Fraunhofer IPA

FRAUNHOFER INSTITUTE FOR MANUFACTURING ENGINEERING AND AUTOMATION IPA

PRESS RELEASE

In four steps from idea to application: Successfully implementing tomorrow's automation today

Offering companies a clear competitive advantage and making them fit to meet the challenges of the production of the future: this is the performance promise that Fraunhofer IPA will be exhibiting at the automatica trade fair from June 27 to June 30, 2023. Here, visitors will experience applications in robotics, automation, artificial intelligence and cleanroom technologies and gain new insights through regular expert sessions and "Interactive Live" interviews.

The Fraunhofer Institute for Manufacturing Engineering and Automation IPA will have eleven exhibits at this year's automatica, which are set to showcase how companies can implement automation solutions at the highest level. The range of exhibits is diverse and will focus both on companies aiming to optimize their existing applications as well as those intending to introduce completely new ones. For each project stage, there are exhibits that enable the successful implementation of that particular phase.

At a glance

What? Fraunhofer IPA at automatica, Munich

When? June 27 to 30, 2023

Where Fraunhofer Gesellschaft joint stand: Hall A4, Stand 321

Phase 1: Evaluating feasibility in terms of both technology and finances

Many companies would like to automate but fear making technological and financial misjudgments. In order to help in this area, Fraunhofer has been offering its **Automation Potential Analysis** (APA) for many years now. The compact project format involves the APA's development team going directly to the business, analyzing the status quo, and producing a "Fitness for Automation" for the production process that was reviewed. The APA has now been implemented by over 500 customers around the world for a wide range of automation projects relating to assembly and is now also available for welding processes. Lorenz Halt, Group Leader at Fraunhofer IPA, explains: "This gives companies a systematic basis for decision-making that significantly reduces the investment risk."

Until now, the APA was linked to the expertise of the experts at Fraunhofer IPA. At the trade fair, it is also available as an app from licensing partner Evia, enabling businesses to analyze for themselves the application that they may want to automate. In addition to assembly and welding applications, the team is also currently working on an APA for machine loading and for logistics.

Press communication
Fred Nemitz | Phone +49 711 970-1611 | fred.nemitz@ipa.fraunhofer.de
Fraunhofer Institute for Manufacturing Engineering and Automation IPA | Nobelstrasse 12 | 70569 Stuttgart | www.ipa.fraunhofer.de

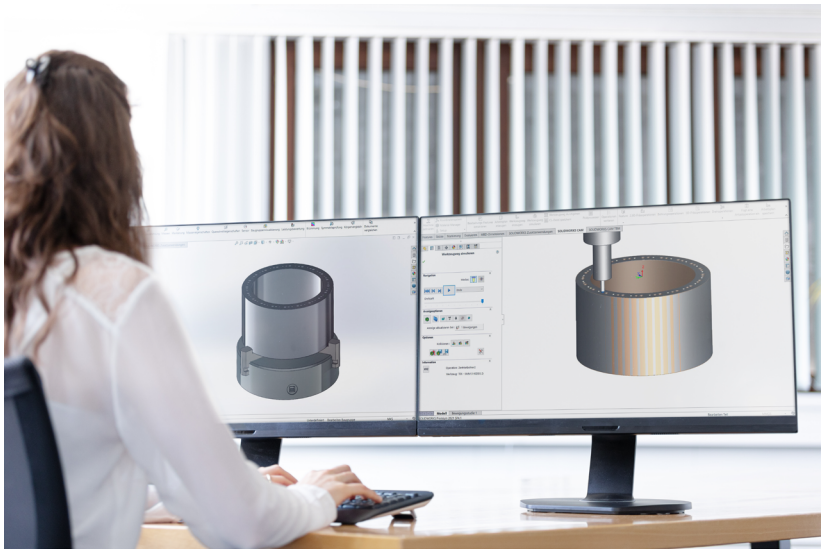
The "Automation Potential Analysis" (APA) is now available for welding processes.
Image credit: Fraunhofer IPA/Picture: Rainer Bez.

Many businesses are also looking to further automate processes outside of their production halls. This is why one group at Fraunhofer IPA has turned its focus on developing robust, autonomous **outdoor navigation** for the challenges presented by typical outdoor environments. These can include outdoor intralogistics, agriculture, and forestry. Key challenges for autonomous outdoor navigation are the varying light and weather conditions as well as a correct assessment of the traversability of the ground and obstacles. For example, in intralogistics processes between factory halls, obstacles such as cable bridges, gully grids, potholes or steps and landings can pose difficulties for autonomous systems. At the trade fair stand, Fraunhofer IPA will present its prototype outdoor robot CURT_mini, which will demonstrate how such difficulties can be resolved by coordinated hardware and software and how intralogistics can also be successfully implemented in outdoor areas.

The exhibit is linked to a comprehensive range of consulting services on the practical use of autonomous mobile robots (AMR) in indoor and outdoor areas. Fraunhofer IPA can look back on a long history of success with its navigation software. One example can be found in the production line of a car manufacturer. In 2014, free-driving automated guided vehicles (AGVs) using the institute's software were deployed here for the first time. At the trade fair stand, visitors will notice such an AGV with a car attached to it – as proof and symbol of the successful technology transfer, which also led to a spin-off.

The **DesignChain** exhibit takes visitors back from the field to the production halls. This exhibit addresses the current demand faced by industry to manufacture products within ever shorter timeframes and which are tailored to increasingly specific customer requirements. Businesses are recommended to use DesignChain to help them keep up with the global competition. "It means that technical order processing is digitized and auto-

mated throughout, from order to finished product", says Jonas Krebs, co-developer of the exhibit. This halves the time and cost required for production preparation. Visitors to the Fraunhofer stand can use the exhibit to configure an individual product, which is then generated as a CAD model, simulated ready for production and then scheduled for 3D printing by just one click.



"DesignChain" is the end-to-end digitization and automation of technical order processing – from the order to the finished product.
Image credit: Fraunhofer IPA/Picture: Rainer Bez.

Phase 2: Creating viable concepts

Successful technology transfers require watertight planning and conception. If this project phase is not implemented well, businesses often pay the price in the later stages through unexpected costs and additional work. To provide targeted support for this project phase Fraunhofer IPA is presenting a solution oriented toward functional safety and the planned spin-off IntRAC for the implementation of assembly cells with robots.

Safety concepts can have an unfavorable impact on the cycle time of a robot application. This can be improved with the exhibit **Robo-Dashcam.** For this purpose, a camera records safety-relevant data and people in compliance with data protection regulations while the robot cell is in operation. Based on this data, the safety concept can also be adapted later on in order to increase the performance or cycle time of the application. Aulon Bajrami from Fraunhofer IPA, who co-developed the application, says: "We measure the optimized robot performance and can reduce safety distances. This reflects the success of the project and the effectiveness of our Robo-dashcam."

A 10% increase in productivity and a 54% reduction in the time taken to carry out a risk assessment are possible. The Robo-Dashcam is part of CARA, the Computer-Aided Risk Assessment, which the Institute uses to help businesses develop safety concepts in a systematic and partially automated manner and to enable performance improvements. As the institute has been active in the international standardization process for 15 years now, all of its developments also leverage the latest knowledge from this committee work.

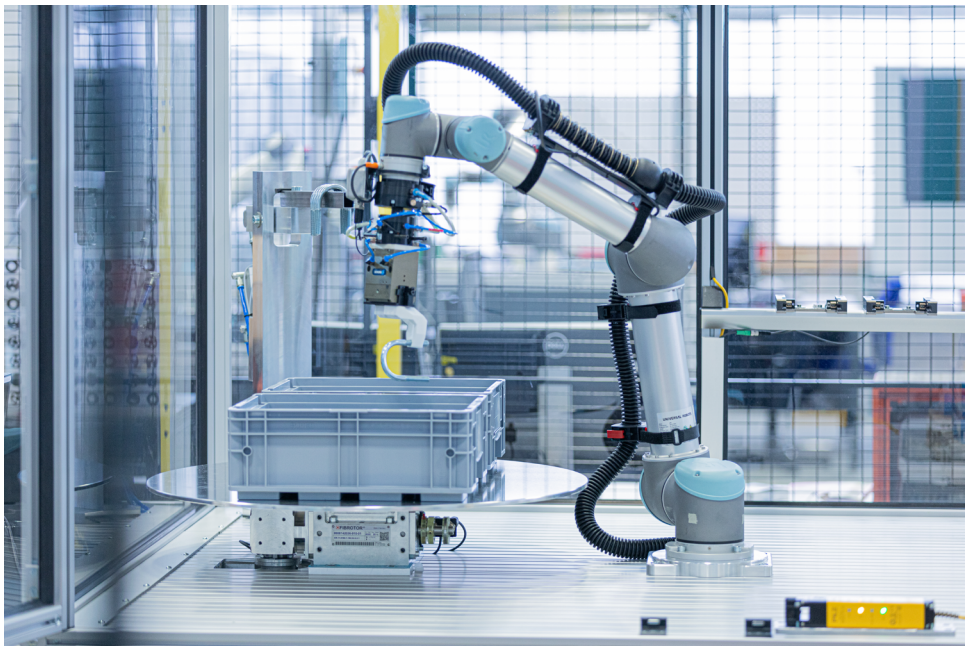
The "Robo-Dashcam" records safety-relevant data and persons in compliance with data protection regulations while the robot cell is in operation. This means that the safety concept can still be adapted at a later date. Image credit: Fraunhofer IPA

With the arising spinoff **intRAC** (intelligent Robotic Assembly Cell), Fraunhofer IPA presents a modular automation solution, especially developed for economical cable and connector assembly, even for small batch sizes. "Our offer addresses the needs of small and medium-sized enterprises by allowing the modular robotic cell to be flexibly and quickly adapted to different products. This enables companies to produce different variants with just one system and consequently, to take predictable investment decisions", says Arik Lämmle from the founding team, describing the value proposition. This way, intRAC directly addresses companies that usually have no knowledge about robots and are particularly affected by the shortage of skilled workers and high wage costs. The spin-off incorporates expert knowledge from 15 years in the field of assembly automation and software development.

Phase 3: Guaranteeing technical feasibility experimentally or by simulation

Once the basic idea has been secured and a concept for implementing the application is available, the next step is to test the feasibility. Fraunhofer IPA also offers exemplary exhibits for this project step at the stand.

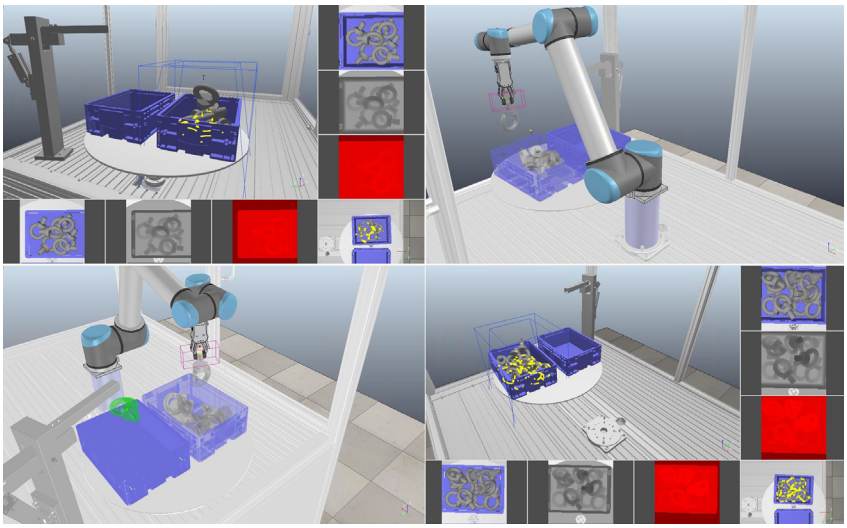
One of them is **AI Picking**, the AI-based bin picking application. With this, the development team is addressing precisely the technical hurdles that still hinder the widespread use of bin picking, despite its high economic potential. Co-developer Marius Moosmann from Fraunhofer IPA explains the AI-based added value: "The use of AI, or more precisely of its subfield machine learning, makes the application more autonomous, faster and more robust." The two-part exhibit shows what this looks like in concrete terms. The first part showcases the traditional bin picking and demonstrates how objects in bins with mixed content can be reliably recognized and grasped. Entangled items are also automatically detected and released as the robot removes them. The other part of the exhibit shows how different packs on a single-variety pallet are detected and gripped. A robot rearranges the packs to fit.



Machine learning makes the bin picking application more autonomous, faster, and more robust.
Image credit: Fraunhofer IPA/Picture: Rainer Bez.

The range of services for the reliable gripping of almost any object also includes **virtual feasibility studies**. With this, companies have the feasibility of a bin picking application checked quickly and without investing in materials. They receive statements about the suitable cell layout, the hardware, the gripping capability of many workpiece geometries and further information such as possible cycle times, availabilities and grips per hour. This provides a comprehensive analysis as a basis for decision-making.

In addition to gripping and extracting items from a box, the experts at Fraunhofer IPA are also receiving an increasing number of enquiries regarding placement in a box. This procedure is growing in importance, in particular as a result of the booming online retail industry. The **Bin Packing** exhibit demonstrates how this can be fully automated. Tim Nickel, co-developer of the application, explains the advantages: "The robot system is able to pack arbitrarily shaped free form objects in a dense saving manner and without a packing pattern or any prior knowledge of the objects and place them neatly in a box. As a result, we can increase packaging density as well as significantly reducing preparation workloads." Visitors to the stand will be able to interact with the robot by handing an object to the robot, which will grasp it and package it without any preparation. Feasibility studies in simulations are also possible for Bin Packing.



With virtual feasibility studies, companies can quickly check the feasibility of a pin picking or bin packing application without investing in materials.
Image credit: Fraunhofer IPA.

Phase 4: Implementing concepts in manufacturing

In conclusion, Fraunhofer also offers a comprehensive range of possibilities for the final realization of the application. Fraunhofer IPA shows what this might look like with three examples.

For example, the **pitasc** software addresses a common hurdle for assembly automation, namely the diversity of variants, which until now has been associated with high programming costs. These costs quickly make the use of robotics uneconomical. This is where pitasc comes in: with the software, an assembly task no longer has to be programmed point by point. Instead, programming is done in a structured and modular way relative to the workpiece, based on data provided by sensors on the robot. Prefabricated, reusable program modules help to implement especially tricky, force-controlled assembly applications faster than before and enable efficient adaptation to new variants. "For example, the position of the robot, the fixtures and even the end effector can be changed without reprogramming", says Anwar Al Assadi, Group Leader at Fraunhofer IPA, explaining the advantages of the pitasc solution.

A spin-off from Fraunhofer IPA is pursuing a different approach for better planning and execution of an assembly task. The start-up is developing the **Assemblio** Assembly Suite, artificial intelligence (AI)-based software which analyses and evaluates CAD STEP files. Any CAD system can generate these information-rich files. They provide the "3D analysis AI" with all the necessary information to precisely derive structured assembly information. A second component of Assemblio is the Assembly Composer, which reads the extracted assembly information and feeds it into an assembly planning tool.

The tool displays assembly-relevant information in a simplified, graphic format, making assembly amazingly easy and possible to plan without error. The AI assembly assistant KIM provides staff with interactive support in the form of automatic and cost-effective assembly assistance. The assistance is variable and can be either 2D or 3D-based. Alexander Neb, CEO of the spin-off, says: "Initial user studies reveal time savings of up to 92% when using Assemblio." The software will be commercially available from July of this year.

A third example of successful application realizations is the cleanroom system CAPE®. This is a flexible cleanroom system that achieves air purity in ISO classes 1 to 9. The CAPE® system can be set up and put into operation within just a few hours or days – not unlike a tent. In previous years, scientists have expanded CAPE® into an entire product family. Frank Bürger, Group Leader at Fraunhofer IPA, explains: "The latest addition to the family is our **DryClean-CAPE®**, which we are showcasing at automatica. It not only creates a clean production environment; it also significantly reduces air humidity, for example, with its dew point of -50°C." DryClean-CAPE® is already being used for industrial battery cell manufacture. The technology is also crucial for auto-motive production as well as air and space travel.

The dry cleanroom system DryClean-CAPE® not only creates a clean production environment, but also one with very low humidity.
Image credit: Fraunhofer IPA/Picture: Rainer Bez.

Successful technology transfer: 50 Years of robotics at Fraunhofer IPA

Many of the above-mentioned exhibits are the result and proof of successful technology transfer and profitable application developments in the area of robotics at Fraunhofer IPA. Here, the department for Robot and Assistive Systems can look back on a success story spanning 50 years. To celebrate this milestone in style, the department will be hosting a celebration week for its golden jubilee from September 26 to 29, 2023. The motto for the week will be **#whatsnextrobotics** – because, even though it is important to look back and celebrate past achievements, it is absolutely crucial to look ahead and showcase how Fraunhofer IPA is shaping the robotics of tomorrow today, and already preparing them for future practical use.

The Golden Jubilee celebration week will offer a range of events, which all those interested are invited to attend:

- **September 26 and 27, 2023:**
  International Symposium on Robotics (ISR)

- **September 27:**
  Technology forum on AGV driverless transport systems and mobile robots

- **September 28:**
  Application Day – Target group-specific events on the topics of human-robot collaboration, welding cobots in practical application, robotic assistance systems for healthcare, Robots in the Warehouse technology seminar, experience exchange automation potential analysis

- **September 29:**
  Public tour of the test facilities,
  followed by Long Night of Robotics starting at 5 pm

For all information on the Golden Jubilee 50-year celebrations, please visit:
ipa.fraunhofer.de/50y

The Fraunhofer IPA team will also be available at automatica to answer any questions about the celebrations.

By the way: at the start of the year, researchers from the department for Robot and Assistive Systems revealed a secret: They have discovered what robots get up to at night!
https://youtu.be/a8ymTUOJuZc

Further information

Expert Sessions:
From Tuesday to Thursday (June 27 to June 29, 2023) Fraunhofer IPA will be offering Expert Sessions at its stand. If you are interested, you can register in advance here, or you can simply show up on the day. For the anticipated schedule (for all three days), please click on the following registration link:
https://s.fhg.de/3hG

Interactive Live:
Twice a day between June 27 and June 29, 2023 at the trade fair stand, there will be a live interview with an expert, which will then be posted on LinkedIn. The interviews will take place with various company representatives and customers, and will focus on their successful technology transfer with Fraunhofer. The anticipated schedule (for all three days) is from 10.30 to 11.00 am and from 2 to 2.30 pm.

Website:
All information about Fraunhofer IPA's trade fair exhibitions as well as downloadable material can be found at:
https://www.ipa.fraunhofer.de/de/veranstaltungen-messen/messen/automatica.html

Expert contacts
Dr. Werner Kraus | Head of Department Robot and Assistive Systems | Phone +49 711 970-1049 | werner.kraus@ipa.fraunhofer.de | Fraunhofer Institute for Manufacturing Engineering and Automation IPA | www.ipa.fraunhofer.de
Marius Moosmann | Topic Manager Machine Learning | Phone +49 711 970 3813 | marius.moosmann@ipa.fraunhofer.de | Fraunhofer Institute for Manufacturing Engineering and Automation IPA | www.ipa.fraunhofer.de

Contacts for press inquiries:
Dr. Karin Röhricht | Phone +49 711 970-3874 | karin.roehricht@ipa.fraunhofer.de

With nearly 1200 employees, the **Fraunhofer Institute for Manufacturing Engineering and Automation**, Fraunhofer IPA, is one of the largest institutes in the Fraunhofer-Gesellschaft. The total budget amounts to € 82 million. The institute's research focus is on organizational and technological aspects of production. We develop, test and implement not only components, devices and methods, but also entire machines and manufacturing plants. Our 19 departments are coordinated via six business units, which together conduct interdisciplinary work with the following industries: automotive, machinery and equipment industry, electronics and microsystems, energy, medical engineering and biotechnology as well as process industry. The research activities of Fraunhofer IPA aim at the economic production of sustainable and personalized products.