ECEN 214 - Lab Report

Lab Number: 5

Lab Title: Electronic Security System Design: Part 2 of 2

Section Number: 502

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TA: Pranabesh Bhattacharjee

Introduction:

In this lab, we used our knowledge of lab 4 to connect different components together to create an electronic security system. The previous lab allowed us to receive a deep understanding of the infrared emitter, photo detector, signal amplifier, and comparator. In this experiment, we rearranged the circuits of these components to combine them to make a successful electronic security system. We rearranged the output of the comparator to a latch that would be able to detect when there was an obstruction in the circuit to allow it to light the alert LED.

Task 1:

This first portion of the experiment was to recreate the circuit made in the previous lab. This included the emitter, detector, signal amplifier, and comparator.Once the circuit was made, we made sure that the light beam was at a measure of 5 volts when it was unobstructed. When the circuit was obstructed, the voltage of the light beam was 0 volts.

Task 2:

The second portion of the experiment consisted of creating a latch circuit to attach to the end of the comparator. This was done successfully by using the output of the comparator to the correct input pin of the latch. After the enable pin was placed along with grounding to allow a reset to the circuit.

Task 3:

The final portion of this experiment was to add the two LED lights that would indicate if the security system was obstructed or not. This step was more detail oriented than the others due to making sure that the anode and cathode was placed properly along with the flow of the circuit moving correctly to have the correct light display.

Discussion:

Emitter:

The value of the resistor that we used for the emitter was 100 ohms. This is due to the lower the resistance value, the higher the voltage over the emitter would be. This will lead to a more successful circuit.

Current to voltage converter:

A single resistor valued at 1000 ohms was used as a current to voltage converter. This was due to the potential of the op-amp circuit saturating is used. This would cause future conflict to the signal amplifier if not done properly.

Signal amplifier:

A non-inverting amplifier was used to make sure that the high voltage was being output to the light beam. If the inverting amplifier was to be used, it would make the amplifier give a high voltage when the light beam was unobstructed and this is the opposite of what we want. For the non-inverting amplifier we used the resistors as listed here:

$R_1 = 2k\Omega$, $R_2 = 3.3k\Omega$, $R_3 = 1k\Omega$

Comparator:

We referenced the input on the negative input in order to prevent the invert value of the circuit. The reference voltage here coming into the comparator was anywhere from 3 to 4 volts. Unfortunately, our comparator chip, the LM-319 was verified by my TA to not be working properly and we were unable to find a proper reference voltage.

Measurements (from task 2):

With the light beam unobstructed, reset the latch. What is the voltage on the Q output?

Measured: 0.4890 mV

Obstruct the light beam so that the comparator output goes low. What is the voltage on the Q output?

Measured: 5.001 V

Remove the obstruction from the light beam so that the comparator voltage goes back to high. What is the voltage on the Q output?

Measured: 5.001 V

Reset the latch by connecting the R input to ground. What is the voltage on the Q output?

Measured: 0.426 mV

Overall:

Yes, a problem within our experiment was the LM-319 comparator chip not working properly. This caused the LEDs to have a reverse effect of our desired observations. This was not discovered until the troubleshooting of our circuit and asking the TA for help. After the TA looked at our circuit, he stated that others were having this problem as well. To solve this problem, we observed and recorded the values of a circuit that worked properly.

Performance:

The emitter and detector were placed 4 inches apart before they did not function correctly. Within our circuit, there were false alarms due to the comparator not working properly. This even happened for the most part, however there would be times when the correct LEDs would be displayed. In order to improve our design, we would use equipment and components that work properly.