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**Assessment Cover Sheet**

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**Assessment Title**

*Project (Traffic Light Simulator) (30%)*

*Bachelor of Engineering Technology*

**Programme Title:**

*ENB5000*

**Course No.:**

*Electrical Fundamentals*

**Course Title:**

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**Due Date:** **Date submitted:**

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# Abstract

This project is about constructing and simulating a traffic light circuit. By building the prototype circuit on a breadboard and using altium designer to draw the traffic light circuit diagram and design the PCB board. After that, constructing the electronic components on the PCB board. In this report the electronics components used in the circuit will be verified. The functioning of the traffic light will be discussed showing the difficulties and obstacles faced.

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# Objectives

The main objective of this project is to create a traffic light circuit on a printed circuit board. Building and testing a circuit on a breadboard based on the circuit diagram, drawing and simulating the circuit by using altium design are required too. Assembling the right components and testing them is important.

# Introduction

Initially a breadboard was used to test the components and how they function later on the circuit was designed on altium designer software for simulation and in order to produce a PCB. Once the PCB was printed the components were added on and then soldered, eventually the circuit was connected to a power supply of 9V where it worked as required.

# Transformer Testing

# Breadboard prototype

# 

To create a traffic light circuit producing a components list is needed as a first step. Based on the traffic light circuit, building the circuit on the breadboard and testing it was my next step.

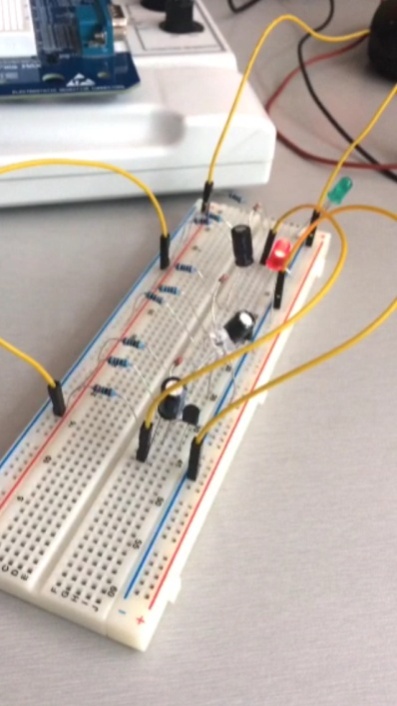
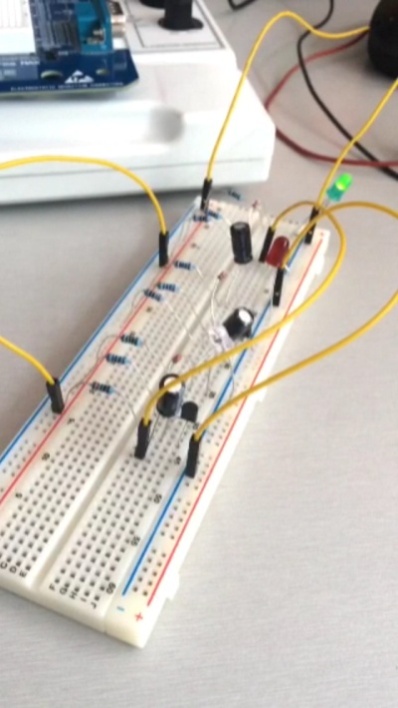
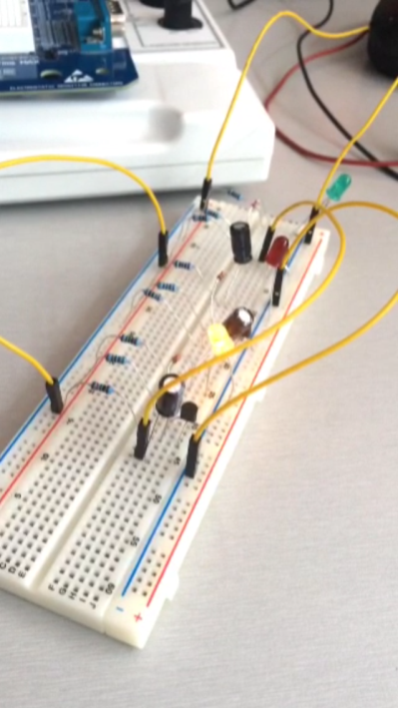
  

Figure 1

Figure 2

Figure 3

the red led is the first to light on then it turns off and the green led lights on and turns off then the yellow one and so on.

The concept of the circuit idea is :

1. The current flows in the circuit and charges the capacitors.
2. When the capacitor is fully charged it begins to discharging because of the transistor that is connected to it.
3. The transistor switches on and allow the current to flow into the LED consequently the LED turns on.
4. The time period of the LED to turn on relies on the discharge of the capacitor into the transistor.
5. When a transistor switches off the current will stop flowing to the LED and it will light off as well.
6. As a protection for the circuit diodes are used to stop the flow of current to the LED during the transistor is switched on which create an open circuit.

After that, the circuit diagram was created and simulated then created a design for the PCB by using altium designer. The electronic components were replaced from the breadboard to the printed circuit board. And they are soldered to the printed circuit board by using soldering machine.

# Circuit Diagram

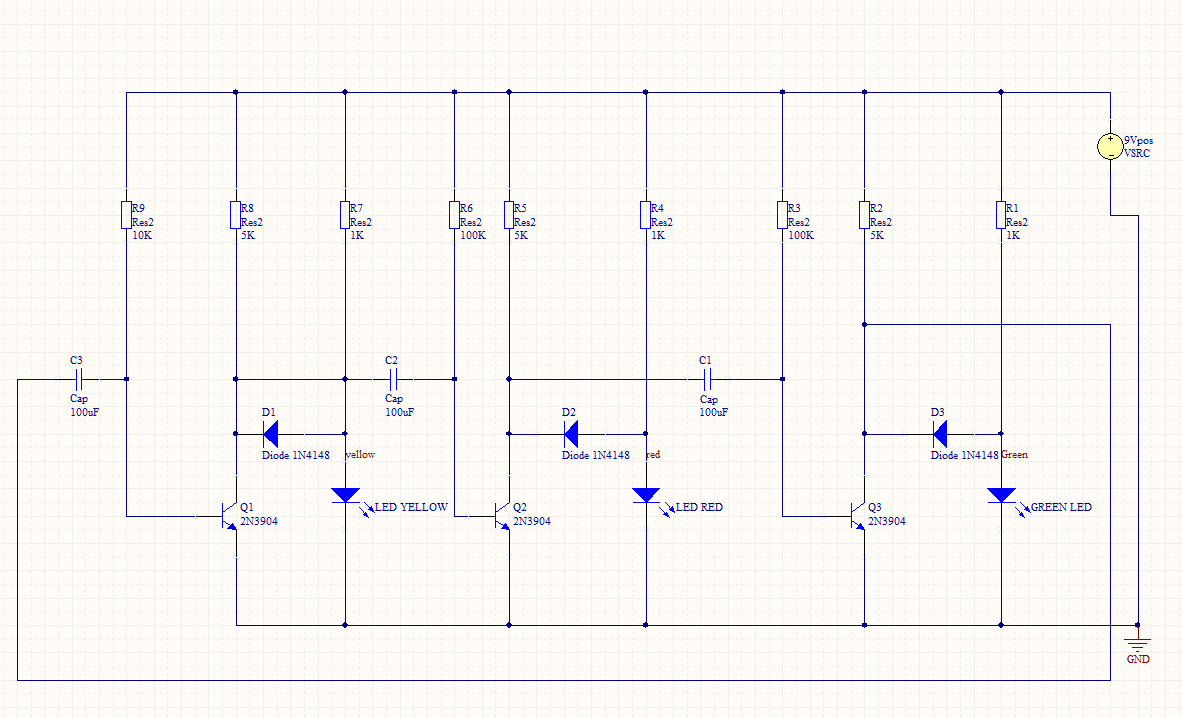
After the breadboard prototype, the circuit diagram has been designed by using altium designer 

Figure - Circuit Diagram

# PCB Diagram

A design for the PCB has been created by using altium designer software and then printed on a PCB board.

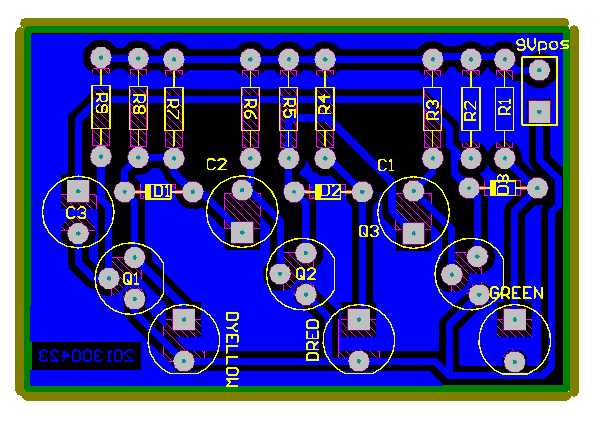


Figure - PCB Diagram

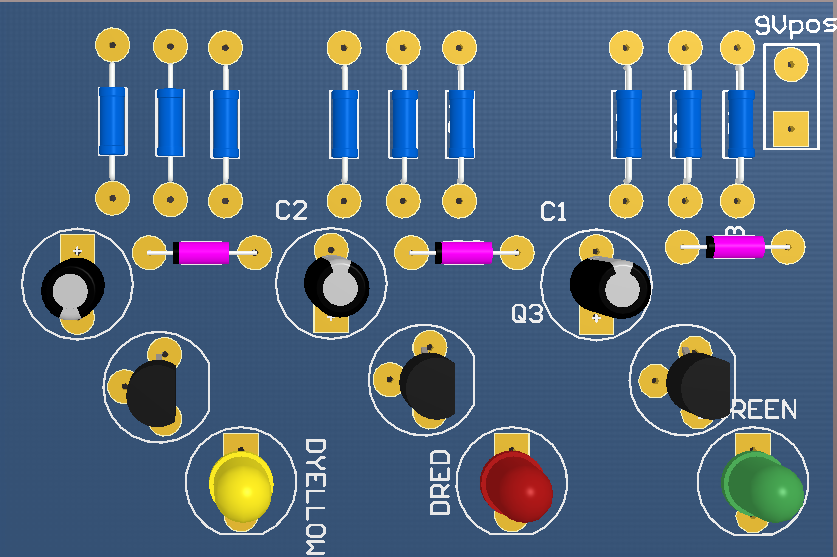


Figure - PCB 3D Diagram

The electronic components were replaced from the breadboard to the printed circuit board. And they are soldered to the printed circuit board by using soldering machine.

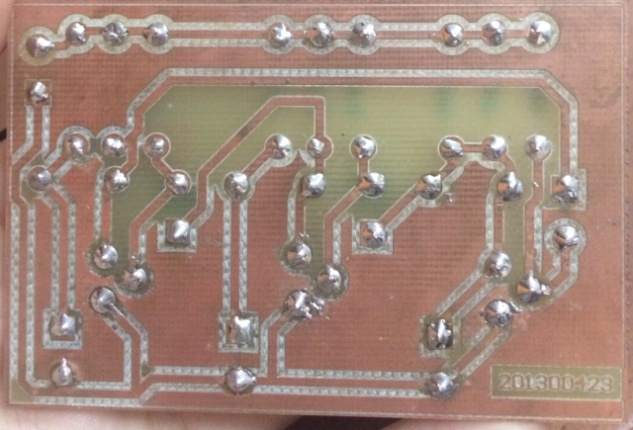


Figure - Soldering

Figure - PCB Board

# Simulation

The simulation has been done by using the altium design and it presents the LEDs (red, green and yellow) when they light on and off.

Figure - Simulation

# Components

Table – Components

|  |  |  |
| --- | --- | --- |
| Quantity | Component | Type |
| 3 | Transistors | 2N3904 |
| 1 | Resistor | 10K |
| 3 | Resistors | 5K |
| 3 | Resistors | 1K |
| 2 | Resistors | 100K |
| 3 | Capacitors | 100uf |
| 3 | Diodes | 1N4148 |
| 3 | LEDs (Light-emitting Diodes) | Red , yellow and green |

# Discussion session

After building the circuit on the breadboard measurements (time period of the LED when it lights on and voltage across each LEDs) had been taken by the multi-meter. The power supply in the circuit was 9v

Table - Experiment

|  |  |  |
| --- | --- | --- |
| LEDs | Time | Volt |
| Red | 1.9s | 1.7v |
| Green | 1.9s | 1.9v |
| Yellow | 0.6s | 1.9v |

Table - Simulation

|  |  |  |
| --- | --- | --- |
| LEDs | Time | Volt |
| Red | 6s | 1.25v |
| Green | 6s | 1.25v |
| Yellow | 1s | 1.25v |

And the measurements of the experiment is similar to the simulation on altium designer which designates success of both.

To improve this project is to make the traffic light as the real one, the red LED light first then the yellow LED after that the green LED. Moreover the period of time of each light stays on should be longer because if the actual one was used as a real traffic light the car will not have enough time to move. To do that we have to increase the capacitance or the resistance.

The most difficulty I faced was soldering and putting the transistors in the right way. Another thing, designing the PCB and having errors in the simulation were challenging.

I enjoyed designing the PCB board and soldering though they were not easy.

# Conclusions

The project was successful. The objectives were accomplished. The circuit had been built on a breadboard then PCB board by replacing the electronic components and soldering them to improve the success of the traffic light.

# References sections

*Resistor Color Codes*. (2000, 03 19). Retrieved from http://www.aikenamps.com/ResistorColorCode.htm