AUTOMATION, ROBOTICS, AND HMI

What Are Automation, Robotics, and HMI?

Automation and robotics are the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies are used to develop machines that can substitute for humans and replicate human actions.

A Human-Machine Interface (HMI) is a panel that that allows a human to control a machine. On modern machines, the interface is often a touch screen like an iPad. The HMI found in industrial environments is software that controls hardware and allows an operator to control machines.

Vocabulary

- **Collaborative robot (cobot)** — robots that can safely work near humans and are intended for direct human-robot interaction

- **Input/Output** — HMI devices or software applications that allow technicians to program and control robots

- **Mechatronics** — a field of study integrating electronics, mechanics, pneumatics, hydraulics and computer controls

- **Pick and place** — a repetitive part transfer task composed of a picking action followed by a placing action

- **Teach pendant** — a hand-held input device with which a robot can be programmed or moved

Automation, Robotics, and HMI

Technicians working with automated systems will use a combination of mechatronics skills such as computer programming and electromechanical knowledge.

Tammy works for a small manufacturing company that designs and creates customized metal parts for the shipping industry. The metal parts are cut and bent from a large piece of steel on a human operated machine then welded by hand. The owner asked Tammy to find out whether a robotic system would

make the work safer, faster, and more precise. She met with several companies to discuss the options and cost of implementing robotics on the manufacturing floor. After months of research, the company purchased eight robots to automate the cutting, bending, and welding. Tammy and the technicians that had been doing the work manually were sent to robotics training so they could configure and code the robots using a coding language called Python.
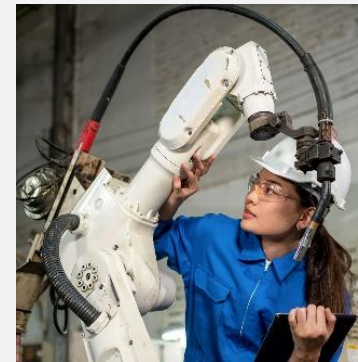
After several months of training, the robots were installed, and Tammy was made Production Lead to ensure they were successful. The staff appreciated that the company trained them to maintain the robots and did not eliminate their positions. After the robots were in place for about six months, the company realized a huge cost savings due to the increase in the number of parts that could be assembled during a shift and a significant reduction in parts that did not meet the quality checks.

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Skills Needed for a High-Paying Job

- Applying general mechanical knowledge
- Troubleshooting automation systems
- Interpreting data read-outs from HMIs
- Installing, maintaining, and repairing hardware and peripheral devices
- Programming industrial robots and cobots

Education

Your local community college provides the advanced technology classes you will need. Skills for building and maintaining robotic systems within Automation, Robotics, HMI are most often taught within Mechanical and Robotics Engineering, Information Technology, or Computer Information Systems programs offering associate degrees and one-year certificates. You will also find the skills applicable in technical specializations, such as biomedical, energy, environmental, and engineering technologies. Community college course schedules are designed to accommodate the needs of working students and often include online and hybrid delivery formats.

Find your nearest community college here or search for robotics programs here.

Future Trends

As the adoption of Industrial Internet of Things (IIoT) Industry 4.0 technologies grows, automated systems and their infrastructure will become more sophisticated. Current and future career opportunities include working with:

- Complex sensors that collect more data
- Informatics to translate data into knowledge
- Industry and government cybersecurity
- Dynamic mesh computer interface architecture
- Artificial Intelligence applications
- HMI graphics creation
- Collaborative robots

Learn More

- Here Come the Cobots!
- Robotics Skills, Robotics Careers
- Automation: A Positive Force in the Power Sector
- Understanding the What and Why of HMI

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What Are Automation, Robotics, and HMI?

An industrial robot is machine controlled by an internal or external computer that can carry out a complex series of movements automatically. Robotic process automation (RPA) is the use of software with artificial intelligence (AI) and machine learning capabilities to handle high-volume, repeatable tasks that previously required humans to perform. (source)

A Human Machine Interface (HMI) is a software application that presents information to an operator about the state of a process and accepts and implements the operator's control instructions. Typically, information is displayed in a graphic format. (source)

Technician Competencies

- Installing and programming automation or robotic systems equipment and HMI software
- Troubleshooting automated production or robotics systems
- Determining causes of operational problems or failure
- Disassembling and reassembling robots or peripheral equipment to make repairs
- Maintaining service and operational records

Cross-disciplinary Skills

- Installing sensors to collect information
- Programming for updating and modifying equipment
- Analyzing information and diagnostics provided by internet-connected devices
- Organizing and communicating information effectively
- Storing data securely

Energy Scenario

Stephanie is a Smart Meter Technician for her local power company. She is responsible for troubleshooting and repairing Smart Meter systems for local commercial and industrial customers. One of her customers, the management company for a 10-story office building, called Stephanie to come to check out their Smart Meter system since it was reporting an error message. Smart Meters enable two-way automated communication between the power company and the customer, the customer and energy suppliers, and are to regulate electricity usage. Smart Meters record energy near real-time with automated communication between the meter and the energy suppliers, allowing it to adjust throughout the day. This enables her customers with better clarity about their energy usage and help them make better business decisions. This is essential for commercial and industrial companies given the amount of energy it takes to run their companies. After troubleshooting the error message, Stephanie was able to fix the problem with the Smart Meter within an hour.

Supply Chain and Logistics Scenario

Oliver, an Agricultural Technician, works at a facility that stores animal feed in large silos needed. He was searching for a way to remotely monitor, analyze, and mix the animal feed since the existing method was manual and time intensive. Oliver had to climb into each silo and physically check the level of the animal feed. The company also provides customized animal feed mixes from multiple silos. Customizing the animal feed required several workers using conveyor belts and it was often mixed improperly. Oliver researched several options that provided a visual representation and remote control for each silo and the conveyor systems. The best option was to install sensors and controls at the industrial facility and attach them to an HMI that can be programmed to display the status of each silo. From one HMI panel a single person is now able monitor and control all the silos and conveyors.

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Activity

This activity asks students to explore industries that are early adopters of robotics and automation and one that has potential for transformation—the construction industry. Begin with the guiding questions in the warm-up. Students will identify familiar HMIs and the tasks they automate, relative to their daily lives and their fields of interest.

Warm-Up

Review the definitions of Automation/Robotics/HMI and the scenarios from the industries they discussed in class.

- Ask students in groups of 3-4 to list the HMIs they encounter on a daily basis.
- What automated processes are the HMIs connected to?
- What graphics do the interfaces display?

Activity Steps

1. Ask students to identify tasks within their technical field of study that used to be performed manually and are now automated.
2. Have student read Top Five Industries That Will Be Transformed by Robotics and Automation. Divide the class into five groups and assign each group an industry. Have them discuss how robotics and automation are transforming the way these industries do business and the changing role of technicians.
3. Have students watch the video What If We Automated Construction?

Discussion questions for the whole group:

4. How do automation and robotics have the potential to transform the construction industry?
5. Why do you think certain industries have been slower to adopt these technologies vs. the ones we read about?
6. What are three technician tasks that have be made safer and more productive using automation and robotics?

Tools for Learning About Robotics

Learn to code basic robot actions on a simulated robot. Complete the interactive learning experience at RoboMind Academy. Hour of Code is recommended for beginners.

Read More

- Top 10 Industrial Automation Trends in 2021
- Understanding the What and Why of HMI
- How IoT and Robotics are Evolving Benefit to the Supply Chain