GmbH is the partner responsible for developing the NILM meter hardware. Discovery GmbH is developing the gateway and the processing servers. GreenPocket GmbH is an additional project partner. This company is looking after the user interface of the software as well as the evaluation and visualization of the data. And, finally, innogy SE is responsible for finding suitable test customers from industry and commerce and analyzing the data with regard to measures that can be taken for more efficient use. The Federal Ministry for Economic Affairs and Energy (BMWi) is funding the joint project. The Fraunhofer researchers are currently continuing to work on the system's detection accuracy and the ideal combination of measuring parameters and algorithms.



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An appliance affects current and voltage in a characteristic manner, giving it a kind of "fingerprint." This fingerprint is detected at a single measurement point using special NILM algorithms, allowing the overall power consumption to be broken down into individual consumers. The result is that NILM is able to provide an itemized electricity bill. © Fraunhofer IMS



Almost real: the Holodeck makes it possible to experience and even walk through winter landscapes. © Fraunhofer IIS / Kurt Fuchs

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The Holodeck allows users to experience virtual reality (VR) up close and personal: within large areas, users can move around without cables and only with VR glasses, and can discover various themed worlds with many other participants. Leisure experiences such as a virtual visit to a museum, sightseeing, or other activities are also a possibility. © Fraunhofer IIS / Kurt Fuchs

From the institutes

Star Trek's vision becomes reality – Holodeck is launched

It is not just Trekkies who have a reason to be pleased: the new Holodeck from Fraunhofer IIS offers up to 100 people at once the option of entering a virtual world and going on an adventure in almost boundless expanses.

The idea for the holodeck was inspired by the science fiction series Star Trek, where virtual worlds could be simulated within the enclosed space on board the starship. At ISPO MUNICH 2017 between February 5 and 8, fiction became reality. The Holodeck system comprises real-time trackers and offers sensor fusion and calibration functions that are combined with virtual reality glasses and innovative content. Within an area of up to 14,000 m² users can enjoy this unique experience together.

Holodeck – interaction and unlimited freedom of movement

Virtual reality often lacks the content needed to attract a mass audience, users cannot have a shared experience with others, they are bound to a certain location, and the motion sometimes results in motion sickness. Dr. Stephan Otto, project manager at the Fraunhofer Institute for Integrated Circuits IIS, explains the solution: "Instead of experiencing virtual reality alone and immovably, you can now move around freely within an area of up to eight soccer fields and interact with over 100 other players." The Holodeck is diverse: its range covers computer games, entertainment, virtual travel and sports, up to and including virtual exhibition spaces. Potential applications

could also include corporate and urban planning, architectural uses, and virtual training sessions and simulations, for example in the area of security.

Walking in a winter wonderland, surrounded by virtual ski slopes

At ISPO MUNICH 2017, winter sports clothing manufacturer Bogner was the first company within the fashion and sports sector to demonstrate the Holodeck. In a small 36 m² version of the holodeck at the ISPO, several users were able to enjoy this unique experience simultaneously. Three people at a time were able to enter a mountainous virtual world and move freely through a winter landscape. Users were able to take a virtual journey through the company's 85 years of history.

The future of Holodeck technology

The aim of this project is to market the Holodeck technology and then to found a startup in order to use virtual reality technologies for various application scenarios. In the long term, the developers expect digital and virtual 3D content to open up new and surprising possibilities, particularly in areas such as entertainment and commerce.



Short news



Parylene is a polymer combining a variety of outstanding properties: Optical transparency, biocompatibility and biostability, chemical inertness, electrical insulation, a hydrophobic surface, and a low degree of permeability to gas and water. It is deposited by a CVD process at ambient temperatures on numerous substrates. Thus, it is free of internal mechanical stresses and highly 3D conformal. In addition it is free of defects even for low layer thicknesses. Hence, Parylene provides manifold potential applications, including the encapsulation of medical implants, MEMS, and organic electronics.

By now, some types of Parylene are certified in accordance with ISO 10993-1 and are classified as biocompatible and biostable, enabling its use in medical applications.



Uncooled IR detectors with a pixel pitch of 12 µm for the farinfrared range

Infrared detectors are used in the most varied applications to provide a better view, as they see a lot that the human eye cannot. In building thermography, for example, these detectors can localize incorrect insulation somewhere in the building, while in driver assistance systems, they help improve pedestrian safety at night. The problem, however, is that existing uncooled sensors available on the market for the long-wave or far-infrared range typically use microbolometers with a pixel pitch of 25 µm or 17 µm. This results in large infrared detectors or large IR lenses, meaning that these kinds of systems come with a big price tag and their possible applications are limited.

For some years, researchers at Fraunhofer IMS have been working on digital "infrared focal plane arrays" (IRFPA) with scalable pixels. The IRFPAs are based on microbolometers – thermal sensors that can measure electromagnetic radiation – and operate within the wavelength range of $8 - 14 \mu m$.

Typically, the pixel pitch cannot be optimized independently of the thermal isolaThe main function of Parylene is to prevent mutual contamination with body fluids or implants. Moreover, it can also be sterilized using conventional methods without losing its distinctive properties. The chemical inertness of Parylene against aggressive chemicals such as all common acids, bases, and solvents, guarantees the long-term functionality of components even in locations with harsh environmental conditions. This is impressively demonstrated by an encapsulated circuit board with just 5 µm of Parylene, which was exposed to a corrosive saline solution.

The aim of Fraunhofer ENAS is to develop new applications for Parylene, the optimization and characterization of the deposition process regarding tailored properties, and to carry out reliability studies.

tion that is the major determiner of an IR detector's sensitivity, meaning that IR detectors with a pixel pitch of 17 µm are currently state of the art. The Duisburg-based experts have developed an innovative microbolometer structure that allows the thermal isolation to be set independently of the pixel pitch. This microbolometer structure forms the basis of scalable pixels. These developments are currently concentrating on a pixel pitch of 12 µm, but structures with a pixel pitch of as little as 6 μ m have already been demonstrated. The microbolometers are encapsulated in a vacuum housing at wafer level. They thus integrate the housing, the CMOS read-out circuit, and the microbolometer array into a complete image-recording chip. Digital conversion is also carried out directly on the chip.





Parylene can protect electronic chips from harsh environmental conditions. © Fraunhofer ENAS

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Innovative 12 µm microbolometer structure.© Fraunhofer IMS



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Short news

Permanent condition monitoring for infrastructural works

Infrastructural works such as bridges need to withstand a lot: they are greatly exposed to wind and weather conditions and also need to deal with constantly increasing traffic levels. What is more, many buildings and elements of infrastructure are currently reaching the end of their projected service life and require regular evaluation of their condition in order to guarantee that it is safe to continue to use them. However, regular and thorough condition monitoring of viaducts has, until now, meant a significant contribution of time and personnel, which has also made it very cost-intensive.

Scientists and engineers at Fraunhofer IZFP in Saarbrücken have developed a sensorbased system to monitor infrastructural works permanently and cost-effectively. The condition monitoring system "MoniDAQ" comprises modular, energy-independent sensors, which are attached permanently to

Cleverly monitored – wireless monitoring for safety-critical industrial systems

Failures and unplanned maintenance work on safety-critical industrial systems generally result in high costs to operators. Often, these failures announce themselves in advance through atypical operating parameters such as rising temperatures, moisture intrusion, or loss of pressure. A flexible monitoring system developed at Fraunhofer IPMS measures just these parameters, evaluates them, and derives failure risks for the systems. Costs can thus be saved by carrying out maintenance work exactly when it needs to be done.



the infrastructure in question. Their energy consumption is extremely low and, among other functions, they can carry out eddy current testing, flux leakage testing, inclination measuring, and ultrasound testing over the long term, storing the data they collect. The data can be read out at any time via a radio connection. The power supply is provided by an integrated solar cell.

The small electronics do not need to be networked to one another, nor do they require a server, and they can detect the tiniest changes in the fabric of the structure. MoniDAQ is intended to function for a decade without maintenance or replacement. The use of this promising technology is not limited only to works of infrastructure: the little electronic helpers could, in the future, improve safety in elevator systems, pipelines, pressure vessels, or traffic light systems.

The developers in Dresden have come up with a flexible system concept in order to monitor machines in an industrial setting using radio frequency identification (RFID) sensors. The continuous wireless and battery-free monitoring, as well as smart sensor data analysis, allows failure risks to be detected in good time and maintenance work to be optimized.

Fraunhofer IPMS uses its own RFID transponder circuits for this solution. These connect sensors - for example for temperature, humidity, pressure, or light - to passive RFID interfaces. "The use of RFID has the advantage that its operation does not require cables or batteries because the required energy is drawn entirely from the electromagnetic field of an external reading device. They are zero-potential and do not require maintenance, have an almost unlimited service life, and can also be attached in difficult-to-reach locations or to rotating machine parts," explains Dr. Frank Deicke, head of the development team at Fraunhofer IPMS.

RFID sensor transponders can even be attached in difficult-to-reach areas or to rotating machine parts. © Fraunhofer IPMS

Short news



More power for electric vehicles

If the aim of the federal government is reached, a million electric vehicles will be on Germany's roads by the year 2020. But a few more hurdles have to be overcome before we are at that stage. One point of concern at the moment is the relatively short range of electric vehicles.

In order to make emissions-free driving over long distances a realistic goal, researchers at Fraunhofer IAF, as part of the "GaNIAL" project, are working with partners from research and industry on a new generation of power electronics. The aim is to integrate the power elements, actuating circuits, and condition monitors on a single semiconductor chip and, in this manner, to make more powerful, miniaturized components for electromobility. In addition to an advanced type of packaging, the scientists would also



DASH streaming based on video tiles – a pioneer in high-quality 360° videos

For complete immersion in VR video applications, ultrahigh video resolution within the user's view window is necessary. A multiple UHD resolution is needed to cover the entire 360° video field. The large quantities of data this produces are a great challenge for the entire chain of ultramodern video streaming. What is more, there are restrictions when it comes to the availability of data throughput for streaming 360° videos over the Internet, and most VR-enabled devices contain hardware video decoders designed for conventional resolutions (Full HD, 4K). This necessitates a new approach to the adaptivity of birate and resolution in VR video applications.

like to make use of the special physical properties of the semiconductor gallium nitride in order to create extremely compact and robust components. The lateral structure of gallium nitride-based devices allows monolithic integration of drivers, transistors, and diodes on a single chip. The compact design significantly reduces losses and thus increases the overall efficiency due to the use of smaller systems with a higher switching frequency. Integrating additional sensors, such as a thermal monitoring system, also allows optimized and reliable operation.

GaNIAL is being funded by the Federal Ministry of Education and Research (BMBF) as part of the funding focus "Compact and robust next-generation power electronics."

The "Compressed Domain Tile Aggregation" technology with HEVC developed at Fraunhofer HHI allows for VR video applications with considerably reduced video bitrates and decoder requirements, allowing it to meet the challenges of content with an ultrahigh resolution despite limited decoder capabilities. DASH streaming, which is based on video "tiles," allows high video quality within the user's current line of vision. The video quality of the remaining content is streamed at low resolution: this allows for greater efficiency in data throughput and decoder use.

The video bitstream can be adapted to the user's current line of sight without comprehensive transcoding. The viewer is offered individual video sequences and the configuration is selected to match the user's line of sight, the Internet throughput, and the video decoder used.





Developing monolithically integrated GaN power devices for extremely compact voltage transformers will allow the GaNIAL project partners to realize higher power levels and greater ranges within electromobility. © Fraunhofer IAF

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HEVC video tiles with high and low resolution are mixed without any preparation in order to match the direction of the viewing window – this results in a personalized bitstream for each user without the need for transcoding. © Fraunhofer HHI





The hands in the white gloves belong to Sandy Klengel, head of the Evaluating Electronic System Integration group at Fraunhofer IMWS in Halle. She is preparing a sample for the Zeiss Supra 55VP scanning electron microscope. She can use the microscope to complete such tasks as investigating the joint orientation of wire contacts in microelectronic devices. © Fraunhofer IMWS / Sven Döring

Editorial notes

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Fraunhofer Group for Microelectronics

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The Fraunhofer Group for Microelectronics, founded in 1996, combines the expertise of 18 Fraunhofer institutes, with a total of more than 3,000 employees. Its main focus is the preparation and coordination of interdisciplinary research projects, conducting studies and to assist in the process of identifying strategies.

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The last word ...



After four members of our Microelectronics News editorial team completed their studies successfully and left us last year, at the beginning of this year we had to say goodbye again to another employee of the Fraunhofer Group for Microelectronics.

Farina, where has your career taken you since you completed your master's degree?

At the beginning of the year, I moved back to my hometown of Trier. I commute across the nearby border to Luxembourg's oldest town, Echternach, where I support the PR work and program planning for the cultural and conference center TRIFOLION Echternach. I did an internship there during my bachelor's degree. I look forward to some exciting duties and can't wait to get immersed in the new challenge.

What do you take away for the future when you think back to your time at the Fraunhofer Group for Microelectronics and on the Microelectronics News editorial team?

I can think of a few things: from the Group's anniversary event and looking after our representation at the SEMICON trade fair in Grenoble, as well as the varied work on the Microelectronics News editorial team, and a lot more. Those were all exciting and responsible tasks, and carrying them out as part of such a great team was a pleasure. Of course, we can't forget the entertaining lunch breaks spent sitting at the round table. In addition to valuable personal contacts, what I will take with me for the future will be the experience of a constructive collaboration. I am very grateful for all of that.

I'm sure that a new city, the move, and the necessary reorientation are very stressful. What do you wish you had more time for?

The landscape around Trier continues to fascinate me as if I were only seeing it for the first time – I would love to have lots of free time to rediscover it: walks through the vineyards or along the Moselle are enjoyable at any time of year. I am also very happy to be back near my family and many old friends. After I've settled in in my "old new home," I will make sure that I make plenty of time for them.

Let's look into the future. What would you like to have achieved in five or ten years' time?

As long as life continues to bring health and happiness, most other things seem to run smoothly by themselves. Naturally enough, I hope that I will continue to enjoy my work and will experience success in my career in the future, and that my personal life will still be happy.

Last but not least, the editorial team at Microelectronics News would like to thank you for your work and wish you all the best for the future. Now you literally have space for a "last word."

I, too, would like to thank all my dear colleagues for their support, the great collaboration, and the lovely time I had at Fraunhofer – a time that I will always enjoy looking back on. During my master's, Fraunhofer gave me the opportunity to look at the wider picture, beyond what I was studying, to discover some thrilling topics, and to have some good experiences.



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About Farina Bender:

At the beginning of her master's in theater studies in 2014, Farina Bender started working in the PR department at the business office of the Fraunhofer Group for Microelectronics in Berlin. In addition to editorial management of Microelectronics News, her tasks included office and event management, as well as looking after the Group's website. Since graduating, she is now working in a different area far away from gallium nitride, semiconductors, and the rest - and takes care of public relations and program planning for the cultural and conference center TRIFOLION Echternach in Luxembourg.

From Berlin to Luxembourg: today, Farina Bender works in PR and program planning for TRIFOLION Echternach. © Pierre Weber

