Student 1 : Mustafa Barış Emektar 2304533
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Assistant : Murat Bayraktar

Date : 08.12.2019
Group : Friday Morning

EE213 Pre-Report

Introduction

In this project, we will design a circuit that determines the environmental noise level. To accomplish that, this circuit will gives feedback by lightning a LED in three different time scales. The levels of noises will be proportional with the time that LED is lightning. First, the sound that is collected by a microphone will be changed into a corrected DC voltage. Then, this voltage will be compared with three different levels and as output 3 levels of voltage values will be obtained. After that, this output will compared with the triangular wave that is created from another part of the circuit by using a square wave input, and the resultant voltage will give the time that is necessary for the LED to lighten.

Overall Circuit Block Diagram & Explanations

The circuit will have six units. The diagrams and the explanations of the units have been given below.

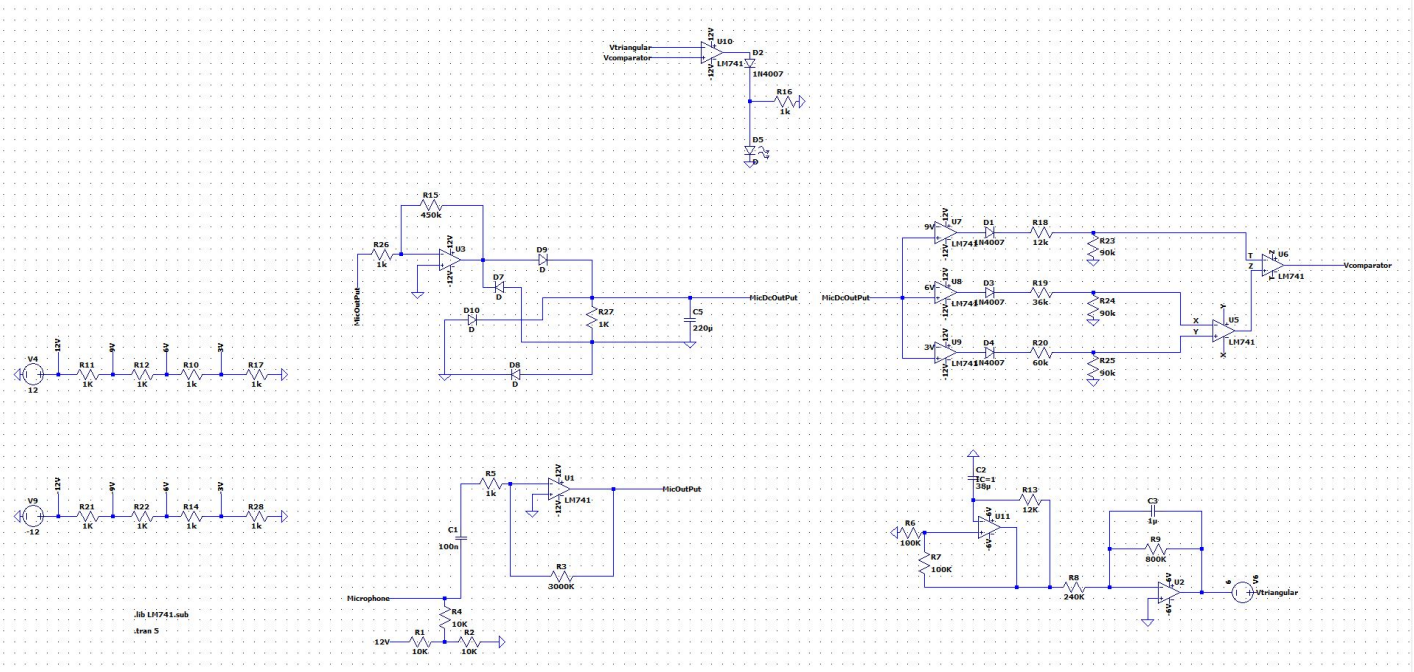

Figure 1: General Schematic of Circuit

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1. Microphone Corrector Unit

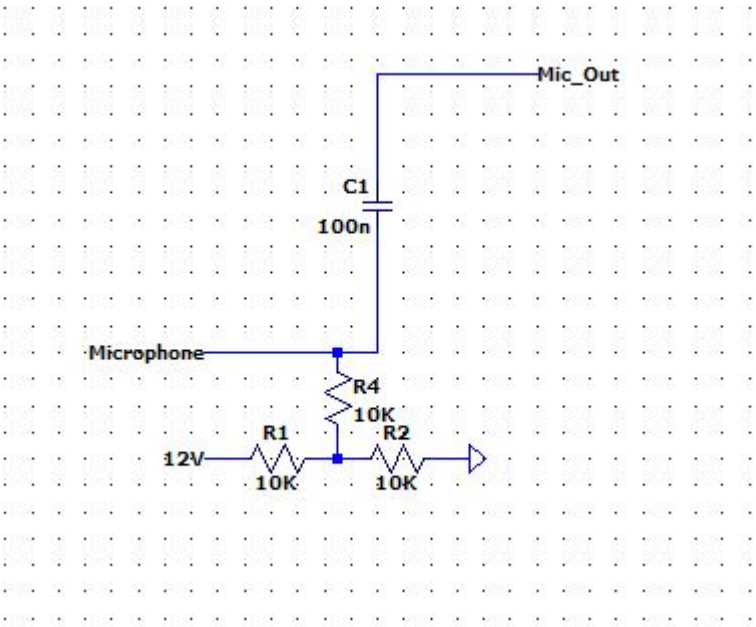

Figure 2: Microphone Corrector Unit

This unit blocks the noises come from environment with the help of capacitor. And 12V source is used to supply the microphone.

2. Microphone Amplifier & Transformer Unit

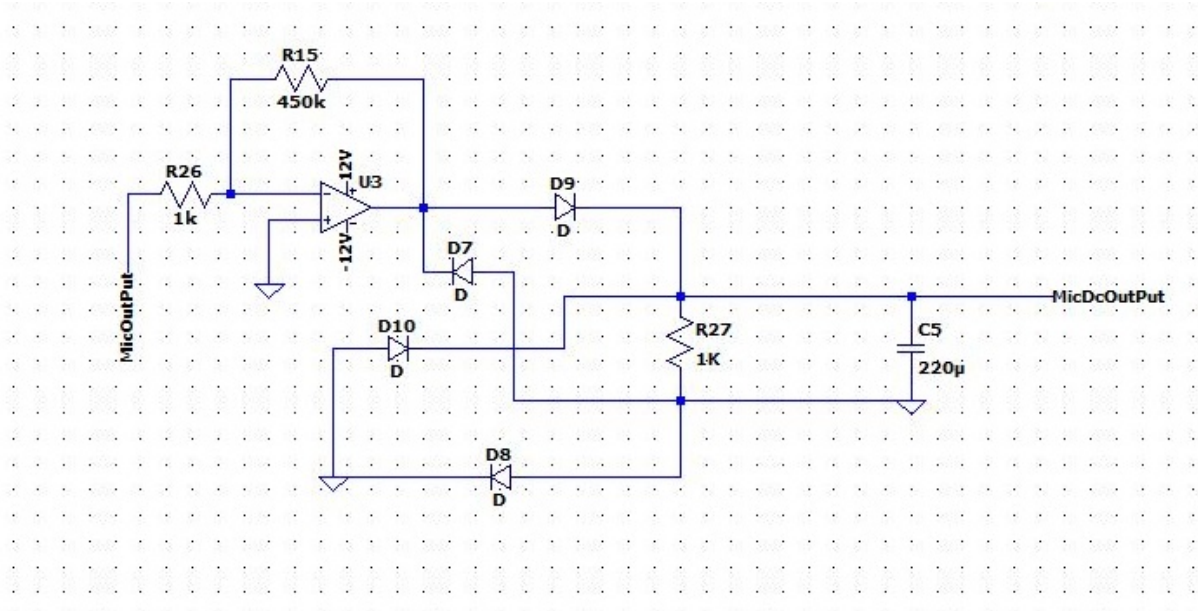

Figure 3: Microphone Amplifier Unit

In this unit of circuit, microphone voltage has been boosted and transformed to dc voltage. The diodes of unit have been used to change AC voltage to DC voltage. Also, non-inverting amplifier is used to boost the voltage of input.

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3. Comparator Unit

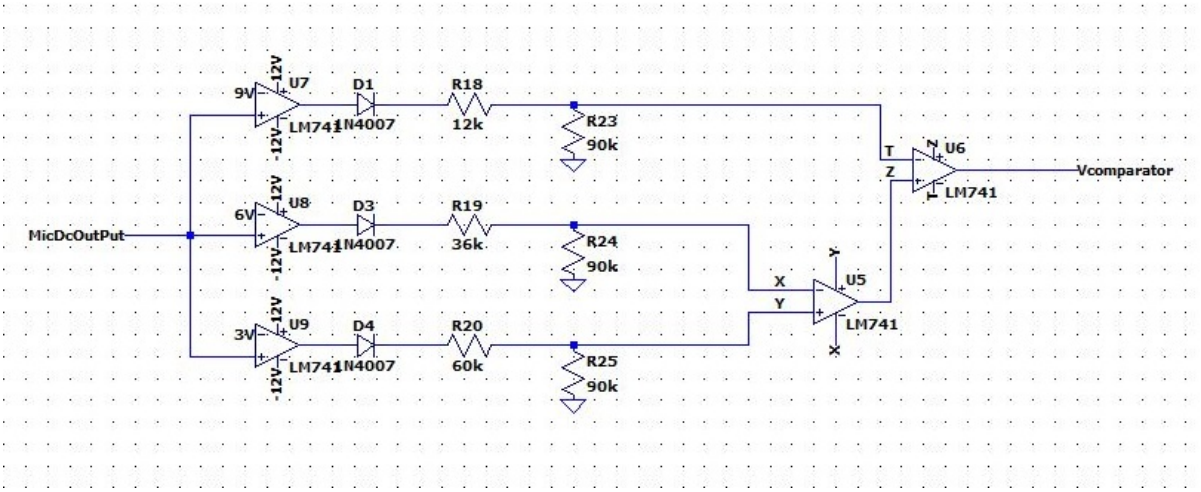

Figure 4: Comparator Unit

In comparator unit, level of the transformed voltage of microphone has been determined by three op-amps have different saturation values. The reason of these op-amps is to separate the voltages by three gaps. Beside this, with the two op-amps at the end of the circuit, the biggest output of entrance op-amps has been separated.

4. Triangular-Wave Creater Unit

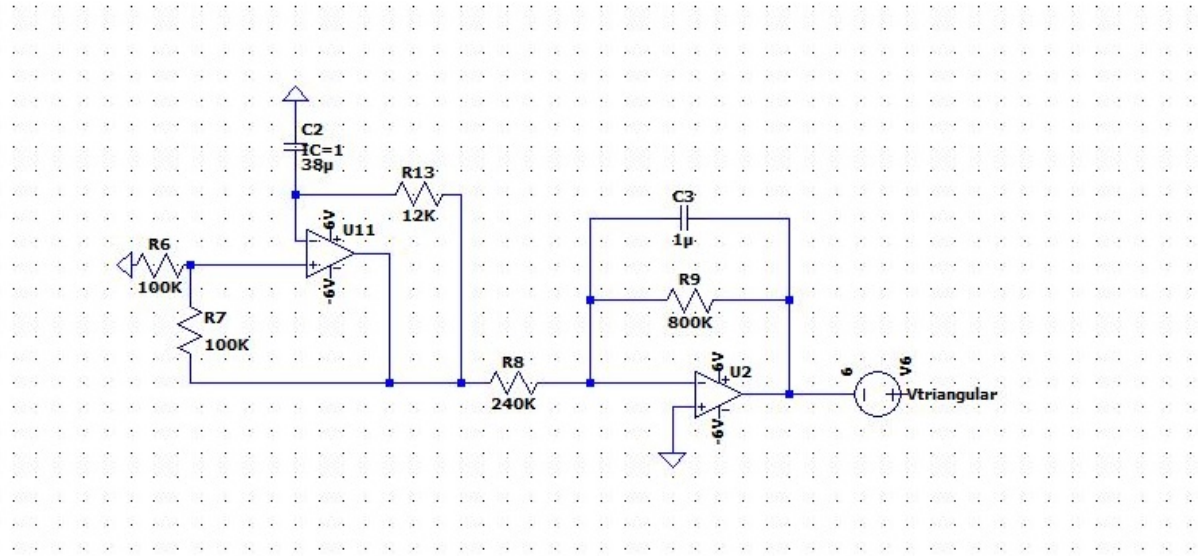

Figure 5: Triangular-Wave Creator Unit

In Triangular-wave creator unit, a triangular wave with frequency of 1Hz has been created to compare with output of comparator unit. The wave changes its shape from square to triangle due to differentiator amplifier.

5. Led Unit

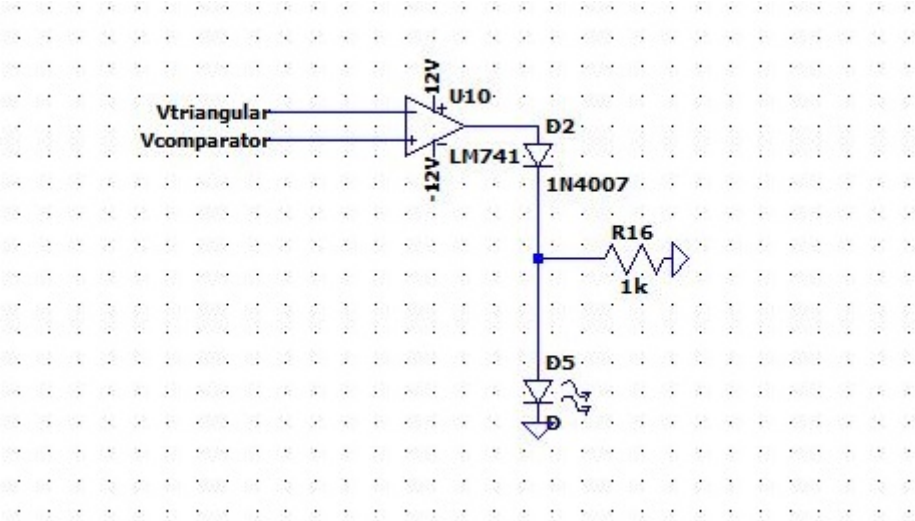

Figure 6: LED Unit

In led unit, output of comparator unit and output of triangular-wave creator unit have been compared and proper saturation voltage has been given so that we obtain different waves with different duty cycles. With these waves, LED has been lightened with different frequencies according to initial given microphone inputs.

6. Voltage Source Unit

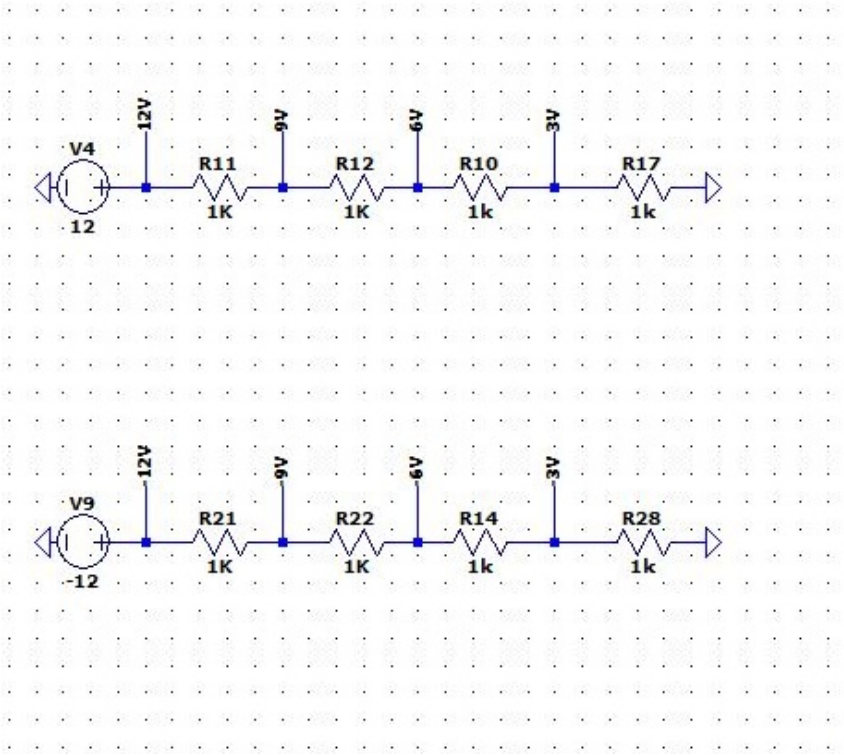

Figure 7: Voltage Source Unit

In voltage source unit, the saturation voltages of the operational amplifiers have been provided. With the proper resistors, intended voltages have been obtained.

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Basic Formulations

Simulation Results

1. Final Simulations

- Green line shows the triangular-wave
- Red line shows boosted and transformed voltage of microphone
- Blue line shows final output of circuit. Led will be lighened by this voltage.

a.

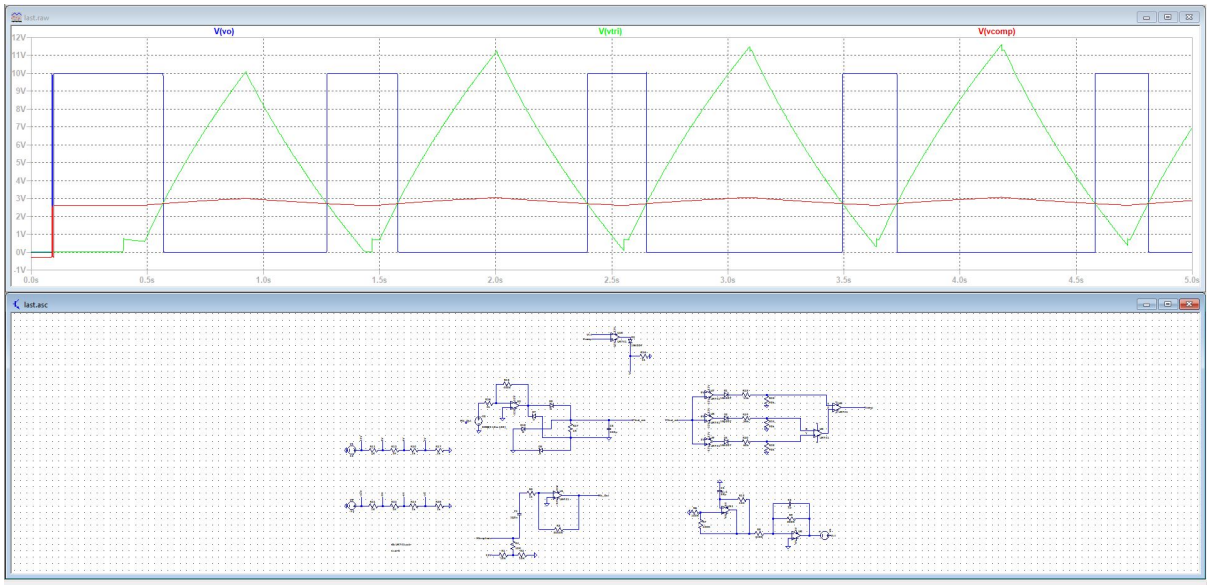

Figure 8: Triangular-Wave Creator Unit

In this result the input was 10mV and it can be easily understood from figure 8 the duty cycle is %25.

b.

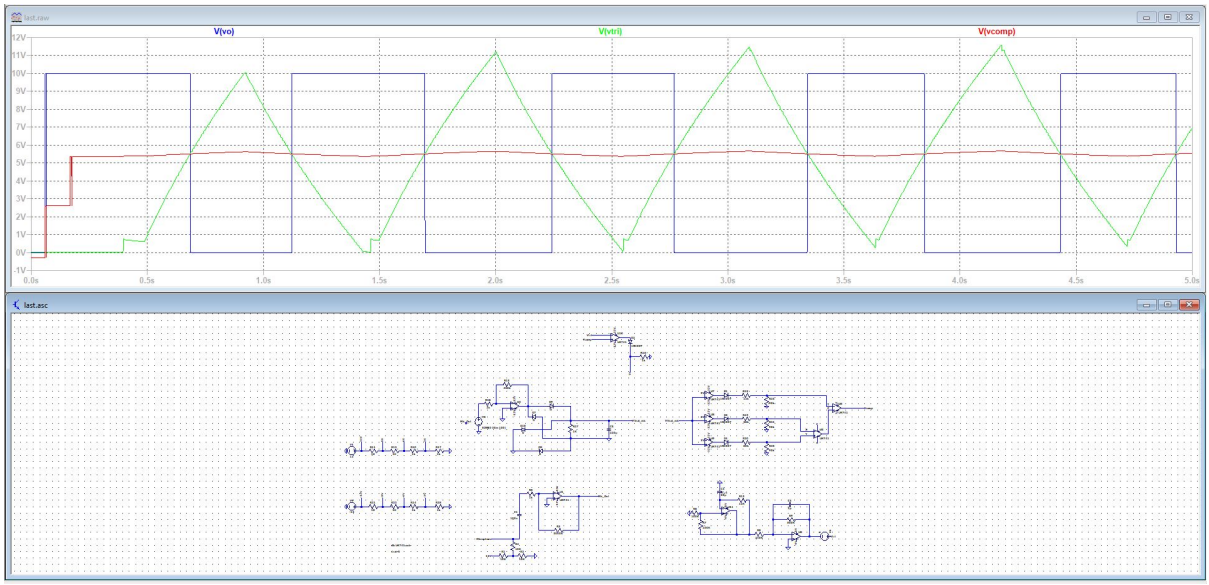

Figure 9: Triangular-Wave Creator Unit

In this result the input was 35mV and it can be easily understood from figure 9 the duty cycle is %50.

c.

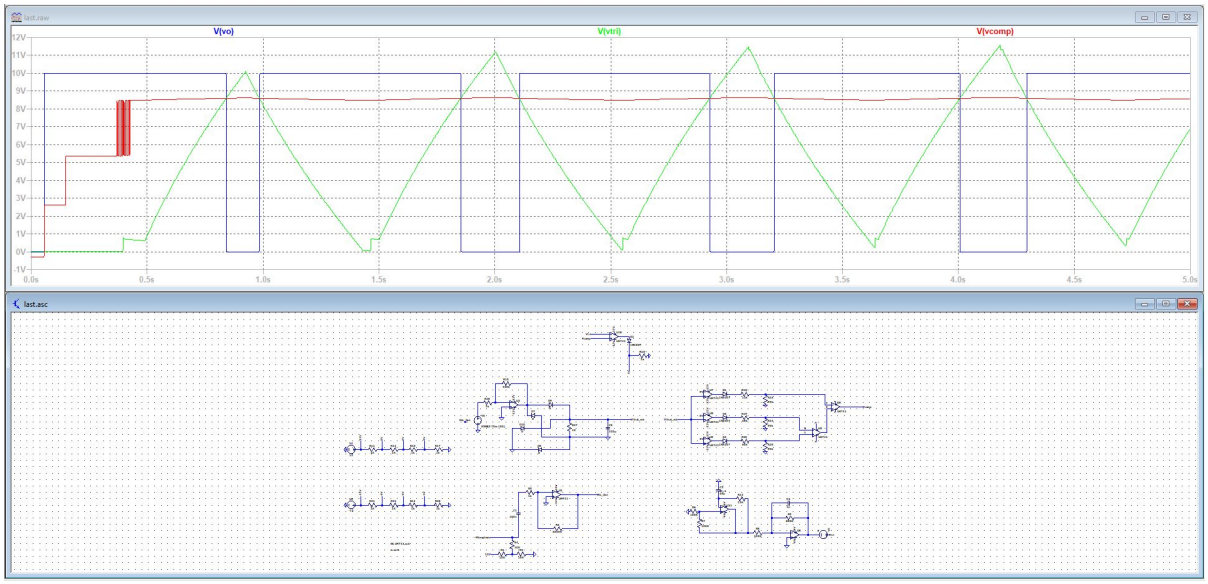

Figure 10: Triangular-Wave Creator Unit

In this result the input was 75mV and it can be easily understood from figure 10 the duty cycle is %75

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2. Simulation of Triangular-Wave Creator Unit

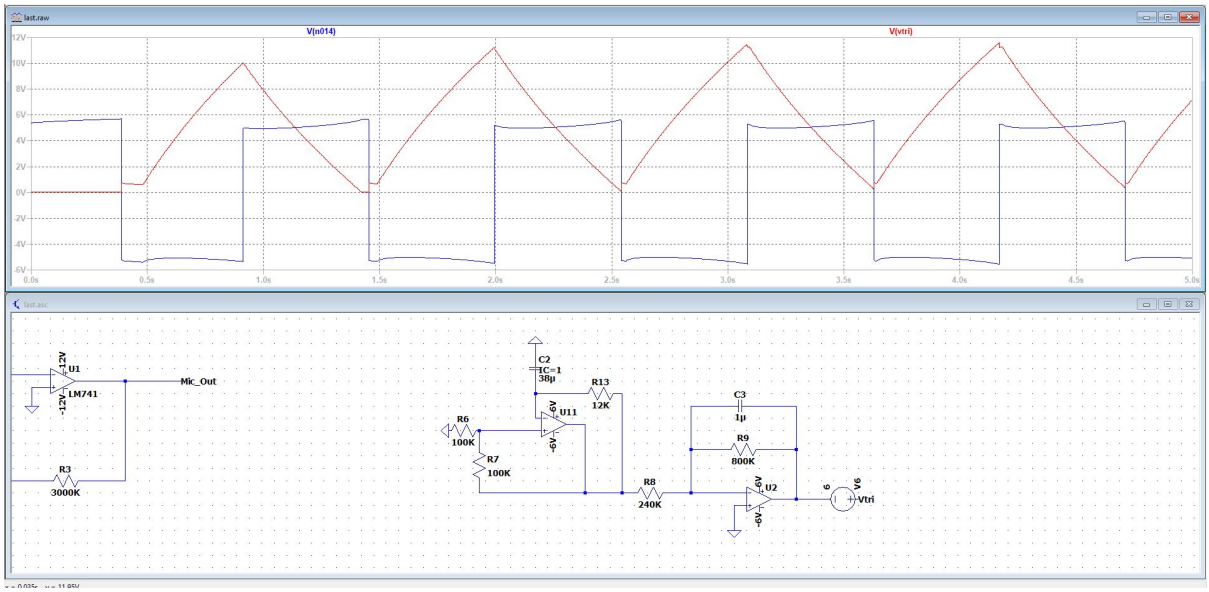

Figure 11: Simulation of Triangular-Wave Creator Unit

The blue line indicates the input of triangular-wave creator unit and the red line shows the output of this unit.

3. Simulation of Comparator Unit

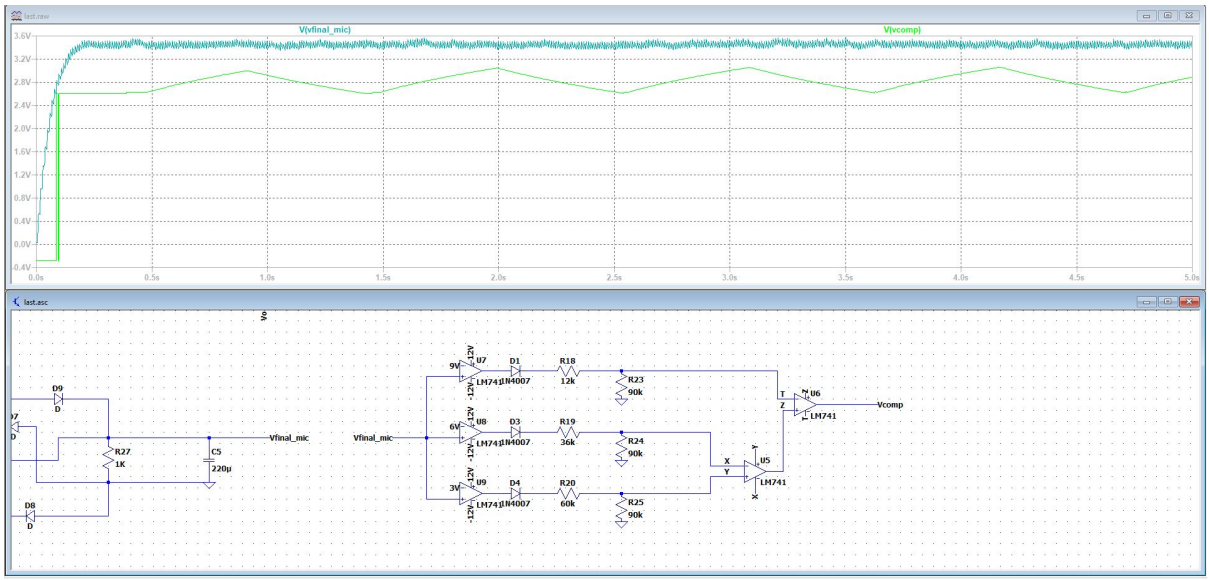

Figure 12: Simulation of Comparator Unit

The blue line shows input of the comparator unit, which is output of microphone voltage amplifier & DC transformer unit and the green line shows the output of this the comparator unit. Desired output has been obtained by the comparator amplifiers used in unit. The fluctuations of the

output voltage may result from the elements which aren't ideal such as LM741 Op-Amps & 1N4007 Diodes.

4. Simulation of Microphone Voltage Amplifier & DC Transformer Unit

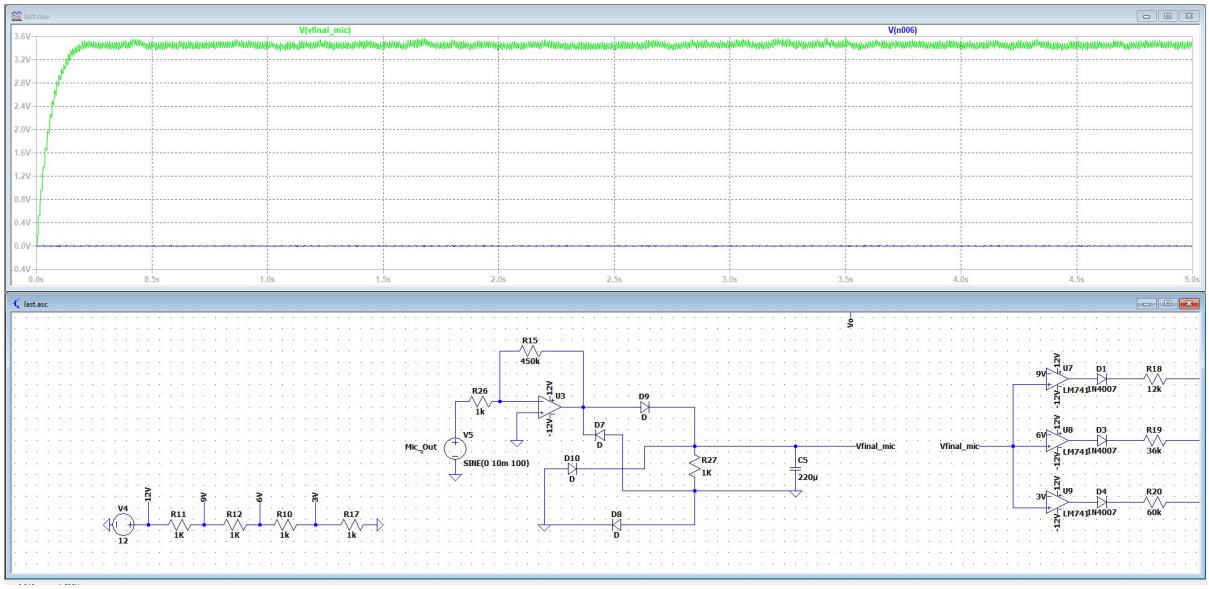

Figure 13: Simulation of Microphone Voltage Amplifier & DC Transformer Unit

The green line shows the boosted and transformed output of microphone voltage amplifier & DC transformer unit and the blue line shows the input AC voltage came from microphone corrector unit.

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Conclusion

With this project, we could determine the noise level outside with the help of the microphone, LED, capacitors, resistors, voltage sources and various amplifiers. We can determine the noise by the lightning time of the LED. If the LED gives light for 0.75 seconds that means there are lots of noise outside. If the LED gives light for 0.50 seconds, there are an average noise outside. Finally, the LED gives light for 0.25 seconds, it means that environment is quite. Beside this, if the LED doesn't give light, there is no such noise, can be measured by the circuit.

Appendix I

Total time spent on/during (items 3-5 are required in your final report)

- Pre-Design Report : 3 hours (average time spent on your initial research and report writing)
- Pre-Report : 15 hours (average time during the design and report writing)