3 Industrial Applications

Module Goal

The purpose of this module is for the learner to distinguish the differences in industrial applications in which industrial robots are used.

INTRODUCTION

Learner will be able to:

- Explain the aspects of material handling with robots
- Explain welding with robots
- Identify robots used in assembly
- Identify other applications in which robots are used
- Expand upon the Advantages and Disadvantages of using robot's with industrial applications

ADVANTAGES/DISADVANTAGES OF USING A ROBOT WITH INDUSTRIAL APPLICATIONS

You vs. The Robot

Robots are able to perform tasks that would be very difficult for you! For the tasks below, which ones would you rather have the robot do?

- **Add and tighten 100,000 bottle caps**
- **Lift 100 pound parts and place them on the conveyor**
- **Paint 1,000 cars**

It is more efficient for a robot to perform the tasks below. Just imagine how tired your arm would be after screwing on all those bottle caps, not to mention how long it would take you!

Using Robots

The initial cost when implementing a robot into an industrial process can seem extreme, however the **ROI or return on investment** can quickly make up for the **initial expense**.

In industrial applications robots take the place of workers, doing the monotonous tasks such as moving heavy objects from one position to the next or the very delicate operations that require **great precision**.

Reliable Robots

Working eight hours a day moving heavy objects repeatedly is not only hazardous to the human worker, but also puts potential fluctuations in the process time for that station.

A robot performs a set number of actions repeatedly and can be **relied on** to finish them within a **consistent** amount of time thereby **increasing production,** remaining **diligent** and on task for 24 hours a day non-stop.

Robots are able to work for much longer and much more consistently than humans on many tasks. They also suffer no health risks from performing the same movements over and over again, as humans do.

Robots Keep Humans Safe

In the aftermath of the nuclear meltdown at the Fukushima Daiichi plant in 2011, robots have played a big role in the clean up! Radiation levels coming from the destroyed plant were too high for humans to safely enter, so robots went in first.

Robots equipped with various tools and cameras are helping to clean up the destruction as well as showing the area to the experts, which allows them to plan the rest of the clean-up.

What do you think are the dangers to humans if they had to perform this task?

- **Burns**

- **Radiation sickness**
- **Nausea**
- **Death**

Exposure to high levels of radiation can cause many health effects, such as burns, radiation sickness, nausea and even death. Using robots to clean up the Fukushima disaster has kept many people safe!

Implementing Robots

By implementing a robot into a system which was controlled by humans there is a significant increase in production, typically around 30%. Robots **can work in areas considered dangerous** to humans such as areas with high levels of heat or radiation without ever having to stop for a break.

- Increase in production
- Can work in areas dangerous to humans
- Never have to stop for breaks

Advantages and Disadvantages of Robots

Using robots can have its advantages, as well as its drawbacks.

Advantages:

- ROI
- Reliability
- Productivity
- Diligent
- Precise
- Consistent
- Increased Production
- Robots can work in areas considered dangerous to humans, (Safer)

Disadvantages:

- Initial expense
- Use large amounts of space
- Require a power source
- Must be maintained
- Time consuming to program
- Trained technicians are required for repairs

List the key terms that are required for the students to understand this topic and provide a definition.

- **Return on Investment (ROI)**:
- **Initial Expense**:

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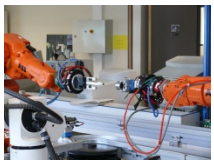
Robot ABB 2.jpg  **ATTRIBUTION:** "Robot ABB 2.jpg" by Peter17 is licensed by CC BY 3.0.	Peter17	http://commons.wikimedia.org/wiki/File:Robot_ABB_2.jpg	Creative Commons Attribution-Share Alike 3.0 Unported license

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MATERIAL HANDLING

Material Handling

One of the key advantages of using a robot as opposed to a human is its reliability and repeatability. Once a robot has been programmed to execute a sequence of commands, movements, or actions it should repeat the sequence consistently with a very small margin of error.

Common activities of a robot include:

- Dispensing
- Machine Loading
- Part Transfer

- Packaging
- Palletizing

Dispensing

Dispensing is the process by which something is filled, coated, covered, or soaked with various materials.

There are many types of Robotic Dispensing.

- **Coating/Painting/Spraying** – A robot is programmed to spray a uniform thickness or coating of substance such as paint or epoxy across something as large as an airplane or as small as a door knob.
- **Gluing** – Much like how a robot can be used to paint, it can also glue by spraying a stream of substance or using injection molding.
- **Injection Molding** – Material is heated, mixed, and forced into a mold cavity which then cools, hardening into the shape of the mold.

Part Transfer

Part Transfer is the moving of a product or component from one station to the next in a continuous process. This may include moving something as large as a vehicle or as small as a door knob.

Other Robotic Processes

Robots are used for many other material handling processes. Can you match the task that the robot would perform with the name of that process?

- **Machine Loading** –Moving material or parts into position on another part of a process.
- **Packaging** - Placing and/or wrapping of a finished product or part to prepare it for transport.
- **Palletizing** – Organizing a pallet based on the order.

List the key terms that are required for the students to understand this topic and provide a definition.

- **Machine Loading:** A role a robot may play in which the robot moves material or parts into position on another part of a process.
- **Packaging**: Placing and/or wrapping of a finished product or part to prepare it for transport.
- **Palletizing**: Organizes a pallet based on user selected order.
- **Dispensing:** the process by which something is filled, coated, covered, or soaked with various materials

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WELDING

Automated Welding

Automated Welding is the process by which a robot joins two materials, usually metal, by heating them and adding a filler material to create a weld pool which then cools thereby joining the two materials.

Of the many different types of welding, the main two which are used by robots are resistance spot welding and arc welding.

Robots use pre-programmed positions, machine vision, or a combination of both to accurately position the welds.

Resistance Spot Welding

Resistance Spot Welding is the method of welding which uses a large amount of current to pass through two electrodes which provide a pressure to the metals that are being joined.

This method allows large amounts of current to pass through a small area quickly thereby preventing unnecessary heating of the base metal.

Arc Welding

Arc Welding is the process by which an arc jumps between the metal to be welded and a consumable wire electrode thereby transferring heat and melting the metal(s). A shielding gas is also introduced to remove contaminants from the air.

List the key terms that are required for the students to understand this topic and provide a definition.

- **Automated Welding**: the process by which a robot joins two materials, usually metal, by heating them and adding a filler material to create a weld pool which then cools thereby joining the two materials
- **Resistance Spot Welding**: method of welding which uses a large amount of current to pass through two electrodes which provide a pressure to the metals which are being joined
- **Arc Welding**: process by which an arc jumps between the metal to be welded and a consumable wire electrode thereby transferring heat and melting the metal(s)

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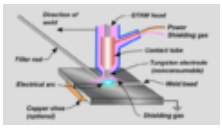
GTAW.png  **ATTRIBUTION:** "GTAW.png" by Duk is licensed by CC BY 3.0.	Duk	http://commons.wikimedia.org/wiki/File:GTAW.png	Creative Commons Attribution -Share Alike 3.0 Unported license

ASSEMBLY

Assembly

In an automated manufacturing process there are a number of items which require **assembly**, ranging from small component level items to large heavy objects that would otherwise be difficult to position by hand.

Robots and Assembly

There are a number of different jobs with which an assembly robot can perform, three of which are:
inserting
press-fitting
press tending

Humans can become tired and distracted but robots can complete a task with precision and consistency 100% of the time. Therefore, a robot is the best choice for assembly-related tasks.

It is true that robots are a better choice for assembly-related tasks, due to their precision and consistency.

Watch a Robotic Assembly

Watch this video to see a SCARA robotic assembly in action!

"TQC SCARA Robot Assembly" by Assembly and Test Automation Systems from TQC is licensed by CC BY.

List the key terms that are required for the students to understand this topic and provide a definition.

- **Assembly**: the action of fitting together the components or parts of a machine
- **Inserting**: a robot places parts into position which may be pressed into place later
- **Press-Fitting**: a robot which provides pressure to two parts require force or pressure to be assembled
- **Press Tending**: the job of managing material placement of a press which bends metal

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OTHER APPLICATIONS MAY INCLUDE:

Robotic Applications

Some other applications in which a robot is well suited include:

- Nuclear Material Handling – Robots are used to reduce the risk of radiation exposure to humans
- Drilling – Holes are drilled to an exact depth, width, and angle
- Milling – Wood is cut automatically to ordered specifications
- Grinding – Safely removes any excess material or grinds the material to a certain amount
- Water Jet – Cuts materials using extremely high water pressure

List the key terms that are required for the students to understand this topic and provide a definition.

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SUMMARY

Robots used in industrial applications are programmed to perform a number of labor intensive, monotonous, and dangerous jobs.

There are multitude applications which robots can be used for, ranging from welding and grinding to nuclear material handling and injection molding.

In most cases, the benefits of robots (their precision, efficiency and consistency) outweigh the downsides (their high cost and the cost of maintenance and repairs).

STATEMENTS

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites, and including, but not limited to accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability or ownership.