Osmond's Academic Portfolio

Taipei Municipal Zhong-Lun High School

Course Name
Self-study of Circuits(A part of Applying Tech)

Instructor

Mr. Huang 黃敦紀
Brief Introduction
This is a journal of my self-study based on circuits, including a simple nightlight I designed using knowledge and principles from my self-study.

I. Motivation & Learning Objectives

In the course Applying Tech this semester, the teacher only planned to let us know the basic principles of engineering and in turn taught us how to build things using Onshape. In other words, this task wan't required by my teacher; however, I've always had a strong passion for technology and engineering, so I spent my own time having some discussion with my teacher about how I could study circuits on my own and what I could produce as a learning outcome. After a few times of discussion with the teacher and some further research I did on my own, I gradually had a picture of how circuits, transistors, and current work in detail. Also, I figured out that I would design a virtual circuit that functions as a light-sensitive nightlight as my final outcome. In the following pages, I will demonstrate my learning journal, the data I collected, and pictures of the virtual circuits, etc.

II. Task/Project & Learning Methods (A)-Concept explanation

To successfully design a light-sensitive nightlight, I had to use transistors to connect two independent circuits; one is used to control the voltage that function as a switch, and the other one is used to let the LED glow. In addition, I would design the nightlight applying to the concept that input different values of voltage can result in different values of current. Thus, I just needed to find two different values of voltages that could individually turn the LED on and off. After finding two different values that could successfully let the LED turn on and off, I used the advantage of the photoresistor (LDR, light-dependent resistor) that is a light-dependent resistor that changes its resistance when different amounts of light fall on it. As light intensity is increased, the resistance will be decreased; as the resistance is increased, the voltage will be increased as a result according to Ohm's law
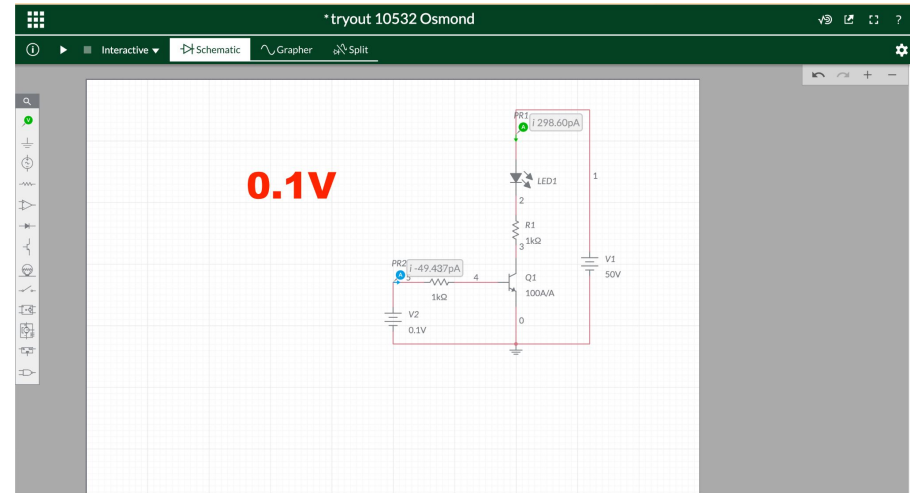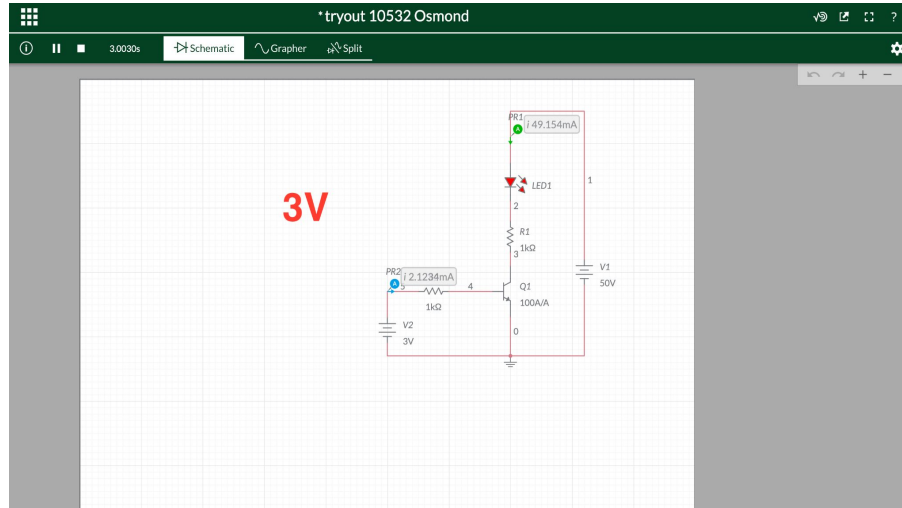
II. Task/Project & Learning Methods (B)-Data collection-1

Here is the data of the relationship between different values of voltage and current.

V(voltage)	PR1(current)	PR2(current)	LED
3	49.154mA	2.1234mA	
2.5	49.145mA	1.6239mA	
2.0	49.130mA	1.1244mA	
1.5	49.091mA	624.95µA	
1.2	33.497mA	334.97µA	
0.9	7.4019mA	74.018µA	

II. Task/Project & Learning Methods (B)-Data collection-2

While documenting all these data coming from different values of voltage, I had come up with a few takeaways. All in all, Transistor can directly affect and even just determine the values of PR1 and PR2; however, to be more specific and practical, the higher the value of voltage is, the higher the current is. In other words, the higher the value of voltage is, the more chance the given LED can work.
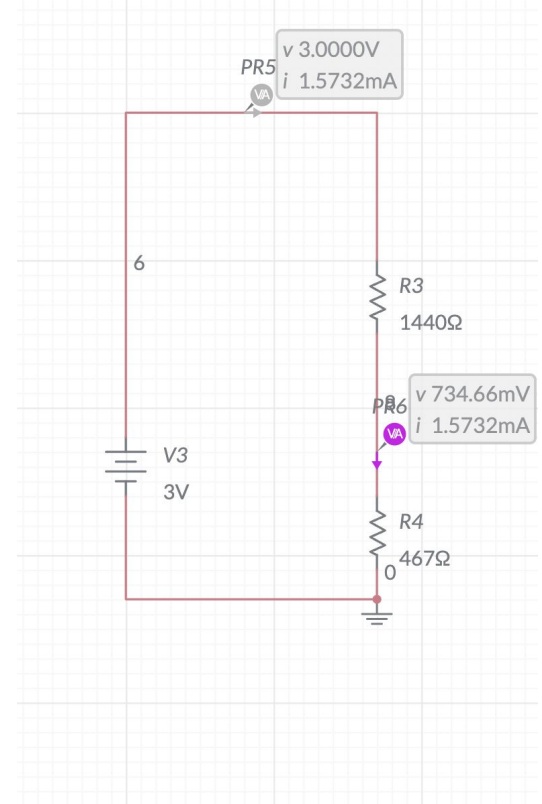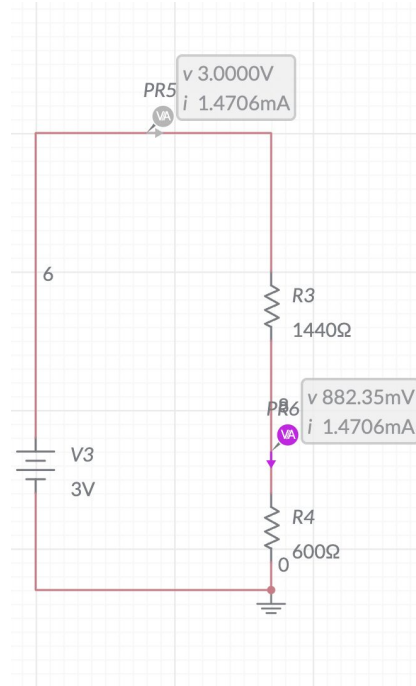
II. Task/Project & Learning Methods (B)-Data collection-3

This is the data of voltage divider circuit. I found two values of voltage that could let the LED turn on and off, so I had to find their values of resistance in order to control the photoresistor; I did this since the current always remains the same in a series circuit.

R3(ohm)	R4(ohm)	R3/R4	I	V2	LED
1440	600	2.4	1.4706mA	0.9	
1440	467	3.1	1.5732mA	0.7	

II. Task/Project & Learning Methods (B)-Data collection-4
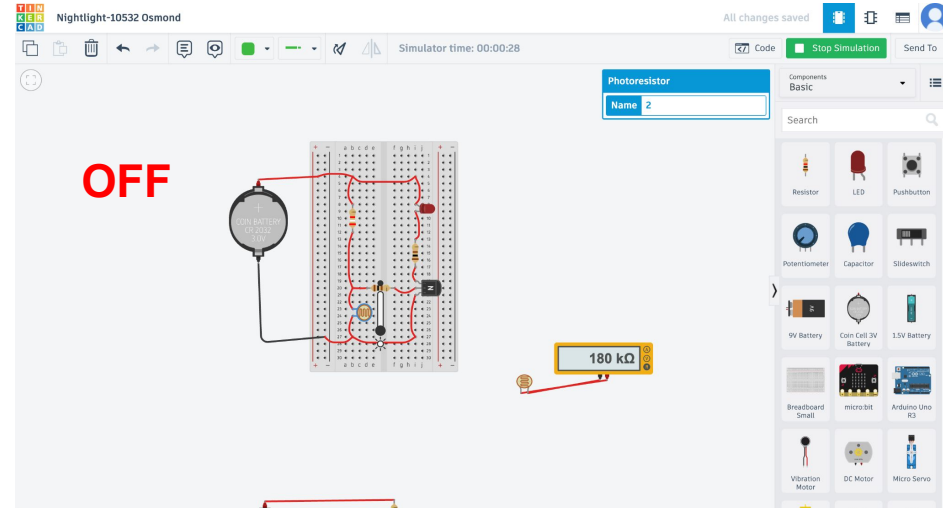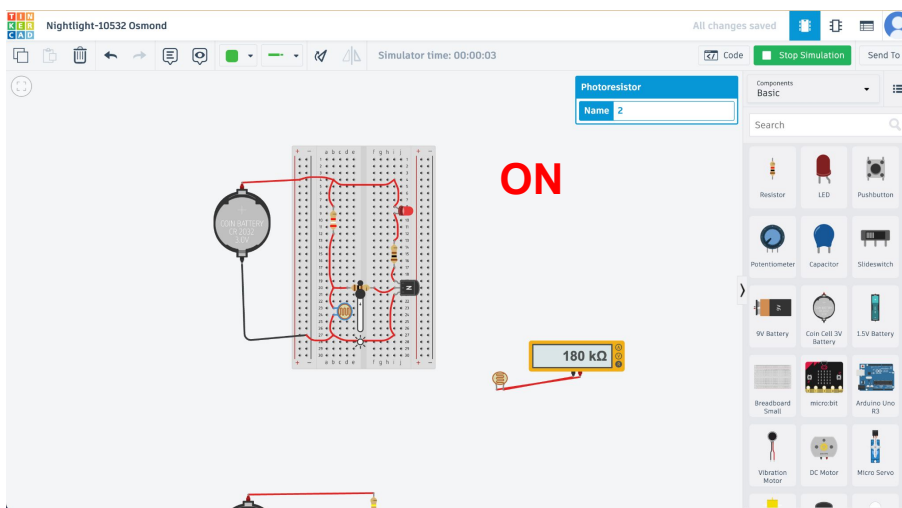
Voltage Divider Circuit:

II. Task/Project & Learning Methods (C)-Nightlight Design

After having all the data I collected and some research of how circuits work, I then designed a virtual nightlight circuits using Tinkercad.

Link to the design:

https://www.tinkercad.com/things/fz5rzhZS9Av-nightlight-10532-osmond/editel?sharecode=ZHMXmZSAnXObXNyX8foU-gy5Apo6A0t6vpS6CVvPZjA

III. Difficulties/Challenges

This path of self-study wasn't a smooth path all along the way, I bumped into a key mistake that stopped the entire circuit from working. The problem I had was that the current(I) might vary when having different resistance. Also, I have to make sure that R3 remains the same when V2 is either 0.9 or 0.7. Finally, I still finished the nightlight successfully under the teacher's help and instruction, I found out that I should not connect the circuit with the multimeter if I want it to work out.

IV. Reflection

I'm truly glad that I had the opportunity to self study circuits and electrical engineering during the class and then learn much more things than I could ever expect. The most important thing and mindset I learned along the way is definitely self-discipline. I had to spend a lot of time learning the theory and collecting data on my own, so none of this would happen without self-discipline. Nonetheless, being able to be persistent is also another key for me to get the final outcome. While learning things on my own, I thought about giving it up a lot of times; however, I still managed to go through those dark moments since I always know how sweet the fruit will be if we wait for it to bear. In the future, I'll certainly remember all the experience I had and mindset to study and work on my own through the amazing Internet constantly in order to keep up with this rapid era.