EGR 262

Fundamental Circuits Lab

File: N262L9

**Lab # 9**

**Serial Communication and Motor Controllers**

A. **Objectives**

The objectives of this laboratory are to introduce the student to:

1. Serial communications
2. The Compact Protocol for the Qik 2s9v1 dual motor controller
3. The PololuQik Library for the Arduino
4. Writing a program using the Compact Protocol to navigate a robot on a specified course
5. Writing a program using the PololuQik Library to navigate a robot on a specified course

B. **Materials**

Robot vehicle that includes:

* Arduino UNO
* Qik 2s9v1 Dual Motor Controller
* 5-AA Battery Pack
* 7805 - 5V Regulator
* Two 580 rpm gearhead motors

C. **Introduction**

See the ***Presentation for Lab #9*** for more detailed background information.

D. **Pre-Lab Tasks**

1. ***Program 1 - Using the Compact Protocol***

Write a program to navigate Course 1 shown on the following page.

* Use the Compact protocol.
* Use the program MotorTest2 in the lecture notes as an example.
* The instructor will specify distance D1 during the lecture.
* Assume that motor M0 is the left motor and motor M1 is the right motor.
* In order to estimate the amount of time for each part of the program, assume that the robot moves at about 3 ft/s at top speed (127).
* The robot can use sharp turns, rounded turns, etc., as long as it follows the general path.
* Include plenty of comments in the program including the usual initial block of comments.

1. ***Program 2 - Using the PololuQik Library for the Arduino UNO***

Write a program to navigate Course 2 shown on the following page.

* Download the PololuQik library from the Pololu website as described in the presentation for this lab.
* Write a program using functions in the PololuQik library.
* Use the program QikTest2 in the lecture notes as an example.
* The instructor will specify distance D2 during the lecture.
* Assume that motor M0 is the left motor and motor M1 is the right motor.
* In order to estimate the amount of time for each part of the program, assume that the robot moves at about 3 ft/s at top speed (127).
* The robot can use sharp turns, rounded turns, etc., as long as it follows the general path.
* Include plenty of comments in the program including the usual initial block of comments.

**Assigned distance:**

**D1 = \_\_\_\_\_\_\_\_\_\_**

**8” x 13” Lab Kit**

**R**

**O**

**B**

**O**

**T**

**R**

**O**

**B**

**O**

**T**

Hallway

Walls

Robot

Start

Position

Robot

End

Position

**D1**

Robot

Path

**Course 1**

Tape or line on floor

**Assigned distance:**

**D2 = \_\_\_\_\_\_\_\_\_\_**

**8” x 13” Lab Kit**

**R**

**O**

**B**

**O**

**T**

**R**

**O**

**B**

**O**

**T**

Hallway

Walls

Robot

Start

Position

Robot

End

Position

**D2**

Robot

Path

**Course 2**

(Follows arrows 1-6 in order)

**8” x 13” Lab Kit**

**D2**

**8” x 13” Lab Kit**

**D2**

**1**

**2**

**3**

**4**

**5**

**6**

Tape or line on floor

E. **In-Lab Tasks**

1. **Robot Wiring**
   * The instructor will assign a robot to each student or team.
   * Obtain 5 AA batteries from the instructor if necessary.
   * The wiring on the robot may not be complete. Check the wiring and/or complete the wiring using the ***Wiring Diagram*** and picture of the robot shown in the lab presentation.
2. **Testing the robot without an Arduino program**
   * No Arduino program is needed for this test, so do not download any programs.
   * Disconnect the TX and RX wires from pins 2 and 3 of the Arduino temporarily in case the Arduino has a previously stored program that might affect the Qik.
   * Flip the toggle switch to turn on the robot.
   * Add the ***demo jumper*** to the Qik motor controller as described in the lab presentation. If the wiring is correct and all components are functioning properly, motor M0 (left motor) should turn forward and then backward and then motor M1 (right motor) should turn forward and then backward.
   * If a motors turn backwards first instead of forwards, reverse the polarity of the motor.
   * If the demo does not work properly, check and wiring and/or ask for help from the instructor. Do not continue this lab until the demo works correctly. Replace the wires to pins 2 and 3 when finished.
3. **Testing Program 1**
   * Check the Arduino library folder on the computer to see if the PololuQik folder is present. If it is not, download the PololuQik library from the Pololu website as described in the lab presentation and add the PololuQik folder to the Arduino/libraries folder.
   * Download Program 1.
   * Test the robot on Course 1. Make adjustments to the program until in properly completes the course.
   * Measure and record the amount to time it takes your robot to complete the course.
   * Demonstrate the robot on Course 1 to the instructor.
4. **Testing Program 2**
   * Download Program 2.
   * Test the robot on Course 2. Make adjustments to the program until in properly completes the course.
   * Measure and record the amount to time it takes your robot to complete the course.
   * Demonstrate the robot on Course 2 to the instructor.

F. **Post-Lab Tasks**

1. Discuss ***Program 1:***

* How difficult was it to complete the course?
* How many times did you have to modify the program?
* How repeatable is the program? In other words, once you completed the course, will the robot complete it again and again without further modification?

1. Discuss ***Program 2***:

* How difficult was it to complete the course?
* How many times did you have to modify the program?
* How repeatable is the program?

1. Discuss the difference between using the Compact Protocol and using the PololuQik library. Which do you prefer?
2. Calculate the approximate length of Course 1 using the path you chose (show your calculations). Using the recorded time to complete the course, calculate the average speed of the robot in ft/s.

G. **Report**

A lab report is due 1 week after the date of the experiment. Use the same format as in previous labs.