Task-5: DC motor control and PWM generation for velocity control

Experiment 1: Getting Familiar with DC Motor Interfacing

The aim of this experiment is to get you familiar with DC Motor interfacing on the Atmega 2560 based firebird V robotic kit. In this experiment, you will write program code to control DC Motor with Atmega 2560 microcontroller. The DC Motor is connected to L293D (motor driver IC) and the pins of **L293D** are connected to Port A and Port L of Atmega 2560.

1• Four Pins for Direction control are connected at PORT A.

1. PA0 - Left Motor Control
2. PA1 - Left Motor Control
3. PA2 - Right Motor Control
4. PA3 - Right Motor Control

2• Two Pins for Enabling Motor Driver IC are connected at PORT L.

1. PL3 - Left Channel Enable
2. PL4 - Right Channel Enable

Note: You can refer to Simple motion control tutorial uploaded on the portal.

Your task is to trace the shape of alphabet “C”, using the path traversed by the Firebird V as shown in the **Figure 1.**

Your robot should start from node “**M**” following the path and direction shown in **Figure 1**. The sequence of traversal should be **M-N-O-P** with your robot stopping at “**P**”. Use time delay to navigate between two nodes. Your robot has to complete the whole experiment in a maximum of **45 seconds** and make sure no side is navigated in less than **2 seconds**.

Note:

Horizontal lines of “C” is half of its vertical side. You have to use _delay_ms() for turning and navigating the sides of the “C” shape. The 90° angle need not be exact. The Length of the sides will depend on the delay you choose.

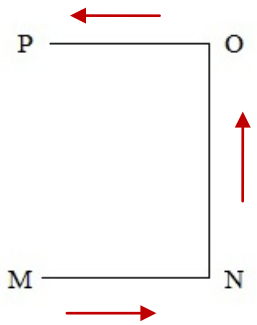

Figure 1: Path that needs to be followed by Firebird V

Procedure:

Step-1: Open Experiment-1 folder. Open the given project named "Experiment-1.aps" in AVR Studio.

Step-2: You will notice some pre-written function declarations included for your assistance. Write program code to complete the functions with the help of function description and inline comments.

Step-3: Check and debug your code on the robot. Ensure that code performs as expected.

Step-4: Save the project and create a .zip file.

Step-5: Upload the .zip file of your saved project on the portal for evaluation

Step-6: Shoot a demonstration video of your robot performing this experiment and upload it on Youtube. Paste the link of your uploaded video in "**link1.txt**" file included in the **Task-5** Folder.

Click on this link: https://youtu.be/_85LZaKuv7I to see the expected output for this experiment.

Note: We request you to strictly adhere to the code layout as given in the project C file and avoid adding any new functions. However, you can declare and define new variables, if required.

Grading:

Maximum marks for this experiment are **10**, divided among the following tasks.

1. Initialization of the ports mentioned under the functions of the project C code. (**4 marks**)
2. Navigating vertical side of the shape"C". (**2 marks**).
3. Navigating horizontal side of the shape"C". (**4 marks**).

Experiment 2: PWM control of the DC motor

The aim of this experiment is to get you familiar with Pulse Width Modulation (PWM) using Atmega 2560 microcontroller.

Your task is to decelerate the robot using PWM and indicate this on the Bar Graph LEDs. Bar Graph LEDs are connected to Port J of Atmega 2560.

1• Robot velocity is proportional to the values passed in the Output Compare Registers (OCR5AL & OCR5BL). Divide the entire velocity range (maximum – minimum) into approximately 8 equal parts.

2• The robot should start with maximum velocity and with all the Bar Graph LEDs turned ON.

3• Decrease the velocity by an equal amount and with each decrement switch off one of the Bar Graph LEDs starting from the top i.e. Pin no. 8 (MSB) of Port J.

4• All the Bar Graph LEDs should be turned off when the minimum velocity is reached. Click on this link: https://youtu.be/rqKY_wSEvGk to see the expected output for this experiment.

5• This experiment has to be completed in a maximum of 45 seconds; hence the time after which a velocity decrement occurs has to be selected appropriately.

Note: The minimum velocity can be assumed to be zero or experimentally determined.

Procedure:

Step-1: Open Experiment-2 folder. Open the given project named "Experiment-2.aps" in AVR Studio.

Step-2: You will notice some familiar pre-written function declarations similar to Experiment-1. Write program code to complete all the functions with the help of function description and inline comments.

Step-3: Write program code in motion_barLED() function to decelerate the robot and simultaneously turn off the LEDs of the Bar Graph from the top. Ensure that at the minimum value of the velocity all the 8 LEDs of the bar graph are turned off.

Step-4: Check and debug your code on the robot. Ensure that code performs as excepted.

Step-5: Save the project and create a .zip file

Step-6: Upload the .zip file of your saved project on the portal for evaluation

Step-7: Shoot a demonstration video of your robot performing this experiment and upload it on Youtube. Paste the link of your uploaded video in "**link2.txt**" file included in the **Task-5** Folder.

Grading:

Maximum marks for this experiment are **10**, divided among the following tasks:

1. Initialization of the pins for both DC motor as well as bar graph mentioned under the functions of the project C code. **(4 marks**)
2. Decelerating the robot with equal decrements in velocity. **(4 marks)**
3. Bar graph LEDs being turned off with corresponding decrease in robot velocity. **(2marks)**