

## ABSTRACT

# ROBOTICS LABORATORY INSTRUCTION

### Lesson 1: Industrial Robot Operation

Basic operation of an industrial robotic arm using a handheld teach pendant.

- Manual robot operation within various coordinate systems.
- Programming a robot for automatic pick-and-place tasks combined with digital I/O usage.

### Lesson 2: Communication between Robot and Machine Controller

Programming the machine controller to communicate with the robot via digital I/O and Ethernet.

- Programming the machine controller to control actuators and coordinate with the robot via digital I/O connections.
- Programming the machine controller to perform Ethernet communication with the robot.

### Lesson 3: Servo Control using Machine Controller

Programming a machine controller to control servo motor motion.

- Programming a machine controller to control the motion of multiple servo motors.
- Programming a machine controller to coordinate the robot, servo motors, and other devices into a complete automated system.

### Lesson 4: Communication between Robot and Computer

Programming a computer application to communicate with the robot using the Qt C++ framework.

- Programming a communication library for a computer to interact with the robot via Ethernet connection.
- Programming a user interface (UI) to allow robot control via computer.

### Lesson 5: Integration of Robot and Machine Vision

Programming a computer application to control the robot for picking objects using machine vision.

- Programming a machine vision application to classify objects and determine the object's 2D pose on a moving conveyor belt using the OpenCV library.
- Programming a coordinate transformation and computer control application for the robot to pick objects and place them into a palette in the correct pose.