Robotics and Automation

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1. Introduction

- **Robotics:** the design, construction and operation of machines that sense, plan and act in the physical world.
- **Automation:** using technology to perform tasks with minimal human intervention.
- AI enhances robots with perception, learning and decision-making abilities.

2. Core Components

- **Sensors:** gather data such as vision, distance, force and orientation.
- **Actuators:** motors and mechanisms that produce movement.
- **Controllers:** processors running software that converts sensing into action.
- Power supply and a mechanical structure or frame.

3. Types and Approaches

- Industrial arms, mobile robots, drones and humanoid robots.
- **Fixed automation:** dedicated to a single repetitive task.
- **Flexible automation:** reprogrammable for varied tasks.

4. Applications

- Manufacturing assembly, welding and packaging.
- Warehouse logistics, agriculture and surgery assistance.
- Exploration in hazardous or inaccessible environments.

5. Benefits and Challenges

- Improves precision, productivity, safety and consistency.
- High initial cost and complex maintenance.
- Workforce displacement and ethical concerns about autonomy.