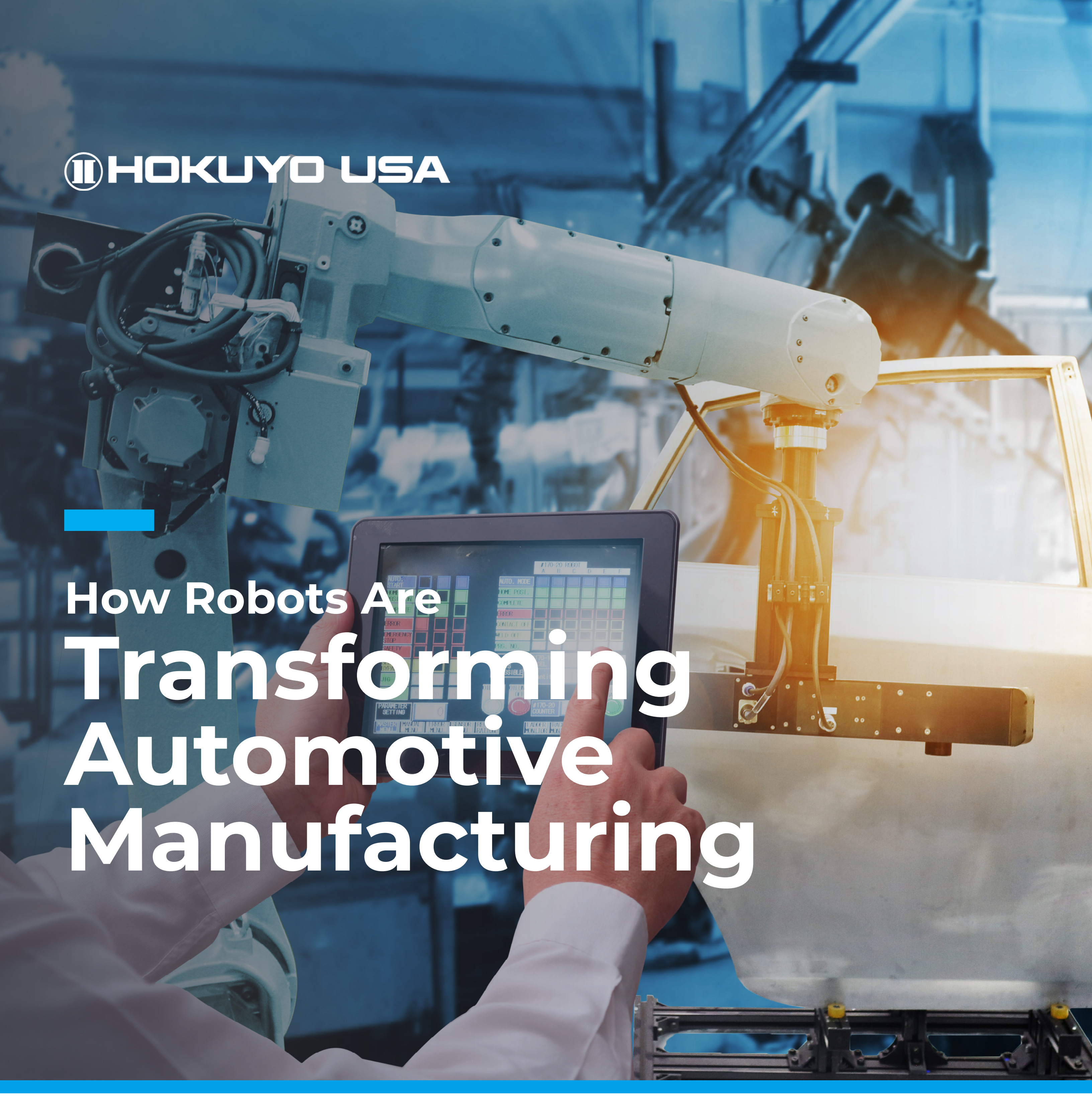

HOKUYO USA

How Robots Are Transforming Automotive Manufacturing

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Sensing the Future.

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Introduction

The automotive industry has always been at the forefront of adopting innovative technologies and solutions to ramp up production while cutting down costs. However, the introduction of robotics and automation processes has radicalized how a vehicle is put together today. As a result, robots today are an essential part of automobile manufacturing plants. From 2021 statistics, the US ranks seventh in terms of overall robot density in the automotive manufacturing industry with 1287 robot installations per 10,000 employees. With the robotics industry set to double its market size from $6.63 billion in 2019 to $13.60 billion by 2027, it is important to understand how intelligent the transformation brought on by robots in automotive manufacturing is. This whitepaper sheds light on the history of robots and how they continue to become an integral part of modern automotive manufacturing facilities.

The Introduction of Robots into Automotive

Manufacturing

The implementation of robots in automotive manufacturing can be traced back to the 1970s. This was an era when significant milestones were achieved in the field of electronics and computing. The first computers were invented in this era, and electronic circuits were the stepping stones towards robotic automation.

The Invention of Robots for Manufacturing: Pneumatic 1960-1970

The robots that we have today feature servo motors, which enable them to move. However, the first industrial robots were not based on servo motors, but hydraulics. The programming was based on logic gates that would actuate the pneumatic valves, which moved the parts of the robot.

During this decade, George Devol made the first programmable industrial robot, the Unimate Robot, and established the Unimation company. The Unimate Robot could pick and place a part or component from one spot to another, repeatedly and tirelessly. Soon, General Motors started implementing Unimation robots in its factories.

Ford followed suit, and with the two biggest automotive manufacturers implementing robots in their workshops, it didn't take long for the entire world to notice. Unimation was also the first company to develop welding robots.

Upgrading Robots with Servos and Better Computers: 1970-1999

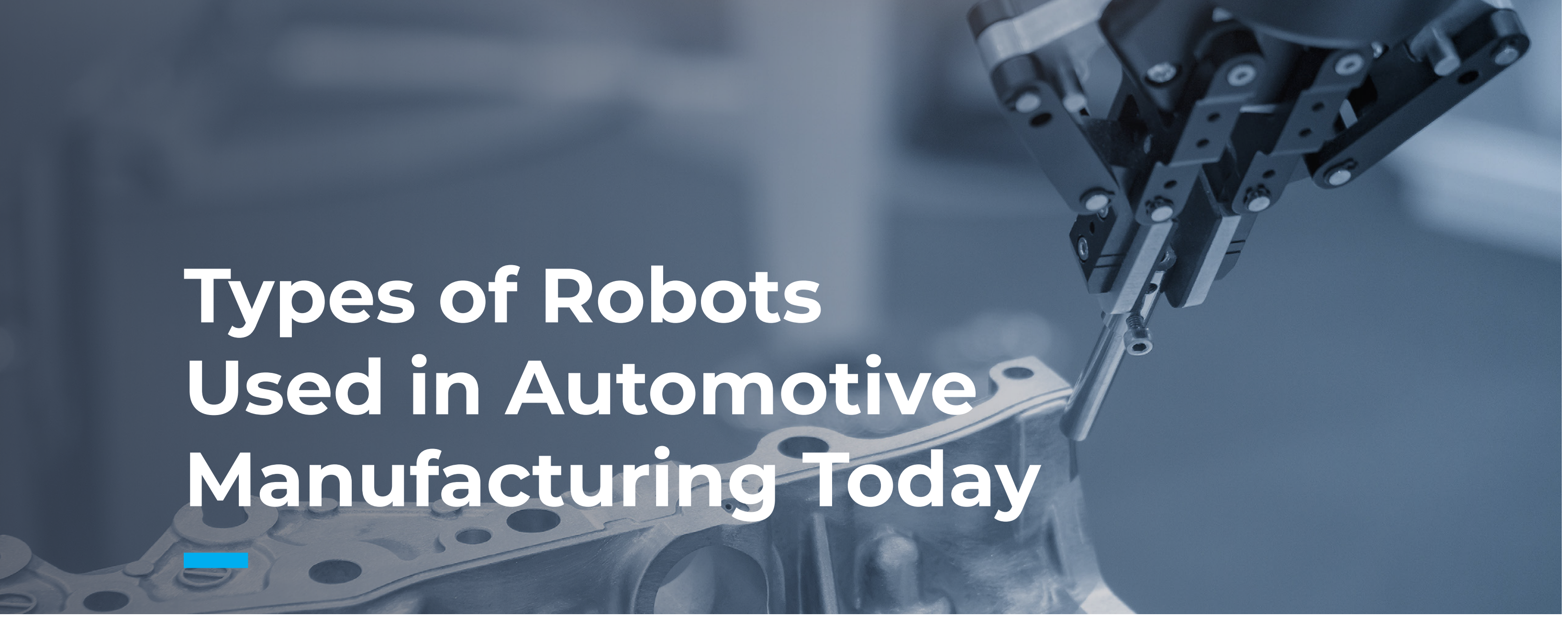
Although robotic arms of the 1970s were not advanced to the level we have today, it marked a new beginning for robotic automation in automotive manufacturing.

The first-ever robotic arm that had servo motors instead of hydraulics was the Stanford Arm, developed in 1969 by Victor Scheinman, a mechanical engineer. The Stanford Arm featured six degrees of motion and microprocessors, enabling precise movement and easy programmability.

From 1960 to the 1980s, large automotive companies started implementing robots in their manufacturing plants to boost productivity.

The Robots of Today – 1999 & Beyond

From 1999, we saw modifications to the electric robots, which made them more intelligent and interactive. For example, the early robots had lights that turned ON when there was an error or fault with the machine. The light denoted that there was a problem, but we could not understand much beyond that unless a technician got a careful look. With advancements in sensor technology, Artificial Intelligence, and Machine Learning, modern industrial robots have become more interactive and smart. The robots of today require minimal human supervision. They perform tasks with greater accuracy and precision. Many of the robots also collect data, learn from those data patterns, and improvise accordingly.



Types of Robots Used in Automotive Manufacturing Today

The robots that we have today are capable of more than just picking and placing objects. They are precise machines that can do a variety of functions within an industry. Let's take a look at the different types of robots being employed in automotive manufacturing.

Welding Robots

Welding robots are designed to perform all types of welds required on a vehicle body. The welding robot is given precise information to perform the procedure. In addition, the robot comes with optical sensors that take the image of the weld for real-time evaluation.

Robots for Paint Jobs

Painting is a complex task where the thickness and layer count are of prime importance. For a long time, painting automotive parts was done by humans. However, thanks to the advancements that we have made, Robotic painting is now much faster, more precise, and more cost-effective than human labor.

Quality Control or Robotic Vision

Robotic vision involves using image sensors to take images of a part or surface to check for defects or blemishes. Since robotic vision can work for hours without experiencing fatigue like human eyes, it dramatically improves quality control.

Assembly

With the help of sensors and lasers, robots can alight parts with high precision. Also, the build of the robot determines its weight carrying capacity. Combining these features, robots of today can assemble automotive parts together reliably.

Part Transfer

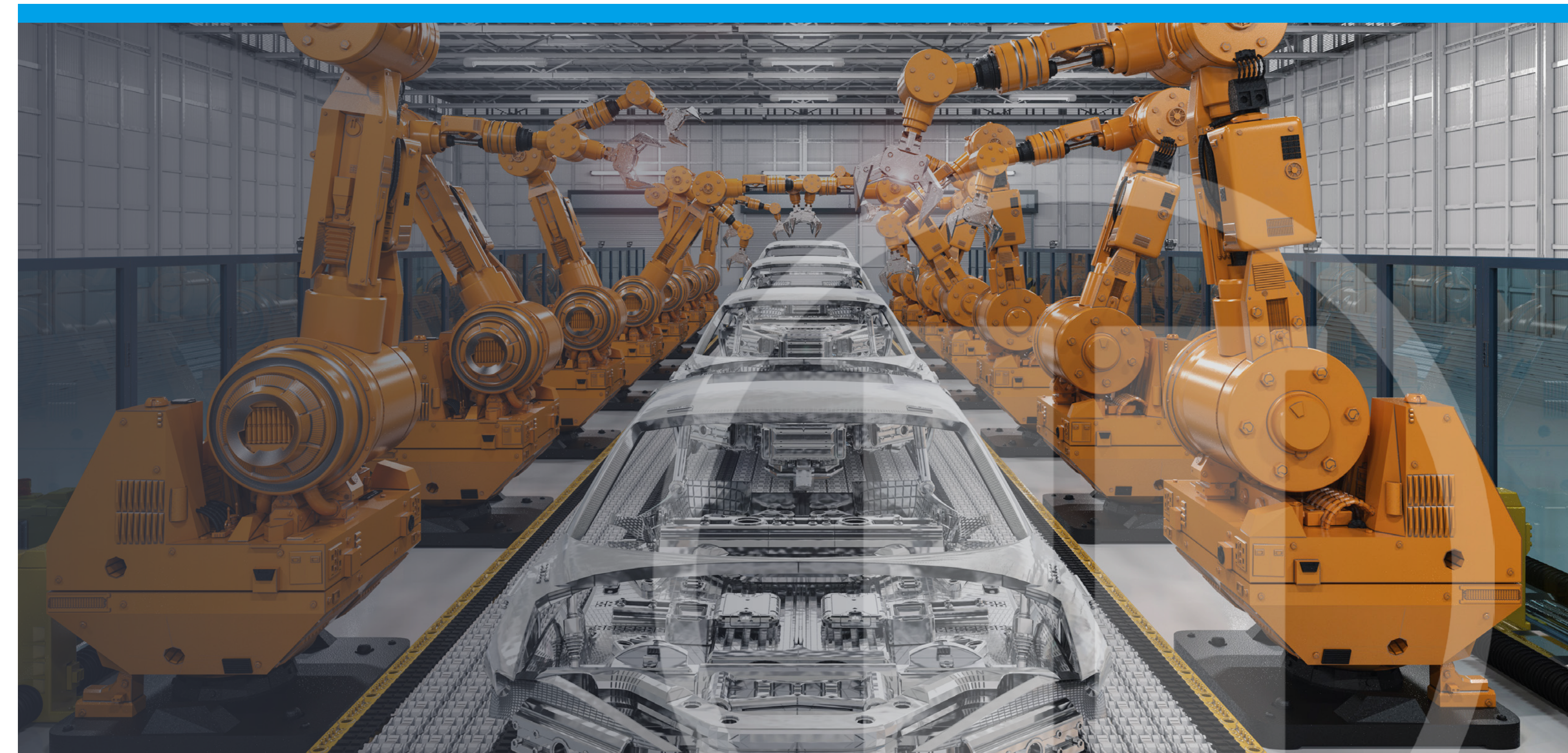
A part transfer is one of the mundane jobs in the automotive industry. It involves picking parts from one point and transferring them to another. Robotic automation is ideal for these repetitive tasks.

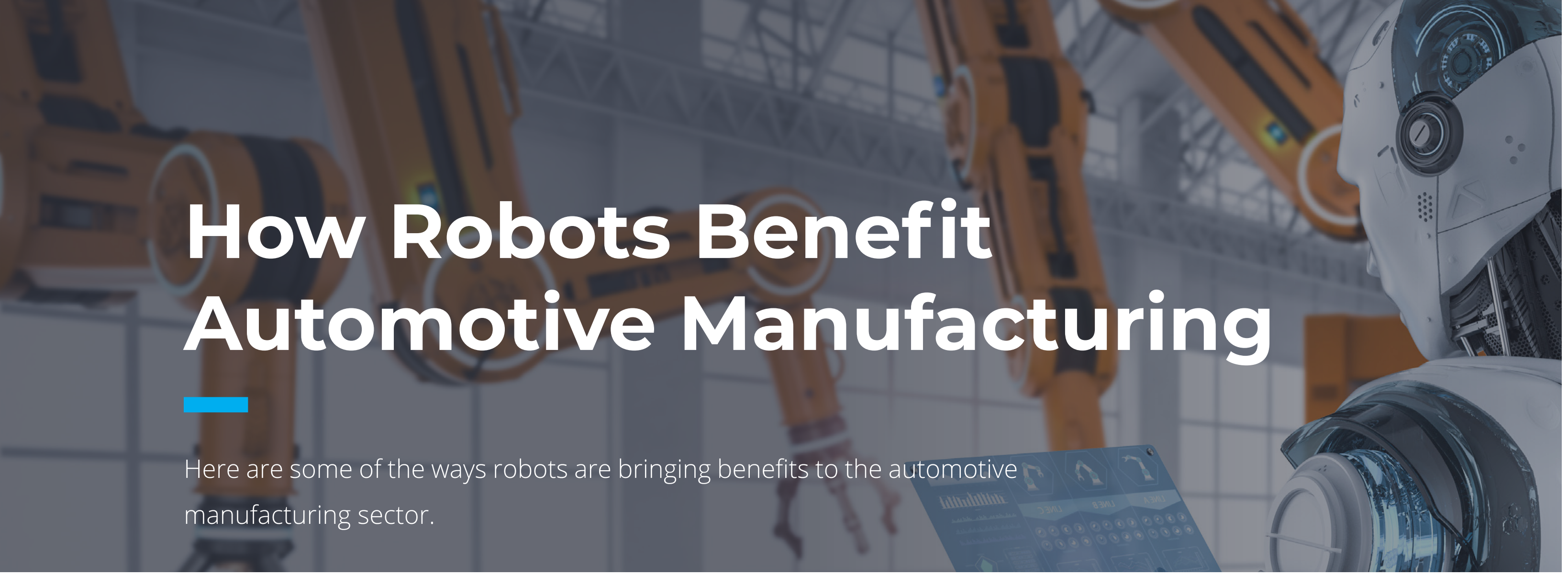
Sealing

Sealing is the process of using a sealant to prevent moisture or air from passing between two surfaces. In automotive manufacturing, gaskets, rubber, and silicone are the prime sealants. Robots are used to apply these sealants to the surfaces to ensure an even spread and faster turnaround.

Logistics

Another area where robots excel is in logistics automation. Using AGVs (Automated Guided Vehicles) or AMRs (Autonomous Mobile Robots), automotive manufacturers can automate logistics processes within a manufacturing plant or parts warehouse. These robots are fitted with LiDAR sensors that help them detect obstacles and measure distances. By taking care of raw materials handling 24/7, these robots ensure that each assembly process gets the required part without needing the worker to move consistently between two points.





How Robots Benefit Automotive Manufacturing

Here are some of the ways robots are bringing benefits to the automotive manufacturing sector.

Reliability: Modern robots are designed considering the reliability factor. The parts and actuators are tested for countless hours before being used in a robot. The advantage of such a system is that these robots are more reliable than human labor. They can work for hours on end without fatigue or any dip in product quality.

Precision: With the change from hydraulics to servomotors, engineers could fine-tune the degree of movement of a robot. Robots used in manufacturing are precise to the degree of millimeters and below so that parts are manufactured with greater precision.
Repeatability: Humans get tired of repetitive jobs. Robots offer the perfect solution where they can repeatedly perform the same task without being tired or losing focus. Also, robots are not restricted to office hours. They can keep on working 24/7, thereby maximizing the overall output.

Capacity: With robots, manufacturers can increase their production capacity by keeping the robots running continuously. There are even factories that employ the concept of "lights-out manufacturing," which means that these facilities are fully automated and require no human presence. The production process will continue even with the lights off.
Saving workers from hazardous environments: A decade ago, most automotive paint jobs were performed by humans. Paint, however, is a chemical that can affect our respiratory system, posing a danger to the worker. With robots, the industry now offsets the hazardous and arduous jobs to machines rather than humans. Also, jobs like lifting, twisting, and other repetitive jobs can be entrusted to robots to make the workplace safer for humans.

Flexibility: Robots can be equipped with replaceable tools. For example, a robot arm tasked with welding can be repurposed to a part picker by changing the weld gun attachment to the gripper. The technician simply needs to switch the operation in the software so that it is programmed with part picker logic. With an attachment change, the entire objective of the robot changes, and that can happen without any downtime for training.

The Future of Robots in Automotive Manufacturing

The market for robots in automotive manufacturing is on the rise, and it will continue to follow the upward trend for many more years to come. In addition, the recent COVID-19 pandemic showed that there are going to be times when factories will fall short of human labor. In such cases, a robot-operated manufacturing plant makes the most sense

In the future, we will see robots getting better and more advanced.

These robots will more likely accompany human workers, helping in making their tasks less tedious and more meaningful. With advancements in AI and machine learning, robots will also become smarter and find new applications across the entire value chain of automotive manufacturing–right from raw material procurement through to delivery.

Sensor Technologies Will Empower Future Robots

The capabilities of these robots largely depend on the underlying sensor technology. With powerful imaging sensors, the robots can see better. Proximity sensors enable them to judge distance easily. LiDAR sensors help these robots avoid obstacles and move quickly within the manufacturing facility. In essence, robots can only operate to the extent that their sensors allow them. The better these sensors get, the better the robots will be able to operate.

As far as the question of how long it will take robots to fully manage a manufacturing plant goes, this paradigm shift has already begun. The future of autonomous manufacturing plants is nearer than we think.

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