



Course **Advanced Manufacturing**  
Section: **Robotics Engineering**



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# Design a Robot to Solve a Problem

## What You Will Do

- Choose a real world problem.
- Design a robot that could solve the problem.
- Sketch your robot and label its parts.
- Explain how your robot would work.

## Materials You Will Need

- Paper (graph paper if you have it)
- Pencil
- Colored pencils or markers (optional)

## Robotics Design

Robotics engineers design machines that solve real problems. Engineers often begin with simple sketches before building prototypes.

### 1) Identify a Problem

- Cleaning trash in a park.
- Delivering supplies in a hospital.
- Helping firefighters search buildings.
- Exploring another planet.

### 2) Movement

How will your robot move? That will depend on its environment.

- **Wheels** are the fastest method for moving over land and floors that don't have too many obstacles.
- **Tracks** are slower but better for handling rough terrain.
- **Legs** may be the best option for stepping over obstacles.
- **Impellers** can push a robot through water.
- **Rotors** are used for flying robots.

### 3) Guiding the Robot

Sensors and cameras are used to detect obstacles and tell the robot where it is in its environment. See the descriptions for different types of sensors on the next page. Which ones will your robot need?

### 4) Manipulation

Once your robot moves into position, how will it perform its tasks? Will it use special tools built into the robot? If it needs to manipulate objects or tools, claws or human-like hands might be better.

### 5) Sketch Your Robot and Explain How it Works

Draw your robot. Label the parts including sensors. Include notes that explain how the robot will move, what sensors it will use, and how it will perform its tasks.

## Engineering Tip

Engineers rarely build a robot perfectly the first time. They create prototypes, test them, and improve the design many times before the robot works well.

# Robot Sensors

Robot sensors are vital components that enable machines to perceive their environment and internal state, facilitating autonomous operation, navigation, and interaction.

## Proximity and Distance Sensors

Detect nearby objects and measure distance for obstacle avoidance, including Ultrasonic, Infrared (IR), and LiDAR (Light Detection and Ranging).

## Vision Sensors (Cameras)

Capture visual data for object recognition, navigation, and 3D mapping. Examples include 2D cameras, stereo vision cameras, and thermal cameras.

## Position and Displacement Sensors

Measure the robot's position and movement. Examples include GPS (for outdoor navigation), potentiometers, and encoders to track motor shaft rotation.

## Environmental Sensors

Monitor environmental conditions, such as temperature, gas, or humidity, for safety, as explained on Standard Bots.

## Motion and Orientation Sensors

Monitor acceleration and orientation. Examples include Accelerometers (for tilt/acceleration) and Gyroscopes (for rotational movement).

## Force/Torque Sensors

Measure the pressure or force applied by the robot, essential for manipulating objects and, in industrial settings, handling materials.

## Tactile/Touch Sensors

Detect physical contact, touch, or pressure. This includes simple switches (limit switches) and complex, artificial "skins" that detect object shape, size, or hardness.

## Next Level Challenge

Do your drawing as a planar and orthographic blueprint. See the "Draw a Blueprint" activity in the Aerospace Engineering lesson to learn how.