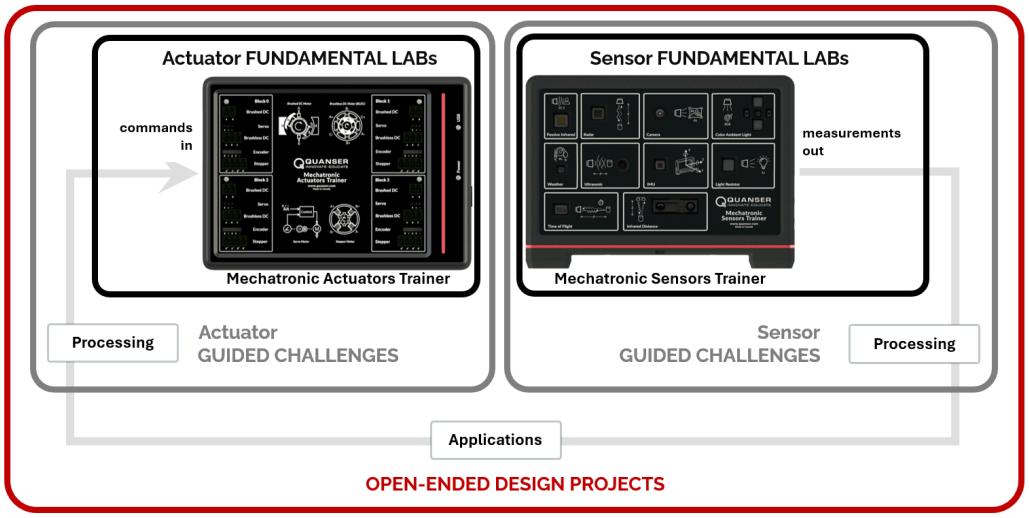
A Quanser Take on Mechatronics

In today's manufacturing industry, mechatronics plays a crucial role in driving automation and efficiency across various sectors and the integration of mechanical, electrical and computer systems. Active academic research in Mechatronics is also exploring the development of intelligent machines optimizing production lines and product quality, streamlining processes using robotics, advanced sensors, and real-time control systems. This sector impacts prominent complex systems ranging from manufacturing robots, precision surgical instruments, smart consumer electronics, all the way to advanced self-driving technology.

Our approach to mechatronics education focuses on the development of design instincts over design experience, and a broad engineering literacy rather than specialization. The multilayered curriculum combines system wide component exploration and creative problem solving.

The Mechatronics Design Lab provides a balanced design experience for your undergraduate mechatronics program with intuitive curriculum built upon Quanser's Mechatronic Sensors Trainer and Mechatronic Actuators Trainer. The curriculum organizes learning objectives and lab content in the form of layered fundamental labs, guided challenges and projects with each layer bringing students closer to application contexts.



Learning Objectives

- Understanding of distance, motion, environmental, light, force and touch sensors
- Develop skills in making context-dependent design decisions for multi-sensor perception systems
- Apply relevant techniques for sensor data acquisition, processing and sensor-fusion
- Explore the working principles of brushed/brushless DC motors, stepper motors & servos in action
- Develop knowledge of relevant techniques in control systems and transmission mechanisms

Textbook Mapping & Reference Material

- Handbook of modern sensors: Physics, Designs, and Applications **by J. Fraden**
- Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering **by W. Bolton**
- The Mechatronics Handbook, second Edition - 2 volume set. **by R. H. Bishop**
- Sensors for mobile robots **by H. Everett**

Relevant Mechatronics Programs

Quanser's Mechatronics Design Lab curriculum is inspired by the innovative programs and efforts of these institutions.

University of Waterloo
Canada

Royal Melbourne Institute of Technology
Australia

Purdue University
USA

University of Manchester
England

Quanser has engaged with the following partners for key transformative experiences across their entire program.

Auckland University of Technology
New Zealand

Oklahoma State University
USA

Norwegian University of Science and Technology
Norway

Shenzhen Polytechnic College
China

Quanser Solutions for Mechatronics

Mechatronic Sensors Trainer

Mechatronic Actuators Trainer

Table of Contents

Sensor Teaching Topics

- Sensor and Actuator Interfacing
- Data Acquisition & Sensor Communication Protocols
- Types & Working Principles of Sensors
- Sensor Selection Criteria
- Calibration and Signal Condition/Filtering
- Real-life applications of sensors
- Encoder decoding algorithms
- Understanding an image
- Understanding datasheets

Actuator Teaching Topics

- Working Principles of Actuators
- How to drive motors
- Deadband, Saturation & Rate-limitation
- Brushless DC motor coil activation tables
- Excitation modes of a stepper motor
- Pulse Width Modulation in different applications
- Controls and PD control for Speed & Position
- Actuator Selection Criteria
- Motor comparison
- Understanding datasheets
- Introduction to transmissions
- Understanding gear ratios

Sensors Fundamental Labs

- Sensor Interfacing
- Touch Sensors
- Distance (Ranging) Sensors
- Motion Sensors
- Light Sensors
- Environment Sensors
- Force Sensors

Actuators Fundamental Labs

- Hardware Interfacing
- Brushed DC Motors
- Brushless DC Motors
- Stepper Motors
- Servo Motors

Sensors Guided Challenges

- Color Instrument
- Multi-sensor passcode Safe
- Weather Dashboard
- Room Security Monito

Actuators Guided Challenges

- DC Motor comparison (brushed DC vs brushless DC)
- Position Control comparison (stepper vs. servo)
- Introduction to Control (servo & brushed DC)
- Transmissions (servo & brushed DC)

Open-ended Projects

- Mobile Robot
- Manipulator
- Smart Home System