

Sensors and Robotics Technology

Introduction to Robotic Unit - 3

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Introduction to Robotic

- Robotics is the branch of engineering that deals with the design, construction, operation, and application of robots. A robot is a machine that can perform tasks automatically, often with human-like precision and reliability.

Key Components of a Robot

A typical robot consists of the following components:

- **Mechanical structure:** This includes the robot's body, limbs, and joints.
- **Actuators:** These are devices that provide the robot with motion, such as electric motors, pneumatic cylinders, or hydraulic actuators.
- **Sensors:** These devices gather information about the robot's environment and its own state, such as cameras, ultrasonic sensors, and force sensors.
- **Control system:** This is the "brain" of the robot, responsible for processing sensor data, making decisions, and controlling the actuators.

Types of Robots

Robots can be classified based on their applications or their physical characteristics. Some common types include:

- **Industrial robots:** These are used in manufacturing to perform tasks such as welding, assembly, and painting.
- **Service robots:** These are designed to assist humans in various tasks, such as cleaning, delivery, and healthcare.
- **Mobile robots:** These can move freely around their environment, such as autonomous vehicles and drones.
- **Humanoid robots:** These are designed to resemble humans in appearance and behavior.

History of Robotics

- The concept of creating artificial beings capable of performing tasks has fascinated humans for centuries. While the term "robot" was coined in the 20th century, the history of robotics can be traced back to ancient myths and legends.

Ancient Origins

- Greek Mythology: The myth of Hephaestus, the god of blacksmiths and craftsmen, who created mechanical servants to assist him in his work.
- Medieval Automata: The creation of mechanical toys and automata, often driven by clockwork mechanisms.

Early Modern Era

- Leonardo da Vinci: The Renaissance polymath sketched designs for a mechanical knight and a self-propelled cart.
- Jacques de Vaucanson: The French inventor created lifelike automata, including a mechanical duck that could eat, drink, and digest.

Industrial Revolution

- Jacquard Loom: The invention of the Jacquard loom, which used punched cards to control the weaving process, laid the foundation for programmable machines.
- Early Industrial Robots: The development of machines to automate tasks in factories, such as the steam-powered cotton gin.

20th Century: The Birth of Modern Robotics

George

- C. Devol: The invention of the programmable universal manipulator (PUMA), one of the first industrial robots.
- Joseph Engelberger: The "father of robotics," who founded Unimation, the first commercial robotics company.
- Isaac Asimov: The science fiction author who formulated the Three Laws of Robotics, a set of guidelines for the behavior of robots.

Modern Robotics

- **Advancements in AI and Sensors:** The integration of artificial intelligence and advanced sensors has enabled robots to perform more complex tasks and interact with their environments in sophisticated ways.
- **Autonomous Vehicles:** The development of self-driving cars and other autonomous vehicles has pushed the boundaries of robotics and transportation.
- **Service Robots:** The increasing use of robots in service industries, such as healthcare, hospitality, and retail.

Anatomy of Robot

- A robot is typically composed of several interconnected components that work together to perform tasks.

Mechanical Structure

- **Body:** The main frame or chassis that supports the other components.
- **Limbs:** These can be arms, legs, or other appendages that allow the robot to move and interact with its environment.
- **Joints:** These are the points of articulation between different parts of the robot, enabling movement.

Actuators

- **Motors:** Electric motors are commonly used to provide power and movement to the robot's limbs.
- **Pneumatic Cylinders:** These use compressed air to generate linear motion.
- **Hydraulic Cylinders:** These use hydraulic fluid to generate linear motion.

Sensors

- **Cameras:** Visual sensors that provide information about the robot's surroundings.
- **Lidar:** Laser-based rangefinding sensors for accurate distance measurement.
- **Sonar:** Sound-based rangefinding sensors for detecting objects.
- **Force Sensors:** Measure the force applied to the robot.
- **Temperature Sensors:** Monitor the temperature of various components.

Laws of Robotics

- The Laws of Robotics are a set of rules governing the behavior of robots, first introduced by science fiction author Isaac Asimov in his 1942 short story "Runaround". These laws have become a cornerstone of science fiction and have been widely discussed and debated in various contexts.

Three Original Laws of Robotics

- A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

- These laws were designed to provide a framework for the safe and ethical development and use of robots. They are often interpreted and debated in different ways, and their application in real-world scenarios can be complex.
- Asimov himself acknowledged the potential limitations and challenges of these laws. In his later works, he introduced additional laws to address specific scenarios and complexities.

- This law prioritizes the well-being of humanity as a whole, even if it means sacrificing the well-being of individual humans.
- The Laws of Robotics have had a significant influence on popular culture and have been explored in various forms of media, including books, movies, and video games.
- They continue to be a topic of discussion and debate as advancements in robotics and artificial intelligence raise new questions about the ethical implications of these technologies.

- While the Laws of Robotics were originally conceived as a fictional concept, they have inspired real-world discussions about the ethical development and use of robots.
- As we continue to develop more sophisticated robotic systems, it is important to consider the potential implications of these technologies and to establish guidelines and regulations to ensure their safe and responsible use.