



SICK AND UNIVERSAL ROBOTS 2D VISION PACKAGE FOR EDUCATION

COLLABORATE 2025

SICK
Sensor Intelligence.

This college-level course is designed to equip learners with the skills and knowledge required to work with 2D vision systems in industrial robotics. Through a combination of lectures and hands-on labs, students will gain proficiency in vision-guided automation applications like pick-and-place and belt-picking.

Target Audience

Students aged 16-22 years who are interested in robotics, vision, automation, and industrial applications.

Course Duration

16-18 hours

Course Type

In-person

Course Release Date

The 2D Vision for Industrial Robotics course will be available starting in the Fall 2025 semester.

Course Prerequisites

- Familiarity with the UR Robot, controller, teach pendant, and basic UR programming is required (taking the UR Core Course first is recommended).
- The course is beginner friendly.



ABOUT THE COURSE

Equip students with the knowledge and hands-on experience to design, implement, and troubleshoot 2D vision systems for industrial robotics, focusing on applications like pick-and-place and belt-picking, while preparing them to work with industry-like setups and solve real-world automation challenges.

KEY FEATURES

- Comprehensive Curriculum: Six modules covering in detail 2D vision system components, alignment methods, calibration, part localization, robot integration (robot-mounted and stationary mounted camera setups) and optimization.
- Hands-On Labs: Practical sessions with industry-like setups including a UR robot, SICK PLOC2D camera, conveyor etc to reinforce concepts.
- Real-World Applications: Exposure to real-world scenarios, applications, systems, and challenges.
- Quizzes and Activities: Knowledge checks throughout the course, culminating in a graded quiz to test understanding and proficiency.
- Capstone Project: A final project to integrate and apply all learned concepts.
- Certificate of Completion: Students receive a certificate upon passing the final assessment.

WHAT STUDENTS WILL GAIN

- A solid understanding of 2D vision systems and their role in industrial automation.
- Hands-on skills for camera setup, calibration, alignment, tuning and integration.
- Experience in troubleshooting and optimizing 2D vision applications.
- Insights into advanced topics like conveyor tracking.
- Learn to work with cutting-edge industrial tools like the SICK PLOC2D camera and the UR robot, ensuring readiness for the world of automation and robotics.
- Career Advancements: Master skills that are high in demand across industries like automotive, logistics, manufacturing, and quality assurance. Gain a competitive edge for roles such as robotics engineer, vision specialist, and automation technician.
- Foundation for Further Studies: Build a strong foundation in vision-guided robotics, ideal for those planning to pursue advanced studies in robotics, automation, or related fields.





WHAT'S INCLUDED IN THE KIT

The course kit provides all the necessary tools and components for hands-on learning in 2D vision-guided robotics, including:

- **SICK PLOC2D Camera:** Industry-standard 2D vision camera for imaging and localization.
- **Calibration Tools:** Patterns for precise alignment and camera calibration.
- **Cabling and Mounts:** Essential cables like ethernet, power cable etc and mounts for seamless setup.
- **Lighting Options:** Red and blue lights to experiment with imaging under varying light conditions.
- **Variety of Test Parts:** A range of shiny, matte, and other unique parts to test and analyze 2D vision performance.
- **Educational Curriculum:** Step-by-step User Guide and Workbook with instruction and exercises for guided learning.
- **UR Collaborative Robot:** A compact robotic arm for integration and practical robot-guided tasks. The 2D vision kit is compatible with any UR e-Series cobot.
- **UR Academy Training Accessory set:** includes a mini conveyor and accessories to simulate belt-picking applications.

Course Modules

MODULE 1: INTRODUCTION TO 2D VISION

Purpose: Introduce the fundamentals of 2D vision system and their importance in industrial automation.

Key Learning Goals:

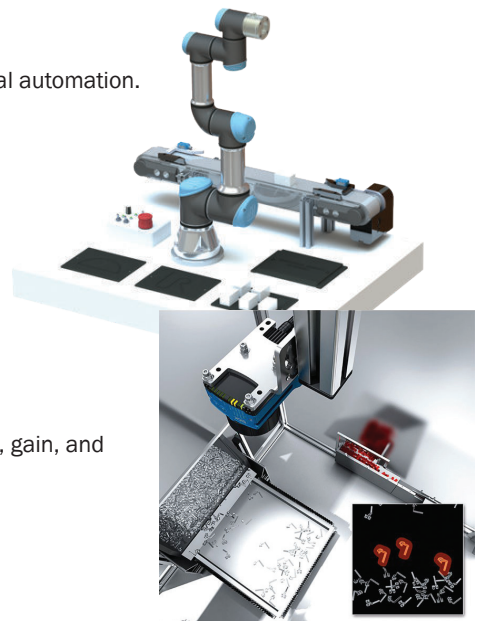
- Define 2D vision and its role in industrial automation.
- Identify applications and benefits of 2D vision systems.
- Discuss how 2D vision enhances efficiency and reduces costs.

MODULE 2: COMPONENTS OF 2D VISION

Purpose: Build a deep understanding of 2D vision components like cameras, lenses, lighting, and imaging parameters.

Key Learning Goals:

- Learn how cameras, lenses, and lighting affect image quality.
- Understand terms like focal length, FOV, resolution, optical center, exposure, brightness, gain, and contrast.
- Recognize common communication protocols, cabling, and part feeder types.





MODULE 3: SICK PLOC2D CAMERA

Purpose: Introduce the SICK PLOC2D camera and its hardware, software, and calibration procedures.

Key Learning Goals:

- Describe the hardware, components, and interface of the PLOC2D camera.
- Demonstrate camera mounting, setup, and calibration, including experimenting with different colored lighting.
- Apply imaging techniques to optimize image quality.

MODULE 4: PART LOCALIZATION USING 2D VISION – PICK AND PLACE

Purpose: Demonstrate how to use 2D vision for part localization and robot-guided pick-and-place applications.

Key Learning Goals:

- Tune imaging settings for different types of parts (shiny, matte, and varying heights)
- Integrate 2D vision with a robot for pick-and-place operations.

MODULE 5: PART LOCALIZATION USING 2D VISION – BELT PICKING

Purpose: Expand learning to conveyor belt applications and synchronization of 2D vision with moving parts.

Key Learning Goals:

- Understand conveyor synchronization with vision systems.
- Set up and troubleshoot a conveyor tracking system.
- Address challenges in tracking moving parts for robot guidance.

MODULE 6: FINAL PROJECT AND WRAP-UP

Purpose: Integrate all concepts in a real-world capstone project to reinforce learning.

Key Learning Goals:

- Recap key concepts.
- Complete capstone project combining all learned skills.
- Pass the graded quiz and receive a certificate of completion.

DEVELOPED IN COLLABORATION BETWEEN
SICK AND UNIVERSAL ROBOTS

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