

Electrical Circuits LAB 7 Online–Controller, Sensors, and Actuators

Objectives

Introduction to control systems using Arduino to read from sensors and control actuators such as motors.

Preparation

Complete the following steps before starting to work on the experiments in this lab:

- 1) Complete Lab 6 and associated report.
- 2) Download Arduino IDE from <https://www.arduino.cc/en/software>
- 3) Procure parts for exp 1-4:
 - a) Arduino Uno board and USB cable
 - b) 1 LED
 - c) 1 1k Ω resistor
 - d) 1 Solar Module
 - e) F-F jumper wire

Experiment 1 - Introduction

Watch Introduction to Arduino video at the following link and build/program the system:

<https://youtu.be/z-mirfRb-w4?si=QsZDuPAWzVIbBzhc>

For this experiment include a copy of the blink program and answer the following questions about Arduino Uno:

- 1) Number of Digital Input Output (I/O) pins
- 2) Number of pins with Pulse Width Modulation (PWM ~)
- 3) Number of Analog Input pins

Experiment 2 – Digital Read and Write

Watch Arduino Digital Read and Write video at the following link and build/program the system:

<https://youtu.be/JNuZMgN5R1E?si=8vfLVdRlsOeJQ4Iv>

For this experiment include a copy of your program and photo of your circuit including Arduino.

Experiment 3 – Analog Write

Watch Arduino Analog Write (using PWM) video at the following link and build/program the system.

https://youtu.be/W0MumDyZAEA?si=ZTNe_3e9TAW-LJCz

For this experiment include a copy of your program and photo of your circuit including Arduino.

Experiment 4 – Analog Read

Watch Arduino Analog Read video at the following link and build/program the system:

<https://youtu.be/sMN9YYiHgeo?si=DYJnUPzDCNvXvqpA>

For this experiment include a copy of your program and photo of your circuit including Arduino and copy of the plot generated.

Experiment 5 – New

Work with your instructor to select a sensor and an actuator from the following list or a different set of your choosing before starting this experiment. Each student should select a combination of sensor and actuator that has not already been selected by another student (First-come Priority).

Sensors	Actuators
<ul style="list-style-type: none">• 3-Axis Digital Accelerometer “GY-291 ADXL345 3• Electrical Current Sensor• Environmental particle/gas Sensor• Force Sensor• InfraRed (IR) Transmitter/Receiver• Microphone “Comidox B07J6N734S”• Photo Resistor• Solar Cell• Thermistor 10 K NTC “USUG1000-103J:”• Tilt Sensor “107-2006-EV”• Touch Sensor “TTP223B”• Ultrasound Sensor “HC-SR04 (5V)”	<ul style="list-style-type: none">• Display “OLED I2C IIC Display Module 12864 128x64 Pixel SSD1306 Mini Self-Luminous”• Motor – Servo “SG90”• Motor- Stepper “28byj-48”• Motor-DC• Peltier Devices “TEC1-12706”• RGB LED• Speaker

Design a system that uses the sensor and Arduino to control the selected actuator behavior based on changes in the sensory input.

For this experiment include a copy of your program, block diagram of your system, photo of your system and describe a potential commercial application for your system.

Report Requirements

Complete each experiment, answer the questions, and provide the material requested.