Assignment 1

COS10004

COMPUTER SYSTEM

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Overview

Description of my circuit

The circuit will show how the simple music player work. The circuit includes the PLAY/PAUSE button, volume control, track counter, ON/OFF sate and will save the previous settings.

Design Outline

My circuit includes:

- 12 LEDs light (which 8 of them used for decoration for the volume settings)
- 8 functional buttons
    - 1 button for ON state and 1 button for OFF state
    - 1 button for PAUSE/PLAY
    - 1 button for increase volume and 1 button for decrease volume
    - 1 button for fun to reset the volume (or can be used for mute)
    - 1 button for skipping track and 1 button to go back previous track
- 1 8-LEDs bar
- 13 D flip flops
- 9 J-K flip flops
- 2-digit decimal display to display track number
  With other components…

Stage 1A: Implement the PLAY/PAUSE state

I have come to the idea that I will use 2 AND gates and 1 NOT gate to make the PLAY/PAUSE and furthermore I have joined this circuit into the ON/OFF state so that for further exercise I can work on quicker.

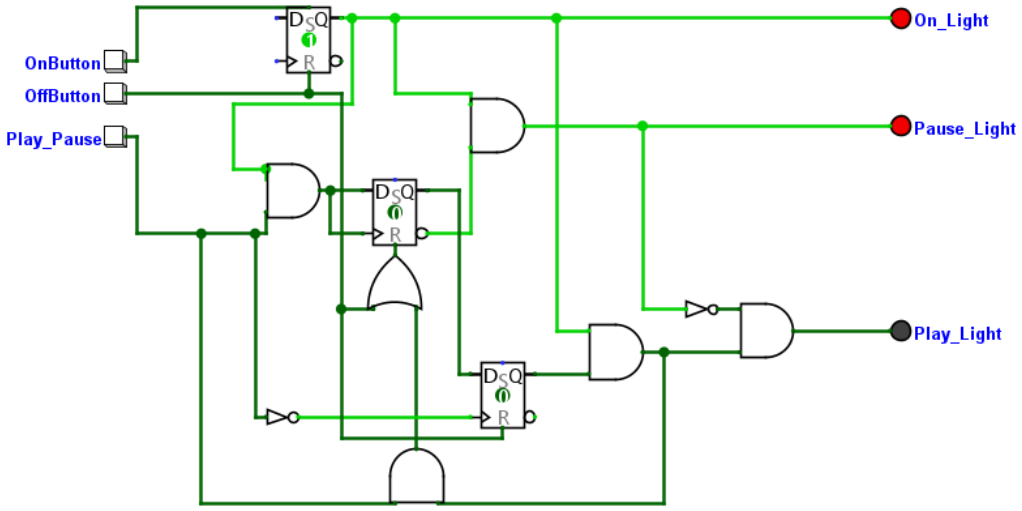

Figure 1: PLAY/PAUSE and ON/OFF state

Stage 1B: Implement the volume control and display

During the lecture, I have realized the hints about how to make the volume control with the below image:

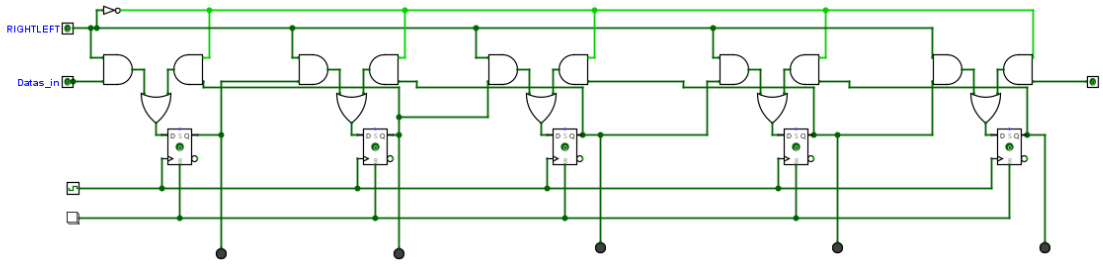

Figure 2: Exercise from lab 5

However, to increase or decrease the volume, I need to press at least 2 buttons so after this lesson I have try to make one from this and it can increase with a press of button to increase or decrease. However, it sometimes delays when re reset it to zero and start to increase it, it is delayed for 3 toggle and when it is maxed, it is delayed for 1 toggle, and when it down crease to zero then I tick the button to decrease, sometimes, it accidentally increases the volume, so I need to fix it to perfect it.

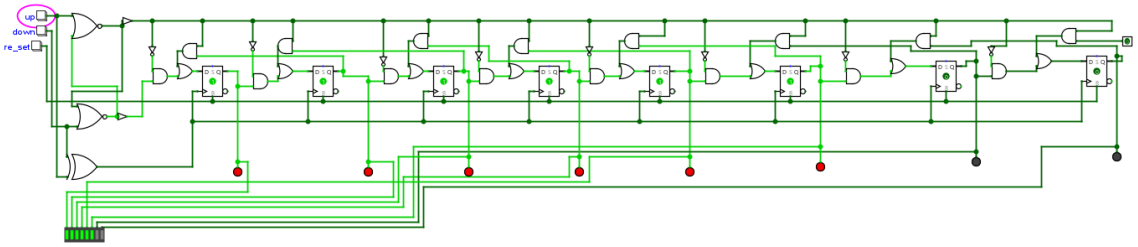

Figure 3: Volume components with some flaws

Then, I try many ways to figure out how to fix the errors and come with the results by adding 6 buffer gates to the circuit then it will fix all the mentioned problems:

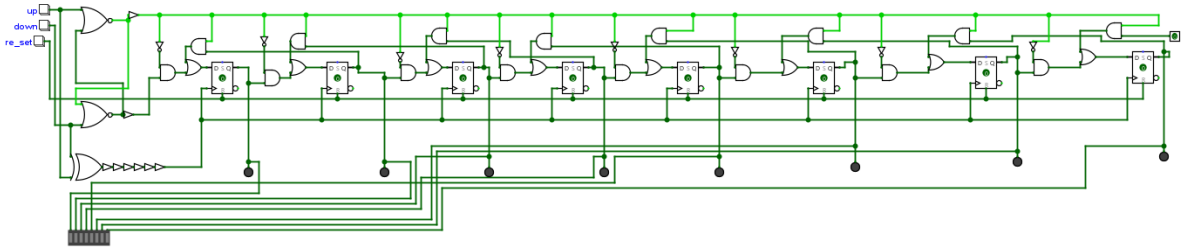

Figure 4: Volume components with less flaws

However, during the process of doing the lab 5, I have realized there is another way to simplify my circuit so that it still gives the same result and work properly by using the flip flop and an OR gate and a NOT gate.

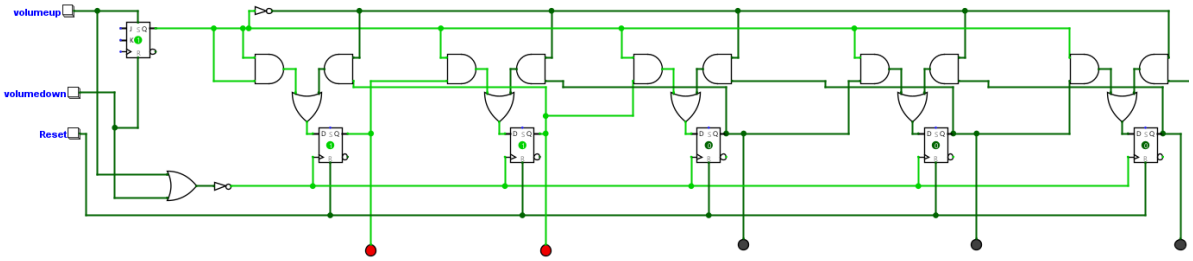

Figure 5: Simplify volume components

The next step to fully develop the volume components is to add more LEDs and more gates to form 8 outputs of LEDs to implement the 8-LEDs bar. Furthermore, the volume component will be combined with other components to fit in the circuit so that I will implement some changes to perfect the volume system.

Stage 3: Implement track skipping and display

Personally, the implement track skipping components are the hardest part in this circuit when I need more than 2 weeks to figure out and test with many gates to come out with the best result. However, there is only one flaw in this circuit when I press the button increase when it is 99, (or when I press the decrease button when it is 1) it will get to 0 and right the moment I release the button, it will skip to 1 so I think if I have more time, I will figure out the way to remove that moment from my circuit. The below image is not the final version for the track skipping and display because I will need to combine with other components especially for step 5 so that I will implement some changes to these components so that it could fit my circuit perfectly.

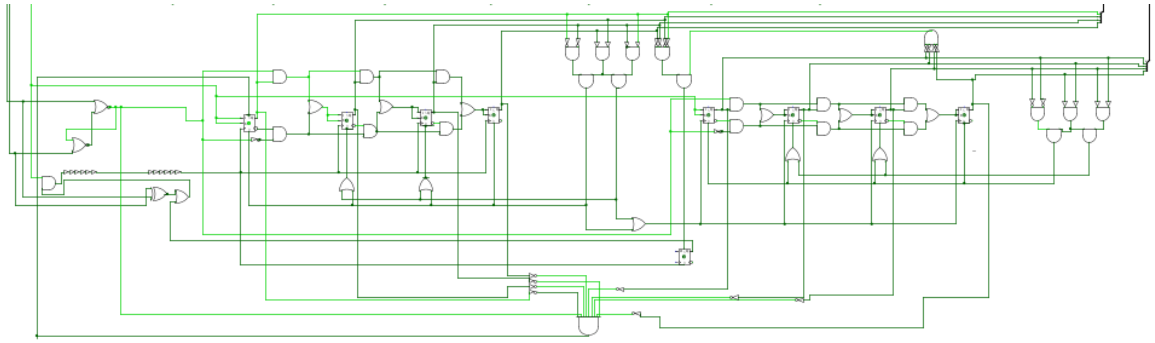

Figure 6: Track counting components

Due there are many delays if I don't add the BUFFER gates such as when I skip the track then I go back to the previous track, it will stop for 1 toggle then it will work normally so the BUFFER gates can help me to fix this.

Notes: Due to the big size of this part so I cannot show the HEX display but there is the HEX and the Final circuit (figure)

Stage 4: Implement an OFF state for your player

During the OFF state all, the light needs to be turn off, so I have come with the idea when connect to the PLAY/PAUSE button:

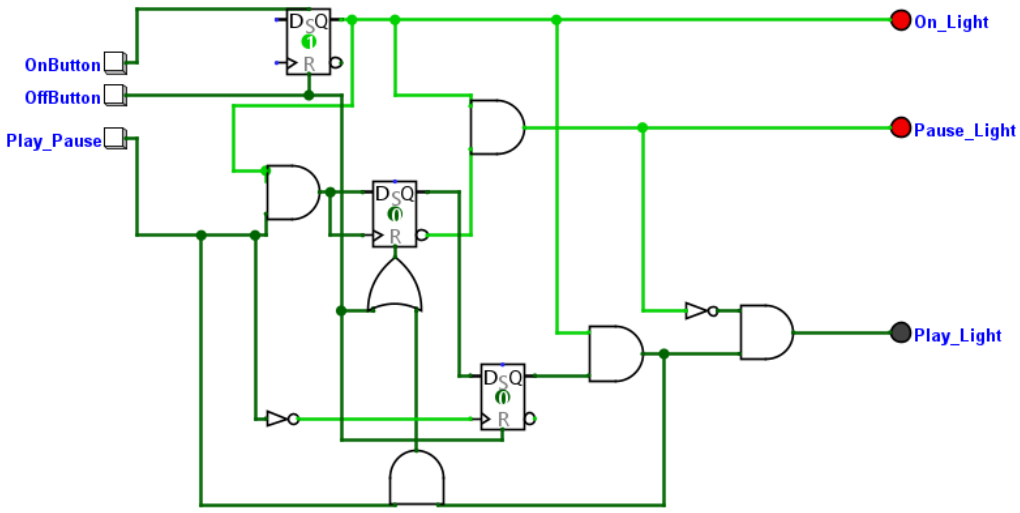

Figure 7: ON/OFF and PLAY/PAUSE

This circuit include all the requirements. All the lights will be turn off when it enters OFF mode. Furthermore, I have figured out the way to after entering the ON state, the circuit will automatically enter the PAUSE mode.

Stage 5A: Implement storage of previous settings for your player

All the bits will be stored directly in the D flip flips (figure 8) so that it can be recalled later step 5B (figure 10, figure 11)

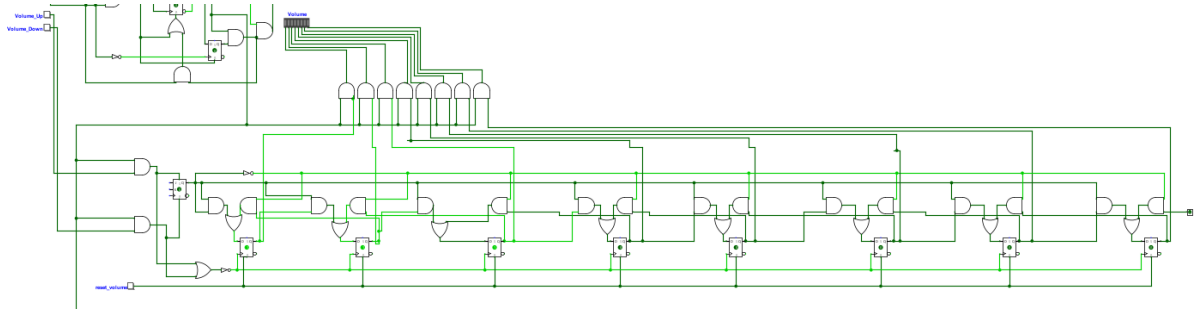

Figure 8: Storage volume settings

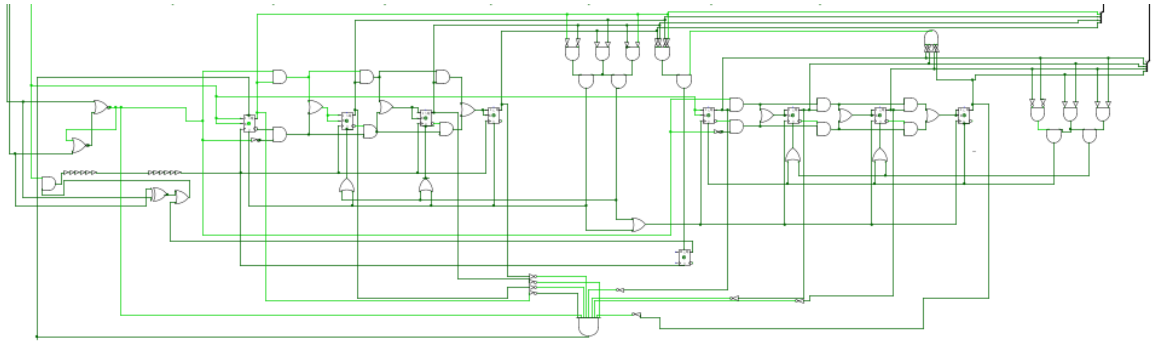

Figure 9: Storage track counter settings

Stage 5B: Implement recall of previous player settings to initialize your player

I have included AND gates in my circuit so that when the circuit is turned ON, the previous settings will be displayed correctly so that even I have turned OFF the circuit, and touch different buttons, the user still cannot affect anything to the circuit when the circuit is in OFF state

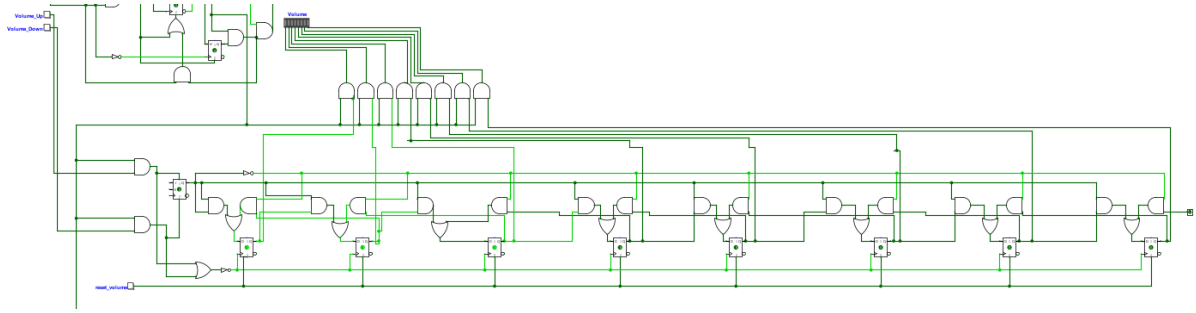

Figure 10: Recall volume settings

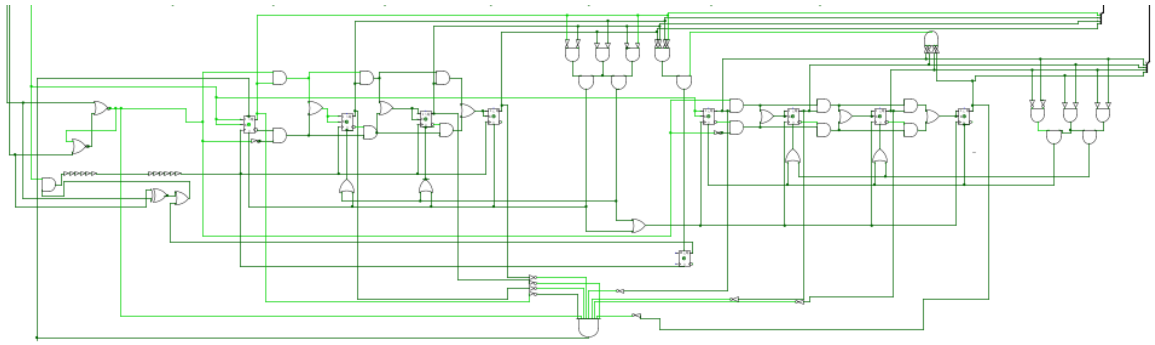

Figure 11: Recall track counter settings

With the Figure 11 show that the bits will be stored in the flip flops automatically and I have used AND gates to prevent any change affect to flip flops when the circuit is in OFF state, and someone accidentally press the button. This circuit can recall the previous track count of the circuit.

Assumption

Note: The assumptions were made while I was developing the circuit so it can be used as my draft for my circuit to test many components whenever it is work or not. I only include the best draft of each circuit in this

Assumption for the PLAY/PAUSE and ON/OFF components

I have tried to create the ON/OFF and PLAY/PAUSE button but for this circuit it is not perfect but still work in some case, the circuit when it is turned on, it will enter the previous state (for example the previous state is PLAY). However, the assignment 1 ask me to make the circuit, when it is turned ON, it must enter the PAUSE mode automatically so this below circuit is not perfect yet.

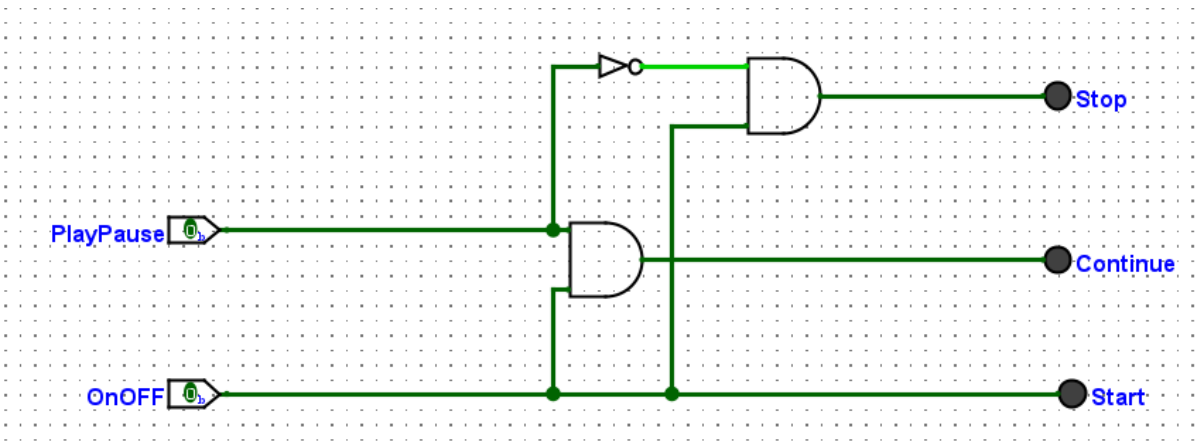

Figure 12: Draft for ON/OFF and PLAY/PAUSE mode

Assumption for the volume components:

I have tried to get create the increase and decrease the volume with 2 buttons, but they come out with the same results. Because the D flip flop cannot hold the value “1” so that’s why it cannot decrease.

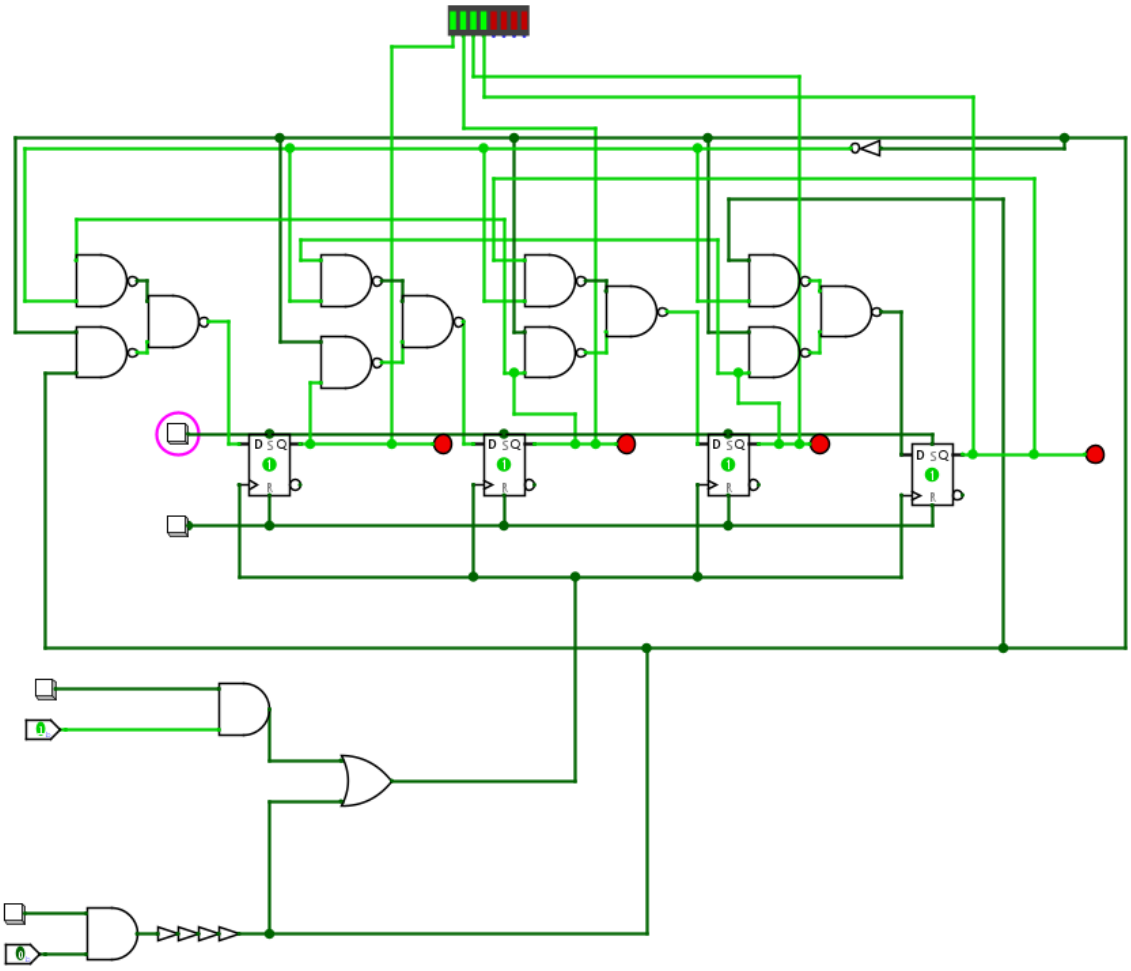

Figure 13: Draft for volume components

Assumption for the increase/decrease track component

For this circuit, it can work properly to increase to the 99 but it cannot go back so I need to figure out the way to add another button to decrease it. Another problem happen to this circuit is that it cannot go back to directly 1 after reaching 99, it must go through 0 before reaching 1.

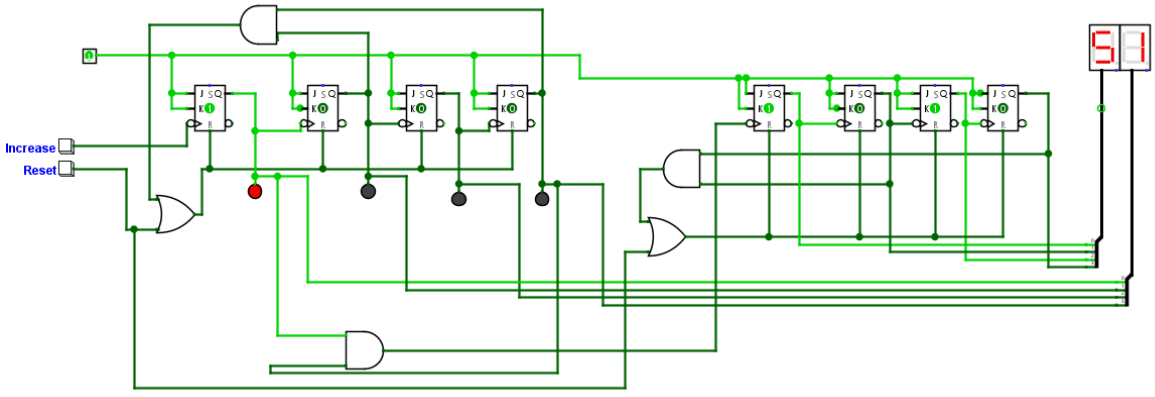

Figure 14: Draft for track counter components

Assumptions for the final circuit

For this circuit it can run normally but there are some flaws such as it will display incorrectly when we first start up the circuit but for later, it can work normally, perfectly.

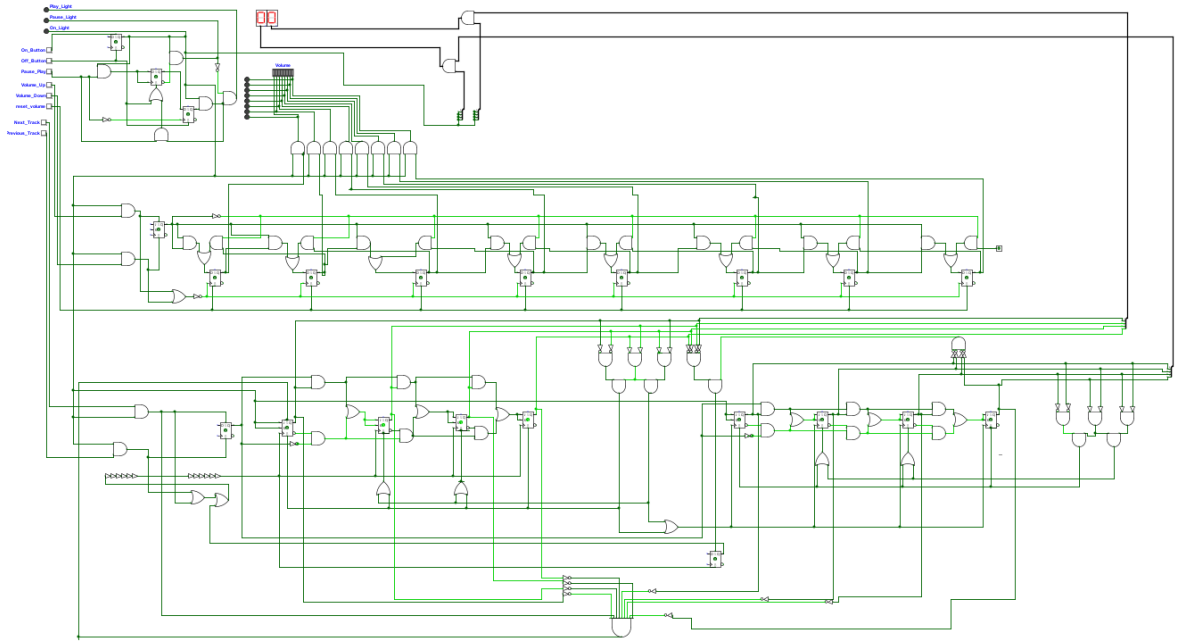

Figure 15: Demo for final circuit

Conclusion

Problem of the circuit

I think there are 1 problem that I have identified in my circuit are:

- The track skipping system when get back to 99 from 1 is still slow for 1 second I think because the moment I press and hold the button, I see the 00 display.

The final circuit

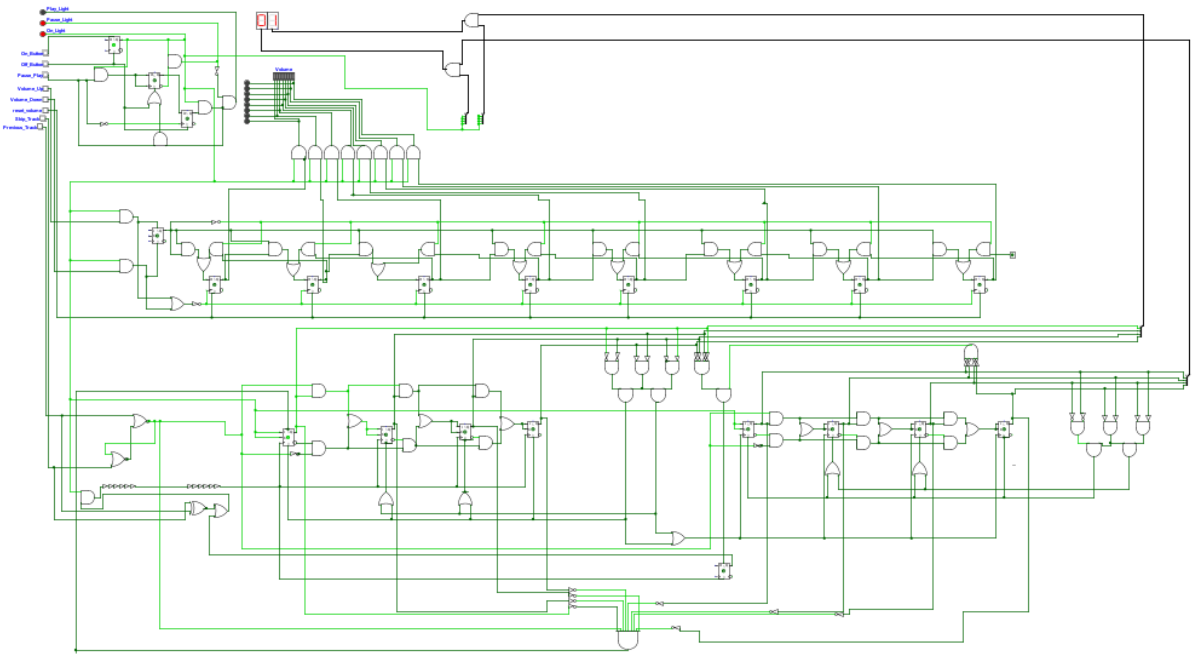

Figure 16: Music play circuit