

CSE435 – Robotics

Lecture 1 Notes

What is a Robot?

- A **robot** is an automatic machine capable of performing tasks with little or no human intervention.
 - Robots can be **mobile** (move in an environment) or **fixed** (work in a defined space).
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Types of Robots

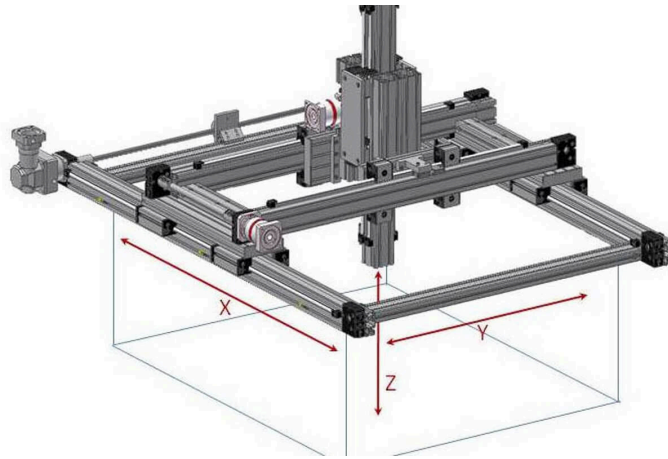
1. Mobile Robots

- Robots that move around freely in their environment.
- **Activities:**
 - Movement (forward, reverse, turning).
 - Light detection and response (may be affected by ambient lighting).
 - Proximity sensing (detect nearby objects via reflected light).
 - Contact sensing (bumpers/antennae to detect obstacles).
 - Communication (human--robot or robot--robot via Bluetooth, etc.).
 - Navigation:
 - *Wall-following* (maze solving).
 - *Line-following* (painted path guidance).
 - *Homing on light*.
 - *Free-space navigation* (difficult due to motor errors and slippage but robot tries to estimate its own position).



2. Gantry Robots (Cartesian Robots)

- Fixed robots operating in a defined **rectangular area**.
- A gripper/tool is suspended from a movable frame (X--Y control).
- **Advantages:** precise positioning, cannot lose bearings.
- **Uses:** industrial automation, handling heavy loads.



Robot Control Concepts

Feedback in Robotics

- **Negative Feedback:** Maintains stability (e.g., wall-following robot adjusting based on IR sensors).
- **Positive Feedback:** Causes instability (wrong wiring → veer or crash).
- **Limit Switch Feedback:** Provides safe stopping/control points.

Random Activity

- Uses pseudo-random behavior (e.g., Monte Carlo Walk).
- Applications: maze solving, trial-and-error learning, adaptive behaviors.

Subsumption Architecture

- A layered control method: higher-priority behaviors override lower ones.
- Example: Robot stops homing → switches to avoidance when obstacle detected → resumes homing once clear.

Distributed Processing

- Splits tasks across multiple controllers.
- Each runs independently, exchanging signals when needed.
- Example: Gantry robot with two controllers (main frame + x-frame).