SICK AG WHITE PAPER

ENSURING EFFICIENT AND FAIL-SAFE PRODUCTION USING ROBOTIC SOLUTIONS

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Summary
From SMEs to large corporations: robotic solutions are in greater demand than ever in many areas of the value chain in industry – from production and quality assurance to packaging and shipping. This is due on the one hand to the greatly reduced cost of entry, and on the other hand to lower technical hurdles, since in most cases external system integrators are no longer required for the initial installation – nor is any knowledge of programming languages.

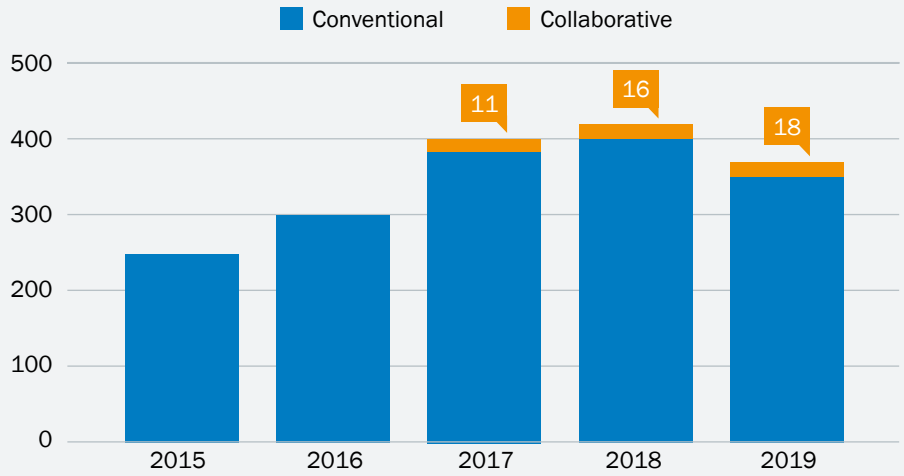
As a result, industrial robots, especially small cobots, have become a sought-after mass-produced item that small businesses can afford and also operate themselves. The cost-benefit equation only works, however, as long as a robot system runs smoothly, because failures are annoying and cost time, money and the technician's nerves. But high-tech helps here, too: The SICK Augmented Reality Assistant (SARA) app turns almost any commercially available smartphone or tablet into a wireless diagnostic system and uses augmented reality technology to help with fast and targeted troubleshooting in order to minimize downtimes.

Developments and advantages in the use of robots

The main advantage of using robots and industrial automation is the ability to combine the cognitive skills of a human with the process-oriented and efficient operation of a robot. Industrial machines deliver constant precision and a continuous workload, and can be used unproblematically in contaminated and hazardous environments where humans cannot work. As a result, more and more companies are deploying automated solutions in addition to their skilled workers to stay competitive, support their valuable human workers in monotonous tasks, and reduce the risk of injury from continuous stress or accidents. According to a study by the International Federation of Robotics (IFR), Germany is number one in Europe, and number three worldwide in terms of the use of robots, and the trend is rising.

Robots have long since ceased to replace jobs – they supplement valuable human resources in a company and contribute to their safety.
But the robotics market is changing: while the number of large and expensive industrial robots working in segregated safe areas without human contact have been declining since 2018, collaborative robots are on the rise. With an affordable entry price starting at just under 2,000 euros, these so-called cobots are ideal assistants that support their human colleagues in their daily work. Thanks to their high versatility, cobots can be used in virtually all areas of the value-adding chain: from component assembly and quality inspection right through to packaging and shipping. Cobots are easier to set up and operate. Compared to conventional industrial robots, cobots can also be operated without segregated work areas. With their advantages, they are an important building block for transforming a plant into a sustainable and competitive Industry 4.0-compatible manufacturing site.

Cobots in the starting blocks
Sales of conventional and collaborative* industrial robots worldwide (in 1,000 units)



* Collaborative robots (“cobots”) work together with humans and are usually not separated from them by protective devices; no data for 2015 and 2016
Source IFR

Sales figures for cobots 2015–2019 (Statista)

Human-robot collaboration

Industry 4.0 networks people, machines and products and is considered to be the fourth industrial revolution. Linking with the help of digital information and communication technology, the so-called Internet of Things (IoT), and machine-to-machine communication (M2M) make a multitude of applications possible for the first time. Remote diagnostic systems that transmit data around the globe in real time, self-driving transporters of components, or continuous quality monitoring through in-process measurements are just a small sample of the possibilities of a smart factory.

Furthermore, the networking of all components also supports the team play between robots and humans. To ensure this collaboration works equally well for both, DIN ISO/TS 15066 specifies certain safety requirements for collaborative industrial robot systems and the work environment. To meet these requirements, cobots must be equipped with appropriate sensors. These detect people and obstacles in their environment using, for example, infrared, ultrasound or radar technology.

The sensors continuously scan important contact areas, detect approaches and movements, and reduce the robot's working speed or stop it if necessary. While the robot performs simple, monotonous or dangerous tasks with the highest precision, the skilled personnel can attend to more important tasks a robot is not capable of performing. At least until the robot colleague brings the process to a standstill due to a malfunction. Then the human must take over again.

Advantages of human-robot collaboration

Employees are relieved: Valuable employees are physically relieved and do not have to perform monotonous work.

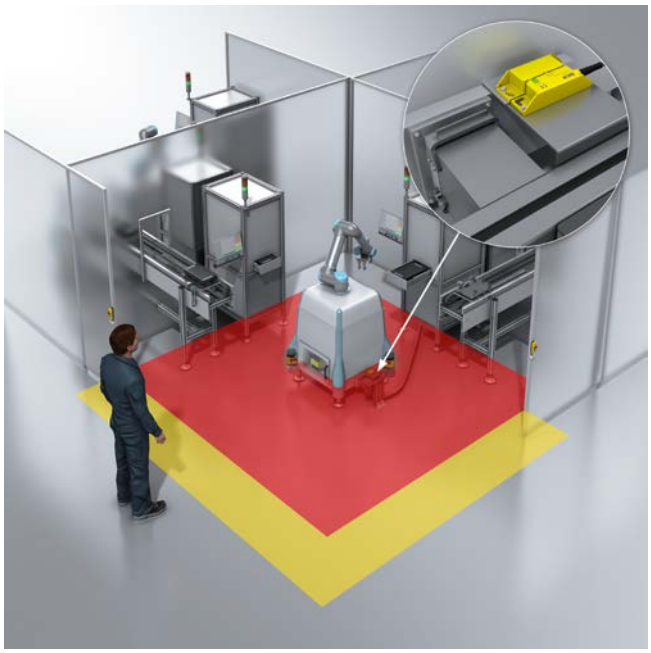
Skilled labor resources are conserved: Given the prevailing shortage of skilled labor in technical professions, cobots can relieve companies by allowing employees to be deployed more profitably in other areas.

Increased productivity: Compared to human labor, cobots can carry out production processes in a more cost- and speed-optimized manner. Thanks to their high precision and repeatability, they also bring about quality improvements and minimize scrap.

Risk factor: downtimes

Integrators, system users and maintainers of robotic solutions in companies are concerned with four aspects in their daily work: the quality of the end product, the efficiency and speed of production, and adherence to set budgets. Only when these aspects are ideally coordinated and the processes interact optimally will the end result be a high-quality product at the calculated price.

Malfunctions, e.g. triggered by the presence of a foreign object in the sensor field of the robot, object detections, or lack of maintenance can interrupt a value-adding chain in a matter of seconds and make costing impossible. Failures in a production chain are a critical factor economically because if something goes wrong at one point in the system, the entire production usually comes to a standstill. It is not uncommon for such an outage to cost several hundred to a thousand euros per hour. According to a study, around 70% of all companies cannot precisely quantify these disruptions (Instandhaltung.de, 2021). Rough estimates can be made of the direct costs resulting from a downtime. If, for example, a company produces 200 units of a product per hour during normal operation with a profit of 20 euros per unit, the cost of one hour of downtime due to lost revenue amounts to 4,000 euros. This does not take into account the hidden costs of service technicians; it should also be borne in mind that the costs for operational readiness are fixed and are incurred irrespective of reduced production or downtimes.

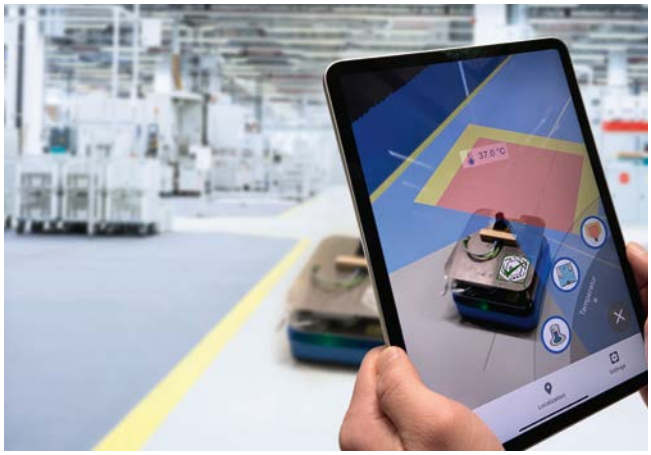


Production stop: fast action required

When a production plant comes to a standstill, things have to move fast. Why has the plant come to a standstill, where exactly is the problem? Very often a laborious and time-consuming localization of the cause of the stoppage then begins. The trigger, such as an object detection in the sensor field, is usually not obvious at first glance. To isolate the error, it is then necessary to also plug a diagnostic panel into each terminal. The responsible employees naturally experience time pressure and stress from the moment of malfunction until the error is found, the malfunction is eliminated, and production can restart.

Solution for faster troubleshooting and maintenance: SARA

With the SICK Augmented Reality Assistant (SARA), the developers at SICK have created a tool that collects data from sensors and robots and merges it with an image of the real environment (live view) on a smartphone or tablet. Once set up, SARA works with any mobile device based on Android or iOS. The app connects wirelessly to the installed sensors and robots and quickly points out the error with the help of augmented reality (AR).



The graphical projection onto the real camera image of the mobile device allows technicians to see the device data from the perspective of the sensor: A detected foreign object, e.g., captured by a spatially high-resolution scanning 2D laser scanner (2D LiDAR sensor), is made visible in the real-time image on the smartphone or tablet display and can thus be easily located and removed in the real world.

Important data such as pressure, temperature or degree of contamination can also be superimposed on the virtual environment, which helps with the maintenance of machines and systems. This saves the company time and money and spares the nerves of the responsible technical personnel.

SARA supports a large number of SICK sensors and is designed to work with any data provider, regardless of technology or manufacturer.

Augmented reality (AR) – what is it?
Unlike virtual reality (VR), which uses only computer-generated 3D graphics for visualization, augmented reality (AR) also uses live images to visually link the real and virtual worlds. In this way, even complex data can be displayed very easily and within the human field of view. Not long ago, this required special and expensive hardware. Almost any smartphone or tablet these days satisfies the technical prerequisites for using AR.

SARA – Advantages at a glance
+ Fast error localization
+ Easy and intuitive to use
+ Does not require any programming knowledge
+ Wireless thanks to WLAN
+ Sensor data can be utilized during operation
+ Available for smartphones and tablets with Android or iOS

Download on the App Store

ANDROID APP ON Google play

DEMO-MODUS

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