HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY

Report Project 1: A LIGHT SENSING CIRCUIT

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Course:
ELECTRONIC DEVICES AND CIRCUIT(LAB)

May 8^{th}, 2019

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Light Sensing Circuit

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1 Proceeding Steps

1.1 Circuit Analysis

When clapping-sound is not recorded, this expression can be inferred:

$$V_{VG1} = 0(V)$$
$$V_{R_{4,5}} = \frac{V_1 x R_5}{R_4 + R_5} = \frac{12x10}{10+10}(V)$$

• In case of $V_F = 3V \longrightarrow 3.4V$.

$$V_3 = V_2 = 6(V)$$
$$\Rightarrow V_{2,3} = 0(O)$$

• Choose $R_L = 40000\Omega$, we have the following expression:

$$V_{out} = V_{R_1} = V_{R_2} = 6(V)$$

When a clapping-sound is detected:

$$V_{VG1} \neq 0(V)$$

C_1 Helps standardize the signal.
$\Rightarrow V_{mic}$ change.
$\Rightarrow V_{mic} = 6(V) - V_{VG1}$.
There is a current running through the circuit.

$$i = \frac{V_{mic}}{R_2} = \frac{V_{mic}}{1K(\Omega)}$$

Applying Kirchoff's Laws:

$$\begin{aligned}
& I_{R_1} = I_{R_2} + I_{R_3} \\
\Longrightarrow\ & I_{R_1} = I_{R_2} + I_F \\
\Longrightarrow\ & I_{R_1} = \frac{0.7}{R_2} + I_F \\
\Longrightarrow\ & I_{R_1} \in [0.025; 0.03](A)
\end{aligned}$$

Measurement results in laboratory reportedly show that voltage at the two ends of the capacitor peaks at $12\sqrt{2}(V)$.

$$V_{0C} = 12\sqrt{2}(V)$$

• In case of the worst situation when $V_{DC} = 18.8(V)$ so that R_1 is going to be designed in a way such that $V_{DC} = 12(V)$.

$$\begin{aligned}
\Longrightarrow\ & R_1 = \frac{18.8 - 12}{I_{R_1}} \\
\Longrightarrow\ & R_1 \in [227; 275](\Omega)
\end{aligned}$$

1.2 Power Evaluation

Given the fact that, the circuit is designed to operate normally at the 12V voltage level. While the value of V_{AC} reportedly stations at 14V ($V_{AC} = 14V$), which resulted in the following value:

$$V_{DCwithoutR_1} = 18.8(V)$$

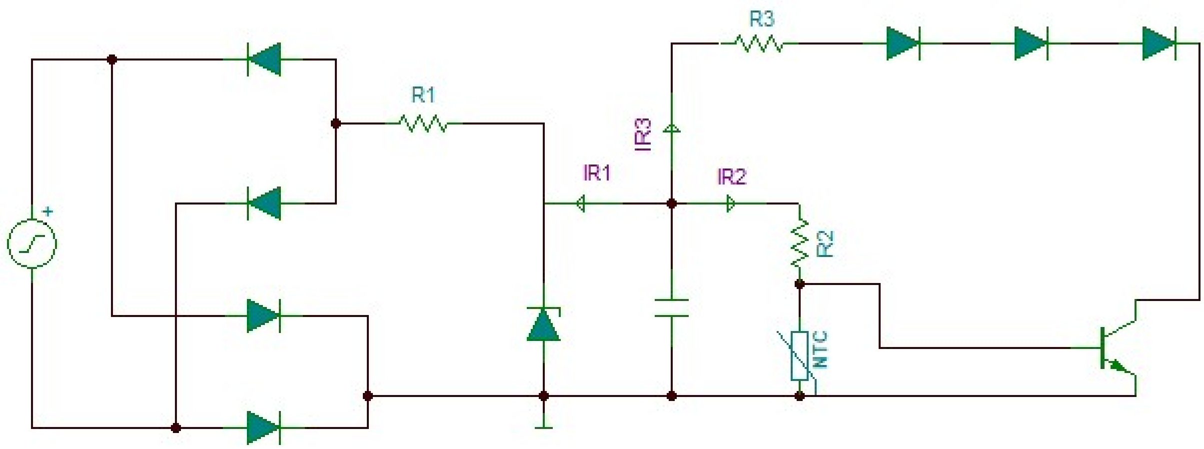
That result leads to the below calculations:

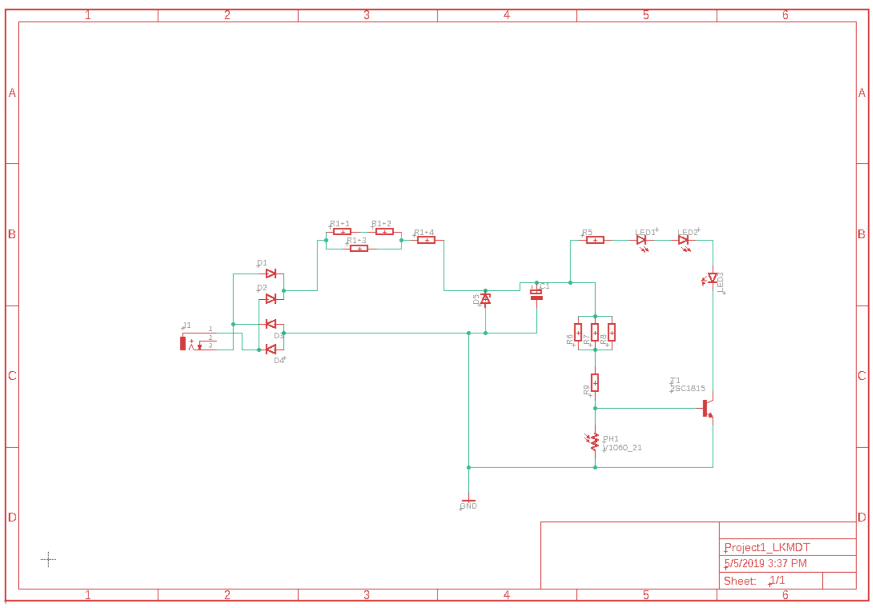
$$\begin{aligned}
& \bullet\ V_{R_1} = 18.8 - 12 = 6.8(V) \\
& \bullet\ P_{R_1} = \frac{(18\sqrt{2} - R_1)^2}{R_1} \\
\Longrightarrow\ & P_{R_1} \in [0.168; 0.204](W)
\end{aligned}$$

Given the Safe Factor to be ≥ 1.5. If V_{AC} exceeds the common voltage of $12V$, the circuit can withstand up to $18.8V$ before suffering structural damages.

$$\begin{aligned}
& P_{R_1} = \frac{(18\sqrt{2} - 12)^2}{R_1} \\
\Longrightarrow\ & P_{R_1} \in [0.7; 0.8](W)
\end{aligned}$$

• Choose $R_1 = 250\Omega, 0.5W$ in order to guarantee that the circuit can withstand the voltage up to 1.5 times higher than the normal designed voltage.


R3
R1
IR3
IR1
IR2
R2
NTC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GND
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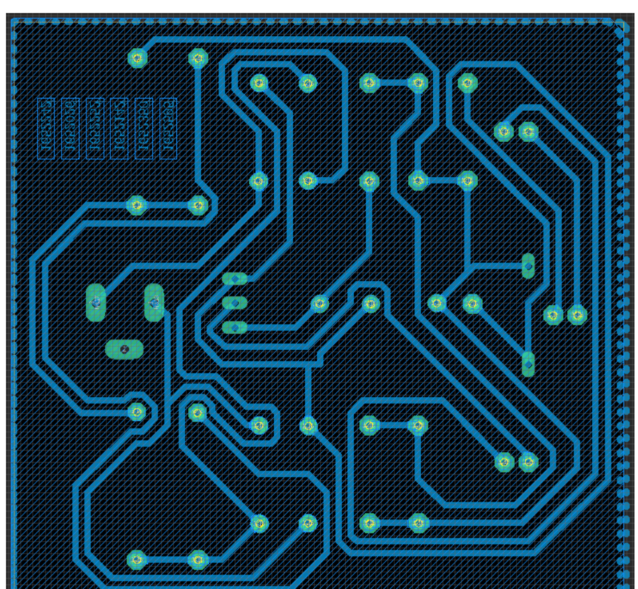


2 Proceeding Steps

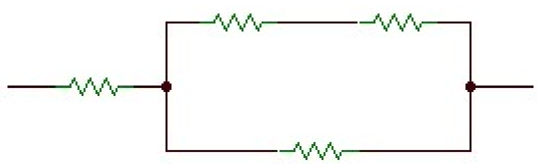
2.1 Components List

- 100Ω, $1/4W$ Resistor
- 150Ω, $0.5W$ Resistor
- $470K\Omega$, $1/4W$ Resistor
- Light Sensoring Resistor
- Zener Diode
- C1815 NPN Transistor
- 3 LEDs
- 4 Diodes

2.2 R_1, R_2, R_3 Build Method

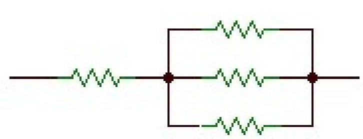
2.2.1 R_1 Component

Only 150Ω, $0.5W$ Resistor is avalable. Thus system of R_1 resistors are built as follow in order to get the exactly calculated value $R_1 = 250(\Omega)$.
R1:



2.2.2 R_2 Component

System of R_2 resistors are built as follow in order to get the exactly calculated value $R_2 = 645(K\Omega)$.
R2:



2.2.3 R_3 Component

$R_3 = R = 100(\Omega)$.

R3: