

# ME 411 Mechatronics @ UIC

## Sensors and Actuators I

This lab is to be done individually, but in the lab.

## 1 Prelab (not graded)

### 1.1 Motivation

The goal of this lab is to introduce you to a sensors and actuators that can be interfaced using an Arduino

### 1.2 Assigned Reading

This part of the lab needs to be done before you come to the lab. Assigned reading is listed below

1. Read about tilt switch sensors for orientation <https://learn.adafruit.com/tilt-sensor>
2. Read about the ultrasonic sensor for measuring distance  
<https://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/>
3. Read about the photocell: <https://learn.adafruit.com/photocells/using-a-photocell>
4. Read about controlling DC motors using H-bridges  
<https://howtomechatronics.com/tutorials/arduino/arduino-dc-motor-control-tutorial-l298n-pwm-h-bridge/>.

## 2 Labwork (graded)

### 2.1 Equipment list

1. Arduino UNO Rev 3 and USB A to B cable (commonly used on printers).
2. 1 Tilt Ball Switch
3. 1 Ultrasonic sensor
4. 1 Photocell
5. 1 DC motor
6. 1 L298 H-bridge for motor control
7. DC voltage supply (please return this back after the lab is done)

### 2.2 (15 pts) Tilt ball switch, an orientation sensor

Connect a tilt ball switch give a binary output based on their orientation. Hook the binary switch between any digital pin. Use appropriate code to read their output. Change their orientation and see the output. Answer the question below. What range of inclinations does the tilt sensor switch give an output of 1. Show the circuit and demonstrate the results to the TA.

### **2.3 (15 pts) Photocell**

This webpage shows how to connect and program the photocell:

<https://learn.adafruit.com/photocells/using-a-photocell>. Demonstrate that the photocell is able to distinguish between ambient light and darkness (you can put your hands over the photocell to block the light). Show the circuit and demonstrate the results to the TA

### **2.4 (20 pts) Ultrasonic sensor, a distance sensor**

This webpage gives theory behind ultrasonic sensor and how to hook it up:

<https://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/>. Hook up the sensor to the arduino and calibrate it to read the distance. Demonstrate that the sensor is able to measure the distance and show it to the TA.

### **2.5 (20 pts) DC motor**

This webpage shows how to interface and program the DC motor.

<https://create.arduino.cc/projecthub/ryanchan/how-to-use-the-l298n-motor-driver-b124c5>. Demonstrate that you are able to spin a single DC motor back and forth using the H-bridge and various speeds.

### **2.6 (30 pts) Application as a backup sensor**

Create a prototype of an automated backup system for an electric car. The DC motor is the proxy for the rear wheel. The DC Motor should be freely spinning. Then, as the distance between the sensor and the obstacle decreases, the speed of the DC motor should decrease till it reaches zero when speed reaches a critical value. Demonstrate the prototype to the teaching assistant.