

Task-2: I/O interfacing on AVR based controllers

Experiment 1: Getting Familiar with I/O port operation – Blinking LEDs

The aim of this experiment is to get you familiar with I/O Ports of Atmega 2560 microcontroller, when used as output ports. In this experiment, you will interface an output device (bar graph LED) with the microcontroller. Bar graph LED comprises of 10 LEDs included in a single module and is connected to PORT J of Atmega 2560 microcontroller.

Your task is to turn on and turn off a set of 4 LEDs connected to upper nibble of Port J and then turn on and turn off another set of 4 LEDs connected to lower nibble of Port J, alternately with an ON time of 1 second.

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 reference. Write program code to complete the following functions. Refer to the function description written below each one.

1. port_init()
 - a. Initialize Port J as output port using DDRJ register
 - b. At the start, keep all the LEDs off. Use PORTJ register to turn OFF all 8 LEDs.
2. led_on_topfour()
 - a. Turn ON 4 LEDs connected to upper nibble of Port J
3. led_off_topfour()
 - a. Turn OFF 4 LEDs connected to upper nibble of Port J
4. led_on_bottomfour()
 - a. Turn ON 4 LEDs connected to lower nibble of Port J
5. led_off_bottomfour()
 - a. Turn OFF 4 LEDs connected to lower nibble of Port J

6. main()

Call functions 1-5 defined above in a way that you have

- a. All 8 LEDs initially turned OFF
- b. Turn ON 4 LEDs connected to higher nibble for 1 second.
- c. Turn OFF these 4 LEDs.
- d. Turn ON 4 LEDs connected to lower nibble for 1 second.
- e. Turn OFF these 4 LEDs.
- f. Repeat steps **b** to **e** continuously to alternately toggle these set of 4 LEDs ON/OFF.

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

Click on this <https://www.youtube.com/watch?v=3V5kxAX63kM> to see the expected output for this experiment.

Grading:

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

1. Turning on 4 LEDs connected to upper nibble
2. Turning on 4 LEDs connected to lower nibble
3. Expected delay of 1 second.
4. Toggling between the two sets of LEDs.

Experiment 2: Interface a switch to turn on Bar graph LEDs. (Implementing a “Push to ON” indicator)

The aim of this experiment is to get you familiar with I/O Ports of Atmega 2560 microcontroller, when used as input ports. In this experiment you will interface an input device (boot switch) with the microcontroller. The boot switch (Refer to Figure 1) is located right beside the reset switch on the Firebird V robot.

Your task is to implement a “**Push to ON**” indicator using a set of 4 LEDs (part of the Bar graph LED) connected to upper nibble of Port J and a boot switch connected to Port E pin number 7. These 4 LEDs will turn ON and remain ON as long as the boot switch is pressed and turn off as soon as the boot switch is released.

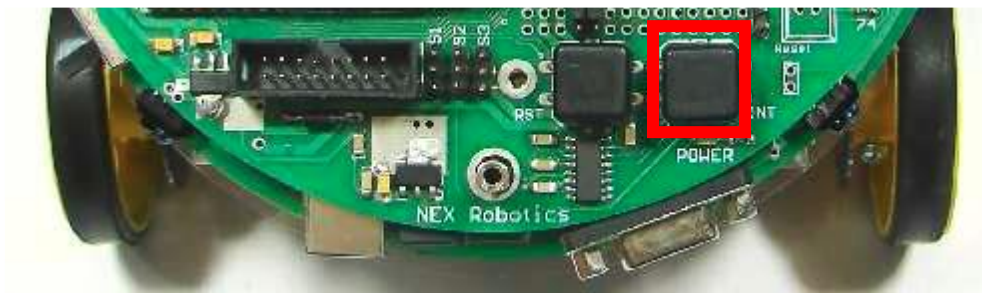


Figure-1: Boot switch on Firebird-V robot (marked in red rectangle)

Procedure:

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

Step-2: You will notice some pre-written function declarations included for your reference. Write program code to complete these functions.

Step-3: Write program code in the main() function to sense boot switch press and turn on 4 LEDs connected to upper nibble of Port J. Keep them ON as long as the switch is pressed. Use the completed functions from **Step-2** to assist you in doing so.

Note: You can create other functions, if required.

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

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

Click on this link https://www.youtube.com/watch?v=5uu_UwNtNfA to see the expected output for this experiment.

Grading:

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

1. Turning on all 4 LEDs connected to upper nibble of Port J
2. Boot switch press is detected (at least one LED should turn ON when switch is pressed).
3. All 4 LEDs remain ON, when the boot switch is kept pressed
4. All 4 LEDs turn off, when the boot switch is released