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RESEARCH NEWS

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1 Intelligent door seal prevents poor air quality

For a long time, heat insulation was en vogue – and nearly no one was concerned about poor indoor air quality. And yet excess CO_2 hampers concentration. Now, researchers have come up with an intelligent door seal system.

2 Less friction loss in combustion engines

Researchers have developed a method that can reduce engine friction and wear even during production of engine components. Special coatings can help to reduce fuel consumption and CO_2 emissions.

3 Effective privacy protection in social networks

Researchers are working on new methods to help them gain a better understanding of the usage habits of participants in social networks. The results will be incorporated in the development of userfriendly tools for privacy protection.

4 Building more sustainable aircrafts

Life Cycle Assessments of components can help make aircraft production more sustainable. The decisive factor is making the data available at an early stage. Thanks to a new eco design software, these data are now available even at the design stage.

5 Prefab houses that are glued, not nailed, together

With prefabricated houses, the dream of having one's own home can quickly become a reality. Until now, nails have been used to hold the individual components together. Now an adhesive tape has been developed to perform this task.

6 Repairing turbines with the help of robots

Compressor and turbine blades are important components in aircraft engines and gas turbines. When they become damaged, it is often cheaper to repair them than to buy replacements. Now there is a new robotassisted technique that is boosting efficiency.

7 Greater convenience and safety for wheelchair users

With modern communication aids, users of electric powered wheelchairs can operate a PC and cellphone without human assistance. A new module is set to transform electric powered wheelchairs into communication hubs.

8 Newsflash

The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe. Its research activities are conducted by 66 institutes and independent research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of more than 22,000, who work with an annual research budget totaling 1.9 billion euros. Roughly two thirds of this sum is generated through contract research on behalf of industry and publicly funded research projects. Branches in the USA and Asia serve to promote international cooperation.

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Intelligent door seal prevents poor air quality

Heated debates and no agreement in sight: the eight employees sitting in a small conference room have come together to get an important project moving. But after an hour, some of them have trouble focusing on the discussion, and some are even beginning to become drowsy. No wonder: the air in the conference room is stuffy and stale, and increased levels of carbon dioxide (CO_2) are making them tired and robbing meeting participants of their concentration.

There's only one solution: air the room out. Or else rely on the intelligent door seal system that has now been developed by researchers at the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in cooperation with the Athmer Company. Users of the system not only spare themselves the effort of regular airing: the door seal is also cold air's worst enemy, insulating to provide a perfect indoor climate.

Indoor concentrations of CO_2 are still a problem, particularly in newer buildings. "Modern buildings are becoming increasingly airtight," according to Hans-Jürgen Schliepkorte, group manager at Fraunhofer IMS in Duisburg. On the one hand, better windows and construction materials provide effective insulation - an issue that was long a major concern. But air quality was overlooked in the process. "In many cases, the supply of fresh air still comes through an open window," Schliepkorte points out. "This has consequences for the energy efficiency."

Sensor measures CO_2 concentration in the air

The electronically controlled door seal developed by IMS engineers opens or closes based on the CO_2 concentration in a room. A CO_2 sensor records concentrations in the air. If this value exceeds a certain threshold, a tiny motor moves a spring to open the door seal at the bottom of the door leaf. The seal raises to permit an exchange of air inside the room. At the same time, the system uses building based measurement and control technology to activate the ventilation system to extract stale air from the room.

"Our standard is based on the Pettenkofer value of 1000 ppm (parts per million)," Schliepkorte explains. It was Max von Pettenkofer who investigated indoor air quality in the middle of the previous century and identified the CO_2 value that, if met or exceeded, makes people begin to feel unwell indoors. Today's rules and guidelines based on DIN for the workplace set 1500 ppm as the upper limit and recommend a CO_2 concentration of 1000 ppm. "We can achieve this with the aid of the intelligent door seal – without having to open doors or windows," Schliepkorte observes.

The door seal system is electronically coupled with building measurement and control systems. If a ventilation system or for that matter a heat recovery system has been installed, they can additionally be activated based on indoor CO_2 concentrations and

temperatures. "The system always calculates the best compromise between good indoor air and optimal utilization of energy efficiency," Schliepkorte says. Beginning in June of this year, it will be in use in the Fraunhofer inHaus-Center in Duisburg, an innovation workshop for application oriented and market based research for systems in rooms and buildings.

Indeed, Fraunhofer researchers have already set their sights on further applications: in the future, the door seal may well also help regulate humidity in residential and commercial buildings. This may soon make mold in the home and dry eyes in the office a thing of the past.

On display at the Fraunhofer inHaus-Center in Duisburg beginning in June: the door seal system developed by IMS. (© Fraunhofer IMS) | Picture in color and printing quality: www.fraunhofer.de/press

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Less friction loss in combustion engines

If a new car engine is to run „smoothly," first it has to be properly run in: drivers should avoid quick acceleration and permanent short trips during the first 1000 kilometers, for instance. Why is this „grace period" necessary at all? When an engine is being run in, the peripheral zone on the articulations – the components in mechanical contact with one another – changes as a result of friction: the surface itself becomes „smoother", and the granularity of the microstructure becomes finer at a material depth of roughly 500 to 1000 nanometers (nm), creating a nanocrystalline layer.

Quite a bit of friction has taken place, though, by the time this nano scale layer has formed. That is why, even now, a large share of the energy is lost to friction during the phase in which an engine is run in. Surface running properties are also a function of the customer's behavior during the running-in phase. A critical topic for the automotive industry: against the backdrop of increasingly scarce resources and the need to reduce CO_2 emissions, reductions of friction loss has top priority on the development agenda.

More precision through optimized production technologies

Within the scope of the "TRIBOMAN" project, researchers at five Fraunhofer Institutes are working to develop production methods and processes to improve combustion engines' tribological (meaning friction-related) performance. The focus is on components exposed to particularly high levels of friction, such as the running surfaces of engine cylinders. „Our common approach is to move the process of forming marginalized layers to an earlier stage in production," explains Torsten Schmidt from the Fraunhofer Institute for Machine Tools and Forming Technology IWU in Chemnitz.

Schmidt and his team have developed optimized production technologies for precision finishing in this connection. „For precision drilling of running surfaces on cylinders, we use defined cutting edges with a specific design. This results in very high surface quality," Schmidt adds. „We also systematically use the force of the machining process to promote ‚grain refinement' - meaning the hardening of the materials - even during production."

The new process is designed to improve the influence on friction and wear in engine components in the future – taking the automotive industry a significant step closer to achieve the goal of using energy more efficiently and reducing CO_2 emissions. But customers stand to benefit as well: these new advancements would considerably shorten the running-in period for new engines. Besides improvements in comfort, it also reduces the risk of premature wear as a result of running in a new engine.

Using a single cylinder test engine with cylinder running surfaces of aluminum, researchers at the Fraunhofer Institute for Mechanics of Materials IWM in Freiburg have

already documented the first positive results of this kind of modified finishing: analyses of the processed cylinder surfaces showed a significantly lower grain size compared to conventional methods. The surface microgeometry is comparable to the cylinder running surfaces of well-run-in cylinders. Researchers are currently working to adapt their method to new development trends in automobile manufacturing such as the introduction of biofuels: since the ethanol content of biofuels is higher, aluminum components are now usually fitted with a coating layer to protect them from corrosion more effectively.

Precision boring of cylinder running surfaces rely on defined cuts with a specific geometry. Thus, surfaces of a very high quality can be created. (© Fraunhofer IWU) | Picture in color and printing quality: www.fraunhofer.de/press

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Effective privacy protection in social networks

In principle, social networks such as Facebook are a good things: users can communicate with other people around the globe, contacting their closest friends in all places and at all times to share experiences with them in real time. Yet many users have problems publishing posts and photos in a way that will protect them from the undesirable side effects to their online identities. To support users' desire for "interactional privacy" - protection of the user's private sphere in online dealings with other people - suggested improvements have already been made for networks such as Facebook. In a practical setting, however, these improved means are either too rigid to do justice to users' multifaceted habits, or they are very complicated to manage because they try to solve a host of different problems all at the same time.

"If we want to develop truly user-friendly tools, we have to understand users better," according to Andreas Poller of the Fraunhofer Institute for Secure Information Technology SIT in Darmstadt. Together with researchers at Goethe University in Frankfurt am Main, for five years, now, he has been working on a project, "Software Design for Interactional Privacy within Online Social Networks," that will create new methods of collecting and evaluating data on usage habits in online social networks (http://dipo.sit.fraunhofer.de/). In contrast to previous studies, researchers not only want to identify the weak spots in privacy management but also want their work to support the design of more effective privacy tools.

Ingenious study design

Initially, researchers focused their attention exclusively on qualitative interviews. Since then, they have begun combining their surveys with analytical software developed at SIT to document Facebook activities by study participants (http://code.google.com/p/rose-browser-extension/). "To make sure that this tool does not influence user behavior – as would be the case, for instance, if a study participant felt he or she was being monitored by the software – we have intentionally designed it to give study subjects full control over their data," Poller explains. The software runs on the user's computer, and not on an external server. Content is not recorded - only the technical functions used. A special commentary function provided by the software inserts itself into the Facebook user interface to give users an opportunity to comment directly, "on site," on their usage behavior and experiences. Data are not automatically transmitted; instead study participants must forward them to the researchers. In a form of protocol, they can first review the documentation and modify it wherever they wish.

"Thanks to the close dovetailing of the two research methods, we can interpret technical facts from the user's perspective," Poller points out. While qualitative interviews often reveal interesting aspects and statements of the problem, they cannot be implemented on a one-to-one basis in specific software design. "You also have to

know what problems are specifically a result of the technology involved," Poller says. Designs developed purely on the basis of technological expertise, on the other hand, lack any reference to users' habits. A knowledge deficit about the ways in which people and technology interact can also lead to false conclusions – as in the case of the "privacy paradox" in which users indicate that they attach great importance to their privacy but have selected very open settings for their Facebook account. "At first glance, this looks like a contradiction. In fact, though, it may well be that the user has only provided spare information in his or her profile and doesn't post anything and thus needs no restrictive protective settings at all," Poller explains.

With their work, the researchers want to help improve the design process of software for social networks. The results of the study are regularly presented to the community of researchers, and the analytical tool is available as open source software. In March of last year, the project team was presented with the coveted Google Faculty Research Award for their efforts on behalf of improved privacy protection.

User-friendliness versus privacy protection: SIT is investigating ways of developing user-friendly software tools for social networks. (© Fraunhofer) | Picture in color and printing quality: www.fraunhofer.de/press

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Building more sustainable aircrafts

The European aviation industry has set ambitious environmental protection goals for itself: by the year 2020, it not only wants to reduce emissions of gases harmful to the climate – carbon dioxide by 50 percent and nitrogen oxide by 80 percent – but it also wants to improve the life cycles of the aircrafts themselves. "Life Cycle Assessment (LCA)" is the term experts use to describe the systematic assessment of the adverse environmental impact of aircraft components in use. The analysis comprises all of the environmental impact that a product has caused throughout the course of its entire life cycle – from production to use to recycling or disposal.

High-performance software is needed to collect these data. These programs are very complex and are currently usually operated by external experts with specific LCA expertise. A further drawback: for the most part, this software only records the relevant data and processes after the fact. "The aviation industry plans for the long term: oftentimes, aircraft models are kept in service for 20 years or more. In this context, if you fail to carry out a Life Cycle Assessment at an early stage, you'll have to offset the impact later on with great effort and expense," explains Robert Ilg of the Life Cycle Engineering Department (GaBi) of the Fraunhofer Institute for Building Physics IBP.

Simplified Life Cycle Assessment

Researchers have now developed a computer program with which environmental impact of aircraft components can be taken into account even at the design stage, during the R&D stage and before production begins. This "Eco-Design Software Tool" is based on an aviation database containing LCA-based environmental information on a host of reference components. "With a click of the mouse, the designer knows how large a component's "environmental backpack" is, based on its prior production process. This means that the related material and energy flows can be quantified," Ilg points out as he describes the functionality of the Eco-Design Tool.

A kilogram of aluminum sheeting, for instance, a material often used in aircraft construction, already has an environmental "backpack" of around 140 Megajoules as a result of bauxite mining, transport from overseas and further processing in Europe. This represents more than four times the energy quantity released when a kilogram of crude oil is combusted. "The Environmental impact of the components used is increased significantly during the further production process as a result of the particularly high material requirements in the aviation sector. That is why the Life Cycle Assessment datasets must be tailored exactly to the aviation industry. This aviation specific component has been missing in the tools used to date," Ilg adds.

Another key element of the new software are specially programmed LCA background models. With these models, designers can vary scenarios with various components and

get an immediate picture of how different materials, construction options or processes affect the environmental performance. The designer does not have to perform detailed analysis and can instead compare the selected components to the reference component settings given in the Eco-Design Tool. An intuitive arranged user interface presents the most important LCA parameters via drop-down menu. There is another benefit as well: "The aircraft designer can use the software to generate the kinds of analyses that were once reserved to trained LCA specialists. This way, environmental aspects in the aviation sector can be taken into account at a very early – and hence decisive – stage in the production process: the planning and development stage," Ilg adds.

The computer program was developed together with the colleagues from the Interactive Engineering Technologies (IET) Department of the Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt and the Life Cycle Engineering Department (GaBi) of the University of Stuttgart as part of "Clean Sky". With a budget of around 1.6 billion euros, the project is one of the largest initiatives of the European Commission and was created in 2008 with the aim of making aviation more environmentally friendly. This is an area in which Fraunhofer has long worked hand-in-hand with the aviation industry. Project partners include, for instance, EADS, Airbus, Eurocopter or Rolls-Royce. "The industry is currently using the technology as part of an initial test phase. With the help of the software, it creates its own Life Cycle Assessments that it then publishes as 'Eco-Statements,'" adds Laura Brethauer of the GaBi Department at IBP. At the "Paris Air Show (SIAE)" from June 17 to 23, 2013, at Paris-Le Bourget, Ilg and Brethauer will showcase the first version of their new Eco-Design Software Tool (Hall 1, Booth G316).

Airbus production hall in Hamburg: using the "Eco-Design Software Tool," Life Cycle Assessments can now be performed even during the design phase. (© EADS)

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Prefab houses that are glued, not nailed, together

A finished house stands on what just a few days ago was an empty green field. Such a feat is possible thanks to components that are industrially prefabricated in a manufacturing plant for finished parts and then simply need to be assembled on the building site – "prefabricated houses" in other words. The individual wall, ceiling, and roof components are usually made of wood. First, the manufacturers make a frame structure out of squared timber in the plant, onto which they then fit boards made of timber derived materials. Nails and staples hold the structure securely together. However, several considerations must be factored in: the squared timber must not be too narrow, else the nails and staples can break out; also, wherever boards meet, there has to be a rib to which the manufacturer can attach the boards.

If it were possible to stick these boards and the other timber parts together using adhesive, it would give the building planners a lot more flexibility in component design. Although there are some companies currently using liquid adhesives in construction, this manufacturing technique has not yet become widespread. This is because the process has some drawbacks: for the liquid adhesive to set, you either have to heat the entire board including squared timber or else wait several hours – a time-consuming business that does not fit easily into industrial production processes.

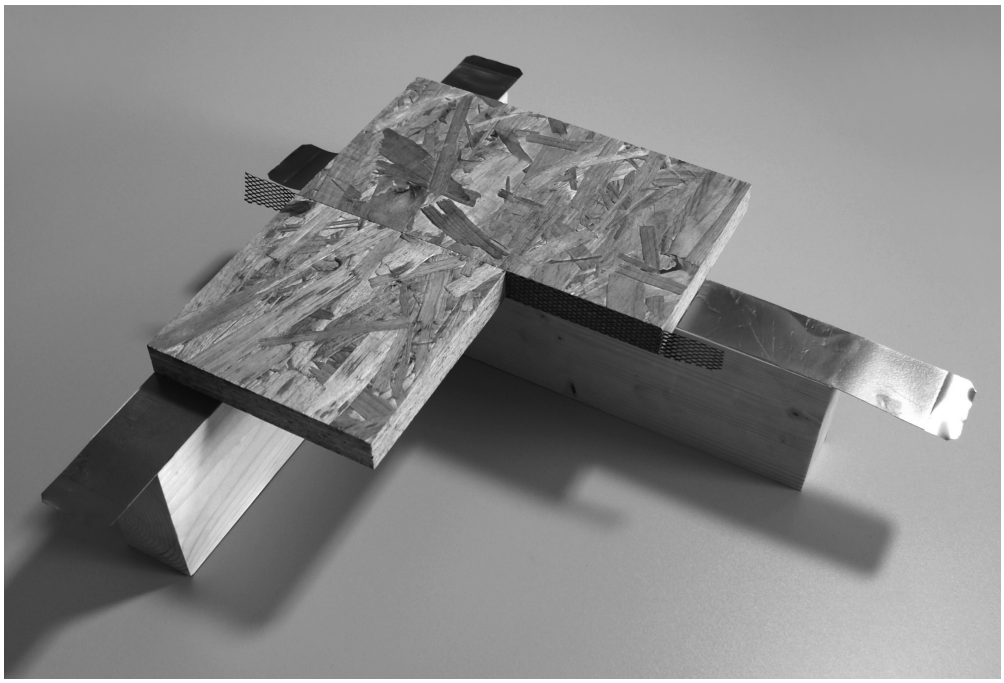
Quick-setting adhesive tape

Researchers from the Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut, WKI in Braunschweig have come up with an alternative together with their colleagues from the Institute of Joining and Welding at the Technische Universität Braunschweig. "We've developed an adhesive tape that sets in under a minute to reliably and durably bond together the individual components," says Dr. Andreas Zillessen, a scientist at the WKI. "The adhesive sets at the push of a button, so to speak. This means that when we apply the adhesive tape when assembling components, we can wait as long as we like without the adhesive drying out, as other kinds of adhesive would."

The secret is inside the material itself: unlike ordinary adhesive tape, it does not consist merely of a backing material and adhesive – it also has its own "heating system". This is a metal strip that is coated with adhesive on both sides. If you want to stick together two strips of wood, you place the adhesive tape in the right position, put the strips of wood in place, and then let an electrical current flow through the metal strip. The metal heats up, and the adhesive melts and binds to the wood. First the adhesive is turned liquid by the heat so that it gets into the pores in the wood; then it sets very quickly once it cools. "At present, the gluing and setting combined take around a minute, but over the long term we want to make these processes significantly shorter," explains Zillessen.

The challenge for the researchers lies not only in finding the ideal adhesive and the most suitable metal strip, but above all in optimizing the interaction of the three components. After all, the adhesive has to stick to the wood as well as to the metal. "As the adhesive tape is designed to be used primarily for load-bearing bonding in buildings, it has to possess structural strength and durable adhesive qualities," says Zillessen.

In order to attain these properties, the researchers are testing different adhesives and metal strips. They have already discovered the optimum adhesive. As for the metal, the scientists still have some work to do. Brass has shown a lot of promise. Next the experts are going to put stainless steel and aluminum through their paces. "We've already been able to demonstrate that the technology works in principle," summarizes Zillessen. In around six months' time, the scientists plan to test the adhesive tape in practical applications with the German company Schwörer.



The WKI has come up with a way of bonding components of prefabricated houses together with adhesive. This allows greater flexibility in component design. (© Fraunhofer WKI) | Picture in color and printing quality: www.fraunhofer.de/press

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Repairing turbines with the help of robots

The German turbomachinery sector is booming. Over the past 25 years, it has doubled its share of the global market from 15 to 30 percent. For manufacturers, the service business – i.e. maintenance, repair, and overhaul (MRO) – is steadily growing in importance. The blades in compressors and turbines are subject to particularly high levels of stress and strain. The job of the blades is to convert fluid energy into mechanical energy. They ensure that aircraft engines generate the required thrust and that power plant generators produce sufficient electricity.

"Damage to the blades of aircraft turbines is caused by wear from vibration and friction, for example, or by erosion from particles of sand and dust. Other triggers are hard landings, when individual engine components come into contact with each other, and large objects striking the engine," explains Martin Bilz, head of manufacturing technologies at the Fraunhofer Institute for Production Systems and Design Technology IPK in Berlin. In such cases, the geometrically complex components, which are mostly made of titanium- or nickel-alloy steels, bend or crack and the flow of air is no longer optimal. This can cause engine performance to drop and fuel consumption to rise.

Time-consuming manual labor

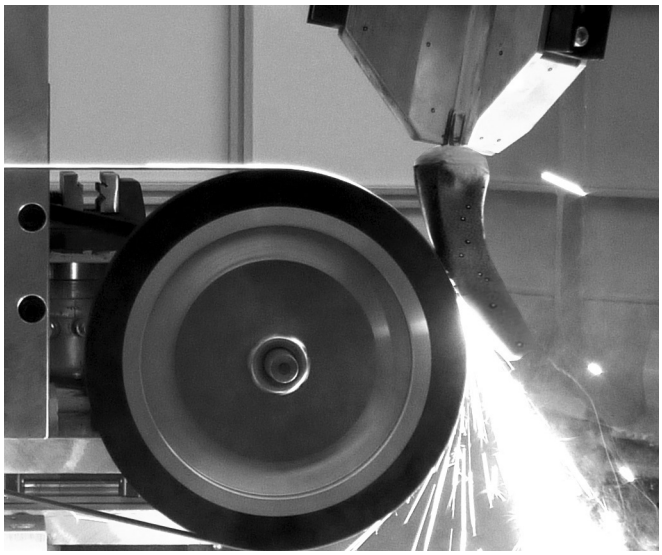
Repairing the damaged components makes sound financial sense. Depending on the stage and engine size, a single turbine blade can cost several thousand euros. With an airplane needing up to 80 blades, the costs stack up very quickly for aircraft operators. Repair, however, is over 50% cheaper. The drawback with repair is that the processes involved are very complicated and elaborate. The individual work steps cannot be easily integrated into largely automated series manufacturing. Specialists process the workpieces by hand or with specially adapted machine tools. Depending on its size, it can take anything from a few hours to several days before a single blade is repaired. Or to give another example: on account of the strict quality assurance requirements in the aviation industry, it can often take two to three weeks before an individual rotating engine component can return to action.

Within the Fraunhofer MRO innovation cluster, Fraunhofer IPK and the Institute for Machine Tools and Factory Management IWF of the Technische Universität Berlin set themselves the goal of developing an automated, robot assisted technique. "Whereas machine tools remain consistently expensive, robots are getting cheaper all the time, and now they can even be used for machining tasks," says Bilz, explaining the institutes' approach. Lending the researchers support were specialists from turbomachinery manufacturers such as MAN, MTU, Rolls-Royce, and Siemens. Together with further partners from business and research, the IPK not only managed to make individual process steps suitable for automation, they also developed a technique whereby a robot passes through several repair stations inside a single production cell. What is

special about this technique is that the robot holds on to the component at all times and moves around to the individual stations in turn, which are arranged around it in an area of about 15 square meters. It cleans the component, measures its geometry, locates the faults, and carries out machining repairs.

"Not only is the robot assisted production cell a good example of a resource conserving and energy-efficient MRO process, it has also opened up new prospects for the manufacture of turbomachine components. For example, it makes the repair of compressor blades faster, cheaper, and more precise. Now we want to see the technology quickly taken up in manufacturing plants ," explains Bilz. IPK scientists will be exhibiting the technique at the International Paris Air Show at Le Bourget, Paris from June 17 to 23, 2013 (Hall 1, Booth 316).

Fraunhofer is driving ahead with further research into this topic with the new "Life Cycle Engineering for Turbomachines" innovation cluster, which was launched at the end of May. Joining the IPK in the cluster are the Fraunhofer Institutes for Reliability and Microintegration IZM in Berlin, for Telecommunications, Heinrich-Hertz-Institut, HHI in Berlin, and for Ceramic Technologies and Systems IKTS in Dresden. Bilz summarizes the cluster's work as follows: "Our goal is to provide energy-efficient and resource conserving technologies for all turbomachine life cycles. In addition to MRO, we are also taking into account the upstream design and production stages. Our focus is on aircraft engines and gas turbines for power plants."



A robot automatically restores the damaged sections of a turbine blade at a grinding station. (© Fraunhofer IWF TU Berlin) | Picture in color and printing quality: www.fraunhofer.de/press

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Greater convenience and safety for wheelchair users

Writing text messages and e-mails, surfing the web, making phone calls – all these things can be a real challenge for people with disabilities. And that applies all the more to wheelchair users with impaired motor skills in their hands and to severely disabled people, who are dependent on communication aids to be able to operate electronic devices without difficulty. And a new communication aid is just what researchers from the Advanced System Technology (AST) branch of the Fraunhofer Institute for Optronics, System Technologies and Image Exploitation IOSB have developed at the request of its longstanding industrial partner, the medical technology manufacturer Otto Bock Mobility Solutions GmbH.

The new aid is an add-on module that expands the functionality of electric powered wheelchairs by connecting up the existing wheelchair control system (e.g. joystick, chin control) to a cellphone, PC, TV, games console, etc. via Bluetooth. The interface for data transmission is the wheelchair's CAN bus, where all wheelchair data converges. "The module allows users to carry out all mouse functions – on their notebook or smartphone, say – and thereby check their e-mails, surf the web, and send an SOS in the event of an emergency. All USB-enabled devices are supported," says Prof. Dr. Andreas Wenzel, group manager for embedded systems at the AST branch in Ilmenau.

Smartphone app calculates wheelchair range

The module is compatible with many electric powered wheelchairs from the Otto Bock range. Box-shaped and compact, its dimensions of 85 x 65 x 32 millimeters mean that it can be discreetly attached to the wheelchair. The box comprises both the hardware in the form of a printed circuit board and the software, and it has two Bluetooth interfaces. Wenzel describes the advantage of the second Bluetooth interface as follows: "The system not only enables interaction with electronic devices, it can also be used to transfer wheelchair data – such as battery capacity, motor currents, and errors in the drive system, for example – to a smartphone." A specially developed smartphone app reads and processes the data.

"When users of electric powered wheelchairs are considering going on an excursion, they are often uncertain about how long the battery will last, because the energy consumed by the wheelchair depends on the temperatures outside and the hilliness of the terrain. A wheelchair uses up more power on steep hills than on flat roads. This uncertainty often means wheelchair users choose to stay in rather than venture out," explains Wenzel. The Android app carries out a precise range projection. The app determines the current location , compares it against the battery capacity, and calculates if there is enough energy left to bring the wheelchair back to the home point. It obtains the requisite data from the Internet. Wheelchair users are informed how much further they can safely travel via their cellphones. When the capacity begins to run low,

a warning appears on the smartphone display telling them that there is only enough power left for another ten kilometers. "This gives users certainty and peace of mind," says Andreas Biederstädt, head of development for e-mobility and drive technology at Otto Bock. "The cellphone can be easily fitted to the wheelchair. Moreover, this enables us to do away with expensive industrial displays."

A further advantage of the app is that the navigation functions allow users to call up wheelchair-accessible routes, for example, or disabled toilets. This means users of all-terrain wheelchairs can go off road and receive a selection of suitable routes on their display. "The add-on module offers users of electric powered wheelchairs greater autonomy, safety, and convenience," sums up Andreas Biederstädt. "Not just the disabled but elderly people with restricted mobility stand to benefit from these sorts of mobility concepts with the Bluetooth module."

Initial tests have been successfully completed, and wheelchair prototypes equipped with the innovative communication aid have already been presented. Otto Bock is currently planning to produce a pilot run, and the finished product should be on sale from the third quarter of this year. Researchers at Fraunhofer IOSB's AST branch also want to drive the development of this technology. "The next step will see us linking our Bluetooth module up with home automation systems. This would enable disabled people to perform tasks such as setting the air conditioning, opening and closing blinds, and switching on and off lights without leaving their wheelchair," says Wenzel.

With the aid of an add-on module developed by the AST, wheelchairs connect up with smartphones, PCs, TVs, and games consoles via Bluetooth. (© Fraunhofer IOSB/AST, Martin Käßler) | Picture in color and printing quality: www.fraunhofer.de/press

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Drivers happy to take long way round to avoid traffic stress

German motorists are willing to accept longer journey times and even detours if it means helping to ease the general traffic situation. This emerged from a recent user study carried out by the Fraunhofer Institute for Open Communication Systems FOKUS in cooperation with the Technische Universität Berlin. Of 120 motorists who agreed to provide information about their driving habits and attitudes towards road traffic, two-thirds said they would rather have a stress-free trip even if it meant adding over three minutes to their journey, and 75 percent said they would even be willing to take a detour. In order to put this willingness to cooperate to good use, researchers at FOKUS are developing automotive communication technologies that will guide motorists around streets in a manner that evens out traffic flows and produces environmentally friendly traffic patterns.

For example, the scientists are working on solutions that will help motorists avoid traffic jams and take routes that result in the smallest amount of exhaust emissions by means of advance traffic warnings and driving recommendations sent to their navigation system or smartphone. FOKUS is a partner in the EU's "TEAM" project, which develops technologies for collaborative traffic management.

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Saving energy in subway stations

As well as being the backbone of urban public transport systems, subways are also major consumers of energy. For example, the entire underground train network in Barcelona consumes around 63.1 million kWh a year. A third of the total energy is used to operate subsystems in the subway stations, such as air conditioning, escalators, elevators, and lighting. If it were possible to reduce energy consumption by just a few percent, this would save an impressive quantity of electricity. The goal of the EU's SEAM4US project is therefore to develop sustainable energy management technologies that will reduce the energy requirements of subsystems. The solution involves integrating additional measuring devices and sensor-actuator networks into the subsystems. The requisite user, environment, and time data will be recorded using specially developed middleware. Researchers at the Fraunhofer Institute for Applied Information Technology FIT in the German town of Sankt Augustin are coordinating the system development activities within the project team. They are also responsible for integration of the different technologies into the SEAM4US platform.

The SEAM4US system is currently being installed and tested in the "Passeig de Gràcia" subway station in Barcelona. This transport hub is one of the busiest stations in the Catalan capital. If five percent was shaved off the energy consumption of Barcelona's underground train network, this would save enough electricity to power about 700 households. According to the experts at the FIT, savings on this scale are a thoroughly realizable prospect with the new energy management system.

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Making electric vehicles smaller and more comfortable

The vehicle looks like an electric scooter and zooms by almost without a sound. Its driver masters tight corners first and then safely brakes to a halt. He doesn't need to put his feet on the ground because the two rear wheels provide plenty of stability. Daniel Borrmann is satisfied with the first test drive of the Electromobile City Scooter. The new three-wheeled electric vehicle from the Fraunhofer Institute for Industrial Engineering IAO in Stuttgart is designed to open up new possibilities for the urban transportation of tomorrow. "Although electric scooters offer many advantages, a lot of motorists either cannot or do not want to make the switch for trips into town. They simply lack the experience of traveling on two wheels," says Borrmann. This is exactly where the Electromobile City Scooter comes in.

Thanks to the additional wheel on the rear axle combined with a special chassis, the electric vehicle manages to be both stable and nimble. To enable it to lean into curves despite having two rear wheels, the IAO researchers suspended the rear wheels separately and supported them in the frame by means of air springs. In fact, the model is scarcely any wider than a regular two-wheeled scooter. Following initial drafts, the scientists worked out detailed specifications, which the engineering firm GreenIng subsequently implemented on a conventional two-wheeled electric scooter. "We demonstrated that our idea works on a real scooter. In the next step, we want to make the vehicle even more comfortable. For example, by means of systems for riding helmet-free, for protecting riders from the elements, and for luggage storage," says Borrmann, summarizing his team's objectives, before getting back on the scooter and zipping off into a new round of tests to the sound of the engine's gentle hum.

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