Robotics Engineering

Starting salary (for manufacturing engineers): $58,581
Median Income (for Mechanical Engineering): $80,580

Robotic engineering is an exciting field with a wide range of newly developing applications. Because of technological leaps in the computer industry, many new opportunities will emerge for robotic engineers. Robotic engineers design and maintain robots, and research new applications for robots. Robots have enormous potential for society. Equipped with the proper sensors, robots can inspect the quality of meat, measure the pollution emissions of manufacturing plants, assist in surgery, detect corrosion in sewer pipes, investigate the depths of a volcano, or assess the speed of a tornado. Robots can improve our standard of living and give us more information about our planet or even the solar system. Such advances can open new doors for space or sea exploration.

Robots have been used primarily in the manufacturing industry, which continues to be the primary employer of robotics engineers. Automobiles are often built with the aid of a programmable machine that incorporates great precision, speed, and power. Robotics is also expanding to mining, agriculture, and other fields that are hazardous or undesirable to people. Robotic engineers work closely with computer programmers, electrical, mechanical and manufacturing engineers, and production managers.

Robotic engineers decide how the controls of a robot will work. For example, a mechanical engineer who is working on robots will design a sensor to detect light, food, tilting, and so forth; the robotics engineer will design how the sensor will be controlled and incorporated into the robot.

There are two main types of robots:

Remotely Operated Vehicle (ROV) - ROVs are robots that are operated with a cable or tether. They can be any shape or size, and are usually designed for the specific job they will

Job Outlook

Employment of robotics engineers, similar to electrical and electronics engineers, is projected to grow 4 percent from 2012 to 2022, slower than the average for all occupations. Job growth is expected because of electrical and electronics engineers' versatility in developing and applying emerging technologies.

Industries with the highest levels of employment in this occupation:

1. Architectural, engineering, and related services
2. Machinery manufacturing
3. Transportation equipment manufacturing
4. Computer and electronic product manufacturing
5. Fabricated metal product manufacturing

Top paying industries for this occupation:

1. Computer and electronic product manufacturing
2. Architectural, engineering, and related services
3. Transportation equipment manufacturing
4. Machinery manufacturing
5. Fabricated metal product manufacturing

Source: US Bureau of Labor Statistics

perform. Underwater ROVs search for treasure or artifacts, research the lives of sea creatures, salvage materials on the ocean floor, and maintain oil rigs or other underwater structures. Usually, an ROV is unmanned—meaning that no man, woman, or child is riding in or on the robot.

Usually, the ROV operator has a hand-held control device, similar to a video game controller, that is used to give the robot commands and power (electricity). The advantage of this system is that the ROV does not need an on-board battery, and if a video camera is attached, the footage can be seen in real time.

Autonomous Vehicles (AV) - Autonomous means that the robot can be operated without a tether. If you have ever seen the LEGO® Mindstorms kit or watched a robotic competition, you know what I mean. These robots swap the tether for wireless or Bluetooth communication. Similar to the ROV, they can be operated by a person using a videogame-like controller directly or by a computer that has been programmed to give it specific commands.

Robot soccer is an excellent example of the complexity involved in creating artificial intelligence. The first Robot World Cup Initiative (RoboCup) was held in Japan in 1997 and has been an annual event ever since. Imagine a robot sensing the location of the orange soccer ball, chasing the ball, and outmaneuvering other players to eventually score a goal. The competitions usually feature teams of robots ranging in size from so small they'll compete on a ping-pong table-sized field to the size of adult humans. A key goal of the RoboCup competition is to create a team of fully autonomous soccer-playing robots that will beat the human world champion soccer team by the year 2050.

The University of Southern California (USC) competed with five "soccer-bots" that could spin and twirl on individual spherical truck wheels. The USC soccer-bots were created from modified radio-controlled toy trucks. Each robot received a Pentium-powered brain and a digital eye. The Pentium laptop was mounted onto each player's back and connected to the eye. Wei-Min Shen, the computer science professor heading the project, said, "The complexity of such a task is extraordinary. Just getting the robot to distinguish between a soccer ball and a human leg requires months of programming. Sometimes their eyes detect the red hue in flesh and mistake it for the orange in a soccer ball."

Robotic competitions have become extremely popular and are a great way to gain exposure to engineering and manufacturing. There are hundreds of robotic competitions every year all around the world. Competitions range from underwater robots to aerial robots to sumo robots to First Robotics, BEST Robotics and Battlebots. Prizes include cash, scholarships, T-shirts, and much more. More information about robotic engineering can be found at the Robotics International of the Society of Manufacturing Engineers (RI/SME) website at www.sme.org and at the IEEE Robotics and Automation Society website located at www.ieee-ras.org.

Glossary of Terms

Algorithm - any well-defined, systematic method of doing something

Autonomous - something that can work by itself.

Calibrate - to set the correct position, value or capacity of something

Caliper - an instrument using converging or diverging arms to determine the external or internal width of an object

Circumference - the distance around the edge of a circle

Code - general term for any command or group of commands in a program

Crystal - the channels used to send signals from the transmitter to the receiver

Data - factual information, like the weight of a robot or the value of a sensor

Design - both the process of originating and developing a plan for a new object, like a project prototype, and the plan itself

Diameter - the distance “across” the center of a circle from edge to edge

Frequency - the number of waves that pass by a point in space in a certain amount of time

Gimbal - a mechanical device that allows the rotation of an object in multiple dimensions

Graphing - representing data on a graph

LIDAR - an acronym standing for Light Detection and Ranging; or Laser Imaging Detection and Ranging. An optical remote sensing technology which measures properties of light to find range and/or other information of a distant target

Mapping - making a map. In robotics, mapping usually refers to the ability of an autonomous robot to enter an area, and navigate, sense and record information in such a way as to allow an accurate map of the area to be constructed

Mining - the extraction of valuable minerals from the earth

Navigation - directing a vehicle from one place to another

Perpendicular - intersecting at a 90 degree angle

Ports - the designated areas for connecting sensors and/or motors to the controller

Protractor - a device used for measuring angles

Receiver - gets messages sent by the transmitter

Sensor - a device that detects some important physical quality or quantity about the surrounding environment, and conveys the information to the robot in electronic form

Specification - a set of requirements.

Timeline - a visual representation of a process or series of events

Wavelength - the distance between successive equivalent points on a wave

ABET Accredited Programs in Robotics Engineering			
School Name	**Location**	**Website**	**Program and Degree Name**
Alfred State College	Alfred, NY, US	www.alfredstate.edu	Electromechanical Engineering Technology, AAS
Alfred State College	Alfred, NY, US	www.alfredstate.edu	Electromechanical Engineering Technology, BS
California State University, Chico	Chico, CA, US	www.csuchico.edu	Mechatronics Engineering, BS
Cincinnati State Technical and Community College	Cincinnati, OH, US	www.cincinnatistate.edu	Electro-Mechanical Engineering Technology, AAS
Denmark Technical College	Denmark, SC, US	www.denmarktech.edu	ElectroMechanical Engineering Technology, AS
Middle Tennessee State University	Murfreesboro, TN, US	www.mtsu.edu	Electromechanical Engineering Technology Concentration in Engineering Technology, BS
New York City College of Technology	Brooklyn, NY, US	www.citytech.cuny.edu	Electromechanical Engineering Technology, AAS
Pennsylvania State University, Altoona Campus	Altoona, PA, US	www.altoona.psu.edu	Electro-Mechanical Engineering Technology, BS
Pennsylvania State University, New Kensington Campus, Commonwealth College	Upper Burrell, PA, US	www.nk.psu.edu	Electro-Mechanical Engineering Technology, BS
Pennsylvania State University, York Campus, Commonwealth College	York, PA, US	www.yk.psu.edu	Electro-Mechanical Engineering Technology, BS
The Pennsylvania State University, Berks Campus	Reading, PA, US	www.bk.psu.edu	Electro-Mechanical Engineering Technology, BS
Vermont Technical College	Randolph Center, VT, US	www.vtc.vsc.edu	Electromechanical Engineering Technology, BS
Wentworth Institute of Technology	Boston, MA, US	www.wit.edu	Electromechanical Engineering, BS
Worcester Polytechnic Institute	Worcester, MA, US	www.wpi.edu	Robotics Engineering, BS