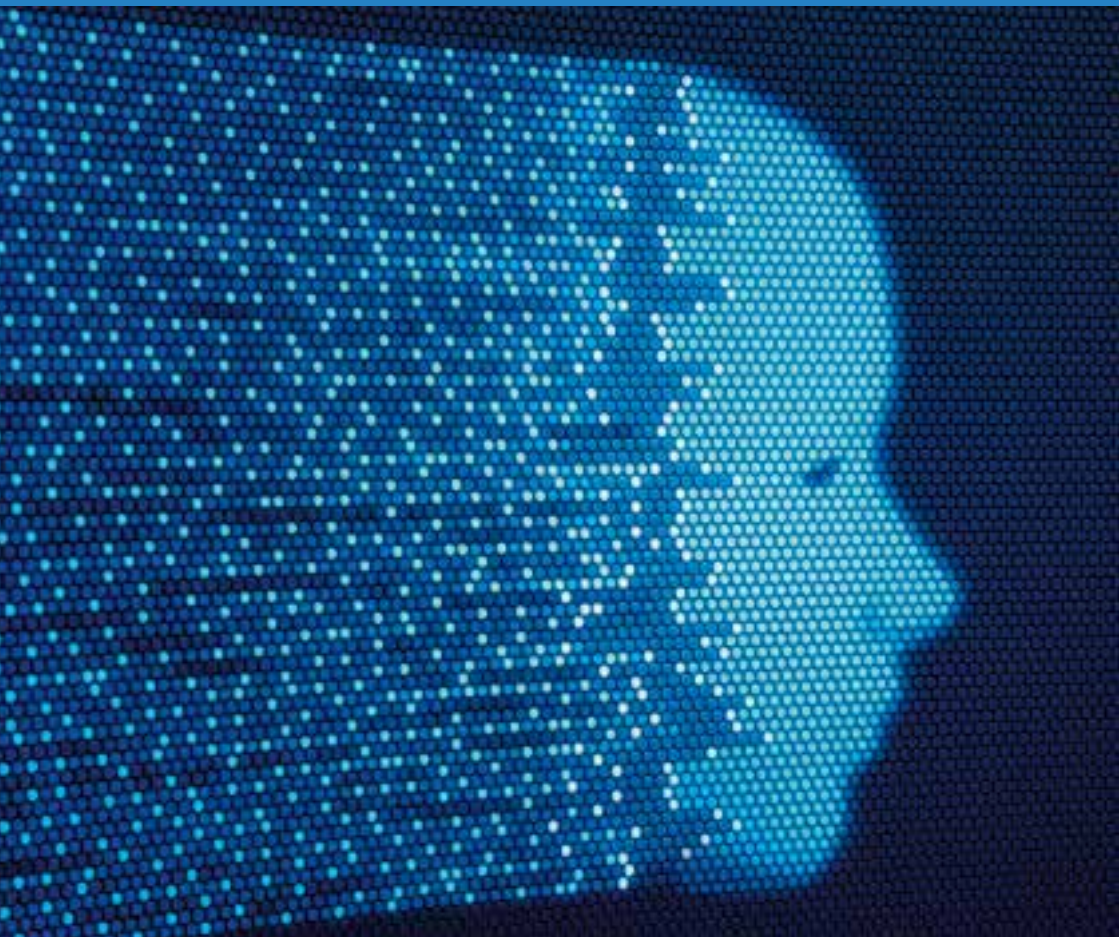
Fraunhofer

TRENDS FOR THE DIGITAL FUTURE



CONTENT

WHERE IS THE DIGITAL JOURNEY HEADING?

The digital transformation is on the point of changing our work and production processes as intensively as it has the way in which we receive and use messages or information. However serious the changes might be – a central key for success and acceptance is the security of data, not only for individuals but also for companies.

An example is Industry 4.0: It is based on networking as well as security. It is essential that companies maintain control of their data. This is the leading thought of the Industrial Data Space, a data space which is protected and networked. This allows the easy combination of our own product data with those of business partners and even with information from public sources. The initiative of Fraunhofer has led, on one hand, to a precompetitive reference project and, on the other hand, to the establishment of a non-profit Industrial Data Space Association, which is open to all industrial enterprises.

In order to promote individual and yet efficient production with "smart things", Fraunhofer is also researching the topic of secure data transmission in real time and on the fifth generation of the mobile telephone network. With peak transmission rates of more than ten gigabits per second, this is the basis for the tactile Internet. A network in which billions of sensors and devices in the Internet of things are connected with each other and which makes the lag time of only one millisecond possible.

In this brochure, you will find many examples of the opportunities that digitalization is continuing to create. For example, it lets rural regions move structurally closer to the cities, it enables people and objects to exchange information securely with each other, and is helps to improve medical processes. In all of this, the focus is always on the individual.

Prof. Dr. Reimund Neugebauer

"ABOVE ALL, IT REQUIRES THE JOINT ACTION OF ALL THE STAKEHOLDERS"

An interview with Professor Dieter W. Fellner of the Fraunhofer ICT Group on the opportunities and challenges of digitization

Professor Fellner, our society and our working lives are already largely digital today. What radical digital changes are we likely to see in the next few years?

A considerable amount, and in all sectors of society. Right away, production comes to mind, which will deal not only with the new technologies of Industry 4.0, but also with altered work sequences, production, supply and distribution chains, as well as new business models. Most exciting are the changes in the automotive sector. A lot has been done in a short time regarding semi-automated driving in that field. Although it will take some time before cars are completely controlled by computers when driving in the streets, this is probably the area with the greatest dynamics in terms of development. The necessary technologies already exist. Now, they have to be used practically, safely and economically. But leaps in innovation are also to be expected in the energy sector, telemedicine and 3D simulation/3D printing in the next few years. Basically, I think we can now predict that many applications will become more complex, but therefore also more mobile and more well-integrated.

Prof. Dr. Dieter W. Fellner, Chairman of the Fraunhofer Group for Information and Communication Technology

Which digital change in recent years have you been particularly glad to see?

Definitely the smartphone. It has a lot of applications connected with each other in the smallest of spaces, and on top of that, its mobile. If we think about how many sensors are installed in such a device, that is close to what science fiction was 25 years ago. As a computer scientist, my smartphone provides me with opportunities for which, as a young researcher, I would have previously needed a lot of expensive, special devices.

Is the often-mentioned "digital revolution" even meaningful and useful in all the various fields and industries then?

The digital revolution is useful wherever it creates competitive advantages, deals sustainably with resources or develops new business models. The path to this objective often passes through a temporary coexistence of old and new technologies. Depending on whether an added value is applied or postponed, the change happens more quickly, more slowly, or not at all. It is important in any case that digitization serves the people. Therefore, the cooperation between man and machine will become closer in the future.

What conditions are necessary to make the digital revolution successful?

Above all, it requires the joint action of all the stakeholders. Innovation is not generated solely by technology, but also by involving all the people. One example is the broadband coverage in rural areas: It is still very hard to get an Internet connection with 50 Mbit/s or more there. That would be technically possible, but the providers don't see any financial incentive to invest in these customer groups. That only results in new companies preferring to settle in regions which already have a strong infrastructure, because broadband

provision is a key criterion for deciding upon a location. However, the digital revolution has to be for everyone and must not stop at national borders. I think we can work together much more effectively at the European level than it is currently the case.

Above all, small and medium-sized enterprises have to catch up in terms of digitization. How can politics as well as research organizations such as Fraunhofer support SMEs?

The Fraunhofer-Gesellschaft is already an established partner of SMEs. We achieve 30 percent of our economic income with small and medium-sized enterprises. At the Fraunhofer ICT Group, we also see one of our most important tasks being to support small and medium-sized companies, which cannot afford their own R&D department, with innovative technologies. Incidentally, in my opinion, rethinking is taking place in small and medium-sized enterprises, particularly in the Industry 4.0 sector. A lot is happening there. Unlike in large companies with many locations around the world, the decision-making process chains are shorter and less complicated.

Security and acceptance are the biggest challenges regarding new digital technologies. How can we best deal with those challenges?

The answer is quite clear: transparency. Many IT systems are "black boxes", in that you cannot tell exactly what happens with the provided data. That's why it has to be honestly explained how something works – what a system can as well as what it cannot do. An important key phrase in this context is "privacy by design": in other words, that systems be designed from the outset with the protection of sensitive data in mind, instead of it being necessary to make a lot of effort to subsequently add this level of security. It's important that only the data is collected which is necessary for the task at

hand, instead of as much data as possible being collected, while the use of it is still undetermined at the time. I am therefore arguing in favor of an expansion of IT security research, because there is still a lot to be done in that area, and it can result in more confidence in digital infrastructures.

What new job descriptions will digitization bring with it over the next few years?

It's not the professions that are changing; It's the job profiles. A designer in the automotive industry, for example, previously drew with pencil and paper; Now, he uses 3D visualization software. The underlying professional knowledge is largely the same, though. So it's the tools and the necessary application knowledge that are developing further. In this context, though, there will be new specializations, such as the "data scientist", a special field of database computer science, which, by the way, some researchers at the Fraunhofer institutes and the Gesellschaft für Informatik [the Society for Computer Science] are actively involved in developing.

Professor Dieter W. Fellner of the Fraunhofer IGD in Darmstadt is the Chairman of the Fraunhofer Group for Information and Communication Technology. The native Austrian is an expert in computer graphics and visual computing. The ICT Group currently comprises 19 Fraunhofer institutes and is a service provider and contact for companies and users with questions about IT innovation.

http://www.iuk.fraunhofer.de/en

MOBILE COMMUNICATION OF TOMORROW

Ultra-fast and a thousand times more capacity: With the next-generation mobile networks (5G), billions of sensors and devices can be connected in the Internet of Things.

Even though only a minority of German mobile phone owners use the wireless network of the fourth generation (LTE), experts are already working on the mobile communication of tomorrow. This is expected to be up to 100 times faster than 4G and provide peak data rates of more than ten gigabits per second.

"But speed is not the only important part of the mobile communication of the future," says Prof. Dr. Thomas Wiegand, Executive Director of the Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut, HHI in Berlin. "What is increasingly important are lag times of less than one millisecond: in other words, an ultra-fast response." In addition, the future mobile communications networks have to enable reliable connections and ensure a significantly more energy-efficient transmission of data. All this will be offered by 5G. "The Internet of Things shall be made possible by default," Wiegand explains.

For this next generation of mobile communications, scientists still have some challenges to master: In future networks, a variety of wireless devices with a low level of transmission power and high lag-time requirements will have uncoordinated access to the mobile communications channel. While a few hundred devices control a radio cell today, in the future, it will be 600,000, estimates Associate Professor Dr. Gerhard Wunder of the Fraunhofer HHI. The EU project

„5GNOW", which he coordinates and which the European Commission has described as excellent, is an important foundation for 5G. The goal: to adapt the architecture and signal processing to these requirements.

All the signals of the transmitters will be synchronized. This is accomplished by the information being translated into a characteristic waveform of wirelessly transmitted radio waves, which professionals call "orthogonal". This allows signals to be assigned to the sender and transmitted in a targeted fashion. "If this is done user by user, it works quite well. But if a million users are transmitting at the same time, it no longer works," Wunder explains. The solution is an "asynchronous access": as part of the project 5GNOW, a method has been developed that allows the receiver to detect and separate signals without prior synchronization being necessary. This also explains the ambiguous name of the project: Aside from its literal meaning, "NOW" also stands for "non-orthogonal waveform."

This provides the foundation for future standardization. Moreover, 5GNOW has "prepared the groundwork for other projects, since we have been able to show that the alternative wave forms provide the necessary robustness and lag time to allow efficient, radio-based access for the Internet of Things and the tactile Internet", Wunder says.

The network will become "tactile" through extremely short reaction times of about one millisecond, with the result, for example, that machines can be operated remotely from a monitor, as if a person were pressing buttons on site. This imperceptible delay is an important prerequisite for real-time communication, without which the Internet of Things would never learn to operate.

www.5gnow.eu

INDUSTRIAL DATA SPACE

IN THE SECURE DATA SPACE

Last year, Fraunhofer launched the Industrial Data Space Initiative. The initiative aims at a virtual data space that fosters secure exchange and easy linking of data within business ecosystems. The initiative is organized as a research project and as a chartered association. The research project delivers a comprehensive architecture model and implements the latter in selected use cases. The chartered association was founded in early 2016, aiming at bundling the user requirements and driving standardization. In the following, Boris Otto who is heading the initiative for Fraunhofer outlines the basic ideas.

Mr. Otto, why do we need an industrial data space?

In terms of digitization, the USA and Asia have been a step ahead of Europe so far. In order to catch up, companies in Germany and Europe need a strategic approach that will enable them to securely exchange and combine their data in value-added networks. This is the fundamental prerequisite for innovation and the basis of modern business models. The industrial data space will enable businesses to network comprehensively and across sectors in an open data space. It will make it easier for companies to exploit the potential of digitization for their business models, without sacrificing control over their data.

How is it possible to exchange data with others without losing control over the data?

The data stays with their owner and is securely exchanged only on demand. Indus-

Prof. Dr. Boris Otto, Head of the Fraunhofer Industrial Data Space Initiative

trial Data Space Connectors provide access for businesses, but also for things like vehicles or containers, to the industrial data space. These software components ensure the secure transfer of data between two partners that have certified identities. In the industrial data space, the data could be easily coupled and processed with public or existing information. For example, navigation data in cars could be combined with current data from traffic control centers to improve route calculations.

How do the industrial data space and the Industry 4.0 platform work together and what are the differences?

The two complement each other. The Industry 4.0 platform focuses on manufacturing industries and addresses not only data questions, but also differentiated services, data transmission issues and shop floor processes. The industrial data space focuses on data services across various sectors – from the manufacturing to the retail and insurance sectors. We work in close cooperation where industrial data space and the Industry 4.0 platform meet, to be more specific – on data. One example are the working groups of the platform.

What new business models may be conceivable with the industrial data space in the future?

In general, it constitutes an infrastructure for digital business models in a wide range of industries. In the meantime, people are bringing new ideas to our attention, which is really a lot of fun. Current scenarios come from the fields of digital farming, wind energy, life sciences and the high performance supply chain. In addition, more and more primary data business models are being developed, such as trustee services for data based on the industrial data space.

http://s.fhg.de/ids

AN ASSOCIATION FOR SECURE NETWORKING

With the establishment of the "Industrial Data Space Association" in Berlin, the industry in Germany has taken an important step towards a digitally networked industry. Dr. Reinhold Achatz, CTO and Director of Corporate Function Technology, Innovation & Sustainability at thyssenKrupp AG, is the new Chairman of the Board of the non-profit association: "Digital transformation and Industry 4.0 are key success factors for companies in Germany," Achatz says. "With the association, we want to ensure that the specific interests of the economy are incorporated into research in a targeted fashion. At the same time, companies should be able to more quickly access the results of this project and to implement them."

The tasks will include matching the needs of businesses with those of publicly funded research project, as well as developing a thematic portal for the use cases. At the same time, the association is establishing committees, working groups and initiatives that deal with issues of scientific and technical standardization as well as certification processes. It will participate at both the national and international levels on the development of guidelines and legislative processes, particularly in the European research area. Furthermore, it will support informational and educational activities concerning the secure data space, especially for small and medium-sized enterprises (SMEs).

The founding members of the Industrial Data Space Association include a total of 18 companies and organizations – including ZVEI – The Electrical and Electronic Manufacturers' Association, Volkswagen, Rewe, Allianz, Bayer and Bosch.

THE DIGITAL VILLAGE

Fraunhofer researchers want to make rural regions more attractive by means of digitalization. To do so, local transportation is to be connected with the transportation of goods, or telemedicine systems are to guarantee better medical care.

Germans like to live in the countryside – in fact, every second person in Germany lives in a municipality with fewer than 20,000 residents. Despite this desire to live in the countryside though, many small towns and villages are shrinking as a result of demographic changes. Above all, young people looking for a job or a place to study are attracted to big cities. As a result, shops, bakeries and crafts businesses close, and the infrastructure gradually vanishes.

To prevent more and more people from moving away, villages and small towns have to become more attractive once again. This can be accomplished to a large extent by networking rural areas through the use of modern information and communication technologies.

IT links services to one other

In the research program "Smart Rural Areas", experts from the Fraunhofer Institute for Experimental Software Engineering IESE led by Dr. Mario Trapp are studying how to do this. In this process, the researchers take many aspects of rural life into consideration: transportation, logistics, supplying the population with food, and medical care. Their goal: To link services together where a service is no longer profitable because of the rural exodus.

"Where the bus is no longer profitable because there are too few passengers, for example, buses could also transport mailed packages or fresh food," says Trapp. "However, this requires powerful information technology that efficiently and reliably combines the previously separate worlds of public transportation and the transport of goods."

In locations where there are no doctors, patients could be cared for from a distance via medical portals. You could, for example, perform your own ECG and the data could then be transmitted in real time to a specialist via the Internet. "Many of the technologies that are necessary to accomplish this are already available," says Trapp. "Our job is to connect them into a functioning whole. This also means that the data have to flow quickly and safely via the IT systems."

Pilot project with the Rhineland-Palatinate Ministry of the Interior

How the concepts being developed at Fraunhofer IESE will work will be tested in 2016 together with the Rhineland-Palatinate Ministry of the Interior in the Rhineland-Palatinate municipalities Betzdorf and Eisenberg/Göllheim with "Crowd Logistics" in the project "Digital Villages".

Citizens can order products and foodstuffs from regional distributors, have these items delivered, and even be active themselves as voluntary "deliverers". "We have developed a simulation framework that maps the various services, from mobility and logistics to local shopping experiences, and integrates all the necessary technologies, from Wi-Fi to sensors," says Trapp.

http://s.fhg.de/smart-rural-areas

LOCK AND KEY FOR E-MAILS

Fraunhofer and Telekom are making end-to-end encryption possible – easily, free and for everyone

Sending e-mails is simple. To encrypt them securely though, has so far required some degree of expertise. That's now intended to change: Deutsche Telekom and the Fraunhofer Institute for Secure Information Technology SIT in Darmstadt are now making encryption easy – with Volksverschlüsselung (the people's encryption).

The software of the same name provides the necessary keys, and configures existing mail programs so that users can perform encryption and decryption. Volksverschlüsselung has been developed by Fraunhofer SIT, while Deutsche Telekom has put the solution into operation in a highly secure data center. The software is expected to be available in the first half of 2016 and will gradually be developed and expanded following its launch.

The centerpiece of Volksverschlüsselung is software that allows users to overcome the technical hurdles of encryption even without possessing special IT knowledge. The software generates the necessary keys, has them certified and then integrates them in applications. In order to be able to send encrypted e-mails, a user has to install this program and identify himself, such as via the established registration procedure of Deutsche Telekom or by means of the German electronic identity card.

Then, on the user's device, the software generates the cryptographic keys, which e-mails and data can be encrypted and

signed with. For the actual encryption, most users do not need a new program, since almost all e-mail programs can encrypt innately when appropriate keys are present. Fraunhofer and Deutsche Telekom only receive the public key. Private keys never leave the computer of the user, so that only the user is able to decrypt or sign messages.

"With Volksverschlüsselung, we want everyone to finally have access to the cryptographic methods that are well-established in the field of research," explains Professor Michael Waidner, the Director of Fraunhofer SIT. Dr. Thomas Kremer, Privacy Officer of Deutsche Telekom, describes the advantages of the procedure: "Volksverschlüsselung is free, simple and transparent. For us, it's the best tool to help the end-to-end encryption of e-mails take root in the general population."

In the first step of this solution, Windows users can encrypt e-mail communication via e-mail programs such as Outlook or Thunderbird. Versions for Mac OS X, Linux, iOS and Android are also planned. The software will initially support the S/MIME standard, and in a following step, it will also support OpenPGP. Fraunhofer SIT will publish the source code of the software. As a result, experts will be able to see for themselves that Volksverschlüsselung does not have any backdoors.

There will be a commercial version of Volksverschlüsselung availabe for companies. It provides the possibility of commercial use and can be customized according to the customer's specification.

http://s.fhg.de/volksverschluesselung

ICU PATIENTS BETTER IN VIEW

Fraunhofer researchers have developed a smart monitor which has optimized the processes in intensive care units: It clearly shows the data of the medical devices while avoiding false alarms. The screen can be controlled from a distance, without contact, by means of gestures and voice commands, thereby reducing the risk of transmitting pathogens.

Everything had just been quiet in the control room of the intensive care unit. Suddenly, though, there is excitement: the alarms on several medical devices in different rooms are sounding. Monitors are flashing and beeping. A drop in blood pressure, cardiac arrhythmia – the computer monitors show exactly what has to be done and where. Doctors and nurses rush to the rooms of the patients. Equipment there provides detailed information on the status of the critically ill patients. Physicians have to quickly filter out the most important information from a variety of digital displays and screens. "It's not easy to keep track of everything here", says Paul Chojecki, scientist from the "Vision & Imaging Technology" Department at the Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut, HHI, in Berlin.

Controlled by gestures

Together with his team as part of the project "control room", the scientist has developed an intelligent monitor. It quickly shows doctors and nurses the most important information about the vital signs of their intensive care patients. The screen has interfaces with the medical equipment in the room, as well as with the information systems in the hos-

pital. It can be controlled by gestures and voice commands. The graphics of its display adapt to the distance from which it is viewed. "From the door, the doctor sees the data in a correspondingly large size. As he gets closer, the screen displays detailed information", Chojecki explains. A 3D camera provides the necessary data. The user interface is programmed based upon the web, so it is also suitable for mobile screens, such as tablets. A practical test in cooperation with Aachen University Hospital is planned in 2016.

The system evaluates the data of the medical devices on the basis of the smart alarm design of the project partner, the Medical Engineering Department of Aachen University Hospital. This prevents false alarms. "Intensive care doctors have told us that this is a big problem. Current devices stick stubbornly to determined limits, without including all of the relevant factors that are necessary in order to comprehensively assess the risk situation. In addition, the acoustic signals produce a very loud noise, which is not beneficial to the health of either the staff or the patient", Chojecki says.

Another advantage of the gesture control is that the doctor or health care provider does not have to touch the devices directly. "The transfer of pathogens in hospitals, particularly in intensive care units, is a problem. The obligatory hand hygiene is sometimes forgotten, and viruses as well as bacteria are carried from room to room", Chojecki describes.

http://s.fhg.de/scu-leitwarte

THE INTELLIGENCE OF OBJECTS

Not only humans can determine their condition on their own and talk to each other; so can objects. For Industry 4.0, the Internet of Things is an important foundation. With technology from Fraunhofer IIS, objects and systems can be tracked and monitored intelligently.

In the course of Industry 4.0, processes in the production halls will become transparent, and the products will guide their production on their own. This is only possible, though, if the workpieces have information about themselves and communicate with other objects and their environment. This is where a communication technique comes in that has been developed by the researchers at the Fraunhofer Institute for Integrated Circuits IIS. "With s-net®, the products can monitor themselves and control their production, and all while using very little energy," says Jürgen Hupp, who heads the Communications Networks Department at the institute. "In addition, the individual radio nodes network with each other autonomously." In day-to-day life, this means: When they are attached to a workpiece, they connect to the network and conduct recorded data from sensors – such as temperature or vibration intensity.

That is not the limit of the technology, though: Even when it comes to tracking – in other words, finding workpieces on the premises – s-net® is quite effective. Using anchor nodes with fixed positions, the mobile nodes attached to the workpieces can determine where they are at any given moment and can send the data to a receiver. In the future, the solution will even be able to simplify production itself, because the wireless nodes in a product

will make it intelligent. As a result, upon arrival in an assembly cell, a product can light up the shelves in which the technicians find the parts which are to be mounted. The wireless nodes also know the right time for each production step. The scientists are currently using s-net® to monitor the state of the cargo in sea containers through wireless nodes on the pallets. These automatically function independently as part of a network in the container and deliver information from the pallet to a telematics box. Since the transmission path sometimes has a lot of obstacles from the nodes to the box, most nodes do not send their data directly to the box, but rather first to other nodes, which then forward this data. This is called multi-hop communication.

For monitoring the condition of objects, Josef Bernhard (Director of the group RFID and Radio Systems) and his team have developed the wireless, miniaturized IoT platform MIOTY. The objects could send information about their condition to the recipient via mobile network instead.

However, this type of communication consumes a lot of energy – so the battery would not last. "Our wireless nodes only need one percent of the mobile communications energy, so the battery lasts a hundred times longer – as much as ten to fifteen years," Josef Bernhard reports. The range is also impressive: In the country, the wireless nodes on an object can be connected to a receiver up to ten kilometers away, and in the city, they can reach at least two to five kilometers, depending on the surrounding buildings. The receivers transfer the data via the Internet in a cloud. Here, all the results are collected and software converts the data into the essential information. Instead of sending all of the information bundled together, as with mobile communications, the researchers divide the information into small packages. These are sent at different times with different frequencies. The transmission is less susceptible to interference, the power consumption is lower and the range is greater.

http://s.fhg.de/s-net-technology

Prof. Dr. Delphine Reinhardt, Assistant Professor

CONTRIBUTE LIVE TO THE DIGITAL REVOLUTION

At Fraunhofer, young scientists directly contribute to the digital revolution. One example is Delphine Reinhardt. The assistant professor at the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE in Wachtberg is working on data protection and privacy. A short profile.

Delphine Reinhardt is computer scientist and electrical engineer alike. It motivates her to protect the privacy of the users of modern technologies. "I am passionate about interdisciplinary research. It is not only the technological challenges I am interested in, but also the human factor, which has often been neglected in the past," says Reinhardt. "I want to ensure that people can benefit from the advantages offered by new technologies without compromising their privacy. The rapid development of these technologies makes it very challenging."

Interdisciplinary research

In the past, people could lock their front door and turn off their computer in order to protect their privacy. But once smart cities collect more and more sensitive data in the future, citizens have less ways to do so. "With our research and development, we want to find appropriate solutions to tackle this issue and to thereby improve the situation," says the assistant professor.

Reinhardt first studied electrical engineering. She earned her diplomas both at the Ecole Nationale Supérieure de l'Electro-

nique et de ses Applications in Cergy, France, and at Technische Universität Darmstadt, Germany, in 2009. For her doctoral studies, she moved on to the field of computer science. Her PhD thesis: Privacy in Participatory Sensing: User-controlled Privacy-preserving Solutions for Mobile Sensing Applications.

Assistant professor in Bonn

Her dissertation received several awards and laid the foundation for her future career: As a specialist for data security, she started an assistant professor position at Rheinische Friedrich-Wilhelms-Universität Bonn in February 2014. Shortly after, she started to develop and manage the "Privacy and Security in Ubiquitous Computing" research group at Fraunhofer FKIE. Her role at FKIE is to conduct research, acquire research funding, and participate in the organization of scientific conferences and events.

Protecting our privacy and our data in the world of ubiquitous computing is just one of many research areas at Fraunhofer FKIE in Wachtberg, south of Bonn. About 400 employees currently work for the research institute, which was founded in North Rhine-Westphalia in 1963 and which conducts applied research for defense and security. In total, there are ten working groups. The topics range from human/machine interfaces to cybertechnologies and cognitive systems.

Fraunhofer as an employer: Fraunhofer is regularly among the most popular employers in Germany. Would you also like to contribute live to the digital revolution? Get to know us and learn more about the careers we offer.

http://s.fhg.de/jobs-and-career

DIGITALIZATION AND THE NEW PARTNERSHIP BETWEEN HUMANS AND MACHINES

Focus on people: In the future computers will be able to take user's intentions and emotions into account, thanks to neurotechnology.

Between humans and technology communication processes do not always work intuitively and smoothly. Users have to adapt to the machines and their logic – a logic that programmers came up with.

In the age of digitalization, we no longer only use a single computer – we have to deal with a number of different devices and systems. Each of them has its own rules which have to be understood and reacted to. This forces the users to become familiar with changes and new functional principles over and over again, which can be challenging and time-consuming. It is hence not a big surprise that many people react skeptically when confronted with new technical solutions - and that many users secretly wish that their device could understand their personal needs, moods or emotions and respond to them appropriately.

Today, such a sensor for user needs and emotions is still a vision – but it could become true in the near future: Neurotechnology provides innovative new tools that could be used to identify user states and related cognitive processes based on the users' brain activity. In the recently established "NeuroLab" of the Fraunhofer Institute for Industrial Engineering IAO researchers are currently working on the realization of this idea. In particular, they investigate what happens in the brain when people use technical products, and apply their findings to improve human-technology interaction (HTI). In the

EMOIO-project, for example, the researchers work together with partners from both, academic research and industry, to develop solution to detect and classify emotional user reactions during HTI using neurotechnology. The final goal of the project is an emotion-sensitive adaptive system that can change its behavior based on the user's emotions and needs.

Using such an emotion sensor, a computer would, for example, incidentally know when to welcome "its" user to the office with a few encouraging words or a photo slideshow of the last vacation, thus ensuring that the user starts the work day in a better mood and with increased motivation. This is, on the one hand, quite an appealing idea. Still, there is a majority of people who perceive such an "omniscient" computer as rather discomforting or even scary – and their concerns are justified: Our brain activity is indeed very sensitive and personal information. When employing neurotechnology, you are thus always confronted with questions of data security. Following up on the scenario described above, it would be quite possible for a PC to pass the information about an employee's emotional state, motivation or performance on to their supervisor.

The scientist of the "Neurolab" want to anticipate and prevent such situations where machines might "turn against" their users instead of supporting them. Therefore, they work in close collaboration with future users and privacy experts to develop application scenarios for neurotechnology in HTI which consider topics like user acceptance and privacy issues. Only if researchers take the user's needs, fears and desires into account, can the partnership between humans and machines be trustful and a pleasant experience for the user.

http://s.fhg.de/emoio-project

THE SAFE "SMART HOME"

The "Smart Home" promises efficient building management. Heating, lighting and many other devices in homes can be controlled via the Internet. In many cases, though, the systems are not secure. At the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE in Wachtberg, researchers have developed a protection software that lets a person easily switch between the Internet and building IT. The technology filters out potential attacks from the communications protocols, even before they reach one's own home or office building. It does not matter what technology is used within the building.

http://s.fhg.de/smart-home

THE THIRD DIMENSION FOR TOUCH DISPLAYS

"It looks pretty good in the picture, but I can't really imagine what it's actually like..." It's not just online shoppers who are familiar with this problem. Researchers at the Fraunhofer Institute for Industrial Engineering IAO are liberating media content from its two-dimensionality: Combined with a handy pyramid, their software allows an interactive, holographic illusion for touch displays. By moving the pyramid, the user can not only adapt his hologram in real time with regard to form and color. Depending on the programming, many more interactions are possible, like movement, sound or zooming. In addition, several pyramids can interact on a touchscreen. As a result, the solution named JUWL is suitable as, among other things, a digital print media extension for comic books or textbooks or an interactive exhibition medium.

www.juwl.it

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