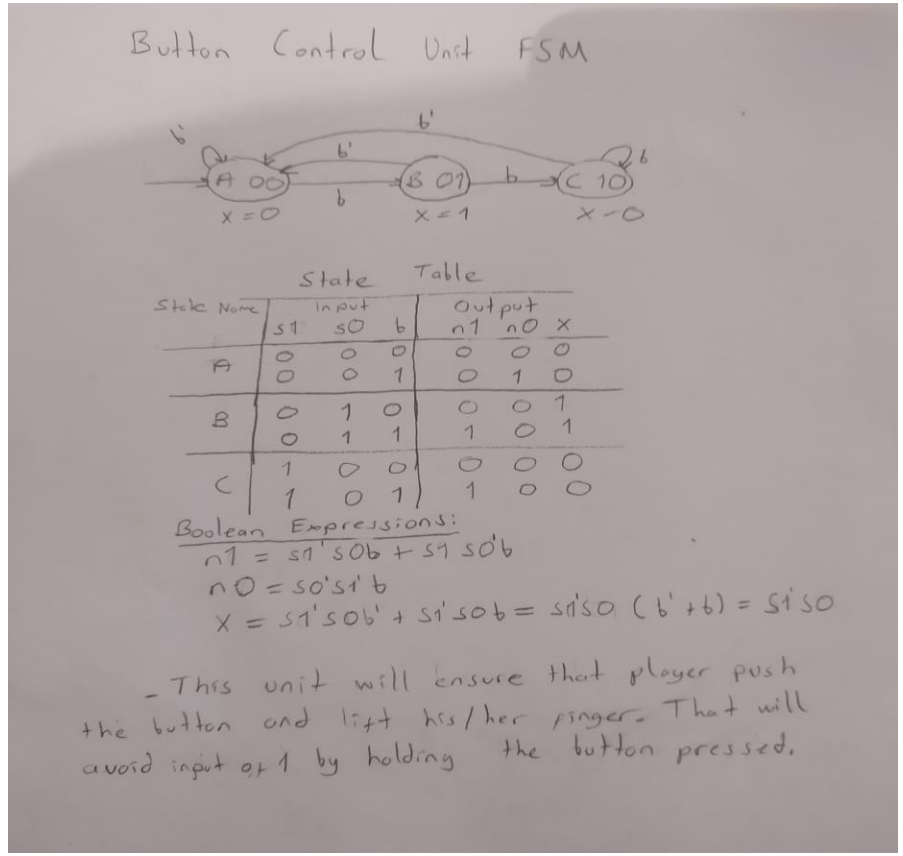
Button Control Unit FSM, State Diagram and Boolean Expressions



State Table

State Name	Input s1	Input s0	Input b	Output n1	Output n0	Output X
A	0	0	0	0	0	0
	0	0	1	0	1	0
B	0	1	0	0	0	1
	0	1	1	1	0	1
C	1	0	0	0	0	0
	1	0	1	1	0	0

Boolean Expressions:

$n1 = s1's0b + s1s0'b$

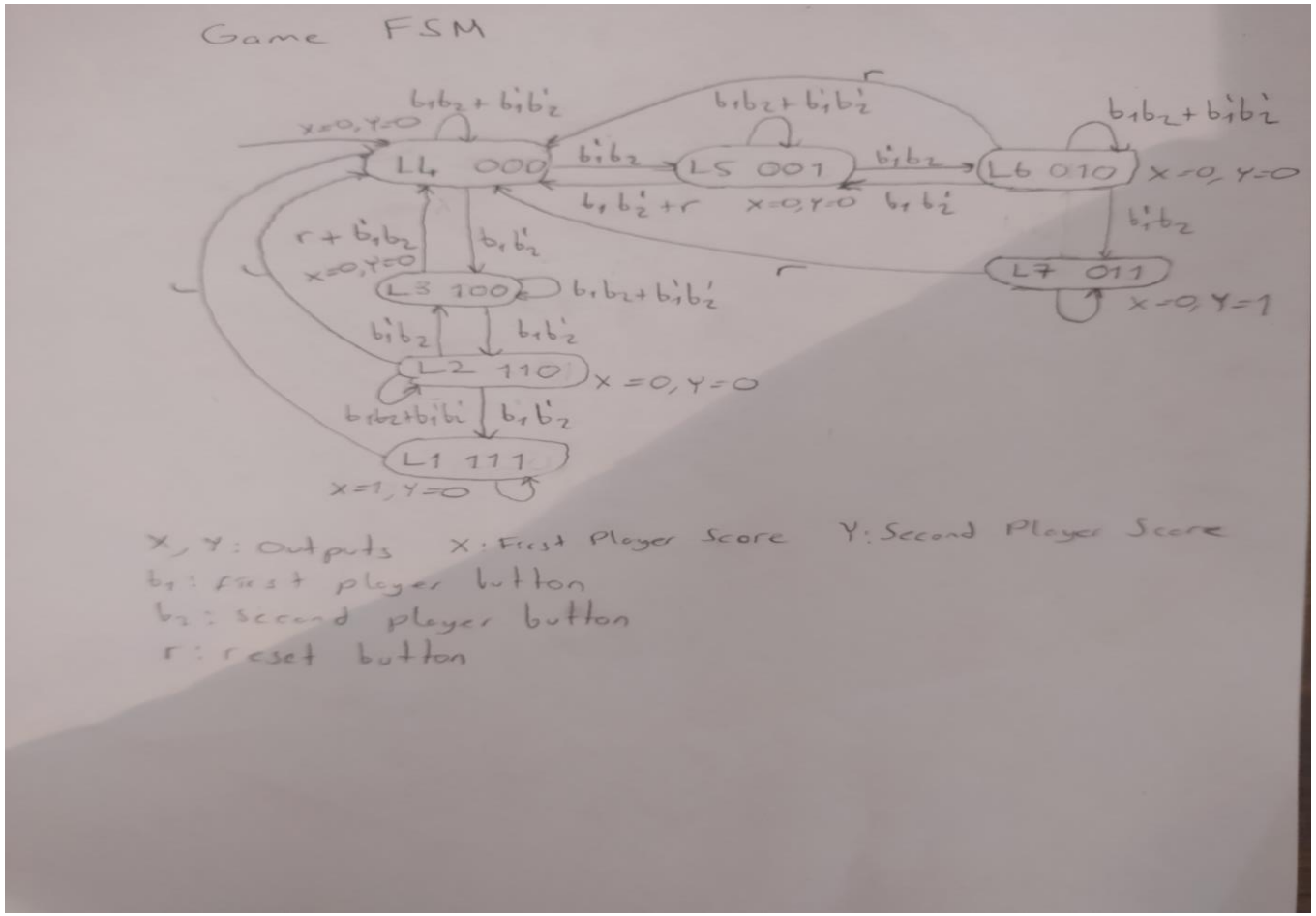
$n0 = s0's1'b$

$X = s1's0b' + s1's0b = s1's0(b' + b) = s1's0$

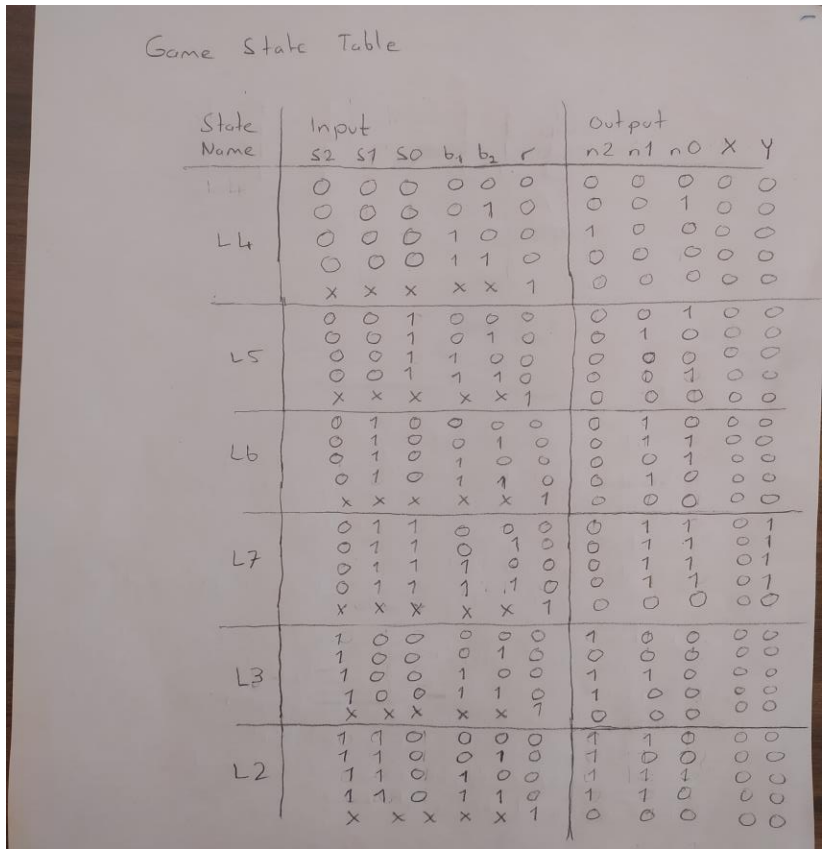
- This unit will ensure that player push the button and lift his/her finger. That will avoid input of 1 by holding the button pressed.

I used that unit 4 times wherever I needed to get input one time during same input comes in a row.

Game's Finite State Machine

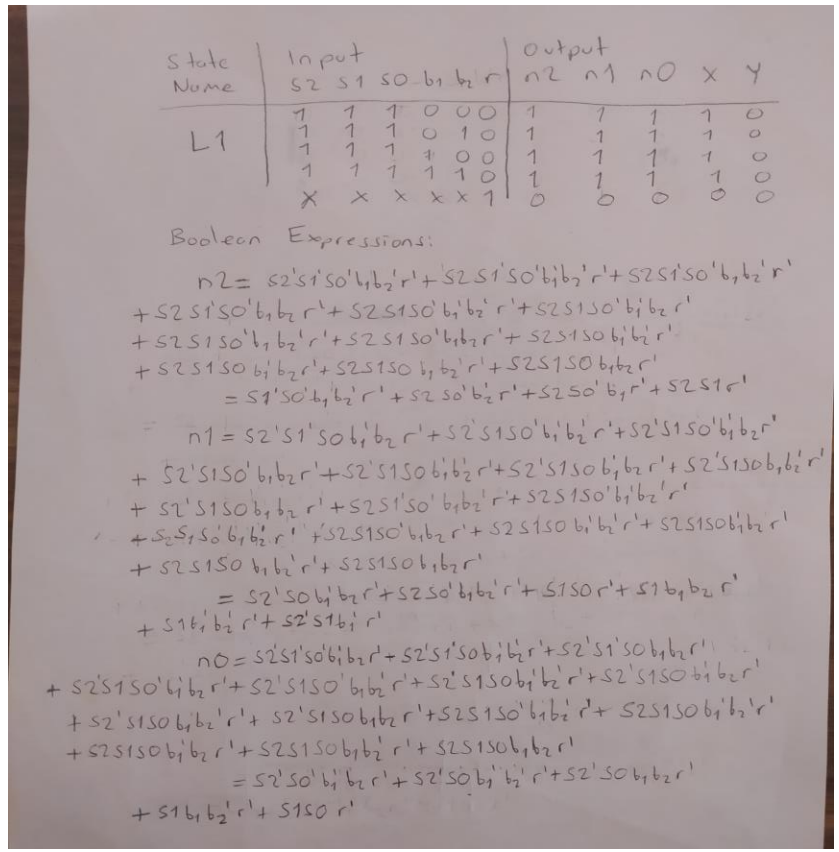


Game State Table and Boolean Expressions



Game State Table

State Name	Input S2	S1	S0	b_1	b_2	r	Output n2	n1	n0	X	Y
L4	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	1	0	0
	0	0	0	1	0	0	1	0	0	0	0
	0	0	0	1	1	0	0	0	0	0	0
	x	x	x	x	x	1	0	0	0	0	0
L5	0	0	1	0	0	0	0	0	1	0	0
	0	0	1	0	1	0	0	1	0	0	0
	0	0	1	1	0	0	0	0	0	0	0
	0	0	1	1	1	0	0	0	1	0	0
	x	x	x	x	x	1	0	0	0	0	0
L6	0	1	0	0	0	0	0	1	0	0	0
	0	1	0	0	1	0	0	1	1	0	0
	0	1	0	1	0	0	0	0	1	0	0
	0	1	0	1	1	0	0	1	0	0	0
	x	x	x	x	x	1	0	0	0	0	0
L7	0	1	1	0	0	0	0	1	1	0	1
	0	1	1	0	1	0	0	1	1	0	1
	0	1	1	1	0	0	0	1	1	0	1
	0	1	1	1	1	0	0	1	1	0	1
	x	x	x	x	x	1	0	0	0	0	0
L3	1	0	0	0	0	0	1	0	0	0	0
	1	0	0	0	1	0	0	0	0	0	0
	1	0	0	1	0	0	1	1	0	0	0
	1	0	0	1	1	0	1	0	0	0	0
	x	x	x	x	x	1	0	0	0	0	0
L2	1	1	0	0	0	0	1	1	0	0	0
	1	1	0	0	1	0	1	0	0	0	0
	1	1	0	1	0	0	1	1	1	0	0
	1	1	0	1	1	0	1	1	0	0	0
	x	x	x	x	x	1	0	0	0	0	0



State Name	Input S2	S1	S0	b_1	b_2	r	Output n2	n1	n0	X	Y
L1	1	1	1	0	0	0	1	1	1	1	0
	1	1	1	0	1	0	1	1	1	1	0
	1	1	1	1	0	0	1	1	1	1	0
	1	1	1	1	1	0	1	1	1	1	0
	x	x	x	x	x	1	0	0	0	0	0

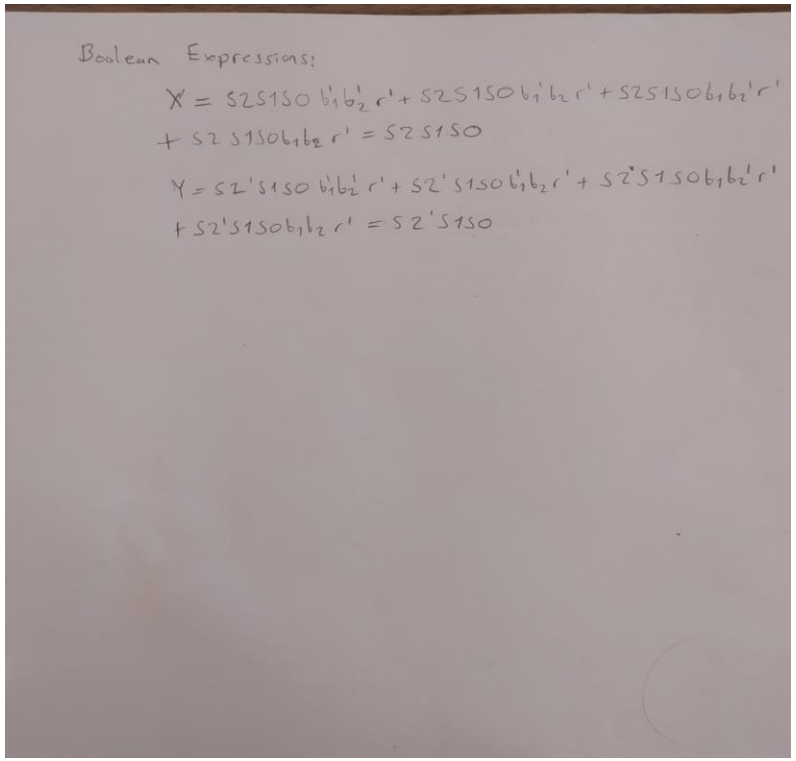
Boolean Expressions:

$$n2 = S2'S1'S0'b_1b_2'r' + S2'S1'S0'b_1'b_2'r' + S2'S1'S0'b_1b_2'r' + S2'S1S0'b_1b_2'r' + S2'S1S0'b_1'b_2r' + S2'S1S0'b_1b_2r' + S2'S1S0b_1'b_2'r' + S2'S1S0b_1'b_2r' + S2'S1S0b_1b_2'r' + S2'S1S0b_1b_2r' + S2S1'S0'b_1'b_2'r' = S1'S0'b_1b_2'r' + S2'S0'b_1'b_2'r' + S2'S0'b_1r' + S2S1r'$$

$$n1 = S2'S1'S0b_1'b_2r' + S2'S1S0'b_1b_2'r' + S2'S1S0'b_1'b_2r' + S2'S1S0'b_1b_2r' + S2'S1S0b_1'b_2'r' + S2'S1S0b_1'b_2r' + S2'S1S0b_1b_2'r' + S2'S1S0b_1b_2r' + S2S1'S0'b_1b_2'r' + S2S1'S0'b_1b_2r' + S2S1S0b_1b_2'r' + S2S1S0b_1'b_2r' + S2S1S0b_1b_2'r' + S2S1S0b_1'b_2'r' = S2'S0'b_1'b_2r' + S2'S0'b_1b_2'r' + S1S0r' + S1b_1b_2r' + S1b_1'b_2'r' + S2'S1b_1'r'$$

$$n0 = S2'S1'S0'b_1'b_2r' + S2'S1'S0b_1b_2'r' + S2'S1'S0b_1'b_2'r' + S2'S1'S0b_1b_2r' + S2'S1S0'b_1'b_2'r' + S2'S1S0'b_1b_2r' + S2'S1S0b_1b_2'r' + S2'S1S0b_1'b_2r' + S2S1'S0'b_1b_2'r' + S2S1'S0b_1'b_2'r' + S2S1S0b_1'b_2'r' + S2S1S0b_1b_2r' = S2'S0'b_1'b_2r' + S2'S0'b_1b_2'r' + S2'S0'b_1'b_2'r' + S2'S0b_1b_2r' + S1b_1b_2'r' + S1S0r'$$

Rest of the Game Boolean Expressions



When X is 1 that means Player 1 win the game.
When Y is 1 that means Player 2 win the game.

My project works very well. There is no such feature that is not added and in addition I added score feature too. It can hold scores until 9. Player can reset score displays by pressing "Score Reset Button".

I tested it 32 Hz clock frequency.