

## Lab Assignment 10—“Zoom! Zoom! Zoom!” Discovering the Zumo Robot for Arduino

### Overview:

In this lab you will become acquainted with the Pololu Zumo robotic platform. The Zumo is an Arduino-controlled tracked robotic platform. The entire robot acts as an Arduino shield. The robot is shown below without its attached Arduino processor.

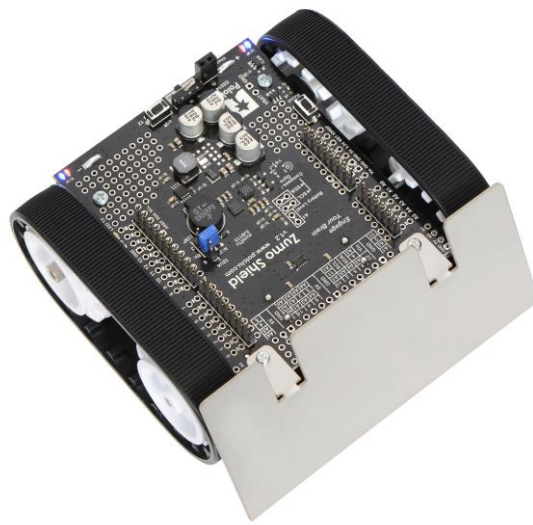


Figure 1. The Zumo Robot

### Lab Procedure:

This lab is about you discovering and becoming familiar with three things:

1. The Arduino board (we’re using the Arduino UNO)
2. The Arduino development environment (on lab computers, and it’s a free download)
3. The Zumo shield for Arduino

Your learning will come from the widely available Arduino material (Google is your friend) as well as the Pololu website. Three documents are available on Blackboard related to the Zumo (zumo\_shield\_for\_arduino.pdf, zumo\_shield\_front\_expansion\_pinout.pdf, and zumo\_shield-v1\_2-schematic.pdf). Also, your instructor will give you a hand out and go over the important parts of the Zumo user’s manual.

Your goal is simple. Program the Zumo to do simple line-following. Your instructor will give you more details in class, but you must use all six line-following LED sensors.

### Install the Arduino IDE

I’m using the default Arduino IDE environment. It is free, supported, and has the libraries to do our Zumo Robot work. If you are familiar with a different option, you are free to use that.

- 1) Go to the Arduino site: <https://www.arduino.cc/en/software>

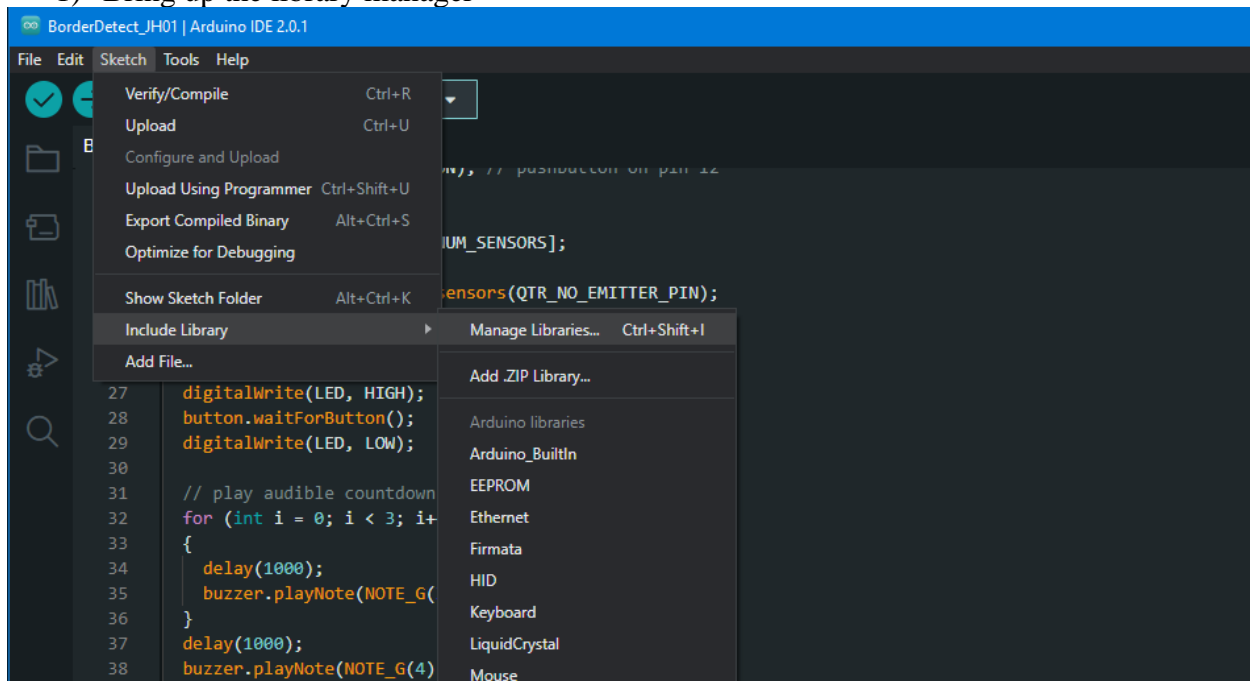
- 2) Download the IDE (I'm currently using 2.0.1, but I do not believe we will be highly version dependent).

Follow a normal install process to get this on your system.

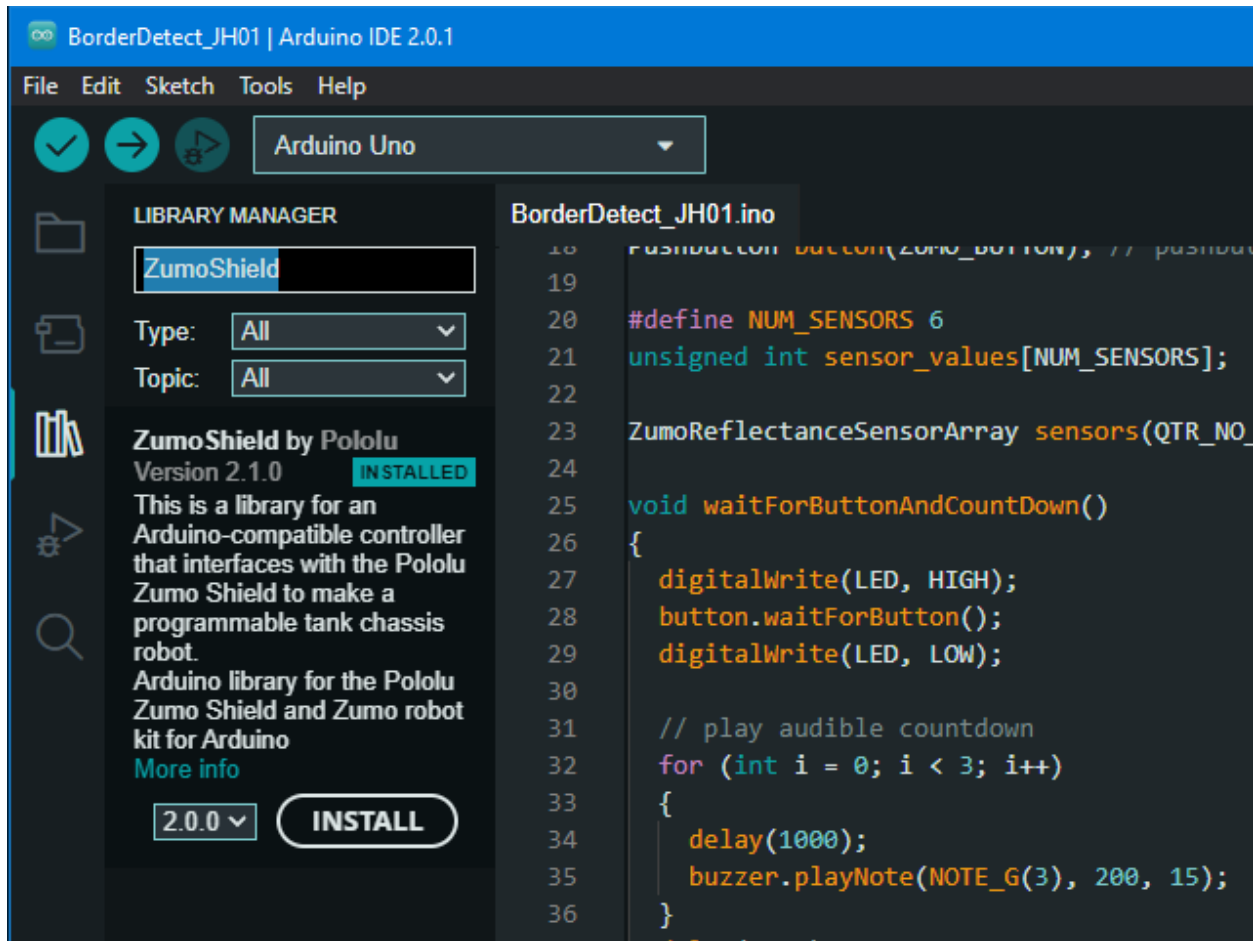
## Zumo Library

The Zumo team has a library which is loadable from inside the Arduino environment.

- 1) Bring up the library manager



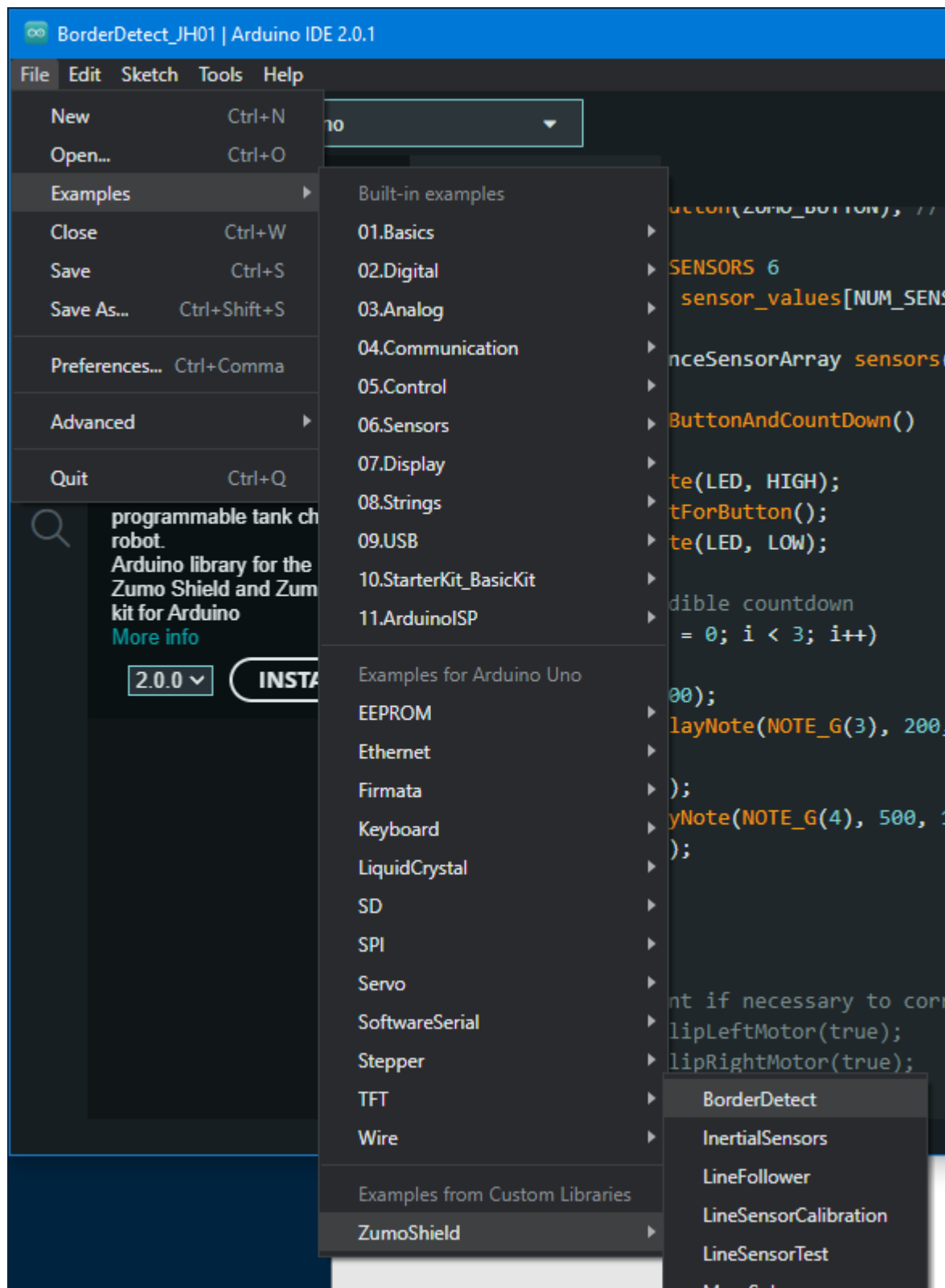
- 2) Search for "ZumoShield"



3) Click “Install”

### Load the BorderDetect sketch

1. Once you have the library loaded, find the BorderDetect sketch.



2. Save a copy to your system as we will be making modifications.
3. Modify the sensor value comparison.

I found that our Sumo Circle seems to cause different sensor readings which do not work out of the example program. Search for the following lines and change the logical comparison from “<” to “>”. Your final code should look like this:

```
if (sensor_values[0] > QTR_THRESHOLD)
{
    // if leftmost sensor detects line, reverse and turn to the right
    motors.setSpeeds(-REVERSE_SPEED, -REVERSE_SPEED);
    delay(REVERSE_DURATION);
    motors.setSpeeds(TURN_SPEED, -TURN_SPEED);
    delay(TURN_DURATION);
    motors.setSpeeds(FORWARD_SPEED, FORWARD_SPEED);
}
else if (sensor_values[5] > QTR_THRESHOLD)
{
    // if rightmost sensor detects line, reverse and turn to the left
    motors.setSpeeds(-REVERSE_SPEED, -REVERSE_SPEED);
    delay(REVERSE_DURATION);
    motors.setSpeeds(-TURN_SPEED, TURN_SPEED);
    delay(TURN_DURATION);
    motors.setSpeeds(FORWARD_SPEED, FORWARD_SPEED);
}
else
{
    // otherwise, go straight
    motors.setSpeeds(FORWARD_SPEED, FORWARD_SPEED);
}
}
```

If you have any issues, you can also download my modified sketch file from GitHub classroom which will be linked in the lab assignment.

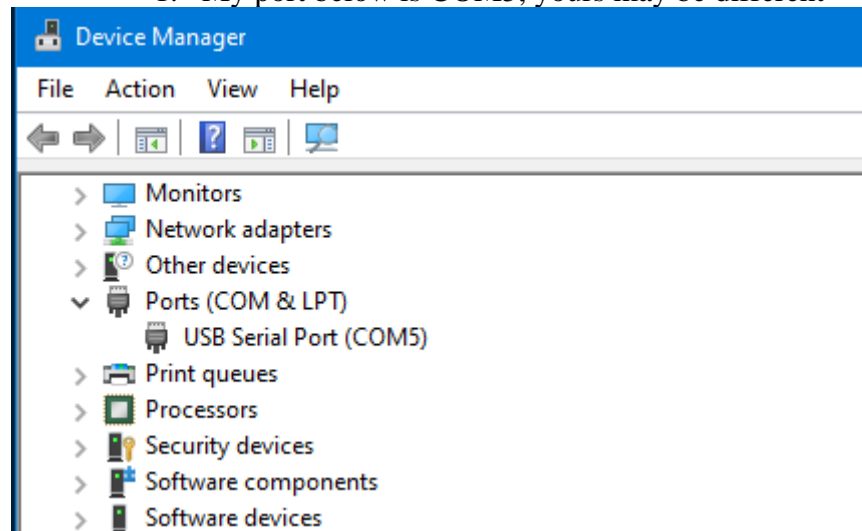
### Download code to your Zumo Robot

This will be where we have some work. I had some minor issues with my robot, so I don't have a 100% reliable solution. Here are some rough steps, but YOUR ROBOT MAY BE SLIGHTLY DIFFERENT. Let me know if you are having any problems and we can work through them.

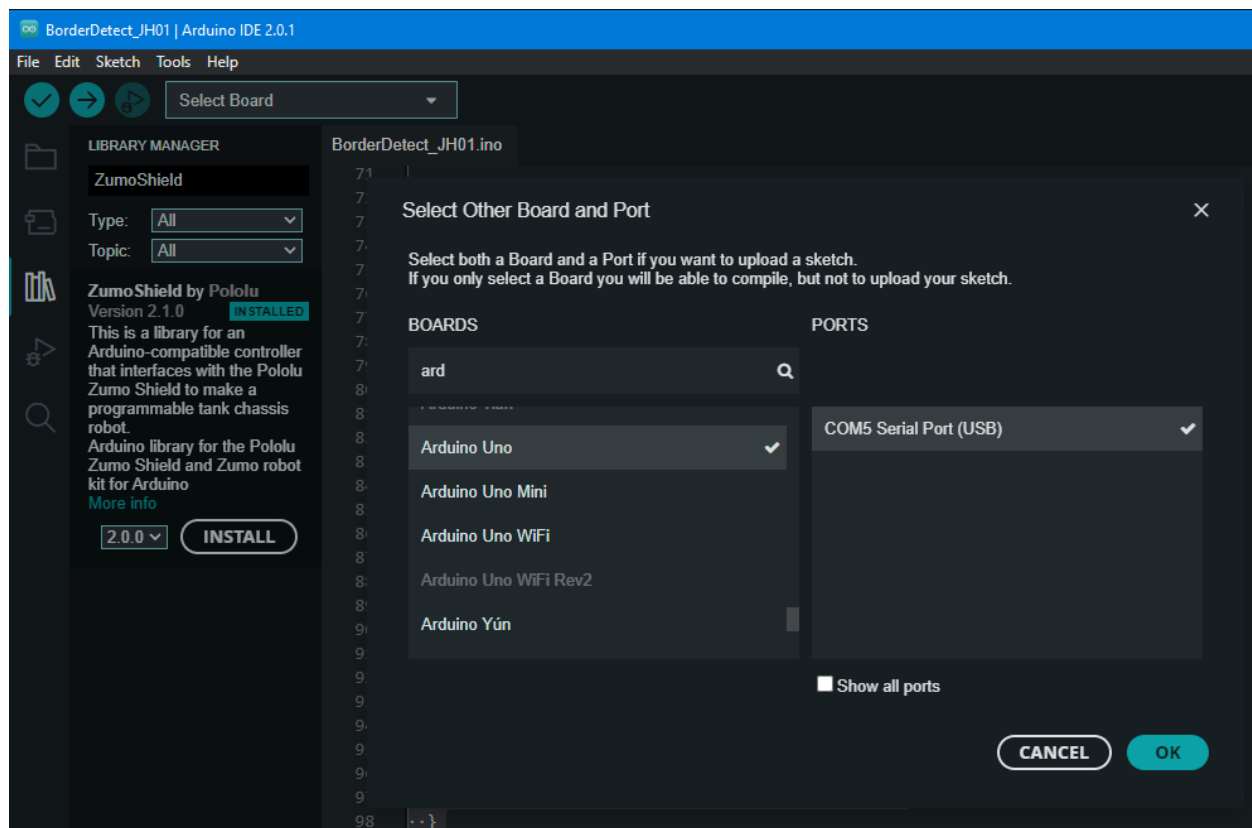
- 1) Plug in your robot with a USB-A to USB-microB cable



- 2) Confirm you have a valid port from the board
  - a. Device Manager
    - i. Ports
      1. My port below is COM5, yours may be different



- 3) Connect your board to your IDE
  - a. Do Select Board and find your COM port



(If you have problems, you will not see your COM port here...)

- 4) Compile and download the program to your robot
  - a. The “right arrow” button does this in one step.
  - b. I had the best luck when the robot switch was “OFF”

## Run the program!

The professor will bring down a sumo ring that you can do an initial test on. Once you have the program in your robot

- 1) Place your robot inside the black ring.
- 2) Turn the robot power switch to “on”.
- 3) Push the button.
- 4) Robot should give some starting beeps and then start running!

If you have issues, there are several things to check:

- Batteries. Do you have charged AA batteries in the Zumo.
- LEDs. This code should light up several of the LEDs on the robot, are they working?
- Robot turning all the time? Probably something wrong with the thresholds that we changed.
  - o We can use the serial monitor to do some debugging... Check with your professor for help if this is needed.

This is designed to be completed in our lab class! If you don’t get this working, work with the professor to figure out how to complete this before our next Tuesdays class. It is critical to get this working before we can move on to our next piece of the final project!

No lab report for this lab.