Robot Line Following

1 Objectives.

1. Become familiar with the QTR-8RC Line Sensor Array.
2. Utilize the Arduino to detect lines.
3. Integrate the Line Sensors with the DFECBot and program the DFECBot to follow a line.

2 Materials.

1. 1x QTR-8RC Reflectance Sensor Array
2. DFECBot
3. USB Programming Cable
4. Black Tape

3 Introduction.

3.1 QTR-8RC Reflectance Sensor Array

The QTR-8RC Line Sensor Array uses 8 infrared radiation (IR) reflectance sensor with an IR light-emitting diode (LED) and an IR sensitive phototransistor.[1] The sensors are powered using the 3.3 V and ground pins on the Arduino. Powering the sensors illuminates the IR LED. A 100 Ω resistor is on-board and placed in series with the LED to limit current. The output of the phototransistor is tied to a 10 nF capacitor. The

[1] Information found at Pololu, `https://www.pololu.com/product/961`

faster the capacitor discharges, the more reflective the surface is.[1] The QTR sensors have an optimal sensing distance of 3 *mm*.

Wire your QTR-8RC Reflectance Sensor Array to the Arduino according to the schematic shown in Figure 1.

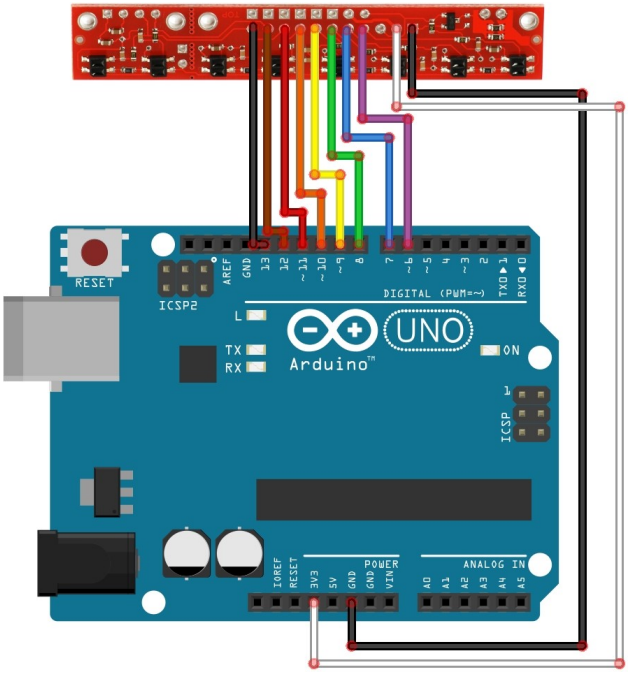

Figure 1: QTR-8RC Reflectance Sensor Array Wiring Schematic

3.2 Example Code

Copy the Arduino sketch folder `robot_linefollowing` from **Teams** (`Labs/robot_linefollowing`). Copy the `QTR-8RC` library from **Teams** (`Labs/Custom Libraries/QTR-8RC`) to your documents folder: `Documents/Arduino/libraries/`. Open the `robot_wallfollowing.ino` sketch.

3.3 QTR-8RC.h

The Arduino Sketch utilizes a library called QTR-8RC. This is a custom library adapted from the QTRSensors library to utilize the QTR-8RC Reflectance Sensor Array. This library provides functions to read values from the sensor array and return the distance off the line.

3.3.1 robot_linefollowing.ino

This example Arduino Sketch provides code to calibrate the DFECBot's QTR-8RC Reflectance Sensor Array and determine the distance off a black line.

```
1  // read calibrated sensor values and obtain a measure of the line position
2  // with a position of 0.1 mm relative to the center of the line
3  // -33.2 mm to 33.2 mm
4  int16_t position = qtr.readLineBlack(sensorValues);
```

4 Procedure

Use the example code provided, `robot_linefollowing`, `Motor.h`, and `QTR-8RC.h` to code the DFECBot to do the following:

1. Use a ruler to confirm the accuracy of the line sensor read function
2. Program the DFECBot to follow a line

CALIBRATION: The first 10 seconds after powering on your robot (or uploading the code) is used to calibrate your line sensor. During calibration, **without lifting your robot off the surface**, slowly move your robot so each line sensor is over a black line for approximately one second. This allows the script to collect minimum (white surface) and maximum (black surface) readings used to calibrate the sensors.

HINT: You should remove all print statements and delays when testing your line following.

5 Notes on Proportional Controller: