Indian Institute of Technology Bombay
CS684: Embedded Systems

Initialization and GPIO

ERTS Lab, CSE Department

1 Lab Objective

1. Understand IO operation in ATmega 2560
2. Get acquainted with using on-board RGB LED and User Switches
3. Interfacing of external Switches and GLCD

2 Pre-requisite

This lab assumes you have completed Lab-0, which means you are aware of creating new project in VS Code, making required configurations, technique to load and run user written program on the board.

3 Problem Statement

In this lab you have to use switch **USER_SW** and **RGB LED** present on eYFi-Mega. You also have to interface external switches and GLCD to board.

1. Download **2. Digital Input** experiment of ATmega 2560 from the Quick Bytes http://products.e-yantra.org/eyfi-mega/tutorials/. Open the project folder using VS Code and load the program on the board using both wired and wireless flashing method to verify the installation of toolchain and extensions. Verify whether the output is according to the program written.
2. Interface **two 2-way dip** switches with ATmega 2560 on pins **PB0**, **PB1**, **PB2** and **PB3**. Write a program to take input from these switches and glow the on-board RGB LED according to the switch pattern as given below:

Switch 1	Switch 2	Switch 3	Switch 4	LED Color
X	X	X	ON	WHITE (ALL)
ON	OFF	OFF	OFF	RED
OFF	ON	OFF	OFF	GREEN
OFF	OFF	ON	OFF	BLUE
ON	ON	OFF	OFF	RED and GREEN
OFF	ON	ON	OFF	GREEN and BLUE
ON	OFF	ON	OFF	RED and BLUE
ON	ON	ON	X	WHITE (ALL)

3. Interface GLCD with ATmega 2560 using GPIO1 header available on eYFi-Mega board. (You are free to use any pins from GPIO1 header). For Interfacing refer the Figure 1 and for example code, refer to the sample code provided in **Resources.zip** file.

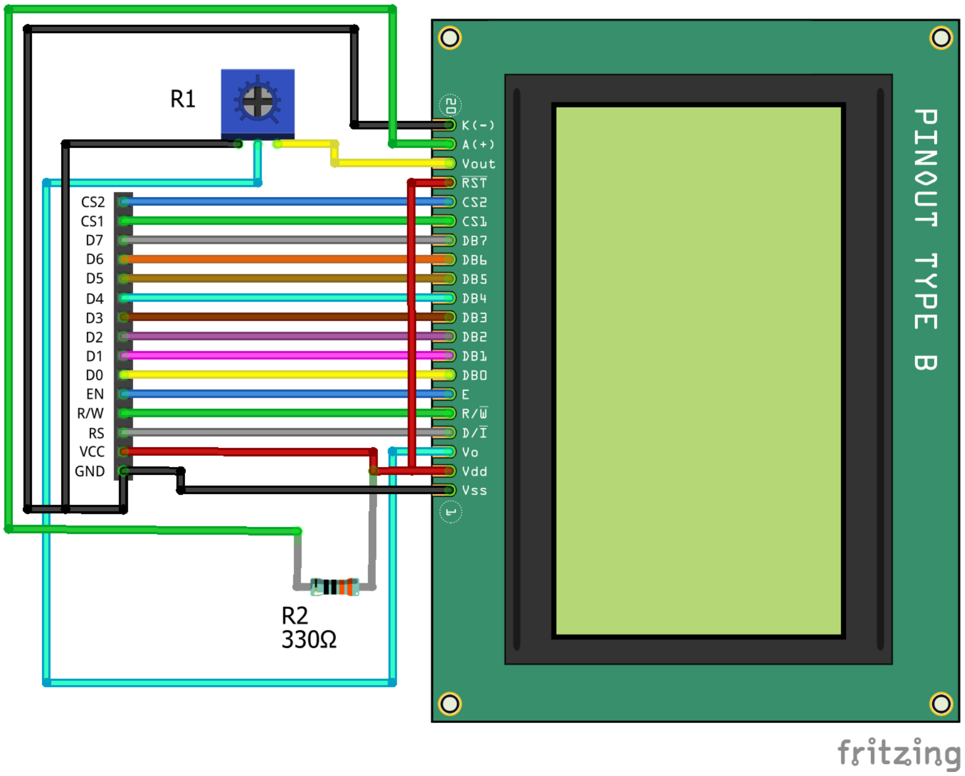

Figure 1: Connections for GLCD

Write a program to display **CS-684** and your <**Group Name**> on **Page 0** of GLCD and all <**Group members roll no**> on **Page 1** of the GLCD. You are free to use any font and any line of GLCD.

4. Write a program which reads the input from the **two 2-way dip** and display the resulting output on the GLCD. Program flow:

(a) Input is 8 bit. lets say X7 to X0 is input. Operation to be performed is given by X7X6, operand 1 is given by X5X4X3 and operand 2 is given by X2X1X0.

(b) Input from 4 switches should be taken for two times to form 8 bit data using the protocol mentioned below:

   i. A notification of the board ready to accept new data should be given by glowing the RED LED.

   ii. After the LED is on, user should set the switch position to give input.

   iii. Onboard switch should be pressed to indicate the board to accept the data.

   iv. LED should be made off and the data read from switches should be saved.

   v. After a delay, LED is made on and the process repeats.

(c) Operations:

Opcode (X7X6)	Operation	Result
00	Concate	X5X4X3X2X1X0
01	Addition	X5X4X3 + X2X1X0
10	Subtraction	X5X4X3 - X2X1X0
11	Multiplication	X5X4X3 * X2X1X0

(d) Data on GLCD should be displayed in following format:

   i. **Opcode** = <**X7X6**> **Operation** = <**Operation**> on Line 1

   ii. **Operand 1** = <**X5X4X3**> **Operand2** = <**X2X1X0**> on Line 2

   iii. **Result** = <**Result obtained in decimal format**> on Line 3

(e) Example: If **X7X6** = **00**, **X5X4X3** = **111** and **X2X1X0** = **111**, then following should be displayed on GLCD:

   i. **Opcode** = **00 Operation** = **Concate** on Line 1

   ii. **Operand 1** = **111 Operand2** = **111** on Line 2

   iii. **Result** = **63** on Line 3

4 Demo and Submissions

- You will be issued a take-away kit to work on the experiment.
- You have to get your output verified by your TA on the lab day.
- There will be a folder **Lab-1** already created on that repo. Add Project folders of all the above **four** Problem Statements in that folder of Github repository shared with you.
- Name each folder as **Problem_Statement-1**, **Problem_Statement-2** and so on.
- Deadline for completing **Lab 1** is **Wednesday, 29th January 2020 midnight**.
- Upload a well documented code with comments of the experiment every week after you have completed the experiment.