

Robotics and Automation Roadmap (12 Weeks)

Week 1: Introduction to Robotics and Automation

- Definition, history, and evolution.
 - Types of robots: industrial, service, mobile.
 - Basic components: sensors, actuators, controllers.
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Week 2: Robot Kinematics

- Degrees of freedom (DOF).
 - Forward and inverse kinematics.
 - Workspace analysis.
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Week 3: Robot Dynamics and Control

- Dynamics equations of motion.
 - Control strategies: PID, adaptive control.
 - Trajectory planning basics.
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Week 4: Sensors and Actuators in Robotics

- Types of sensors: proximity, vision, tactile, force.
 - Actuators: DC motors, stepper motors, servos, pneumatics.
 - Sensor interfacing and signal conditioning.
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Week 5: Microcontrollers and Embedded Systems

- Basics of microcontrollers (Arduino, Raspberry Pi).
 - Real-time operating systems (RTOS) basics.
 - Interfacing sensors and actuators.
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Week 6: Robot Programming

- Robot Operating System (ROS) basics.

- Simulation tools: Gazebo, V-REP.
 - Basic programming in Python/C++ for robotics.
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Week 7: Industrial Automation Systems

- PLC basics and ladder logic programming.
 - SCADA systems overview.
 - Automation in manufacturing processes.
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Week 8: Machine Vision and Image Processing

- Camera types and vision sensors.
 - Image processing basics using OpenCV.
 - Applications in robot guidance and inspection.
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Week 9: Mobile Robots and Navigation

- Localization and mapping (SLAM).
 - Path planning algorithms: A*, Dijkstra.
 - Obstacle detection and avoidance.
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Week 10: Artificial Intelligence in Robotics

- AI techniques: machine learning, reinforcement learning.
 - Robot learning and adaptation.
 - Human-robot interaction basics.
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Week 11: Collaborative Robots (Cobots)

- Safety standards and human collaboration.
 - Applications and case studies.
 - Design considerations for cobots.
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Week 12: Final Project / Practical Implementation

- Build and program a robotic arm or mobile robot.
 - Integrate sensors for automation task.
 - Demo with a simple industrial or service application.
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Tools and Platforms:

- Arduino, Raspberry Pi, ROS, Gazebo, OpenCV, PLC simulators
- Programming: Python, C++