CE 432 Robotics II

Sensors and Actuators Assignment

1. The following figure shows the Wheatstone Bridge and strain gauges forming a quarter bridge, a half bridge, and a full bridge. Explain why (use equations) the full bridge is the most sensitive one to resistance variations (show the calculation process on your webpage). (10 points)
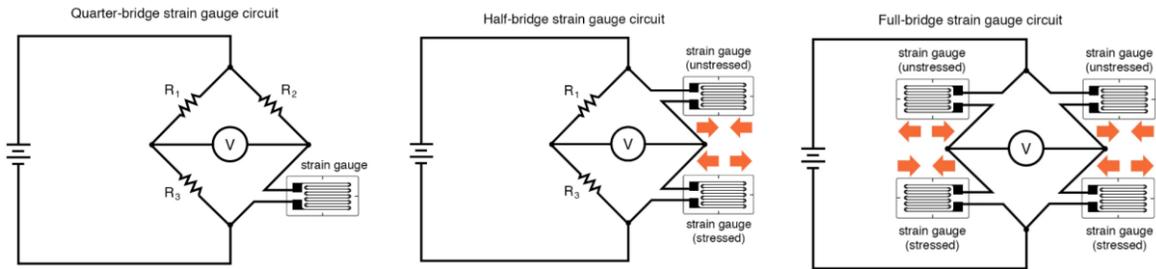
2. Use your Arduino UNO kit, create a sketch that can measure distance using the HC-SR04 ultrasonic module without using the SR04.h library (refer to the sketch showed in the slides). (Insert the demonstration video to your Webpage). (20 points)

3. Design a pulse detector using an UNO board. The input is a single 5 V pulse from a function generator. The pulse width of the input is not specified but you can use a value around 400 us. Design a program to let your UNO board sense the pulse and deliver a 400 us pulse 800 us later than the input. If there are multiple pulses from the input, the output should constantly send the same delayed pulse trailing the input pulse. Use a function generator and an oscilloscope to demonstrate the results in a video. (20 points)
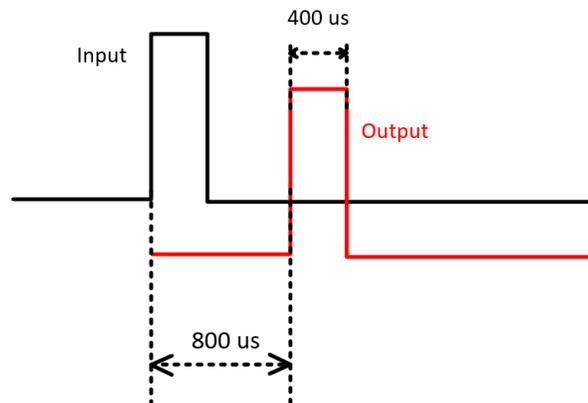

4. Use a MPU6050, an Arduino UNO, and a buzzer to create a vibration detector (for the Z direction only). When the vibration is higher than a certain threshold, the buzzer will be triggered. (The system can be tested on a table, someone knock the table to trigger the buzzer). (Insert the demonstration video to your Webpage).. (20 points)

5. Use the joystick of the Arduino Elegoo kit to control the speed and rotation direction of the NEMA stepper motor. Use both wire connections and wireless connections between the joystick and the NEMA motor. Wireless modules can be the HC05 Bluetooth module or the Open-Smart 2.4GHz module. (Insert the demonstration video to your Webpage). (20 points)

6. Refer to the slides regarding the rotary encoder. Implement Algorithm II on your UNO board and demonstrate the functioning encoder in a video. (10 points)
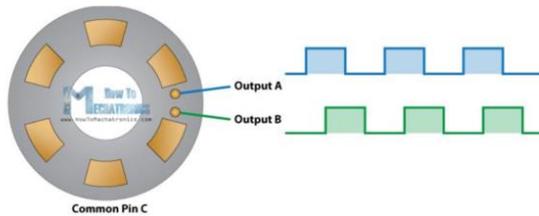
Algorithm II:
Counter Clockwise: When A changes from LOW to HIGH, B is HIGH.
Clockwise: When A changes from LOW to HIGH, B is LOW.