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COMMENTARY PAPER

Global automation: assessing the risk of robots

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Global automation: assessing the risk of robots

The history of emerging technologies and robotic assemblies paved a future for automation to become a meaningful part of life. The rational for increased dependency has revolved around improved efficiency, productivity, safety and convenience. From a financial perspective, it makes sense. After all, machines can't test positive for COVID-19, they don't take vacations or holidays off, and they don't get injured. However, as long as humans are involved with design, maintenance, repair and systems updates, utilization of robotic assemblies is not a risk-free proposition.

Popular robot technologies

Robotics pioneer Victor Scheinman invented the "Stanford arm" in 1969. The arm was a six-axis all-electric articulated robot that contained rotary joints. Scheinman's six-axis arm demonstrated the potential of robots to perform complex tasks such as material handling, welding, packaging and assembly. Tesla's auto manufacturing plants are a prime example of just how far articulated robots have come since 1969.

Articulated robots

Articulated robots are designed to mimic the functionality of a human arm. These arms incorporate two to 10 rotary joints (axis). Each additional joint enables a greater degree of motion. Alfred and his mate, who is also called Alfred, are pictured in this image preparing a Mediterranean salad at Bonapita in West Roxbury, MA.

Both robots are honing their skills, refining their techniques and learning from Chef Ilan Barniv — originally a baker from Jerusalem — to turn his recipes into entrées. As each robot gains more knowledge, it is shared with the second robot, and will be shared with every future robot Chef Ilan will deploy. Both robots are considered part of a new generation of smart robots that use artificial intelligence (AI) to continuously learn, adapt and improve their performance in the field.

Autonomous mobile robots

On several college campuses you may witness a fairly new phenomenon: six-wheeled food delivery robots. Autonomous mobile robots (AMRs) negotiate their way throughout campuses and make decisions in near real-time. Sensors and cameras continuously feed the onboard computer information about the AMR's surroundings.

Automated guided vehicles

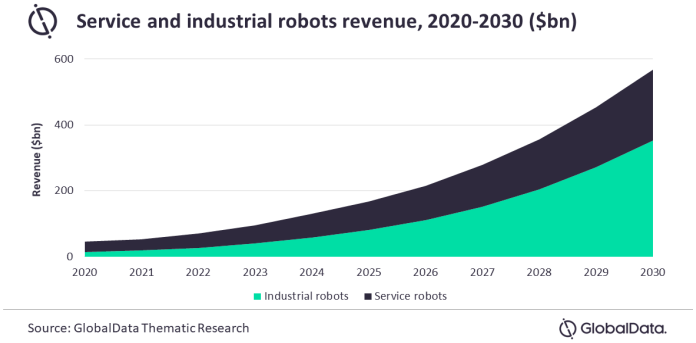
When we envision automated guided vehicles (AGVs), we likely consider Amazon warehouses and the robots that race from aisle to aisle to fulfill our order. At times, AGVs rely on tracks or predefined paths and some require operator oversight.

Cobots

Collaborative robots, also referred to as cobots, are designed to function alongside or directly with humans. Cobots are able to learn multiple tasks so they can assist their human colleagues. As with most other robots, they were designed to reduce or eliminate manual, dangerous or strenuous tasks from day-to-day workflows. The da Vinci system pictured was built with robot arms and high-tech cameras to assist surgeons during operations. The da Vinci's arms translate the surgeon hand movements into smaller, more precise movements, allowing for less invasive procedures.

Industry growth

GlobalData, a London based data analytics company, noted in a report titled "Robotics - Thematic research report" that the robotics market generated $45.3 billion in 2020. GlobalData is predicting that between 2021 and 2030 the industry will grow at a compound annual growth rate (CAGR) of 28%, and by 2030 the industry will generate more than $500 billion. Filipe Oliveira, Senior Analyst at GlobalData, stated that *"Despite the long history of robotics, there is sometimes the feeling that the industry has not reached its full potential. That is about to change due to technological breakthroughs and other factors like the economics and demographics of rich and middle-income countries".*



GlobalData's report goes on to state that the industry is divided into two main foci: industrial robots and service robots. Service robots assist humans by undertaking tasks such as explosive handling, delivery in offices or hospitals, firefighting and warehouse fulfillment, among other tasks. While the service market potential was found to be larger than the industrial, adoption of industrial robots is predicted to grow faster over the next decade.

Robot application hazards

The Occupational Safety and Health Administration (OSHA) published a manual titled "Industrial robots and robot system safety". The manual advises the following, "Studies in Sweden and Japan indicated that many robot accidents do not occur under normal operating conditions, but instead during assembly, installation, and testing where workers are first exposed to the robot application. These stages are when errors in design, assembly, and installation will present themselves – during initial programming (and program touch-up or refinement) and maintenance (repair, testing, setup, or adjustment)."

OSHA identified hazards to humans while working with robots. The list below was transcribed directly from section V subsection C, to eliminate misinterpretation of critical information:

Control errors

These are faults within the control system, software, electromagnetic interference, and radio frequency interference. If the control system has a fault, this can create erratic behavior or an increase in the hazardous energy potential of the machine.

Unauthorized access

Unauthorized entry into a safeguarded area by someone who is unfamiliar with the safety hardware can easily result in a serious injury.

Mechanical failures

Mechanical issues can result in faulty or unexpected operation of the robot. These types of failures are unpredictable and potentially dangerous.

Environmental sources

Some factors can't always be anticipated, such as sudden environmental causes of electromagnetic or radio-frequency interference that can influence the robot's performance. It's important to plan for events such as power surges or power loss when designing and implementing automation in the workplace.

Power systems

Robots' power sources can be disrupted and lead to malfunctions. For example, pneumatic, hydraulic or electrical power sources with malfunctioning control or transmission elements in the power system can disrupt electrical signals to the control and/or power-supply lines. This can become the source of an energy release and cause electrical shocks. The risk of fires can also be increased due to electrical overloads, especially when they occur in robots that make use of flammable hydraulic oil.

Improper installation

When an industrial robot is being installed, it is critically important to do it correctly. Incorrect installation can result in different hazards depending on the specific variance from the original design. This is why the design, installation requirements, and layout of equipment and utilities of a robot or automation system have to be followed to the letter.

Human errors

This cause of serious incidents covers a wide range of mistakes: faulty programming, interfacing, maintenance, or incorrect activation of the "teach pendant" or control panel, among other issues. In addition, operators or other workers may put themselves in danger due to over-familiarity with the robot or fail to recognize line-of-fire risks associated with the robot's motions.

Risk considerations

2018

A food delivery robot spontaneously burst into flames. Kiwi, the startup that built the robot, determined that the fire resulted from human error. A bad battery was inserted into the robot, which eventually caused thermal runaway. Thermal runaway is one of the primary risks associated with lithium-ion batteries. A drawback of using batteries is that they are required to operate in a relatively narrow temperature range. The battery cells' safety and stability depends on maintaining internal temperatures within specific limits. If the internal temperature exceeds a critical limit, thermal runaway can occur — destroying the battery or starting a fire, as was the case with the Kiwi robot.

2019

In Andover, United Kingdom (UK), Ocado is an online grocer that operates massive warehouses, similar to Amazon's set up. Ocado invested heavily in automation to speed home grocery delivery. In 2019, a fault in a battery charging unit caused a robot to catch fire. The fire burned for four days and the site was completely destroyed.

2021

In London, UK, Ocado sustained another fire in July 2021, when a malfunction caused three robots in the Erith fulfillment warehouse to collide. The Erith facility usually handles 150,000 orders per week, utilizing over 1,000 robots on a grid that negotiate their way around the facility picking groceries for delivery.

2021

General Motors (GM) announced in August 2021 that it was recalling every Chevrolet Bolt (not Volt) it had ever manufactured. The recall was a result of a string of fires that affected the Bolt models. The company traced the problem to two simultaneously occurring defects in the cars' batteries. Further investigation pointed to a misaligned factory assembly robot that may have caused the problem.

Subrogation and remediation

When a battery malfunctions and spontaneously combusts, subrogation becomes an important topic to consider. This is also true if the battery charger malfunctions, robots randomly collide, or a precise assembly robot was not programmed correctly or misaligned. Securing the evidence and safeguarding it is critical.

The second factor to consider is remediation. Businesses that incorporate robots are typically large, so business income loss is often substantial. Assembling a team of environmental experts, building consultants and equipment engineers will ensure that proper recovery protocols are followed as the loss progresses towards full recovery.

About EFI Global

EFI Global, part of Sedgwick, is a well-established brand with an excellent reputation in the Americas, Africa, Asia-Pacific and Europe as a market leader in environmental consulting, engineering failure analysis and origin-and-cause investigations. Each year, EFI Global completes more than 45,000 projects worldwide for a wide range of clients, such as commercial, industrial, institutional, insurance, government, risk managers, public and private entities. EFI Global is one of the world's most respected emergency response firms, capable of providing practical solutions to the most complex problems. Our multidisciplinary team of first responders, project managers, engineers, geologists and scientists are selected for their technical proficiency and in-depth industry knowledge to aid clients in resolving technical problems. For more, see **efiglobal.com**.

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Get in touch with an expert

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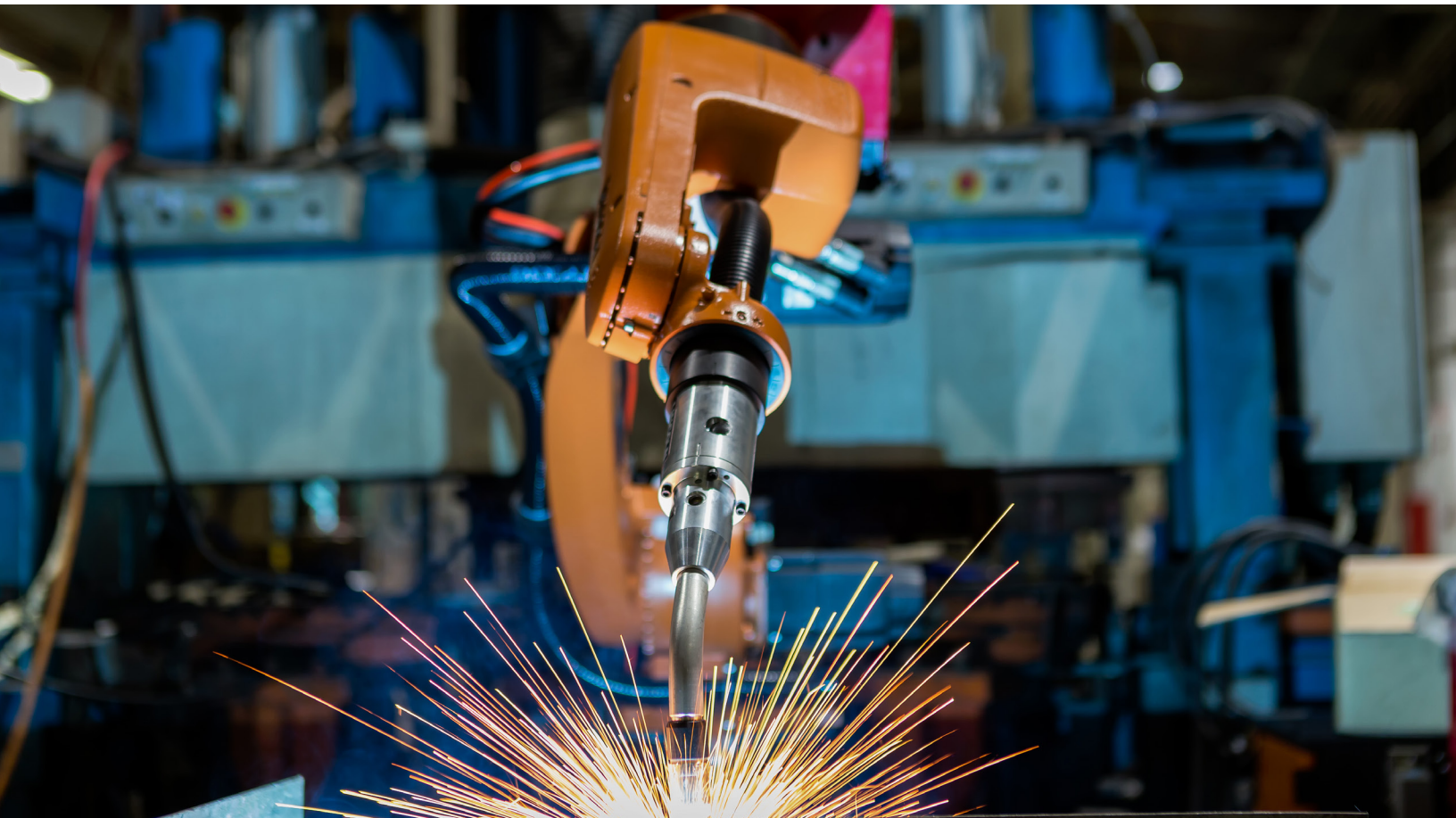

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