

## ESP – Assignment 2

1. After you write 74 to /sys/class/gpio/export will you receive an error when opening /sys/class/gpio/gpio74/direction? Explain your answer.

**Ans.** Gpio74 corresponds to Mux 1 pin for gpio10 – IO10. Gpio10 is intended to be used as chip-select signal when it is connected to an external SPI device via shield IO pins.

For chip-select signalling, Arduino assumes that any Gpio pin can be used , whereas Gpio10 is the dedicated chip-select managed by SPI controller driver in Linux. And this creates conflict between the Linux and Arduino.

For Linux, the SPI controller driver wants Gpio10 pin and Arduino considers as free general purpose I/O. To avoid this situation, the SPI controller in driver is instructed on start-up by default to not to use Gpio10. Hence, while exporting the direction of Gpio74 which belongs to Gpio10, we receive an error.

To resolve this error, edit the grub.config file (i.e. /media/mmcblk0p1/boot/grub/grub.conf), then pass the parameter to the kernel command line as “ intel\_qrk\_plat\_galileo\_Gen 2.gpio\_cs=1 “ and reboot.

2. Can we receive an interrupt when there is a rising edge on gpio38 which is connected to IO7 directly on Galileo Gen2 board? Explain your answer.

**Ans. No.** From Pin configuration table for Galileo Gen 2, IO7 pin has gpio38 as Linux pin. Gpio38 pin doesn't support any interrupt mode , and hence , interrupt can't be received when there is a rising edge on gpio38.

Refer the table as given below.

Shield pin	Function	Linux	Level Shifter GPIO L: dir_out H: dir_in I: *	22k Pull-Up GPIO L: pulldown H: pullup I: of f	Pin Mux 1 GPIO	Pin Mux 2 GPIO	Interrupt modes L: low-level H: high-level R: rising-edge F: falling-edge B: both edges
IO0	UART0 RX	ttyS0	gpio32	gpio33	-	-	-
	GPIO	gpio11			-	-	L/H/R/F
IO1	UART0 TX	ttyS0	gpio28	gpio29	gpio45 (H)	-	-
	GPIO	gpio12			gpio45 (L)	-	L/H/R/F
IO2	UART1 RX	ttyS1	gpio34	gpio35	gpio77 (H)	-	-
	GPIO	gpio13			gpio77 (L)	-	L/H/R/F
	GPIO	gpio61			gpio77 (L)	-	R/F/B
IO3	UART1 TX	ttyS1	gpio16	gpio17	gpio76(H)	-	-
	GPIO	gpio14			gpio76(L)	gpio64(L)	L/H/R/F
	PWM	pwm1			gpio76(L)	gpio64(H)	-
	GPIO	gpio62			gpio76(L)	gpio64(L)	R/F/B
IO4	GPIO	gpio6	gpio36	gpio37	-	-	R/F/B
IO5	GPIO	gpio0	gpio18	gpio19	gpio66(L)	-	R/F/B
	PWM	pwm3			gpio66(H)	-	-
IO6	GPIO	gpio1	gpio20	gpio21	gpio68(L)	-	R/F/B
	PWM	pwm5			gpio68(H)	-	-
IO7	GPIO	gpio38	-	gpio39	-	-	-
IO8	GPIO	gpio40	-	gpio41	-	-	-
IO9	GPIO	gpio4	gpio22	gpio23	gpio70(L)	-	R/F/B
	PWM	pwm7			gpio70(L)	-	-
IO10	GPIO	gpio10	gpio26	gpio27	gpio74(L)	-	L/H/R/F
	PWM	pwm11			gpio74(H)	-	-

3. After you export 3 to /sys/class/pwm/pwmchip0/export, what is the period of pwm3 signal? Can you modify it? Explain your answer.

Ans. The PWM period for all PWM pins is **5000000 ns** by default. And hence, after exporting 3 to /sys/class/pwm/pwmchip0/export , the period of pwm3 signal would be **5000000 ns**.

We can modify the period by writing the preferred value to pwm\_period in the /sys/class/pwm/pwmchip0/device directory. The period is be set for all PWM signals and not set to individual PWM signal.

Also, the period should range from **666666 ns** to **41666666 ns**.

For Example :

Type the following commands to set the duty cycle to 50%:

**echo 2500000 > /sys/class/pwm/pwmchip0/pwm1/duty\_cycle**

### **Description : RGBLed\_1**

We have implemented sequence of leds as mentioned in problem statement using GPIOs.

All GPIO pins are mapped according to the pin configuration of the Intel Board Gen 2. Inputs can be dynamically given for all valid pins for certain duty cycle in the text file. If any invalid pin is given , then it prints the error message.

Inputs are mapped to Red, Green and Blue Led pins on the board. We have exported these GPIO pins and after with direction and values are assigned. The sequence of the led runs for mentioned time period and for given cycles.

Mouse event is read from path : dev/input/event2. When mouse is clicked, the sequence is interrupted and it starts from the beginning.

### **Description : RGBLed\_2**

We have implemented sequence of leds as mentioned in problem statement using PWM pins.

All PWM pins are mapped according to the pin configuration of the Intel Board Gen 2. Inputs can be dynamically given for all valid pins for certain duty cycle in the text file. If any invalid pin is given , then it prints the error message.

Inputs are mapped to Red, Green and Blue Led pins on the board. We have exported these PWM pins and after with direction and values are assigned. The sequence of the led runs for mentioned time period and for given cycles.

Mouse event is read from path : dev/input/event2. When the left button of mouse is clicked, the intensity of leds are increased by 10%. Similarly, when the right button of mouse is clicked , the intensity of leds is decreased by 10%.