Industrial Application of Robots in Material Handling and Assembly

Module-6

Introduction

A **robot** is a machine, especially one programmable by a computer capable of carrying out a complex series of actions automatically. Robots can be guided by an external control device or the control may be embedded within. Robots may be constructed on the lines of human form, but most robots are machines designed to perform a task with no regard to their aesthetics.

Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, underwater, in high heat, and clean up and containment of hazardous materials and radiation). Robots can take on any form but some are made to resemble humans in appearance.

Areas of Application of Robots

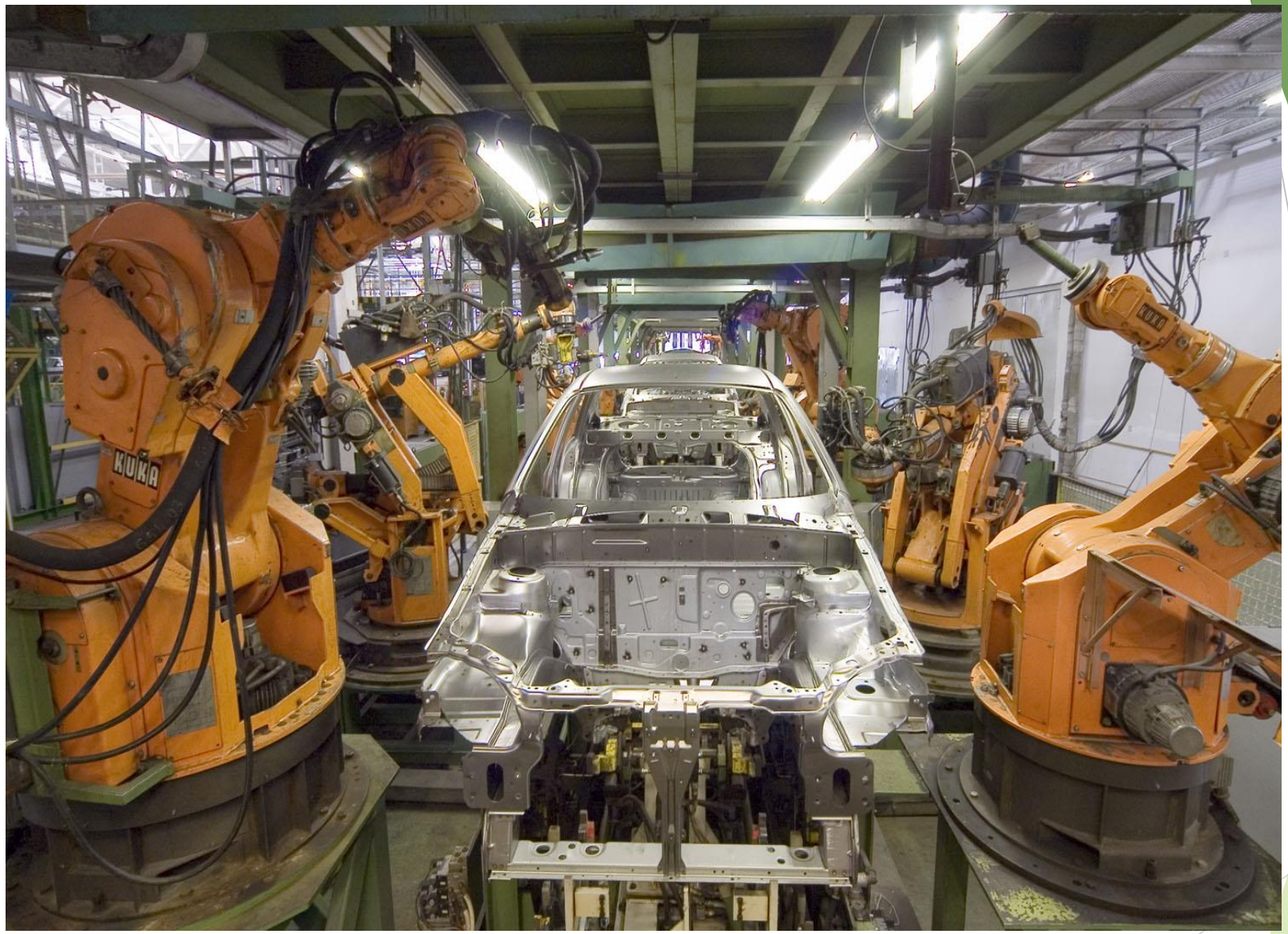
- Outer Space
- Military
- Industry
- Health Service
- Agriculture
- Underwater
- Security and Surveillance

Industrial Application

An **industrial robot** is a robot system used for manufacturing. Industrial robots are automated, programmable and capable of movement on three or more axis.
Typical applications of robots include welding, painting, assembly, disassembly, pick and place for printed circuit boards, packaging and labeling, palletizing , product inspection, and testing; all accomplished with high endurance, speed, and precision. They can assist in material handling.
Some of the applications of robots in Industry are:

- **Loading and Unloading:** Robots are extensively being utilized for the loading and unloading of machines and parts in industries, thus substituting human labor and other mechanical methods. Robots possess the benefit of duplicating the designed tasks, performing accurately, and being compatible with the nearby equipment.
- **Arc Welding**: The surroundings of arc welding are unsafe for the fitness of human beings, and achievement of quality welds is difficult by manual operations. Therefore, since smooth movements provide superior welds, the use of robots for such operations is growing very rapidly. Utilization of industrial robots for arc welding is economical, and the welds are of an excellent quality.
- **Repetitive work cycle:** A second characteristic that tends to promote the use of robotics is a repetitive work cycle. If the sequence of elements in the cycle is the same, and the elements consist of relatively simple motions, a robot is usually capable of performing the work cycle with greater consistency and repeatability than a human worker. Greater consistency and repeatability are usually manifested as higher product quality than can he achieved in a manual operation.

- **Spot Welding**: Robots perform spot welding very accurately, with recurring operations, and are extensively being used in automotive industry. They can extend to places which normally would be difficult to reach by manual welding.
- **Painting**: It is a difficult and unhealthy operation, where hazardous fumes are released that are extremely dangerous for human beings, and in which a danger of explosion exists in the areas of operation. Furthermore, manual painting results are not consistent due to unpredictable speed of movement of the components involved in this process.
- **Investment Casting**: Investment casting requires duplication, accuracy, and uniformity in production, all of which can be achieved with employment of industrial robots.
- **Integration of Parts**: The integration of parts in various sub systems of production is an important application where robots can function more efficiently and with extra speed, thus assisting in the increase of production rate. Presently, robots are being used for tightening of bolts and nuts, placing of components in circuit boards, and a variety of other similar tasks. Logic devices are used for identification and rectification of defects or inconsistencies.
- **Hazardous work environment for humans:** When the work environment is unsafe, unhealthful, hazardous, uncomfortable, or otherwise unpleasant for humans, there is reason to consider an industrial robot for the work.



Industrial Robots being used for Automotive Manufacturing And Assembly

Material Handling

Material handling robots can automate some of the most tedious, dull, and unsafe tasks in a production line and is one of the easiest ways to add automation. Material handling robots enhance the efficiency of your production line and increase customer satisfaction by providing quality products in a timely manner.

The term material handling encompasses a wide variety of product movements. Part selection and transferring, palletizing, packing, and machine loading are just a few of the applications that are considered material handling.

When picking material handling equipment for your facility, you should consider payload and speed requirements, end-of-arm tooling or grippers needed, facility layout and floor-space, the type of material being handled and any additional possible production problems.

- Part transfer, a dull and tedious process, can also be injury-inducing to human workers. By adding robots to this job, human workers are kept free of the hazardous environment.
- Packaging robots are extremely flexible and easy to integrate into a workspace. Some of the advantages of packaging robots include reduced part package time, ability to lift larger packages and labor cost reduction . With the right end of arm tooling, a robot can complete any packaging process. There is a large variety of robot sizes, mounting options, payload and reach available to choose from.
- Palletizing robots can be seen in many industries including food processing, manufacturing, and shipping.
- Machine loading robots not only increase production speeds, it also protects workers from injury.

Die casting: The robot unloads parts from the die casting machine. Peripheral operations sometimes performed by the robot include dipping the parts into a water bath for cooling.

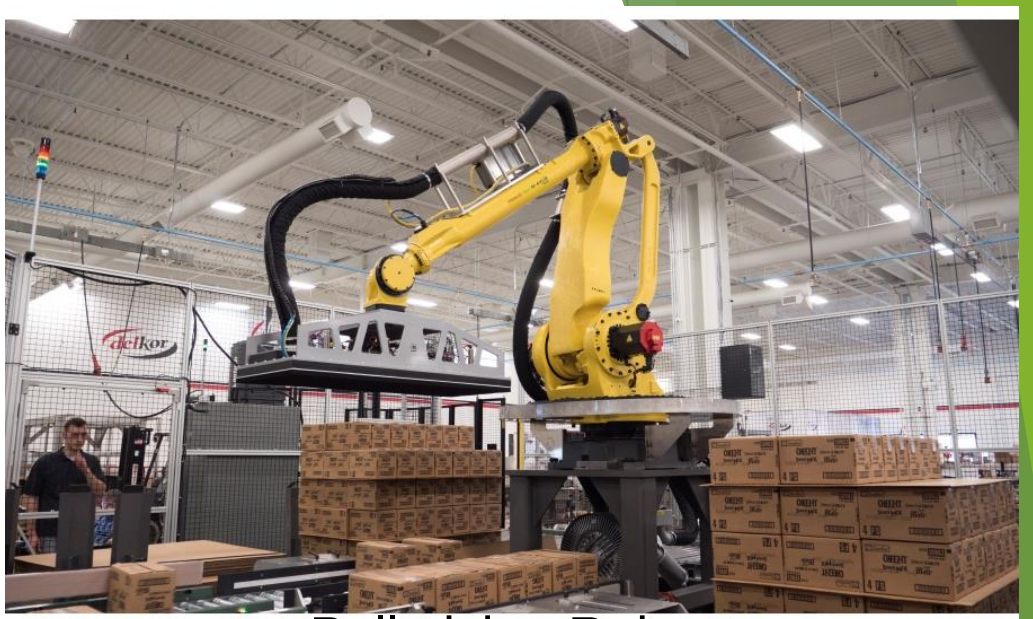
Plastic molding: Plastic molding is a robot application similar to die casting. The robot is used to unload molded parts from the injection molding machine.

Machining operations: The robot is used to load raw blanks into the machine tool and unload finished parts from the machine. The change in shape and size of the part before and after machining often presents a problem in end effector design; and dual grippers are often used to deal with this issue.
Forging: The robot is typically used to load the raw hot billet into the die, hold it during the forging blows, and remove it from the forge hammer. The hammering action and the risk of damage to the die or end effector are significant technical problems. Forging and related processes are difficult as robot applications because of the severe conditions under which the robot must operate

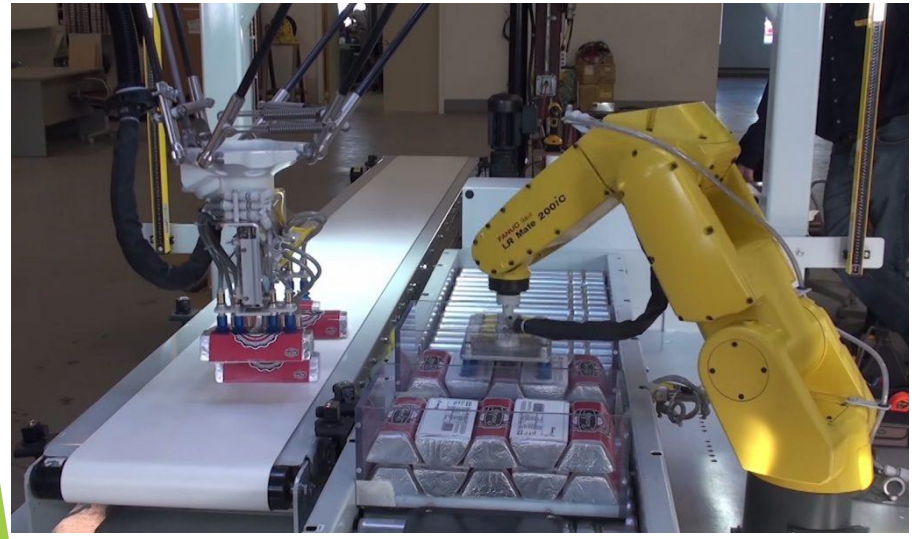
Press working: Human operators work at considerable risk in sheet-metal press working operations because of the action of the press. Robots are used as substitutes for the human workers to reduce the danger. In these applications, the robot loads the blank into the press, the stamping operation is performed, and the part fails out the back of the machine into a container. In high production runs, press working operations can be mechanized by using sheet metal coils instead of individual blanks. These operations require neither humans nor robots to participate directly in the process

Hear treating: These are often relatively simple operations in which the robot loads and/or unloads parts from a furnace

Part Selection and Transfer Robot



Palletizing Robot



Packing Robots

Machine Loading Robot

Robots in Assembly

Assembly robots are used for lean industrial processes and have expanded production capabilities in the manufacturing world. An assembly line robot can dramatically increase production speed and consistency. They also save workers from tedious and dull assembly line jobs.
End of arm tooling can be customized for each assembly robot to cater to the manufacturing requirements. Additional options, like robotic vision, can also be incorporated to improve efficiency and accuracy of part orientation or sorting identifiers.

Applications

Applications for robotic assembly include automotive components, like pumps, motors and gearboxes. Computers and consumer electronics are another excellent area, as are medical devices and household appliances. Assembly robots are ideal for tasks demanding speed and precision like applying sealants and adhesives. Not only can they put together parts that are too small or intricate for a human, but they work quickly and accurately without tiring or making mistakes. They are good in applications where cleanliness is paramount, like pharmaceuticals and medical device assembly, and they aren’t prone to debilitating injuries, like carpal tunnel syndrome, that come with repetitive work.

Advantages

- **Increased efficiency**

Industrial robots can complete certain tasks faster and more efficiently than humans as they are designed and built to perform them with higher accuracy. This combined with the fact they are used to automate processes which previously might have taken significantly more time and resource results in the use of industrial robots to increase the efficiency of production lines.

- **Improved quality**

Given their higher levels of accuracy, industrial robots can be used to produce higher quality products which result in the reduction of time required for quality control and ensures that standards of quality are adhered to.

- **Improved working environment**

Some tasks are deemed as too dangerous or laborious and repetitive for humans to carry out and so instead robots can perform these tasks instead. Working conditions, therefore, can be vastly improved as well as the safety within factories and production plants by introducing industrial robots.

- **Increased profitability**

The results of introducing industrial robots can only ensure higher profitability levels with lower cost per product as by increasing the efficiency of your process, reducing the resource and time required to complete it whilst also achieving higher quality products, introducing industrial robots save money in the long run.

- **Longer working hours**

As human breaks in the working day are required, distractions happen and attention spans slow. Whereas robots can work 24/7 and keep working at 100% efficiency. On average a 40% increase in the output of a production line occurs when one key person is replaced by a robot who operates the same working hours, simply because of stamina. Also, robots don’t take holidays or have unexpected absences.

Disadvantages

- **Capital cost**

Implementing industrial robots can incur a high capital cost however, they do prove highly effective and bring a positive ROI. This is why, prior to decisions being made, we always recommend consideration is given to both the investment required and also the ROI you expect to achieve in implementing robots. Often the advice we give is to take out asset finance and the ROI of the robot more than pays for the interest on the asset finance.

- **Expertise**

The initial set up of industrial robots requires a lot of training and expertise as with any other type of technology, this is because they are excellent for performing many tasks. Good automation companies provide a support package of their expertise which is an extremely important factor. However, to minimize reliance on automation companies, training can be given to engineers to allow them to program the robots – though the assistance of experienced automation companies is still required for the original integration of the robot.