GP 106 : : Course Project

Tac-Tic-Toe Game

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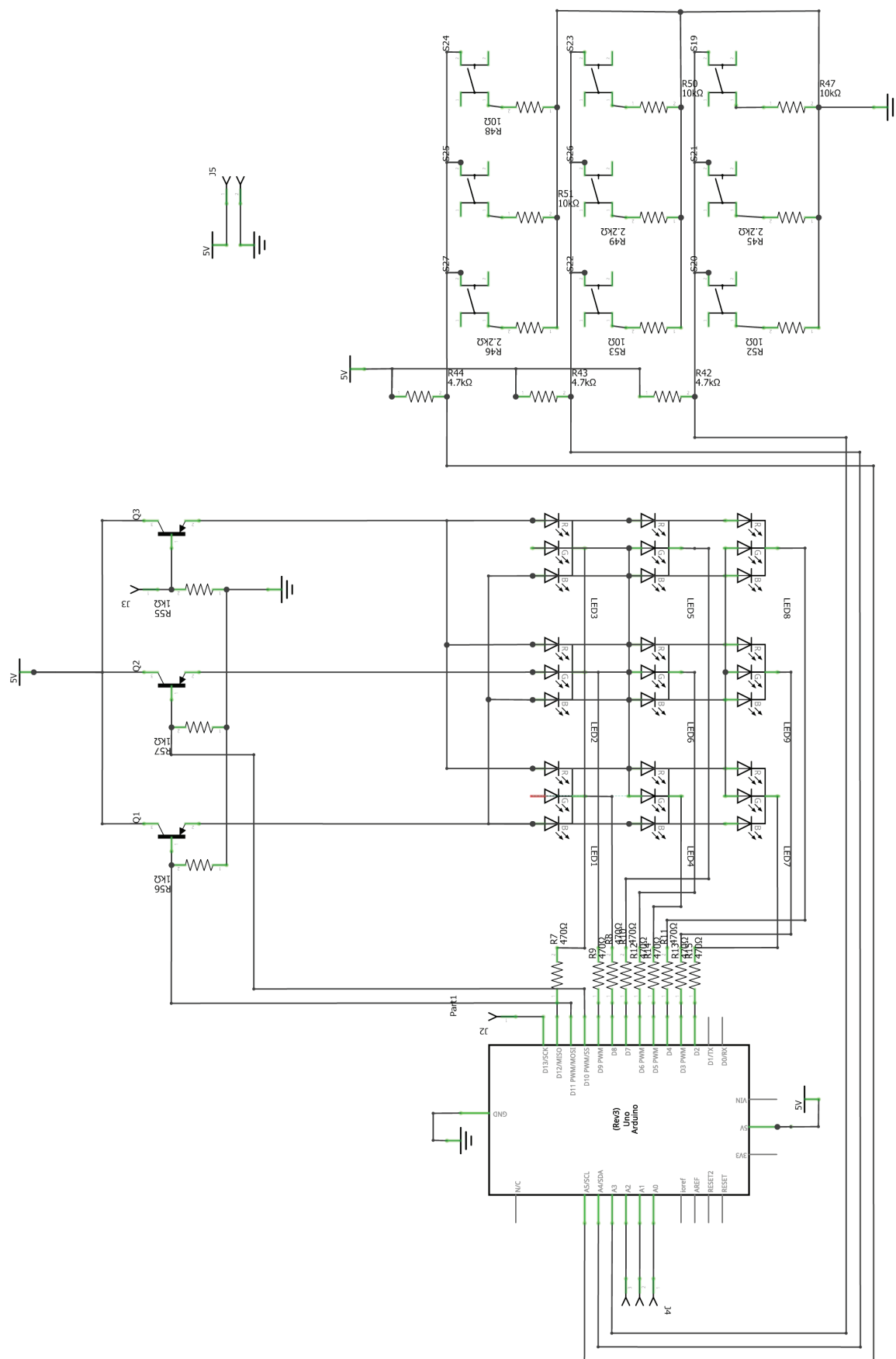
GROUP B 11
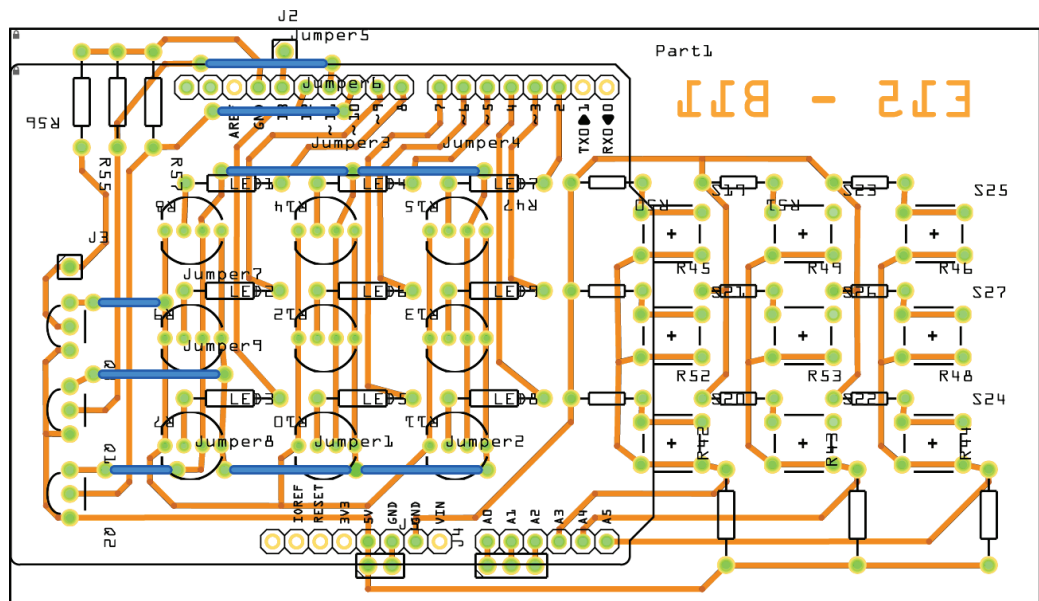Semester 2

2. Circuit Diagram

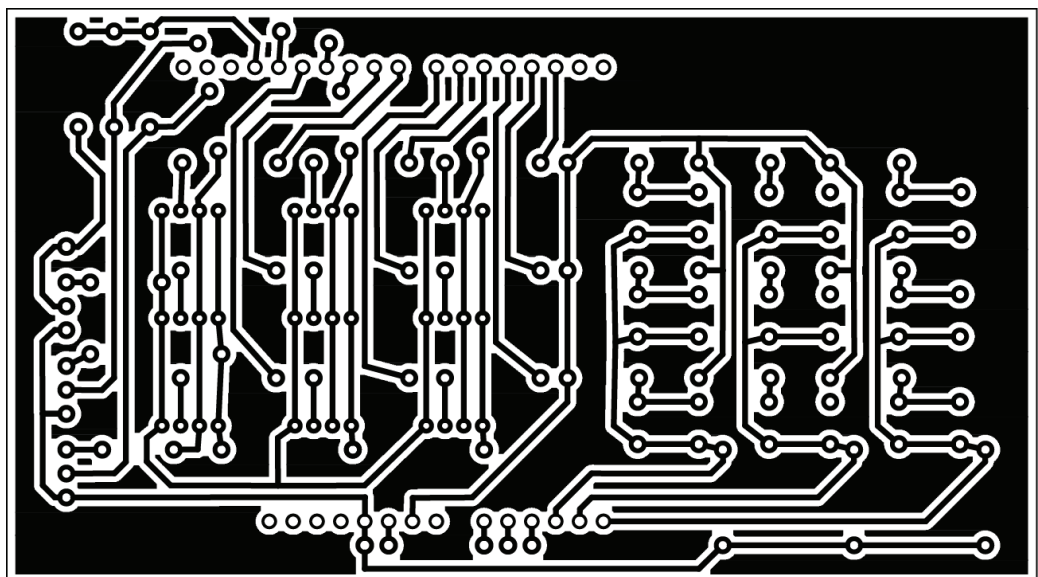Figure 1 : Schematic View

Figure 2 : PCB Schematic View (Top View)


Figure 3 : PCB Etching Layout (Bottom View, Mirrored)

3. Explanation of the Design

Arduino Uno board is used as microcontroller development board. In this project, we need nine outputs (LEDs) and nine Button inputs. RGB LEDs (For our bonus milestone) are used, so there are 9x3=27 LEDs need to be controlled while taking 9 button readings.

Arduino Uno board had only 14 digital IO pins and 6 Analog Pins. So it is required to use special technologies to fulfill the above requirement.

3.1 Controlling LEDs

All Anodes of LEDs are connected to Digital IO ports through 470 Ohm resistors and other ends of each LEDs (R, G, B cathode pins) are connected each other separately and controlled by NPN transistor as shown below.
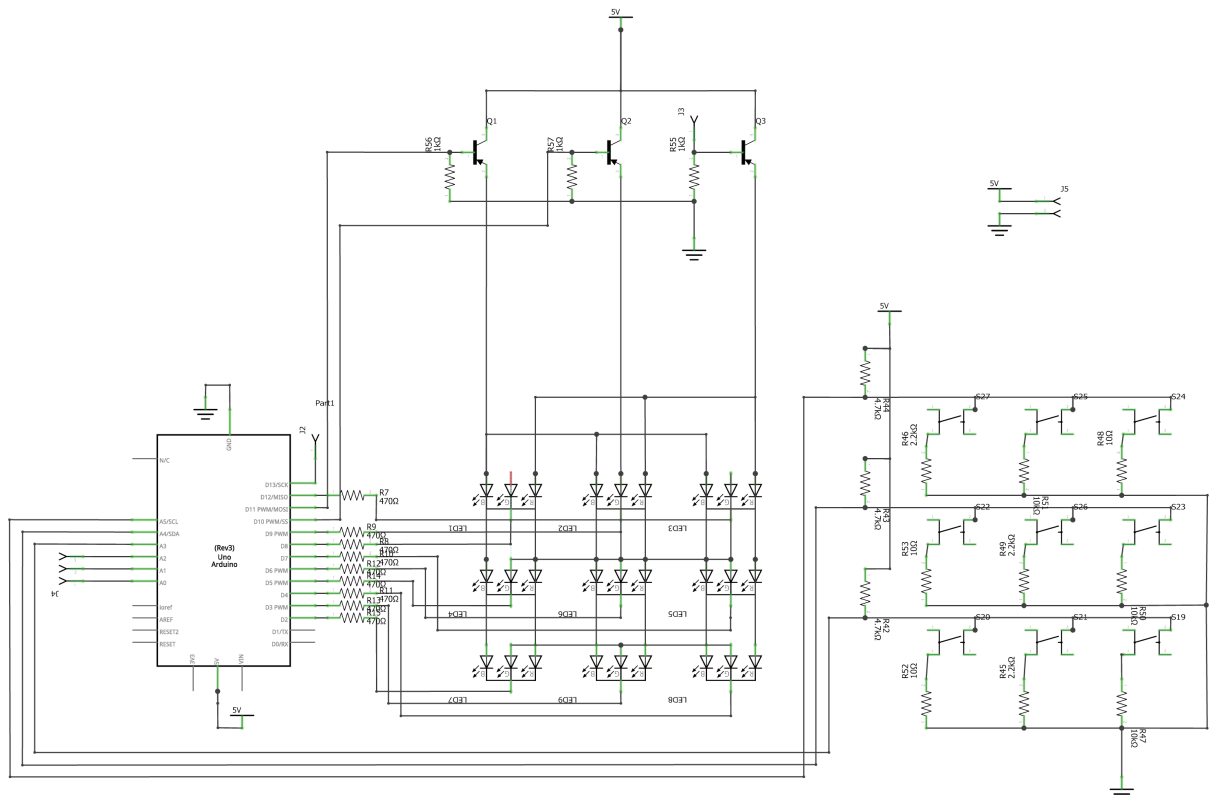
To turn on a LED, It is necessary to digital write logic low (0v) state to the LED pin and need to set logic high (5v) state to the base of the transistor which color we need.

3.1 Controlling Button

A voltage divider with 4 resistors are used to get 9 button inputs using only 3 analog pins. Circuit diagram, as shown below.
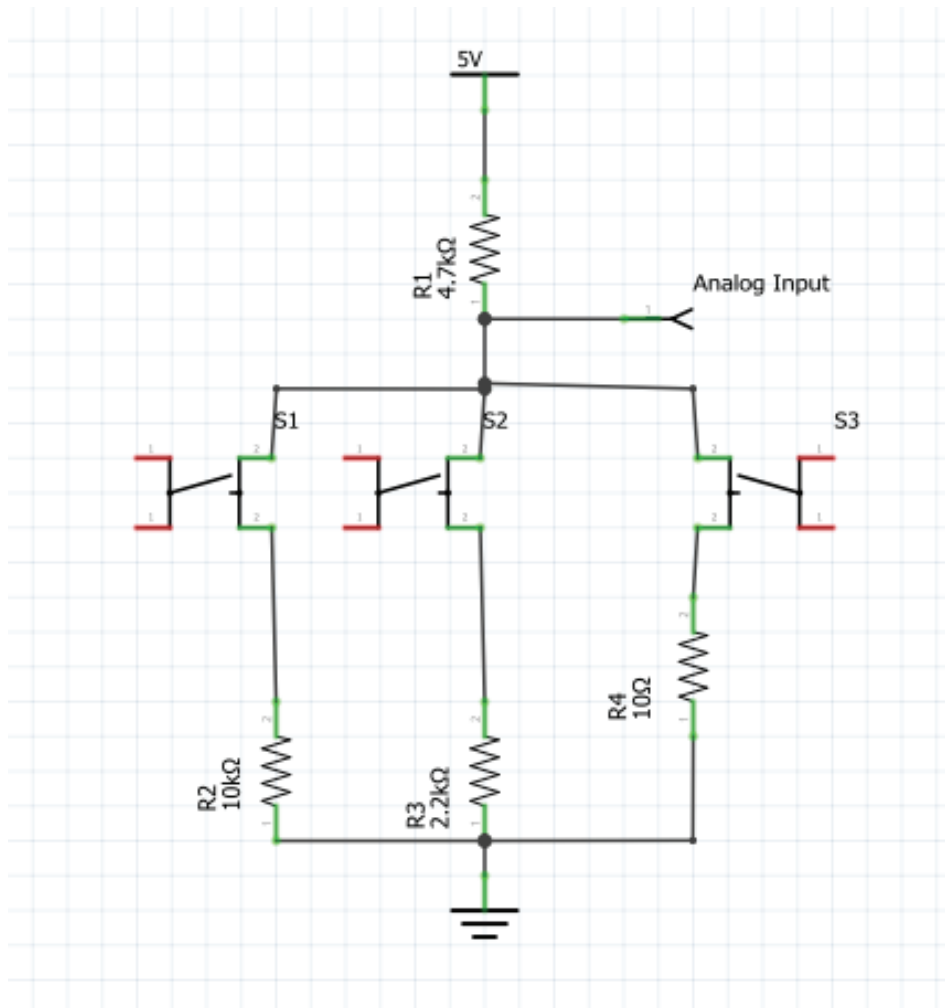
Resistor values are calculated according to the potential dividing method.

$$V_0 = \frac{R}{R + R} V$$

4.2. Input methods

This game can be played by either a **user input (1-9)** given by the user or by using **pushbuttons** in the PCB.

4.2.1. Use of the keyboard

Numbers in the keyboard of your PC which is in the right hand side can be used as inputs. The numbers represents the places in the Tic-Tac-Toe game.
When the code is run in Matlab command window, it will ask to enter the place to be locked for each player.

4.2.2. Use of push buttons

You may use push buttons to blink the LEDs .The push buttons are arranged to the same pattern of the numbers in the keyboard

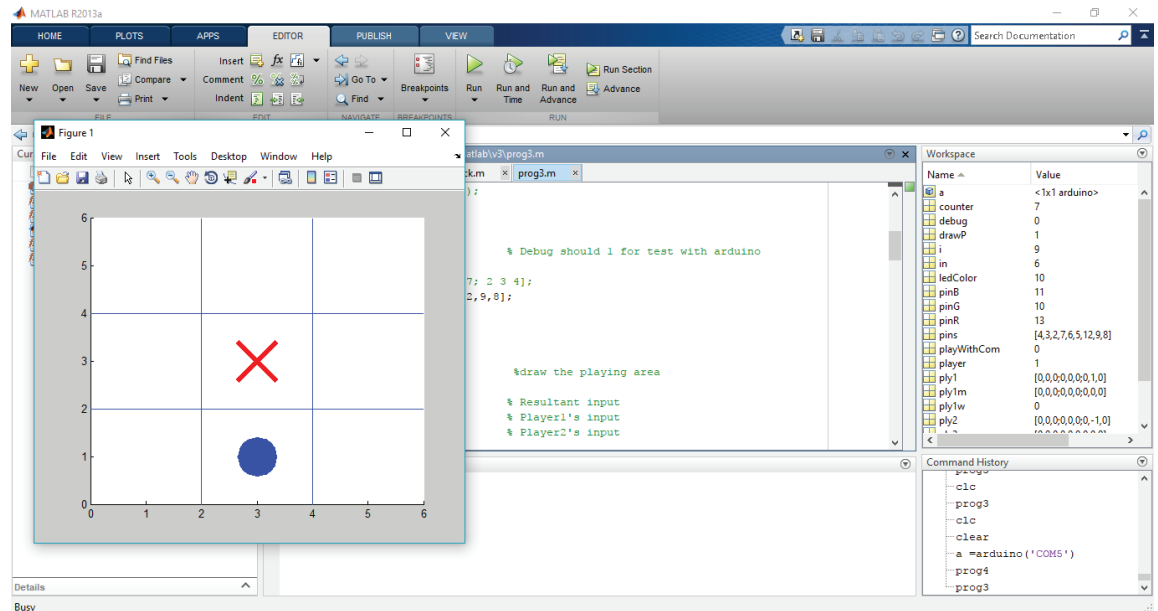➢ **This is how the LEDs are numbered for the game**

7	8	9
4	5	6
1	2	3

➢ **This is how the Pushbuttons are numbers for the game**

7	8	9
4	5	6
1	2	3

4.3. Let's play

After running the code in Matlab, it will show a figure designed same as tic-tac-toe game.

It will indicate the ongoing game clearly. it will show a red colored circle for the player 1's input and a blue colored cross for the player 2's input. This can be used to identify the locked places for the corresponding players. **Moreover this figure can be used to play the game without Arduino board (debug mode= 1).**

Now two persons can play the game and they can choose who goes first, the first person who starts the game will play the chance of PLAYER 1. Both players will get the chance repeatedly to give inputs.

If you are using LEDs to play, note that PLAYER 2's LEDs will Blink, PLAYER 1'S LEDs will be lighten without any blink.

The game will continue up to a player wins or the draw condition. Then the tic-tac-toe figure will display who has won or draw.

This game is designed same as the usual tic-tac-toe game, so the rules are the same for the winning and draw conditions. (Reference: *https://en.wikipedia.org/wiki/Tic-tac-toe*)

Special modifications

- If a player enters/inputs the already locked place, the player will be given the chance again to enter/input a correct place.

Cautions

- Note that the program will end if you input is not valid.
  Valid input is ONLY NUMBERS FROM 1-9. Moreover it will be comfortable if the number pad in the right side of the keyboard is used.

- When playing the game with push buttons, it's very important to press only one button at a time.

5. Reference

- https://arduino.cc
- https://en.wikipedia.org/wiki/Tic-tac-toe
- http://neverstopbuilding.com/minimax