Secure and Efficient Logistics

Secure Chains of Goods: More Than a Technical Solution
Threat Detection with Pedestrian Motion Pattern Analysis
VIERforES: Three-point Landing for More Security
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Dear Readers,

The issue of security accompanies logistics on all its journeys. Goods ought to arrive undamaged at the right place at the right time. How can logistics providers guarantee this to their clients? People have to be safely guided through zones with heavy traffic. Sensitive areas must be securely protected. Emergency plans have to function when there is an emergency, response teams have to be coordinated quickly. How can airports, train stations and stadiums, i.e. facilities with extremely high traffic density and high numbers of visitors, best prepare for this?

Security concepts rely on clever systems, software and, naturally, technologies. The particular challenge is to make systems reliable. This is easier said than done. Nearly every technical device contains embedded systems. Earlier, levers were activated; now, hidden processors activate the desired function from inside the device. Newer and newer models with increasingly sophisticated technology are being launched on the market. So far, no manufacture has been able to promise trouble-free operation. Small technical details may have devastating effects should they malfunction.

In the project VierforES, researchers from Magdeburg’s Fraunhofer Institute for Factory Operation and Automation IFF and their project partners at Otto von Guericke University Magdeburg, the Fraunhofer Institute IESE and the Technical University of Kaiserslautern are now jointly working on concepts intended to help manufacturers perfect their products. Logistics experts are primarily working on material handling systems and researchers on pedestrian motion patterns as the basis for threat detection.

Logistics providers on the other hand have entirely different worries. Problems with distribution usually arise wherever goods are handled. Goods may be improperly transported or stored, they may be at the wrong location or not locatable at the right time. In the worst case, they may even disappear. Logistics providers always bear full responsibility for their goods in transit; claims for damages may be lodged when they are lost or damaged. They are placing their hopes in the vision of completely secure chains of goods. Researchers at the Fraunhofer IFF in Magdeburg are also working on this aspect of security.

This issue of IFFocus is devoted to different topics related to secure, reliable and efficient logistics. Peer through this window and catch a glimpse of exciting research work from the Fraunhofer IFF in Magdeburg. I wish you interesting reading.

Your,

Prof. Michael Schenk

Director of the Fraunhofer Institute for Factory Operation and Automation

[Photo: Dirk Mahler]
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Even in these days of tight travel budgets, the Fraunhofer IFF knows how to get large numbers of experts interested in current research topics. Once again, more than 500 guests from business, academia, research and government gathered in Magdeburg on June 16 to 18, 2009. The annual event’s program included conferences on digital engineering, logistics and robotics.

The Fraunhofer’s digital engineering specialists are in great demand particularly in the machinery and plant manufacturing sector and automotive industry. Hence, Director Michael Schenk is emphasizing digital product and process development, the digital factory and professional qualification and thus in tune with the times: “You get much more out of virtual reality than pure 3-D engineering. Every company has to save time and money. Doing better long term with virtual technologies is what the 12th IFF Science Days are about.”

In addition to mobility and transportation, the logistics conference also focused on the trends and prospects of green logistics. Contemporary logistics not only has to plan, control and optimize global networks but also manage complex networks, control risks and simultaneously conserve existing resources better. Minister of Transportation Karl-Heinz Daehre used the 12th IFF Science Days as a forum to present the state’s new logistics concept.

Automation experts also found topics right up their alley. One program topic, Safe Human-Robot Interaction, i.e. human-robot interaction without protective barriers, is a current preoccupation in the industry. New safety concepts and technologies are needed as the trend moves in this direction.

For more information, visit: www.wissenschaftstage.iff.fraunhofer.de

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Timber Logistics Experts Meet in Hundisburg

This year’s timber logistics workshop was devoted to fundamental issues of logistics, interfaces and efficient energy use. Jointly organized by the Fraunhofer IFF, the Forstbetrieb Sachsen-Anhalt and the Niedersächsischen Landesforsten, the March event drew forest owners, haulers and wood processing companies to Hundisburg. Industry experts discussed potentials and opportunities for cooperation as well as fields of action. A case study from a pilot region in Lower Saxony highlighted current issues in day-to-day business. Preparations are underway for the popular industry meeting in 2010.

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Logistics Day was held throughout the country on April 16, 2009. Logistics services are highlighted on this day, an initiative of the German Logistics Association (BVL). The goal is to give the general public insight into logistics operations and jobs in logistics. Numerous companies and institutions including the Fraunhofer Institute for Factory Operation and Automation IFF were involved in this campaign.

The Fraunhofer IFF opened its doors in the morning for a look behind the scenes. Visitors were able to learn about advanced logistics systems in the LogMotion-Lab, one Europe’s leading labs for the development, testing and certification of RFID and telematic technologies. At the lab, Fraunhofer experts develop customized solutions for their clients from industry and the service sector. For instance, they employ RFID transponders, small transmitting labels that are already found stuck to every CD. These clever companions are increasingly accompanying logistical items on their way to consumers and have become indispensable in modern logistics systems. They make chains of goods more secure because they reveal the location of goods to their owners at any moment and any effects environmental conditions are having on their shipment.

In the afternoon, visitors to the Fraunhofer IFF had the opportunity to attend an interesting presentation that was part of the Logistics Guest Lecture Series. Winner of the German Logistics Award in 2007, logistics consultant Marc Schleyer discussed certain methods that improve waiting and cycle times in logistics systems. The Guest Lecture Series was opened by its patron, Saxony-Anhalt Minister for State Development and Transportation Karl-Heinz Daehre.

Nearly three hundred events were already scheduled for Logistics Day shortly before April 16, eight of them in Magdeburg. Thus, the program offered even more than in 2008 when more than 20,000 attendees explored the diversity of logistical solutions and services at 212 events. For detailed information, visit www.tag-der-logistik.de.
Wind, water, sun and above all biomass – renewable energies hold tremendous potential. These natural treasures are outstandingly suited for efficient and environmentally compatible conversion into energy. Saxony-Anhalt Minister of Economics and Labor Reiner Haseloff emphasized this during the opening event at the Fraunhofer Institute for Factory Operation and Automation IFF: “Saxony-Anhalt has the best prerequisites. We in Germany are far ahead with renewable energies, particularly wind power and photovoltaics. We intend to further consolidate this leadership with the cluster initiative to make regional companies even more competitive.

The Saxony-Anhalt Renewable Energies cluster commenced its work in Magdeburg in February. The cluster of regional companies and research organizations intends to strengthen the renewable energy industry and consolidate the state’s leadership in the sector. The Ministry of Economics and Labor is supporting the project with 500,000 euros.

Small and medium-sized enterprises could operate much more efficiently and cost effectively. Considerable potential lies dormant in procurement and distribution management and is just waiting to be optimized. This is easier said than done though. Since they ship and deliver relatively small quantities, these companies have hardly any options to optimize their European transportation on their own. The consequence is poorly utilized transport and underutilization of intermodal transportation. A lot of air is driven here and there on European roads.

Researchers are working on solving this problem in the Kassetts project. They are pursuing the idea of implementing a European network of logistics brokers. Every broker is backed up by a logistics office that manufacturing companies may use to electronically record and aggregate shipping orders and optimize them according to vehicle routes and the volume of traffic. When necessary, regional and transnational brokers working in the network are available to efficiently plan transnational supply chains by incorporating the different manufacturing companies’ specific order and delivery data to be precise. Only then are the combined inquiries forwarded to logistics providers. Thus, rather than being a new logistics company or a fourth party logistics provider, the broker improves the supply and demand relationships of the companies involved. In addition, the broker opens opportunities for outsourcing and supports a logistics provider with organized demand. Consequently, this approach benefits both parties and helps save hard cash and protect the environment. The Istituto sui Trasporti e la Logistica in Bologna has already been tested the approach in Italy with convincing results. Over 20 percent of the costs were cut, 30 percent fewer kilometers were driven and the number of transport routes were reduced by 37 percent. Kassetts is being supported by the European Union. For more information on the project, its progress and the European logistics organizations involved, visit the official website: www.kassetts.eu.

Intending to collaborate closely in the CEESA cluster in the future: Prof. Zbigniew Styczynski, President of the Saxony-Anhalt Center for Renewable Energies (ZERE); Cluster Manager Frank Busch from ATI GmbH Anhalt Dessau-Rosslau, Prof. Klaus-Erich Pollmann, President of Otto von Guericke University Magdeburg; Dr. Gerhard Müller, Deputy Director of the Fraunhofer IFF and Prof. Heribert Münch from Magdeburg-Stendal University of Applied Sciences. Photo: Viktoria Kühne.
The Saxony-Anhalt Renewable Energies cluster aims to combine the activities of companies, research organizations and institutions in the energy sector. The close collaboration will particularly enable the partners to profit from technology transfer and know-how exchange. They are intensively committed to acquiring projects and attracting investors and providing them support when they locate in Saxony-Anhalt. The cluster management particularly concentrates on energy recovery from biomass and biowastes, wind energy converter construction and photovoltaics. “Ten percent of the world’s energy requirement will be coverable with biomass alone in the future. We absolutely have to tap this potential,” demands Prof. Zbigniew Styczynski from the Center for Renewable Energies (ZERE). The center was authorized to manage the cluster jointly with the Agentur für Technologie transfer and Innovationsförderung GmbH Anhalt. The initiators are inviting committed companies and organizations to actively collaborate. The cluster opens promising prospects for Saxony-Anhalt’s industry to successfully position itself on the global energy market.

State Supports Project for Professional Qualification with Virtual Reality

Haseloff: Everyday business will be hard to imagine without virtual technologies in the future.

Nothing changes faster than modern technology. A number of things such as technology and machinery at the workplace or a job itself are replaced over the course of one’s professional career. People who work with complex machinery and equipment in their job must be able to handle it particularly quickly and confidently. RKW Sachsen-Anhalt GmbH, education providers and companies intend to break new ground for professional qualification with virtual reality in the project ViReKon. Virtual reality imparts complicated technical knowledge much more easily and cost effectively than present instructional materials. Hence, virtual reality will become ordinary equipment in Saxony-Anhalt’s small and medium-sized enterprises.

At the ViReKon business day at the Fraunhofer Institute for Factory Operation and Automation IFF’s Virtual Development and Training Centre VDTC, Minister of Economics and Labor Reiner Haseloff expressed his conviction that “Saxony-Anhalt’s companies will only be able to keep up with global competition when progress and innovation are lived. Earlier this meant CAD programs, today it means virtual reality. Everyday business will be hard to imagine without virtual technologies in the future.”

Supported with funds from the European Union and the State of Saxony-Anhalt, the ViReKon project will enable the Technologie und Berufsbildungszentrum Magdeburg gGmbH and Schweisstechnische Lehr- und Versuchsanstalt Halle GmbH to qualify engineers and machinists on virtual machinery in the future. To this end, trainers are developing special e-learning methods together with the experts at the Fraunhofer IFF. Virtual models of the same machinery on which operators and maintenance technicians will work later are being produced in cyberspace.

Thus, for example, future machinist will learn how to prepare a job, correctly clamp a workpiece in a CNC lathe and correctly program the machine for machining. That’s not all. As an ambassador for progress, the virtual lathe comes directly from training to the company where it may be utilized versatilely. The virtual models are ideally suited for training colleagues or as an interactive maintenance manual. In other applications, the virtual models are used for quality inspection or as an attractive marketing tool for sales.
Web 2.0 for Companies

Blogs, Wikis, portals such as YouTube and social networks such as Xing have lastingly changed the Internet. Although companies have also long since recognized the potential of these Web 2.0 technologies, many remain hesitant to implement them. The concrete benefits are hard to assess, especially for small and medium-sized enterprises. In the project ICKE 2.0 (Integrated Collaboration & Knowledge Environment), specialists from the Fraunhofer Institute for Factory Operation and Automation IFF, the Fraunhofer Institute for Software and Systems Engineering ISST and the agency CosmoCode are developing new Web 2.0 communication portals adapted to corporate needs. Three companies, Krautzberger GmbH, Kristronics GmbH and Stelco GmbH, are establishing the platform’s practicability.

According to Dr. Fuchs-Kittowski, a researcher at the Fraunhofer ISST, “The key to the success of Web 2.0 in companies is integration. We intend to develop a complete system from many isolated applications and integrate it in existing corporate infrastructures.” This necessitates merging things as the technical foundation, which have not yet fit together. On the one hand, different Web 2.0 applications such as Wikis and logs will be harmonized and merged in a common system where their functions complement one another as Bliki for example. On the other hand, applications will be integrated in ERP and content management systems to support existing business processes.

The experts from the Fraunhofer Institutes and CosmoCode are relying on systematic economic feasibility studies and Web 2.0 implementation strategies to identify and efficiently utilize concrete fields of application in companies. “Many companies have difficulty establishing the organizational conditions for Web 2.0 applications,” observes Stefan Voigt, researcher at the Fraunhofer IFF. “While large companies have resources even to occasionally experiment with the implementation of social software, gather experiences and create relevant expertise, many SMEs are faced by problems at times.” The experts intend to use the systematic approach to particularly help SMEs also successfully enter the Web 2.0 age, which are situated outside the information economy where the barriers to entry are often largest.

The project is being supported by the BMBF. For more information, visit www.ike-projekt.de.

Center for Digital Engineering Opens

Magdeburg is an established center of applied virtual technologies. Research and development of virtual and augmented reality is now going to be expanded. To this end, the Fraunhofer Institute for Factory Operation and Automation IFF and Otto von Guericke University jointly founded the Center for Digital Engineering (CDE). In the future, the academic center will be based in the Experimental Factory in Magdeburg.

Embedded systems are increasingly controlling and monitoring devices that have become a given in everyday life. Researchers intend to take advantage of the benefits of virtual reality to develop more secure and reliable equipment. The performance of software integrated in machinery and devices can be demonstrated precisely in cyberspace. Photo: Viktoria Kühne.
An Intense Bond with the Technical University

In 1994, Fraunhofer had been in Magdeburg for two years. The senate had already named the institute an autonomous institute one year after its founding. The staff at the Fraunhofer IFF had grown to fifty in the meantime. The offices on Elbstrasse were bursting at the seams. Therefore, the institute opened a branch office at the Innovations- and Gründerzentrum in Barleben.

However, the year’s main event was the change in management at the Fraunhofer Institute for Factory Operation and Automation IFF. Prof. Michael Schenk and Prof. Herrmann Kühnle jointly assumed the management of the institute on July 1. Director until then, Prof. Eberhard Gottschalk transferred to the Fraunhofer-Gesellschaft’s headquarters in Munich.

In particular, the institute’s new management worked to implement the cooperation agreement between the Fraunhofer IFF and Otto von Guericke University Magdeburg. The Fraunhofer IFF expanded its applied research with specializations in the research fields of the teaching disciplines represented by the Fraunhofer directors at the university. This model is characteristic for institutes in the Fraunhofer-Gesellschaft. Institutes are closely connected with the system of higher education and directors normally hold chairs. Diplom theses and research papers may be completed directly at a Fraunhofer Institute. Institutes serve to prepare researchers and engineers for the working world in industry. Thus, by rigorously promoting the transfer of knowledge to practice, the Fraunhofer-Gesellschaft plays a special role in the innovative alliance of research and industry.
In a Flash
12th IFF Science Days
June 16 to 18, 2009

IMPRESSIONS
Optimizing Processes of the Trade
Dentures Made in Germany

An interview with Master Dental Technician Mathias Baumgart, Managing Director of Baumgart Dental Lab in Braunschweig

Baumgart Dental Lab’s advertising promises dentures up to 50 percent cheaper. How is master dental technician Mathias Baumgart able to keep this ambitious promise? He optimized his processes and expanded his range of products together with experts from the Fraunhofer IFF in Magdeburg. The entrepreneur from Braunschweig talked with IFFocus editor Anna-Kristina Wassilew about his offensive against cheap Chinese manufacturing.

Interview

Anyone in need of dentures has to be ready to make a larger investment in their health. Who has a four digit sum on hand quickly though? Everyone is watching costs – even patients. Therefore, dentists are increasingly ordering implants, bridges and crowns from China. What alternatives do you offer?

Production in Germany. Foreign production became interesting some time ago because German denture production became too expensive. I encountered boxes from China all over.

I quickly realized that this doesn’t actually have to be. We ought to recapture this market. After all, it’s far better to manufacture here and create jobs here. The Chinese use the same equipment. The quality of their product is good but China doesn’t have to be cheaper than here.

How were you able to cut production costs?

By optimizing the processes. The process engineers from the Fraunhofer IFF scrutinized the operations in our lab. The researchers were extremely precise. They even timed some processes with a stopwatch. They uncovered a number of potentials for optimization. Bit by bit, we modified some processes. After roughly two years, the lab has been completely converted.

Let us consider a typical process. What steps do you go through when producing a crown or a bridge for example?

A dentist makes an impression of a patient’s teeth. We digitize the impression and develop a three-dimensional CAD model of a crown, a bridge or even an implant. Then, we use a special machine to mill the frame for a patient’s individual dentures from zirconium oxide, a novel material. Thus, it doesn’t necessarily have to be gold anymore. The new materials have outstanding properties. They are unbelievably durable. Brake disks for Porsches are made of zirconium oxide. Then, the dental technicians finish the dentures in the lab. Finally, they are colored so that the crown also matches the natural coloration of the other teeth well and doesn’t stand out. The many work steps depend on real craftsmanship. On the other hand, some work steps in the lab can already be completed very well by apprentices after brief orientation.
Where have you cut costs?

Some processes were automated. Elsewhere, we were able to save material or assign differently qualified staff. China is able to save labor costs tremendously. We on the other hand are saving the considerable logistics costs incurred when manufacturing in distant Asia. Our services right here are one significant advantage for patients. We are much closer to them. So, you see that Made in Germany has many advantages.

What’s the job situation? Are you cutting staff?

No, quite the opposite. We precisely examined what skills and qualifications are demanded where. You don’t need a master for every work step. I hired three new employees just this year alone. By the way, we are one of the few labs in the region that offers training at all. Three apprentices are learning their trade at Baumgart Dental Lab. That is comparatively many. In the 1980s, for example, there were around 120 apprentices in Braunschweig. There are just 20 today. The numbers clearly illustrate the shortage of skilled labor threatening our industry.

Talking about innovation is always talking about money. With which product innovations will you be able to earn money after collaborating with the Fraunhofer IFF?

We even developed a new product line called Divident together with Fraunhofer researchers. Divident has special properties defined by standards, price and warranty.

Will you also implement new methods and technologies in the future? What might they be?

I saw various technologies during my visits to the Fraunhofer IFF in Magdeburg. I was really taken by the impressive possibilities. It inspired me and I came home with many new ideas.
Just where are you headed?

Pedestrian Motion Patterns as the Basis for Threat Detection

Prof. Klaus Richter and Cathrin Plate
Airports and security are are steadily converging in practice. Demands on airport security have steadily increased in recent years. Taking Frankfurt Airport as an example, the joint airport security system project FluSs is investigating the potential structure of an integrated holistic security management concept for airport infrastructures. The Fraunhofer IFF is one of the fifteen partners in this project supported by the Federal Ministry of Education and Research. The Magdeburg researchers are examining the behavior of pedestrians and intend to identify threat situations on the basis of motion pattern analyses.

The free transit of information, people and goods is the most important factor for the success of an export-oriented economy. One cannot be the global export leader without secure energy and transportation networks, internet and telecommunications, food supply and health care.

Germany has a dense transport infrastructure. More than 230,000 kilometers of roads, 44,000 kilometers of rails and 7,500 kilometers of waterways crisscross the country. According to the Federal Statistical Office, 150 million people are transported by air routes annually.

Vital Arteries are Vulnerable

As significance increases, so does the risk. Given the high population density and the high-tech infrastructure, the global export leader Germany is being exposed to ever newer threats. Although technology is becoming more dependable, even little disturbances can produce great impacts. Transportation routes are so finely balanced that they are even vulnerable to minor disturbances. Global mobility enables dangers to spread more easily and makes them more difficult to combat. Airports, train stations and ports in particular and rail and road systems are critical nodes for the German economy. Natural catastrophes and technical breakdowns as well as terrorism, criminality and sabotage can cause considerable damage in a world that is growing ever closer together.

Protection of Transportation Infrastructures

As part of its high-tech strategy, the Federal Ministry for Education and Research (BMBF) is investing around 123 million euros in its Research Program for Civil Security until 2010. The best ideas from science and research are being sought in order to advance innovative security solutions. One emphasis is the protection of transportation infrastructures.

Roads, rails, air routes and waterways are important cornerstones of the German economy and society. This not only includes all transportation routes but also the related installations such as airports, train stations and subway systems or bridges and tunnels. It also includes nationally significant installations, e.g. air traffic control centers, central rail control centers or road traffic control and information systems. All carriers, installations and systems are highly interconnected, thus making them vulnerable. Comparatively minor, individual disturbances can snowball. The failure of just one transportation node can cause lasting consequential damage in passenger and freight transportation. Therefore, as an important European transit country, Germany has a particular interest in the security of transportation infrastructures.

Customized Security Solutions

Along with the impacts perceptible every day, area-wide failures of transportation systems caused by technical or natural catastrophes such as fire or flood constitute risk factors for society and the economy as much as terrorist threats. These risks require customized security solutions. This will improve both early warning systems and emergency management strategies.

For instance, complex operations must be coordinated when an accident involving hazardous materials occurs. Police and fire departments must be alerted, on site response teams and agencies must collaborate and resi-
attacks in New York and London are particularly interfering with airport processes. New challenges demand new responses. Airport operators are facing the challenge of adapting existing security management to new threats and developing efficient, scalable and customer-oriented process architectures. All this must be done in the context of steadily rising numbers of passengers and commercial transport and it must remain affordable.

**Scenario: Threats at an Airport**

Airport structures can fall prey to a number of attacks, e.g. by explosives or biological or chemical weapons. Appropriate intelligence, monitoring and security measures are needed to counter the various threats. While minimizing the impact of a potential attack might suffice for less critical areas, more critical areas require passive or additional active protective measures. Early threat detection is imperative for highly critical areas.

The implementation of measures to minimize the impact of an attack in the less sensitive outdoor area of an airport without making costly investments may be more expedient from the perspective of cost and benefit. On the other hand, every security measure in a terminal has to be applied where there is bustling pedestrian traffic. Impacts must be minimized, passive and active protective measures implemented and threats detected early. It is essential that specific investments assure maximum security, while minimally interfering with personal security and flight operations.

What should the response to the various threat scenarios in different critical areas be? The partners in the joint project FluSs have selected the "onion principal" as their conceptual approach: They are analyzing and evaluating Frankfurt Airport and its environs from the outside in as a model site. They are performing a gap analysis of the current security infrastructure and processes and an event and risk analysis to identify fields of action, which will be the starting points for further analyses. In the process, the partners are examining different subareas. They are looking into the latest fluoroscopic and sensor systems for hazardous material detection, ID technologies, localization and navigation technologies and object, motion and pattern recognition technologies. This is precisely where the Fraunhofer Institute for Factory Operation and Automation comes into action. It is responsible for the analysis of individuals and pedestrian flows.

**Transparency**

Knowledge of such motion patterns will be an important contribution to increased security at airports because more people are increasingly spending time in non-security critical areas of airports (shops and restaurants), which are not under surveillance. The Fraunhofer researchers’ analyses will also include these people in its analysis, thus making the airport more transparent.
Situation Analysis
The researchers from Magdeburg are analyzing people and pedestrian flows in diverse airport areas on the basis of video recordings (pixel data). This enables them to answer certain questions. How many people are located in one place at what time? Are they moving? If yes, in what direction? How quickly? What is the makeup of the group (mother with child or tour group)? Is any individual leaving the group? Where is the individual headed? Are there aberrations in the ordinary routine?

Approach: Automatic Threat Detection
Motion patterns identified as typical form the basis for the identification of atypical movements and situations. As many as five scenarios for diverse airport areas will be developed in the coming three years. Different movement patterns are considered typical in different places, whether at the terminal or on the apron. Therefore, individual profiles will be compiled for each area. A comparison of actual movements and established patterns will be piloted for a selected area at Frankfurt Airport.

The idea behind this is to automatically identify threats by means of an automatic trigger that goes off like a smoke detector when there is a fire. However, instead of plumes of smoke, atypical movements are detected on the basis of deviations from typical patterns.

When an emergency occurs, relevant information can be extracted from the captured data. This is a positive secondary effect of pedestrian flow analysis. Anyone who knows where people are located when a fire breaks out is able to systematically reroute them. The airport’s data security supervisors and employee representations are being involved to increase acceptance of the project.

Optimized Catalog of Measures
The solution developed by the Fraunhofer IFF as well as other applications developed in the joint project are being evaluated for their interactions as well as cost effectiveness. The goal is to derive a catalog of optimized measures that will define which security measures must be initiated for what threat at what time. The concept for integrated system architecture will constitute the basis of implementation. Building upon this, a theoretically grounded security management concept ready for implementation will be developed. Airport employees’ attitudes and concerns will also be taken into account.

Allowing for varying basic conditions, the results will theoretically be applicable to any German airport. The transferability of the results to other carriers will also be analyzed.

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Three-point Landing for More Security

Prof. Klaus Richter, Martin Kirch and Olaf Pönicke

While operations and communication in international logistics are largely virtualized and automated, they do not always provide a complete overview of events. Under the umbrella of the research project ViERforES, researchers at the Fraunhofer Institute for Factory Operation and Automation IFF are working not only on monitoring situations in the logistics process by radio and but also visualizing them reliably. To do so, they are analyzing the movements of assets pixel by pixel and merged into motion patterns. Thus, in interaction with advanced identification technologies, information can be obtained more reliably.
"Just in time" – logistics has become the linchpin of business in this age of globalization. High demand for punctuality and precision determine the appearance of modern manufacturing processes. Our economy’s future prospects will largely depend on the performance of the transportation system and the competitiveness of logistics.

Part of comprehensive supply chain management throughout the entire value added chain, highly efficient logistics processes and structures significantly determine Germany’s success as a center of manufacturing and as an export nation. Our economy’s steadily increasing export orientation has furthered the development of very efficient logistics structures, making Germany an export world leader.

In this context, the logistics industry itself has evolved into an important branch of industry, characterized by high growth and potential for innovation for new jobs in the future. However, dynamics is inconceivable without continual optimization of process chains. If they come to a standstill, nothing moves forward.

The logistics industry plans and controls every flow of material, goods and information holistically and market-driven from suppliers to companies, within companies and from companies to customers. Changes in basic political and economic conditions as the EU expands eastward and increasing trade with Asian countries are enhancing Germany’s position as a center of logistics. Our country is moving to the center of global commerce and thus has potential to secure and consolidate its position as Europe’s logistics hub. However, this is confronting German logistics with particular challenges, including mounting demands for reliability, quality and cost effectiveness. Competition requires secure transport chains, punctual supplies, perfectly presorted deliveries and increasingly more efficiency, which can be obtained by intelligently combining transports and improving the utilization of available cargo space and storage capacities. A reliable infrastructure and trouble-free, maximally transparent transport processes are the prerequisite for all of this.

Innovative technologies such as the Fraunhofer Institute for Factory Operation and Automation IFF develops provide logistics providers support in their efforts for more transparency and security. Continuous tracking of goods at sensitive security areas such as international cargo centers is particularly important. Its internationality and numerous national and international legal regulations make air and sea freight an extraordinarily security-critical element of the global supply chain. Monitoring the domains involved in the process is a substantial step toward more transparency. How can events at a logistics node be ob-
sent to the control center – at least in theory. In reality, the fields of application for motion pattern analysis are presently limited to sports and forensics. For instance, researchers from the University Bremen think they will be able to recognize whether someone intends to steal a car or is just looking for his car based on his movements in a parking lot.

Recording and analyzing the movements of logistics assets necessitates initially researching methods suitable for processing localization data and identifying typical motion patterns. In the project VIERforEs (Virtual and Augmented Reality for Maximum Embedded System Safety, Security and Reliability in the program Cutting Edge Research and Innovation in the New States) supported by the Federal Ministry of Education and Research, experts from the Fraunhofer IFF in Magdeburg are investigating means to utilize scene understanding based on motion pattern analyses with reliable information for logistics. This research forms the foundation for more precise analysis of specific scenarios, e.g. events at a cargo hub. They want to describe the flow of goods precisely and thus detect security-critical situations and generate appropriate alerts. The researchers’ practical goal is to capture the overall situation at a logistics hub: What happens at the warehouse distribution center? When and where do trucks enter and exit? Are they unloading or loading pallets? Is everything happening according to the pattern typical for the situation or are misplaced containers or equipment obstructing the specified routes? While motion pattern analyses provide answers about correct conduct at the served though? Aviation security regulations prohibit the transport of active telematic units in the international cargo business. This limits the options to localize cargo considerably and necessitates keeping an eye on cargo with neutral systems unrelated to customers.

One method is video-based localization. The movement flows of individual logistics assets in the surrounding of such a logistics hubs are collected based on pixel data and assembled into motion patterns. Critical system states can be detected automatically based on the actual patterns’ deviations from the motion patterns identified as typical and an alarm message
hub, embedded radio-based systems on equipment and staff deliver additional information on cargo. An RFID glove developed by the Fraunhofer IFF transmits data between cargo and equipment. It is worn by a worker and reliably scans – practically with one hand movement – all relevant information on vehicles, goods or carriers such as containers, thus supplying information on every single container. This simplifies the loading of trucks, ships or even aircraft because every container must be placed in the spot designated for it in the cargo hold according to a specified sequence for security reasons. Knowledge of the precise position of every container makes loading easier to plan. That saves time.

Thus, when many autonomous and dependable radio units are available on an airport apron, the combination of pixel-based situation analysis and radio-based localization not only produces more security but also more efficiency at a logistics hub. Since the requirements for both will continue increasing in international transportation, the experts in Magdeburg are pressing ahead with their research and continuously testing other potential applications (e.g. in the project FLUSs on p. 16).

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Clever Combinations

The “Secure Chain of Goods” Is More than a Technical Solution

Helmut Röben and Dr. Daniel Reh

Like real life, logistics is complex everywhere. Obtaining secure chains of good from end to end requires clever interaction on different levels. Tactical and operative planning methods are just as much a part of this as suitable technical solutions. Only the combination of risk analysis and assessment and the systematic use of new technologies enable making supply chains more stable against external influences.
Circling the world – supply chains reflect global interconnectedness that has become ubiquitous. Especially for networked companies, ongoing globalization is a risk driver, which should not be underestimated. Novel security concepts that meet these challenges are in demand. Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF have developed innovative approaches and technologies to organize global chains of goods securely.

Technical support of secure processes is only one aspect of the implementation of a secure chain of goods. In fact, the interplay of tactical and operational planning methods and suitable technical solutions is necessary.

Despite current discussions about rising energy prices, the trend is continuing toward creating value added by means of widely branching international supply chains since supply chain optimization and organization, e.g. by means of outsourcing and lean management methods, are still primarily oriented toward cost. The consequences are obvious. Value added is shifted to the supplier structure, supplier and logistics processes are increasingly becoming more international, inventories and safety stocks are decreasing.

Mounting Risks
Reducing inventories and buffers within processes increases risk. The disappearance of decoupling points constitutes a mounting danger for companies.

Intense streamlining diminishes processes’ impregnability – a leaner and leaner supply chain becomes extremely vulnerable to adverse events and loses transparency. Long-distance delivery relationships and partners’ interconnectedness make it difficult for companies such as logistics planners to maintain an overview. All this bestows a particular risk potential on logistics as the connecting element in the supply chain, thus making appropriate action advisable.

Risk Analysis
The implementation of a "secure chain of goods" necessitates making allowance for every adverse influence. First, risks in processes must be identified. Discussions and workshops are suited for this.

Once they have been systematically identified, the risks must be evaluated logistically, ideally so that the evaluation results can be integrated in existing planning approaches of logistics systems. Software can help here.

In recent years, the researchers at Magdeburg’s Fraunhofer Institute have developed various tools that evaluate and simulate risks. They help systematically analyze risks and basically sensitize everyone involved in a process to the vulnerability of installed operations. Thus, the influence of risks to the certainty of supply of individual companies in a manufacturing network can be simulated in the medium term.

Analysis is focused on logistics planning parameters such as delivery reliability for the purpose of logistical risk assessment. In addition, the results of the simulation enable prioritizing risks to define actions.

Not every risk is really critical and requires immediate action. The implementation of measures to actively and passively control risks is important on the planning level to prevent, reduce or limit risks. This is precisely where technical solutions come into play again.

Electronic Aids
Just-in-time! Identifying goods anywhere at any time, monitoring them and checking their intactness and quality is becoming increasingly important for international logistics companies. RF technologies are ideal for this.

Contactless identification of assets in the supply chain is the basis for every development with which data can be saved individually for every asset. The integration of localization technologies and sensor systems make it possible to determine the condition and location of individual assets. In addition, these technologies help interconnect individual assets. All this facilitates control in the supply chain. Systematic implementation of RF technologies reduce and potentially even eliminate weak points identified in the risk analysis.

Simple and rugged solutions are considered the means of choice. Ideally, these electronic aids are in action from identification through control.

Classic Configuration
The entire technical process begins with identification by barcodes or simple RFID tags in enclosed areas. Data storage on the asset is expedient for complex capital goods or machinery.

It is always interesting whenever a constant connection with a superordinate system cannot always be assured and further information on the asset is required.

Data storage on an asset also produces value added when different participants throughout the supply chain require data and a central database is unavailable or unfeasible. Moreover, it can be combined with additional modules such as localization and sensor systems.

With the aid of GPS receivers, the assets in the supply chain outdoors can be located and tracked to the exact meter. Even more precise results are possible inside buildings or vehicles. A coordinate system may be defined in a warehouse so that assets can be localized down to the centimeter. Thus, localization technologies facilitate continuous monitoring within a supply chain.
is reached. The tag head sensor can be used, for example, to retrieve localization data by GSM or write it on an RFID transponder. The tag head regularly transmits a status report to the warehouse software or when it is retrieved by WLAN, GSM, ZigBee, etc. If the sensor values leave the defined security area, an alarm is automatically transmitted and the relevant sensor values and the position are written on the RFID transponder. Communication technologies enable interconnecting supply chain assets autonomously rather than observing them singly. This establishes a connection between assets or to a central control station. The particular challenge is to expediently utilize the accumulating data for purpose of control.

Risk Management Creates Value Added
The technologies behind the monitoring and control of goods and vehicles, secure transit of goods, direct monitoring and running inventories hold considerable potentials. This is not only an issue of security but also of cost. How long does transport take from unloading to receiving in the distribution center? What is the level of container utilization and can it be optimized? How can lost goods be relocated fastest? Does the driver even take the stipulated route? RF solutions provide answers. Sensor systems provide an additional plus. For
instance, critical components can be replaced by “intelligent components” or downtimes required by maintenance can be planned better.

The interplay of planning methods and technology not only makes supply chains more secure but also more cost effective, reliable and transparent.

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Finally, chains of goods can be fully secured with a clever combination of the latest RFID developments such as the RFID glove for documented handling of goods and a delivery van equipped with radio technologies. Photo: Dirk Mahler

Find out how others do it:
September 15, 2009 at MEVA in Haterbach
October 22, 2009 at BMA AG in Braunschweig
November 12, 2009 at Fraport AG in Frankfurt

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The history of transportation is as old as humanity and a new chapter is added every year. A desire to observe transports from end-to-end has been driving the logistics industry worldwide for some time. The Fraunhofer IFF’s developments are making this reality. Innovative radio and video-based localization technologies facilitate continuously monitored routes, even when delivering replacement parts for industrial plants in remote regions.
Waiting for the right moment entails the risk of missing it. Being able to foresee the right moment puts one on the safe side. Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF know best that this has nothing to do with magic. They employ the latest technologies to predict specific scenarios that will take place in the future.

Help with Wear
Every system reaches its limit at some point. Plants succumb to wear. No later than then, the moment has come to take action. What is to be done though when a quick reaction is technically or logistically impossible or when a replacement part is not in stock or cannot be purchased and transported to the required location in time? In such cases, operators may wait, complain or hope, have good luck or bad luck. The perfect solution looks different though. Ideally, they intervene before damage occurs. This is where a new generation of maintenance solutions comes into play, which interlinks identification and condition monitoring technologies.

Technologies for Condition-based Maintenance
Medical checkups can save lives. The automotive industry also has good reason for making recommendations for maintenance. Components such as spark plugs, engine oil, oil filters and toothed belts wear out and must be replaced at regular intervals. Other components such as hoses and seals must be inspected regularly. Neglecting such important work and components usually results in expensive major repairs. Therefore, regular inspections assure safety, reliability and cost effectiveness not just in cars but also in complex industrial plants.

The technologies for condition-based maintenance being developed at the Fraunhofer IFF are a type of early warning system. A combination of measured and empirical values enables plant operators to infer when individual components must be replaced and, in particular, to gather information on a plant’s level of load and wear.

The Plant Speaks
Providing a plant with localization technology and sensor systems makes it possible to localize faults and measure current sensor conditions such as temperature increases, pressure decreases or undesired vibrations. Radio modules transmit captured data to a control station – the plant speaks. The received information on the actual state must be utilized expediently. Logisticians are primarily aiming for one thing, i.e. to identify the ideal time to order and ship replacement parts.

When specific system components’ times of failure are known, the warehouse system can be searched for replacement parts so they are available when needed. RF technologies provide an overview and create a transparent warehousing system. If the search is fruitless and a part is not in stock, an order process must be initiated. Everything here depends on the right moment too because the timing of the order normally determines the delivery date.

First Rate Lab
Researchers in Magdeburg have been working in the field of condition-based maintenance managements for years. They test the RFID, auto-ID and telematics applications they employ in their LogMotionLab. One of Europe’s leading development labs, LogMotionLab houses most every identification technology that is commercially available or in development – altogether more than forty systems – on around 1,800 m².

Researchers in Magdeburg chiefly work on new and special applications of proven principles such as radio frequency identification (RFID) and applied communication in distributed networks.
conditions deliver sound information and data on the quality of a logistics process supported by RFID.

**Intelligent Container**
This has practical consequences. Model processes are set up in the LogMotionLab to run as they would under harsh conditions. Established identification, localization and sensing technologies are implemented. The “talking” system is the center of attention. It reports a need for repair and initiates an order process, thus activating the supply chain at the right time. Transport chain monitoring helps goods reach their destination intact. This may be done by the IFF Smart Box, an intelligent transport container developed at the Fraunhofer IFF.

Integrated RFID antennas and a reader based on HF radio waves enable the container to detect every loaded or unloaded package and store the information in a database. To this end, every package must be equipped with a transponder. This enables the container and its contents to “converse” and compare inventories. A telematic module with integrated GPS receiver and wireless GSM simultaneously monitors and localizes the box. Its location can be retrieved in the Internet with the aid of map software or over the phone with a fully automatic language application. Sensors help monitor the quality of the contents too. Thus, transported goods’ “state health” can be tracked.

Maintenance managers also know the location and condition of transported replacement parts at any the time. They know when they have reached their destination and whether they are intact. Naturally, they are also able to react to problems.

**Putting It to the Test**
First and foremost, the researchers have set themselves two goals this year. On the one hand, they intend to interconnect the sensor systems integrated in the LogMotionLab even further. On the other hand, they intend to make them more utilizable for mobile systems and vehicles in harsh environments, e.g. jeeps in the desert or trucks in the Arctic. Extreme basic climatic conditions confront the technologists with new challenges. Sandstorms, searing heat or temperatures above 40 degrees Celsius demand quite a bit from sensors. Moreover, heavy contamination, e.g. a vehicle’ oily underbody, makes measurement difficult. The LogMotionLab’s test environment may be used to test different RFID solutions under different physical and organizational conditions. Standardized and reproducible test
monitor the assembly of spare parts once they have reached their destination intact. To do so, they have installed a smart workbench – a high-tech assembly table that thinks for itself – in the LogMotionLab. The removal and installation of different components may be documented by means of radio technologies. The table could also conceivably assume the role of an assembly helper. Since it is able to identify every individual component placed on its surface, the table is able to recognize the overall situation. In other words, the table knows which work steps come next. It is able to support assemblers by starting the proper assembly video for instance. This requires equipping all components with RFID transponders. The manageable number of repair scenarios even makes this attractive idea appear financially feasible in maintenance management.

**Better Safe than Sorry**

Precise radio localization is not necessarily precise enough. Whether because of unfavorable external conditions, unforeseen interfering factors or the implementation of certain procedures, which deliver results that are only precise to the centimeter, wishes remain open, particularly outdoors. Magdeburg’s Fraunhofer researchers routinely advise anyone in need of accurate results to combine radio and video-based localization. Precisely this mix of methods is being installed in the LogMotionLab as a prototype right now.

While radio technologies have primarily been used so far to localize and identify assets in supply chains, images integrate another dimension. Video camera recordings are analyzed by differential image methods. The location of assets can be determined with the results. They are identified by radio. Even video-based localization has limits though. Poor weather conditions such as fog, rain and snow or simple objects that obstruct the view appear to constitute almost insurmountable obstacles. A combination of both localization systems provides a remedy. Effective implementation of such sensor data fusion is currently being field tested at Leipzig-Halle Airport. Researchers and practitioners intend to use it to more precisely capture the situation at the DHL Logistics Hub.

www.logmotionlab.de

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When you say A, you must also say B. ALUNorf GmbH in Neuss has put this wisdom into practice. Actually, the foundry only wanted to implement a maintenance program with SAP R3/PM. Today, radio frequency identification (RFID) is transmitting from one end of production to another. The Westphalians are utilizing RFID technology to continuously track tools such as permanent molds. Since the data flows into the ERP system, maintenance managers know components’ condition and location at any time. Thus, searches on the plant premises are as much a thing of the past as undocumented permanent mold installation.
Radio frequency identification (RFID) facilitates automatic identification of individual items by radio waves at short distance. More and more companies are implementing transponders in manufacturing, warehousing and logistics. The researchers at the Fraunhofer Institute in Magdeburg were themselves initially skeptical that transponders would even function in such a raw environment as an aluminum remelt plant but their pilot project “RFID Technology for Permanent Mold Tracking” dispelled any doubts.

What do a commercial kitchen and a foundry have in common? At first glance, the differences couldn’t be greater. Yet, some parallels exist too: heat, grease, noise and production that is heavily dependent on a functioning flow of material and goods. Whether flour or metal, both must be at the right place at the right time so that the result is right.

Comparable Operations
Intralogistics is an integral element of reliable, continuous production in every enterprise. Material flows in the foundry or metal processing industry do not fundamentally differ from those in manufacturing companies in other sectors. In every case, materials are delivered, processed and subsequently shipped as semi-finished or finished products. In turn, certain tools are needed to process the materials. The organization of the optimal internal flow of materials and goods depends on this as well as on company size or the number of facilities. If one intends to systematically control the flow – and that ought to be the goal – one must fulfill several conditions.

First off, coordinators of intralogistics and maintenance should be aware of every unit’s condition. They also ought to be able to externally update or control them. This is important in critical situations in particular because knowledge is useless if one is unable to intervene in an emergency.

An Overview Thanks to ERP Software?
Companies rely on data processing systems such as SAP for their production planning and control. They map all the processes that occur in production. Meticulous system maintenance is the prerequisite through. The structures mapped in SAP provide a view of the current status of any process, piece of equipment or tool and is thus the best foundation for functioning and efficient maintenance management.

Manufacturing operations are too complex to always represent easily. The situation becomes problematic whenever equipment or tools change their location in a company. ERP software does not register this on its own. Employees in the shop or warehouse must enter the new locations manually.

Forklifts, tractors and permanent molds are examples of such tools or equipment that change location. The latter are foundry tools for melting aluminum bars. Anything but delicate, they are nonetheless sensitive and therefore must be serviced routinely. SAP helps here. The traceable history in the system serves as a basis to keep the schedule of and perform certain maintenance and inspection work based on usage. For instance, permanent molds must be cleaned and recoated after a specified number of founding processes. Problems that occur at a permanent mold can be documented in the SAP system. The mold is barred from ongoing production from this time onward and transferred to the shop for maintenance.

Minor Errors and Great Impacts
The basis of every action is the plant maintenance (PM) job order, which is used to enter or forecast maintenance work, requirements and maintenance and inspection job orders in the ERP system. This is the basis for the main-
tenance processes mapped in the ERP system. These processes are based solely on manual entries and this is the critical point. After all, there are situations in which the real world departs from the virtual world, e.g. when a foundry job order with a particular permanent mold is entered into the system but cannot be completed because the permanent mold is unavailable at the appropriate time or a permanent mold of the same type is available faster. These changes must be added manually. Who should do this though? This necessitates training every employee in system entry, which entails considerable time.

Locating a Permanent Mold
Since important updates such as permanent mold exchanges are often not entered, errors with serious consequences slip into the system. Since the maintenance department plans its processes on the basis of the entries in the ERP system, erroneously planning inevitably results. Equipment and tools must be registered automatically so that maintenance work is continuously monitored and thus consistently performed. This is where the automatic component tracking solution developed at the Fraunhofer Institute in Magdeburg takes effect, which ALUNorf implemented in a foundry for the first time. It is based on identification, localization and hybrid technologies.

The ALUNorf GmbH Pilot Project
Permanent molds are transported back and forth between permanent mold storage, the shop and the remelt plant with the individual pouring stations. Permanent mold shelves for temporary storage are located between the pouring stations. Continuous tracking of the permanent molds necessitates registering their transfer from one place to another.

Maximum read ranges of three meters must be bridged. In addition, a permanent mold is routinely subject to temperatures of up to 60 °C, dirt, water and oil and diverse impact loads when installed and removed.

UHF RFID systems specially adjusted to the environment are able to meet the specific demands these conditions place on the hardware. The passive transponders installed on the permanent molds must have a housing that resists water and oil. A strong metal frame provides protection against mechanical loads. All the reader systems and antennas are integrated in the less vulnerable infrastructure.

Doors Can Read
The permanent mold flow begins in permanent mold storage whence the tool may only be transferred to the shop or loaded onto a tractor with a trailer for permanent molds. RFID reader systems at the doors capture and document their transit. The data enters the ERP system and the SAP system is informed.

An RFID system installed on a tractor and connected to the ERP system by WLAN registers when the trailer for permanent molds is loaded. Thus, a permanent mold can also be allocated to a tractor during its entire transport over the plant premises. Since a tractor with a trailer for permanent molds is mobile, the current location of the permanent mold-tractor aggregate is missing when said aggregate is allocated. A WLAN localization process allocates the aggregate in space. Thus, a permanent mold’s current location can be indirectly determined by the tractor’s location. This hybrid technology can be used in the ERP system to continuously track a permanent mold’s location.

If the tractor-permanent mold aggregate is separated again, the last known location coordinate of the tractor is binding for the current location of the permanent mold. This enables allocating permanent molds in space. Thus, even permanent molds

Work meeting in permanent mold storage. Photo: Martin Kirch
temporarily placed in buffer zones are always locatable. If, on the other hand, a permanent mold is stored in a rack for permanent molds or installed in a pouring station, then its new location is registered by the UHF RFID systems installed in these stations and transmitted to the ERP system.

Systematically Supplying the ERP System
All data are transmitted to a central localization server, processed, filtered, formatted and exported to the ERP system. This guarantees that only relevant information is exported through an interface to the ERP system and prevents a needless flood of data. In addition, the systems store only a very limited component tracking history. The last known location is guaranteed to always be available when a fault occurs.

Outlook
ALUNorf GmbH has already been convinced by the use of RF supported component tracking. Standardized, online and always up-to-date component information has had positive effects, reduced cracking rates, extended maintenance intervals, less maintenance and lower costs being but a few.

This system provides the basis for potential expansion to equipment such as tractors and coils as well as products such as aluminum bars. This is another challenge for the researchers at the Fraunhofer IFF. It represents all sorts of potential for foundries and other industrial companies.

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Intelligently Green

Innovative Logistics Concepts for Converting Energy from Residual Biomass

Prof. Michael Schenk, Sebastian Trojahn and Dr. Ina Ehrhardt

The depletion of fossil energy sources such as coal and crude oil is making new approaches to energy recovery imperative. Utilizing biomass for energy conversion on a grand scale does not appear to be the magic formula in response though. Lasting damage to forests from intensive utilization as well as competition with agriculture and forestry would be too great. The utilization of residual biomass furnishes a way out. Its logistics is difficult though. Magdeburg’s Fraunhofer IFF is developing innovative solutions to this problem right now.
Biomass Protects the Climate

Plant biomass is hotly discussed as the energy source of the future. The “old fashioned” energy source wood has been regaining its attractiveness since the world became aware that crude oil is actually a finite resource and thus sets clearly discernible limits on our current energy supply concept. The nearly omnipresent old great new hope feeds energy suppliers’ fantasies of a virtually unlimited raw material that is constantly available, is renewable and has a positive life cycle analysis. When it is burned, plant material such as wood only releases as much CO$_2$ as it has absorbed and stored during its growth. Thus, unlike energy recovery from crude oil or coal, additional CO$_2$ does not enter the atmosphere.

According to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the percentage of renewable energies in Germany’s gross energy consumption nearly tripled from 1992 to 2007 and is now above 14 percent. More than one quarter of this is recovered from biomass. Among other things, easy availability and rising energy and raw material prices are also responsible for this positive development. They alone have made biomass a cost effective energy supplier at present. In addition, technologies that recover energy from biomass have steadily advanced. Their growing efficiency improves the chances of sustainably establishing biomass recovery to generate energy.

Limited Potential

Despite all the advantages this technology brings, this valuable resource’s potential is limited because it is not infinitely available. So far, it has been obtained primarily from raw wood or agricultural crops. Thus, it directly competes with material recovery from timber and the food industry. However, intensified raw wood utilization is inconsistent with ecologically sustainable forestry. Intensive utilization of agricultural lands to produce biomass for energy recovery is just as questionable.

Residual Biomass as an Alternative

Therefore, a hunt for alternatives is fully underway. One alternative is the utilization of residual biomass, i.e. a multitude of hitherto largely ignored plant residues and wastes from agriculture, forestry and landscape conservation and botanical material that would otherwise be unutilized and disposed of. The variety is substantial and includes hay, straw, bark, roadside vegetation cuttings and private residual wood. The development of new technologies to utilize this material for energy conversion is just about ready for implementation.

The researchers at Magdeburg’s Fraunhofer Institute believe that a large part of the biomass for energy recovery could be obtained from this rich pool of residual material in the future. The energy recovered from the quantities of available residual straw alone could cover approximately six percent of Saxony-Anhalt’s primary energy requirement. If one projects this on the total potential of all residual biomass, one can imagine how many natural renewable energy resources still remain unutilized.

Difficult Logistics

The difficulty lies not only in the technology needed for recovery but also in the often widespread and partly very small yield of such residual biomass. Only its sum reveals its true potential. Finding, structuring, collecting and supplying it to maximally effective utilization constitute a profoundly complex job, especially when one considers that the total work required for this effort may not devour more energy and money than may be generated with it.

Success-oriented Cooperation

Given this situation, a joint research group from the Institute of Logistics and Material Handling Systems at Otto von Guericke University and the Max Planck Institute for Dynamics of Complex Technical Systems has been at work in Magdeburg under the lead management of the Fraunhofer IFF since the start of 2008. Their joint project is called NEWE, an acronym for “Netzwerke elektrochemischer Wandler in der Energieerzeugung” (Electrochemical Converter Networks in Energy Conversion). Financed with Excellence Funds from the state of Saxony-Anhalt, NEWE deals with logistics processes that efficiently supply the energy source biomass. The common focus in this ambitious project is the effort to make biomass available for hydrogen production. Afterward, it will be supplied to sustainable utilization in fuel cells. The goal of these efforts is a maximally positive energy balance when they start utilizing biomass for conversion into electrical power or heat. The research organizations’ are pooling their different overlapping fields of expertise in this promising collaborative effort.

The Fraunhofer IFF already has considerable know-how in the field of timber and biomass logistics. Its logistics experts have been working on the sustainable supply of raw material for several years. They have already organized existing supply processes more efficiently and further developed service provider models to utilize raw wood. Together with partners from the industry and forest management agencies, they are working on innovative strategies to supply residual biomass in the future. Their experience in the field of timber logistics is specialized knowledge, which is sought after to provide support when economically and ecologically justifiable biomass supplies are being operatively planned.
Innovative Logistics Concepts

One of the many problems is the different ownership structures and microstructures confronted when dealing with residual biomass. Few large and a multitude of smaller communal and private suppliers are offset by a variable number of transport providers and potential end buyers such as biomass cogeneration plants. Ultimately, it is essential to efficiently interconnect all of them so that the system of closed natural resource utilization also functions.

The Fraunhofer IFF considers one of the main tasks for this to be the evaluation and specification of the available base of data such as the quantity, quality and geographic location of the biomass yield. Afterward, this is supplemented with logistically relevant factors, e.g. infrastructure, equipment requirements and costs. On this basis, the researchers finally develop appropriate planning methods, i.e. models and processes for later organization of strategic and operative processes. This is intended to enable the relevant stakeholders to know in the future where and when what type of residual biomass is yielded, what its current value is, who is offering it, who potential buyers for it are and ultimately also which service providers will take over its transport. This is a tremendous challenge that also entails the development of suitable solutions that localize the smallest registered quantity of hay on an open field or timber residues in the middle of a forest for instance.

Such solutions require open systems for distributed partner networks in which all the stakeholders in the recovery processes engage or disengage depending on their interests. This is important because the entire process ultimately consists of sensitive interaction between providers and service providers. Everyone involved will be able to choose their form of collaboration based on the current market situation and the logistics work required. The goal is to organize the route from the site of origin up through processing so efficiently, cost effectively and ecologically justifiably as well as profitably for the stakeholders involved as possible.

Life Cycle Analysis Counts

Together with partners such as the Deutsches Biomasseforschungszentrum, Saxony-Anhalt’s Center for Renewable Energies and Otto von Guericke University Magdeburg, the Fraunhofer IFF is working on developing optimal biomass logistics concepts. Among other things, this includes optimally siting a biomass cogeneration plant, while factoring in the existing transportation infrastructure. The properties of the potentially recovered residual biomass are of particular interest. They determine the type and quantity of raw material that may ultimately be developed economically justifiably and supplied to continuously operate the plant. Above all, safeguarding sustainable, economic and ecological factors such as the life cycle analysis and the CO2 balance will be important for the construction of future power plants. “Nobody,” according to Holger Seidel, Manager of the Logistics and Factory Systems Business Unit Fraunhofer IFF, “is going to be interested in a power plant at the wrong site or in an incorrectly sized power plant that is actually much too large for the relatively small amount of biomass that can be justifiably drawn from the surrounding region.”
Distributed Energy Supply
The biomass’s relatively low energy density is the primary impetus for the construction of only small distributed energy conversion plants in the single digit megawatt range. Supplying larger power plants with biomass would require transporting large quantities of it from ever greater distances. Such effort would no longer be worthwhile because of the higher costs. Therefore, the specialists from the Fraunhofer IFF’s Process and Plant Engineering Business Unit advocate distributed solutions for biomass plants. Since they are operated with renewable resources from the vicinity, they constitute an important step toward a sustainable and nevertheless region-wide energy supply.

Sustainable Biomass Utilization
Naturally, energy recovery from renewable raw materials is exceptionally environmentally compatible. Classic biomass is growing scarce however. at best, it was composted in agriculture and forestry earlier; it will be quite valuable in the future. Therefore, in a joint research project, experts from Saxony-Anhalt and Valencia in Spain are analyzing methods to profitably recovery material from biomass residues.

Saxony-Anhalt primarily has residues and waste from landscape conservation. Valencia on the other hand has large quantities of biomass from the cultivation of olive and orange groves. The plant residues hold tremendous potential. Unfortunately, standardized and low cost recovery of these diverse residues is difficult for the industry. Immediate energy recovery is certainly profitable. Material recovery, e.g. processing in the furniture industry, is significantly more sustainable. As Business Unit Manager Holger Seidel reports, researchers at the Fraunhofer Institute for Factory Operation and Automation IFF and their international partners are jointly developing new processes and technologies for just this. Since industrial utilization necessitates sorting the different plant residues and sorting requires identification, his researchers are working interdisciplinary on smart concepts for biomass logistics. A look at any gardener’s compost heap and the unbelievable variety of different plant residues it contains are enough to convince anyone that this is no easy task. In the Fraunhofer researchers’ vision for the future, residual timber could be equipped with RFID labels or green waste yielded during landscape conservation marked with luminescent nanoparticles. Once the precise biomass has been identified, a decision can be made about its intended use.

Limbs and branches can be processed into tons of woodchips or pressed into particle board for a furniture manufacturer. Even its use as insulation or as an additive in concrete parts is conceivable. The supply chain may be reorganized and monitored accordingly from harvesting to storage and transport up to the final place of utilization.

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Harz Power

An Entire Region Is Pursuing One Goal: A Renewable Energy Supply

Until now, there have been few direct points of contact between energy efficiency and information and communication technologies (ICT). However, this is changing right now. The E-Energy support program launched by the federal government is aimed at intelligently uniting energy conversion, distribution, consumption and trade with ICT. Concrete structures are being tested by expert teams in six model regions throughout Germany, including the “Model Renewable Harz Region”, which intends to launch model solutions that link energy and communication networks by 2012. Attention is focused on the utilization of different renewable energy sources and controllable loads, which will be united in virtual power plants.
On the one hand, our climate is changing, energy demand is mounting and fossil fuels are running out. On the other hand, renewable energy sources have nearly inexhaustible potential. Everything ought to be fine and the energy issue resolved, shouldn’t it? Deceivingly simple at first glance, the situation demands more complex solutions. Ultimately, the energy supply must be organized cost effectively and environmentally compatibly in the future too.

Power plants always supply as much power as industry, households or other consumers need at the moment. Conventional power plants do this largely with nuclear power, lignite, water power, anthracite or natural gas. Peaking power plants (e.g. pumped-storage power plants) kick in in an emergency. Renewable energies are gaining momentum though. In 2007, they already accounted for 32 percent of the power generated in Saxony-Anhalt. According to the State Statistical Office, nearly every third kilowatt hour is obtained from renewable energies. However, precisely predicting sun, wind and heat is difficult. They supply power as a function of the weather. Does that mean every mill needs to be backed up by a power plant at the ready when they subside? Are renewable energies at all able to flexibly respond to fluctuating demand? Combined renewable power plants are considered the solution. When they are smartly interconnected, wind, sun and biogas mutually compensate each other’s fluctuations during production.

**Energy Internet**

Assuring a green and stable supply of electrical power from its generation to distribution through its consumption is the crucial challenge for the future. Information and communication technologies (ICT) will play a key role. They will support a so-called “Energy Internet” in which many generation plants communicate with power system facilities and the millions of power-consuming terminals.

This is where the E-Energy support program endowed with a total of 140 million euros comes into action. Six projects are developing model solutions that will link energy and communication networks by 2012. A key point in all the projects is the creation of market platforms for residential and commercial customers supported by ICT. Interdisciplinary assembled teams of experts are developing and testing ICT products, methods and services intended to increase energy efficiency and supply certainty and strengthen climate protection. The Fraunhofer Institute for Factory Operation and Automation and the Department of Electrical Power Systems at Otto von Guericke University Magdeburg are two of nineteen consortium partners in the model project “Model Renewable Harz Region RegModHarz”, the Harz region being the only model region in eastern Germany.

**A Small Town with Big Goals**

The small town of Dardesheim is in the center of the model renewable Harz region. It is pursuing an ambitious plan. In the medium term, it intends to supply more than 250,000 residents with renewable energy. Roughly two thirds of the energy now consumed in the rural county is already obtained renewable. The mix of wind power, solar energy, water power and biomass is considered exemplary. Some forty wind energy converters are in operation atop the Druiberg on the outskirt of town. Biogas plants, solar cells on the roofs of schools, preschools, businesses and residences, a 5 MW cogeneration plant operated with vegetable oil and a renewable power charging station complete the picture of the model energy town. The project “Model Renewable Harz Region” is intended to further increase the share of renewable energies while guaranteeing cost effectiveness, supply certainty and environmental compatibility.

Dardesheim is 1500% renewable. In 2007, fifteen times the local demand for power, heat and fuel was produced from indigenous renewable energies, partly in Druiberg wind park. Photo: Energiepark Druiberg GmbH.
Perfect Interaction
The key element for the residents of the Harz on their way to an energy supply without fossil resources is a combined renewable power plant. Modern information and communication technologies will collect information on all renewable power generators and consumption data. This will allow adjusting consumption to the supply of renewable energies at any time and vice versa. In conjunction with an innovative online network, it will provide the generators, traders, power system operators and customers involved an ecologically and economically optimized energy supply up through full supply. Power system operators Vattenfall Europe Transmission and E.ON Avacon and municipal utility companies in Quedlinburg, Halberstadt and Blankenburg are the partners. They are making the entire transmission system of the 380 KV high voltage to low voltage grid available to the project. The populace is also cooperating. Regional acceptance of the project is very high.

Virtual Combined Power Plant
ICT are being implemented to optimize the overall electricity supply system from generation to transport and distribution up through consumption. The heart is a virtual combined power plant that optimally combines the advantages of the different renewable energies. The main challenge is how to intelligently bring renewable energy generation, power consumption and storage technology together by means of online data acquisition. The combined renewable power plant’s control center receives near real-time information on the situation in the region. This complete overview of generation, storage and consumption facilitates forecasting. The benefit is the ability to utilize renewable energies optimally.

Wash When the Wind Blows
The Harz virtual combined power plant intends to break new ground in efficient energy use. Not only the output of the energy generators but also the energy consumption of voluntarily cooperating consumers shall be registered and coordinated. The goal is to adjust variable power consumption to supply. In other words, consumers could turn on their washers or dishwashers manually or automatically when the wind is blowing or the sun is shining strongly.

A Giant Battery
One important part of the project is the pumped-storage power plant at Rappbode dam in Wendefurth, which already provides considerable storage potential. It is able to intermediate store excess renewable power practically like a giant battery – theoretically the entire output from twenty-four hours. The excess power can be used to pump water from the Bode River into the upper reservoir built in 1967. If the water is needed again, perhaps because the air is still at the moment, it can flow back into the valley and drive two 40 megawatt turbines. Thus, generated power returns to the network.

Cars as Energy Carriers
Electric vehicles could be instrumental in further stabilizing the grid in the future. Since ICT facilitate data exchange, such vehicles will primarily charge with excess wind or solar power. Since a car is normally driven no longer than forty minutes a day, enough time remains to connect mobile batteries to the grid.

The energy independent town of Dardesheim. The residents of the Harz region are pursuing their goal with all their power. They are breaking pioneering new ground in order to supply the roughly 250,000 residents of the rural county exclusively with regionally produced renewable energies such as wind, biomass, water power, solar energy and geothermal. All the strands merge in the “Energy Internet”, which links supply and demand as well as generators and consumers. Photo: Energiepark Druiberg GmbH
Supply, cars may be used as energy carriers. Such concepts are also being researched in the project RegModHarz. In addition to a vehicle’s function as a storage system, the Fraunhofer researchers are also studying load management options. The approach behind this entails only charging vehicles at times that are ideal for the power system. To this end, the e-mobility experts in Magdeburg will be developing and testing system services that integrate electric vehicles in the power supply system.

If, for example, an excess of wind power were produced and were therefore particularly inexpensive, a car could charge green power. If there were a lull and not even the sun were shining when demand is high, the battery would simply feed its power back into and thus stabilize the grid.

The scenario described is also discussed as an “electromobility concept”, i.e. locomotion with vehicles with powerful rechargeable batteries and operated with electricity from the power distribution network by means of so-called plug-ins, which treat the consumption and supply of electrical power independently from one another. Thus, electricity from the distribution network may be stored and utilized for driving at a later time or fed back into the distribution network. When such plug-ins are integrated in the electricity supply, cars may be used as energy carriers. Such concepts are also being researched in the project RegModHarz. In addition to a vehicle’s function as a storage system, the Fraunhofer researchers are also studying load management options. The approach behind this entails only charging vehicles at times that are ideal for the power system. To this end, the e-mobility experts in Magdeburg will be developing and testing system services that integrate electric vehicles in the power supply system.

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The two pumped-storage power plant connecting pipelines/canals discharge in the powerhouse with two pumped storage/turbine sets apiece with 40 MW of power. For more information, visit www.energiepark-druiberg.de. Photo: Energiepark Druiberg GmbH.

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The Fraunhofer IFF has had a new marketing manager since the beginning of the year. A native of Magdeburg, Erik Dietzel is enjoying the wide ranging challenges. He provides Fraunhofer researchers support when they showcase their services at trade shows or when they visit companies. The industrial engineer is increasingly directing his energy toward conceiving and organizing events that particularly address potential clients. Erik Dietzel intends to meet the special challenges of research marketing at the Fraunhofer IFF with customerized marketing concepts.

Marie Curie Program Facilitates Early Careers

He earned his undergraduate degree in Budapest but his doctorate in Magdeburg. Dr. Tamás Juhász traveled to his homeland of Hungary to defend his dissertation on “Object-oriented Simulation in Mechatronics” where the examination committee awarded him the highest grade possible. Born in Miskolc in 1980, Tamás Juhász’s undergraduate studies drew him to the Hungarian capital. The computer science major wrote his Diplom thesis on the simulation of mobile robots in 2003. Afterward, while already a doctoral candidate at the Technical University of Budapest, a Marie Curie Fellowship from the European Union brought him to the Fraunhofer IFF in Magdeburg in 2006 where he worked in the Virtual Engineering Expert Group. Today he is working at the Center for Digital Engineering currently under development in the project ViERforES. The Fraunhofer IFF and Otto von Guericke University in Magdeburg jointly opened the academic center on March 30, 2009.

Dr. Juhász is very happy with his research work. In the project ViERforES, he is primarily working on automotive engineering. “That’s really great. I always wanted to do something in that field,” says the pleased twenty-nine year old. He would also like to remain true to applied research in the future too and work in Magdeburg for a while longer. He reveals his dream: “I’m taken with Fraunhofer. Maybe there

Erik Dietzel. Photo: Dirk Mahler

Erik Dietzel earned his degree in industrial engineering from Magdeburg-Stendal University of Applied Sciences in 2001. When he was still an undergrad, he acquired his first professional experience developing the regional sales area for a major nursery. Later, he freelanced at a law firm. His path first led him to the Fraunhofer IFF as a student assistant in 2000. After graduation, the marketing expert took up a more responsible position. Dietzel managed the business of the Forschungs- und Entwicklungscentrum Magdeburg. Finally, he came to the Fraunhofer Institute in 2009 as its marketing manager. Along with his volunteer work for a Lutheran congregation in Magdeburg where he looks after the finances as a member of the church council, Erik Dietzel teaches marketing at Magdeburg-Stendal University of Applied Sciences. When he finds time, Erik Dietzel has a great deal of athletic spirit. He has been a passionate tennis player for thirty years and is training for the Magdeburg marathon. Erik Dietzel is a family man. He lives with his wife and two daughters in lovely Biederitz on the outskirts of the capital.

Dr. Tamás Juhász enjoys being in Saxony-Anhalt’s capital. He was impressed when he arrived in Magdeburg: “Everything had already been prepared. My Fraunhofer colleagues had found a nice place for me to live and had even already paid the deposit for me. That made me very happy because time was very tight and I didn’t have to hunt for a room first.” It was quite obviously a good choice; the young doctor is still living there three years later. Evenings, he likes to meet up with friends and colleagues. They go to the movies together or hit the bars around Hasselbachplatz. “It’s too bad that the night life isn’t closer to campus though. It’s rare that something is going on here in the evening,” says the computer scientist.
where many members of his family worked influenced Daniel Reh. He completed several internships there. He was drawn to Magdeburg for his undergraduate studies because he could major in the industrial engineering program in logistics, which was new and unique in Germany in 1997. The student belonged to the first class, was one of the first graduates and is now the first to earn a doctorate.

When he started at the Fraunhofer IFF in 2002, the talented young researcher knew from the start that the road to his goal would be rocky. He was involved in industry projects in the Logistics and Factory Systems Business Unit from the beginning. Dr. Daniel Reh is an enthusiastic Fraunhofer employee: “Young staff members are given a great deal of responsibility right from the very first day. The mix of research and practice provides great variety.” Now the manager of seven research associates and ten students, Dr. Reh can imagine working at Magdeburg’s Fraunhofer Institute a while longer.

A doctorate was always the stated goal of the man from Lower Saxony. Dr. Reh was born in Gifhorn near Wolfsburg in 1977. The proximity to Volkswagen

Always On the Move

Prof. Klaus Richter has joined the ranks of professors at Otto von Guericke University Magdeburg. The Fraunhofer researcher was officially appointed supernumerary professor at the meeting of the Advisory Board of the School of Mechanical Engineering in June. Prof. Richter will now also take on work at the Institute of Logistics and Material Handling Systems (ILM).

The native of Dresden spent his youth in the chemical region of Merseburg and came to Magdeburg to become a mechanical engineer. Richter earned his doctorate from the Department of Material Handling Systems at Magdeburg Technical College in 1985. After a brief stint in industry, Richter returned to research in 1991 and came to the Fraunhofer IFF in Magdeburg in 2000. Today, he manages the researchers in the Material Handling Engineering and Systems Expert Group. The researcher with a mischievous grin manages projects intended to make train stations and airports more secure. The tracking of logistics assets is one of Richter’s special topics. He researches technologies that enable us to know where a package is at any given moment day or night.

Whenever his extensive work occasionally allows a little free time, Prof. Richter enjoys skiing but he’s still thinking about logistics even then. With his project partner Abatec, he developed an RFID system that uses electromagnetic waves to analyze the direction and motion sequences of skiers with absolute precision. This smart system is also now being employed in other sports. Prof. Richter has also outfitted other professional athletes such as the handball players on Magdeburg’s team SCM.
Magdeburg has evolved into an outstanding center of research and many outstanding researchers live and work in the city on the Elbe. They are spreading Magdeburg’s name throughout the world with international research studies and global activities at conventions and conferences. The city marketing association ProMagdeburg is working to make the people in Magdeburg aware of this. Its new campaign “Researchers for Magdeburg” is intended to introduce researchers who are very well known in the research community through their work. Few residents of Magdeburg are aware of how many sharp minds are working on the development of our future world at their research organizations.

The campaign started in June with a series of profiles in the Magdeburger Volksstimme. Every day, the daily newspaper published a lengthy report on the researchers’ research work and achievements. A brochure with the collected researcher profiles will be appearing soon, followed by a large exhibit of photos, panel discussions and much more. Four researchers from the Fraunhofer IFF are part of this.

Prof. Michael Schenk is simultaneously the institute’s Director and the Managing Director of the Institute of Logistics and Material Handling Systems at Otto von Guericke University. In his profile, Schenk related the stages of the Fraunhofer IFF’s development from its start in a rundown building in the Buckau neighborhood in 1991 to the move to the new building on Sandtorstrasse in 1998 to the opening of the Virtual Development and Training Centre in the Port of Science eight years later. Today, the institute is the research hub for many programs in the federal government’s high-tech strategy.

Prof. Klaus Richter was just recently appointed professor at the university. “Precisely in light of the urban development on the Elbe, Magdeburg has developed tremendously and will increasingly be perceived as a successful and future-oriented center of research and business with an optimal infrastructure,” according to the researcher in his profile. Prof. Richter then reported on the latest investments made by the Ministries of Transportation, Economics and Education and Culture’s in Europe’s most important and most innovative satellite navigation system Galileo.

Dr. Norbert Elkmann is responsible for the biggest industry project at the Fraunhofer IFF, the development of a sewer inspection system in the form of a fleet of robots for the Emscher sewer system. “The robots take detailed measurements in inaccessible areas and clean the sewer. The systems are unique; the Fraunhofer IFF is years ahead of the global competition. The native of Wiesbaden has never regretted taking the step of coming to the state capital. “Today, I’m proud to come from Magdeburg,” reports the researcher who has been instrumental in the Fraunhofer IFF’s development, particularly the field of robotics, practically from the start.
Marco Schumann spent a major part of his academic career at the Fraunhofer IFF. He came to Magdeburg’s Fraunhofer Institute in 1995 as a student. Today, the native of Halberstadt manages three of the most important projects in the field of virtual and augmented reality. “I’m incredibly happy to have been able to support and be part of the development of the field of virtual reality from the start,” the researcher relates.

Pro Magdeburg carried out several domestic marketing campaigns in the past and promoted a sense of identity and identification with our city. The campaigns introduced residents of Magdeburg who exemplify Magdeburg’s positive development.

Dr. Norbert Elkmann manages the Robotic Systems Business Unit at the Fraunhofer IFF.
Field test at Leipzig/Halle Airport: Together with its project partners, the logistics experts at the Fraunhofer IFF are developing state-of-the-art systems that determine the position of logistics assets. This makes supply chains more secure and reliable. Logistics hubs with the latest localization technologies will have intelligent management systems in the future.
Gallery
Every second counts in an emergency. Detailed security concepts and reliable emergency management are in demand precisely wherever many people are underway, in train stations or at airports for instance. Response teams must be coordinated in an emergency. However, dangerous situations can be assessed much better with prior knowledge of the development of pedestrian flows. This not only improves preparation for an emergency but also enables preventing certain dangerous situations entirely. Researchers from Magdeburg’s Fraunhofer IFF are working on concepts for increased security in the project VIERforEs.
The Fraunhofer IFF hosts Jugend forscht:
At the state competition in Magdeburg in April, sixty-one young researchers with thirty-seven exciting projects strove to win a ticket to the national competition. Elisabeth Hahn (14) and Anna Victoria Behr (17) from Halle were thrilled to take first place in the chemistry category. They developed a light pen that quickly checks the vitamin C content of food. Jugend forscht is clearly a source of inspiration. This was Elisabeth Hahn’s second win at a state competition.
Meet up with researchers from the Fraunhofer Institute for Factory Operation and Automation IFF at these events:

**August 19, 2009**
Symposium on Dentistry through the Ages
Magdeburg

**August 24-26, 2009**
International Railway Equipment Exhibition IREE 2009
New Delhi, India

**August 25, 2009**
Opening of the Fraunhofer IFF ASEAN Regional Office
Bangkok, Thailand

**August 26, 2009**
1st Central German Logistics Forum
Leipzig

**September 8-10, 2009**
Federal Armed Forces’ Distance Learning Convention
Hamburg

**September 13-25, 2009**
Ergonomics and Productivity: Selecting a Location
Mühlstatt/Kärnten, Austria

**September 14-17, 2009**
Learning in the Digital Age
Berlin

**September 15, 2009**
ProWis-Connect South: Knowledge Management with Corporate Presentations
Haiterbach

**September 17-18, 2009**
Virtual Technology Innovation Alliance Status Conference
Magdeburg

**September 17-27, 2009**
63rd International Motor Show IAA
Frankfurt am Main

**September 23, 2009**
EMPASIA Best Practice Conference on Sustainability for SMEs
Bangkok, Thailand

**September 25, 2009**
23.-25. September 2009
10 International Rail Vehicle Conference Dresden

**September 2009**
Contactless Wheel Measurement System Workshop
Magdeburg

**October 6-7, 2009**
KnowTech 2009
Bad Homburg

**October 9-10, 2009**
Image Processing Technology Day
Kaiserslautern

**October 13-15, 2009**
MAINTAIN – The Leading Trade Fair for Industrial Maintenance
München

**October 15, 2009**
In-Process Knowledge: Knowledge Management for SME
Magdeburg

**October 21-23, 2009**
26th German Logistics Congress
Berlin

**October 21-23, 2009**
eChallenges 2009
Istanbul, Turkey

**October 22, 2009**
ProWis-Connect North: Knowledge Management with Corporate Presentations
Braunschweig

**October 28 – December 2, 2009**
Virtual Reality Guest Lecture Series: Interactive Human and Machine
Magdeburg

**November 2-3, 2009**
RFID in Maintenance (Conference)
Dortmund

**November 3, 2009**
12th Cooperation in Plant Engineering Working Group
Leverkusen

**November 3-5, 2009**
VISION International Trade Fair for Machine Vision and Identification Technologies
Stuttgart

**November 11-12, 2009**
North German Manufacturing Days
Dortmund

**November 15, 2009**
ProWis-Connect Central: Knowledge Management with Corporate Presentations
Frankfurt am Main

**November 19-20, 2009**
Optical 3-D Metrology for Quality Assurance in Manufacturing
Magdeburg

**December 9, 2009**
Identifying Potentials in Dealing with Knowledge: Practical Solutions for Effective Knowledge Management (Seminar)
Magdeburg

Editorial Notes

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“Fraunhofer is an indispensable partner for German machinery and plant manufacturers, enabling them to be at the forefront of international competition.”

Dr. Manfred Wittenstein, VDMA President

60 YEARS OF DEDICATION TO THE FUTURE.

Photo: Matthias Heyde
EFFICIENCY IN THE PLANT LIFE CYCLE is an issue that preoccupies every manufacturer and operator of industrial plants. Industry experts see clear potential for optimization. Concepts are being demanded for solutions that increase resource efficiency. Technical innovations and new control tools for efficient manufacturing will enable you to secure a competitive edge in the future. Join the discussion with Germany’s experts.

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