

item

Cobots bring an extra dimension to industry

Why robotics can do so much more than just mass production.



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1. The aim of this white paper

Mention “robotics in industry” and most people will immediately think of large, heavy-duty industrial robots and mass production in large companies. That is precisely why many small and medium-sized enterprises (SMEs) have never really given much thought to the benefits of robotics-based process automation – the idea has always seemed irrelevant to them. However, the arrival of lightweight robots that are considerably cheaper and easy to integrate is now bringing these applications within the reach of SMEs, too. Collaborative robots (cobots) are also being used more and more often in special applications. This white

paper provides an overview of the various ways (lightweight) robotics can be used to automate production steps. In addition to setting out the basic benefits of integrating lightweight robotics in SMEs, it also presents examples of typical applications that are already being successfully implemented in companies. In doing so, it highlights the key considerations when designing a customized robotics application for your own business.



2. Challenges in the manufacturing industry

Added to that, manufacturing companies have been more acutely affected by the skills shortage than other sectors of industry. After all, the number of people interested in spending hours carrying out simple and monotonous tasks is only getting smaller. What's more, the manufacturing industry is continuously losing its appeal to potential trainees, too. This situation calls for flexible solutions that will enable companies to make full use of their machinery and plants while also making jobs in manual production areas more appealing.

Ultimately, young people today are less interested in typical industrial trades. However, they have grown up as digital natives and therefore have no problems when it comes to the new

opportunities automation in industry brings with it – quite the opposite in fact. Digitalization, robotics and everything that goes with it are thus not just the key to staying competitive in production, they are also the things that will make a company more appealing to potential trainees.



3. How robotics are being used in the manufacturing industry

For decades, robotics has been used as an efficient way to automate repetitive activities in the manufacturing industry. As with so many technological innovations in industry, it is the automotive sector that has led the way. Tasks such as welding bodywork and painting vehicles were handed over to industrial robots a long time ago. Robots have a long reach, can carry heavy loads, and achieve rapid working speeds. However, “classic” robotic automation like this has specific down sides when transferred to SMEs – it is rigidly incorporated into the workflow and only benefits from large-volume production. Furthermore, the robots are always kept apart from human workers by guards and enclosures and are usually integrated into production on a fixed, stationary basis.

Due to this very specific range of uses and the fact that programming requirements make it difficult to get started, industrial robots have not yet made a real breakthrough in smaller manufacturing companies. By contrast, cobots are a relatively new type of lightweight robot designed specifically to be easy to operate, program and use in scenarios where they work with people. The collaborative functions of these robots only need

to be governed by custom-configured safety measures when there is direct human-machine cooperation. There are, however, numerous application scenarios that don't require any direct collaboration between human workers and robots and where the safety measures already integrated into the cobots' controllers are therefore perfectly adequate.

When integrating a cobot into a non-collaborative environment like this, ease of use becomes a major advantage and the barriers to getting started with process automation come crashing down. The robot can take care of tasks that are potentially hazardous to people, extremely monotonous or ergonomically unsound, thereby freeing up staff to focus on more demanding and varied tasks.



4. The basic benefits of lightweight robotics for SMEs

Few companies start off by asking themselves what kind of robot they want to use in production. Instead, they are more focused on finding a solution that will resolve a very specific problem while also being easy to implement and cost effective. Often, they won't even consider robotics. When using classic industrial robots for the first time, not only are there high investment costs, but relatively complex integration requirements also present a major obstacle. By contrast – and specifically because indus-

trial robots are usually designed for one specific task – lightweight robots score highly thanks to their versatility. This is one advantage that is much more important in practical terms than aspects such as load-carrying capacity and speed, where they don't score quite as highly. As a result, relatively economical lightweight robots are opening up the benefits of robotics to an ever-growing number of companies.

Mobility

Compared to industrial robots, lightweight robots take up much less floorspace, which is why they can also be used in very cramped production environments. When production lines need to be altered, lightweight robots can also be easily moved and then set up again. Since they are low in weight and therefore also exhibit low operating forces, many of these robotic solutions can be mounted on mobile frame constructions and deployed on a flexible basis. This means the same robot can be used to assist production staff with various different tasks over the course of a single day.





Continuous production

In the face of growing staff shortages, many SMEs are finding it increasingly difficult to sustain multiple-shift operation in production, even though their order books are healthy. Unlike human workers, robots don't need break times and can take on an additional night shift, for example. On a practical level, this time can be used primarily for production and assembly activi-

ties or pick-and-place tasks for individual components – using the robot for certain aspects of preparatory work. That means staff can get off to a flying start when they come on shift – and companies can also make better use of their machinery and plant, too.

Increased production

Besides taking on additional shifts, lightweight robots can also assist staff directly on a collaborative basis when production is underway. While a robot does the groundwork for staff by carrying out activities that can be automated, staff can take care of complex tasks that are difficult to automate. Using robots can

also significantly reduce the likelihood of production faults that would usually be attributed to human error. Ultimately, production can be boosted without having to hire extra staff or increase the workload of current employees.

Consistent quality

Besides boosting productivity through automation, robots also help companies maintain consistently high production quality standards thanks to their outstanding performance in terms of repeatability. This comes into play both when they are integrated

into a production process and when they are used in automated quality control operations, as they are not subject to certain influences that can vary from one human worker to the next.



5. The wide range of uses for lightweight robots

Due to their small size and lightweight design, lightweight robots offer a great deal of flexibility when it comes to integrating them into pre-existing production areas. Thanks to graphical user guidance and configuration templates, it is relatively easy to work through the necessary programming steps, and many robot suppliers also offer e-learning content that gives prospective customers a realistic idea of the programming outlay for various applications. Furthermore, a broad selection of end effectors – also referred to as end-of-arm tooling, or EOAT – is available for lightweight robots made by leading manufacturers. End effectors are the tools that robots use. They can include pneumatic

and electromechanical grippers and systems for making screw fixings, carrying out welding work or executing dispensing tasks. Additional accessories such as tool changing and measurement systems make lightweight robots an extremely versatile tool for automation. When added together, all these various points make it much easier to implement and utilize robots.

Palletizing

Palletizing is one of the easiest robotics applications to grasp. The final stage in many production chains is a clearly defined, repetitive task that is the ideal place to get started with robotics. Various end effectors such as suction grippers can cope with even the widest range of packaging formats. Meanwhile, simple programming and user guidance ensure that new package sizes and stacking patterns can be incorporated with ease.

Even intermediate steps can be automated in this way, such as combining packages in a strapping machine or packaging products. Equipped with a load-carrying capacity of more than 10 kilograms, lightweight robots can move several metric tons of packages over the course of a shift.



Machine loading

Machine loading is another task that is monotonous for staff and therefore leads to fatigue. Over the course of a shift, concentration levels inevitably decline as this fatigue sets in, and the risk of accidents and production errors increases. Robots can be used to load a whole range of machines. In fact, they can considerably improve safety standards for staff when it comes to working with bending or stamping presses. As with all

robotics applications, it is important to ensure the automation process itself does not pose any risks to workers. If the safety measures built into a robot's controller are not adequate on their own, it may be necessary to use an enclosure to keep the robot and employees apart during operations. This would apply, for example, when sharp or pointed workpieces from CNC milling machines are being handled.

Quality control

Cutting-edge production plants achieve high productivity ratings because their production processes are extensively automated. This increasingly makes manual quality control steps a bottleneck in the overall process. Compared to the classic approach of fully automating quality control, using lightweight robots has

the advantage that companies can then easily adapt the inspection process to new or additional parts. For example, a robot can examine different specific optical or mechanical parameters depending on what is to be inspected.

Assembly

It isn't just at the start and end of the production process that cobots can help out – they can also be integrated directly into the heart of the action. This usually means more work in terms of design and programming, but can enhance value creation and quality at numerous stages in the process. Although collaborative lightweight robots are capable of undertaking complex

activities, practical experience has shown that even just using them for simple tasks can also boost efficiency. For example, they can help out by holding, passing and placing components so staff can then carry out further work on them.



Installing screws and bolts

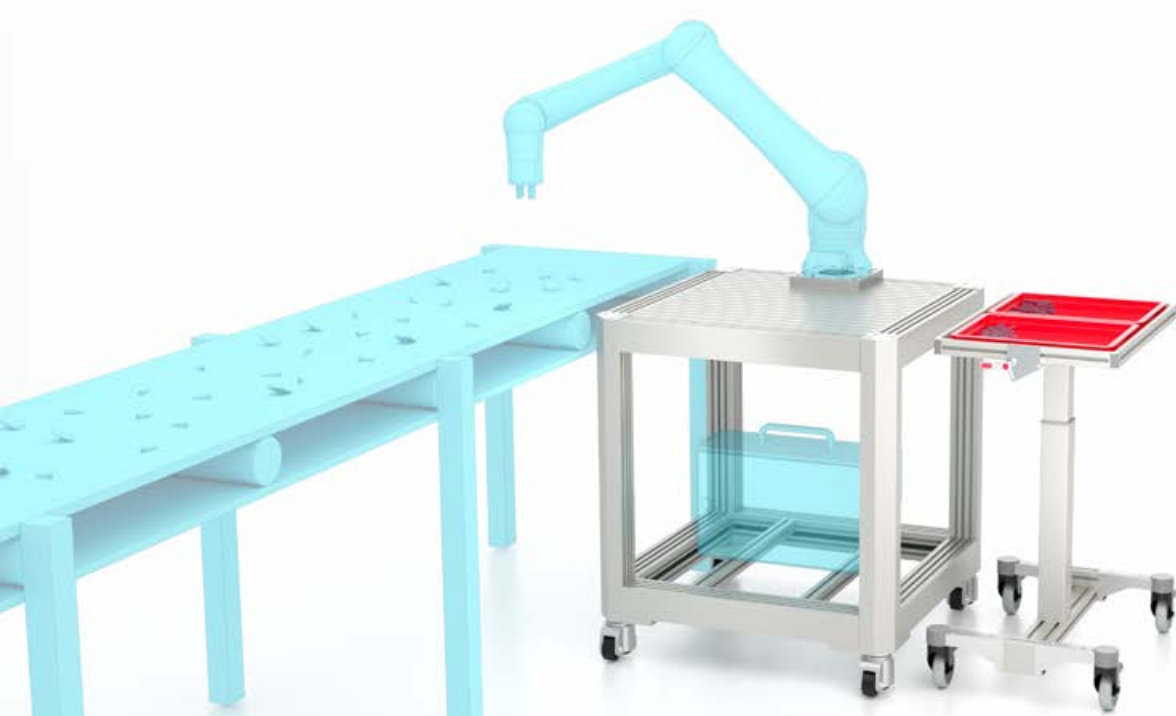
When it comes to using screw fixings to connect components carefully and precisely, robotics applications can be fitted with special high-quality end effectors featuring integrated force torque sensors. These integrated sensor elements continuously monitor and automatically adapt the force being used to operate the screwdriver. The robot's controller can also use the sensor data to independently identify whether the robot and its tool are in the correct position and make any necessary adjustments.

In practice, robotics applications can very closely approximate the power and dexterity of the human hand when fitting screws and can also – in the space of a single shift – install several thousand screws or bolts in exactly the same way.

Welding

In addition to the above examples, lightweight robots are also ideal as alternative solutions for processes that require staff to work in a hazardous environment with appropriate protective equipment. Besides bonding, sealing and painting components and surfaces, welding is another example of one such potentially hazardous task. When fitted with a specially designed

chassis, mobile robotic solutions can simply be docked with pre-existing welding tables. Due to their many degrees of freedom, robots can also apply even weld seams and precise weld dots in places that would be uncomfortable or impossible for a human worker to reach.

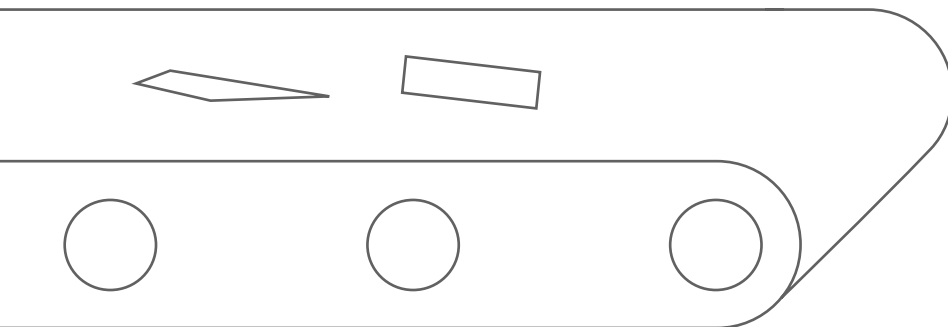


Specialists such as robominds offer turnkey solutions to help companies implement cobot applications for sorting bulk goods and other smart picking applications. These comprise a camera system and software for programming custom applications. The systems interact with the robot via various interfaces and are therefore compatible with cobot models from numerous manufacturers. https://www.robominds.de/en/robobrain-vision-2_en/

Sorting

For a long time, the task of sorting and separating haphazardly stored bulk material in production was considered a job that could only be automated with considerable difficulty – if at all. Things are different now, though. Together, state-of-the-art 3D cameras, machine learning systems and innovative gripper systems can be used to control robots without having to work within the confines of a coordinate system. Integrated image process-

ing systems convert data supplied by a camera into a situation-specific motion profile for the robot. This means that, after a brief teach-in phase, appropriately configured robotics applications can safely grasp overlapping objects at a precisely defined point and then follow a predetermined pattern to set them down for staff or an automated production process.





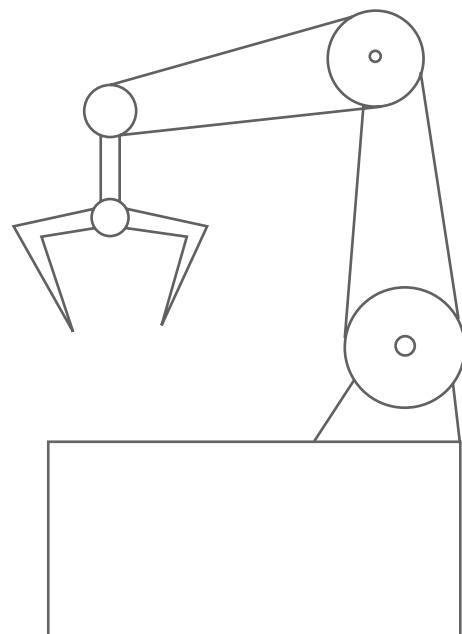
6. Choosing the right base construction

The range of options when implementing a customized solution is just as varied as the different areas where SMEs can use robots. Fundamentally, every robotics application consists of the robot itself (whatever type that might be), peripherals that are connected to it and a base, which is where cables and control technology can also be integrated. That makes the base construction an integral component of any robotics application

and one that has a direct influence on how effectively the robot can be used to support production processes. When it comes to actually creating custom solutions, the fundamental strengths of the item building kit system for industrial engineering can be used to their fullest extent.

Modularity

Thanks to a success story stretching back decades, the item building kit system currently offers engineers an overall range of more than 4000 components. Based on the same lightweight aluminum profile technology, this portfolio is a one-stop shop for everything needed to create the widest range of robotics applications. A solid and stable base construction can be turned into a mobile solution simply by adding castors, and new guard and enclosure elements can be easily added as required.

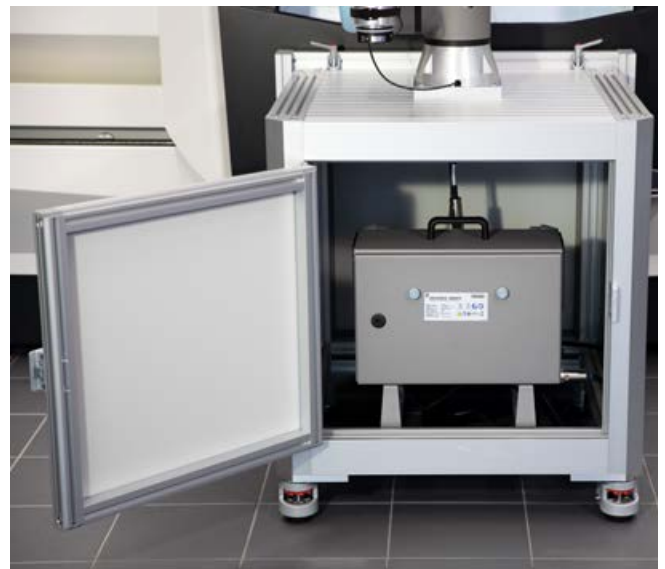




Companies rolling out robotics applications for the first time can turn to experienced system integrators to get valuable tips and turnkey, all-in-one solutions. This is where item partners can help – accredited, independent companies with specialist expertise. Wide-ranging industry know-how and the use of cutting-edge technologies form the solid foundations of this unique network of experts for contemporary and efficient robotic solutions.

Flexibility

This is made possible by innovative fastening technology that uses screw fixings to connect individual profiles instead of welding them. Pre-load on the flanks of the profile technology ensures that connections don't lose their strength – even under the highest of loads. Smaller modifications, such as incorporating additional handles so that a mobile solution can be easily moved around, can be made in a few simple steps and will hold firm on a permanent basis, without becoming loose. Added to that, the comparatively low weight of aluminum ensures that even an encapsulated mobile robotics application can be safely transported by a single employee.





Compatibility

Another important factor is that all the components in the item building kit system are mutually compatible. This means, for example, that a robot mounting plate can be easily integrated into a pre-existing item work bench system. Robotics applications can also be connected to pre-existing machine bases just

as effectively. What's more, the use of fastening technology that can be disassembled without destroying components means the basic frame of a standalone robotic solution can also be quickly modified for the requirements of a new application.

7. Summary

The fundamental advantages and specific application examples set out above clearly illustrate the impressive potential of innovative robotic solutions using lightweight robots. These solutions take over tasks that are repetitive or pose a health risk and contribute directly to process stability and quality assurance in production. They can do this because of their compact size, low weight and ease of use – with no need to hire in specialists. As a result, small and medium-sized enterprises can break down the barriers preventing them from getting started with robotics-based process automation. In the medium term, lightweight robots – and specifically cobots – can be a crucial component in

helping companies maintain the production capacities that will enable them to compete as the shortage of skilled workers gets worse. Businesses that invest in robotics applications now are also addressing the specific interests of the upcoming generation of young, digitally savvy workers. Furthermore, building kit systems for industrial engineering offer that all-important flexibility for creating and continuously optimizing appropriate base frames, guards and enclosures.



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About item

item America LLC is dedicated to the development and world-wide sale of high-quality components used to build fixtures, machinery, and plants as well as system solutions for lean production operations and work bench design. item building kit systems are based on aluminum construction profiles and fastening techniques that are tailored to a whole range of application scenarios in terms of their function and design. Its wide portfolio of over 4,000 components and accessories enables users to create an almost unlimited range of applications – from simple frames and machine enclosures right through to complex handling systems and custom machines.

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