Sound Transmission through Laser Modulation

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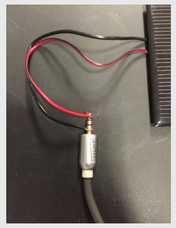
Abstract

A secure source of communication would be great in today's society. It would prevent hackers from listening in on people's conversations. In order to deal with this problem I have built a device to demonstrate that sound can be transmitted securely with a laser beam. The device works well at long distances and the sound quality is great, but can be improved. This project demonstrates a proof of concept for the transmission of information/sound with laser beams.

Assembly

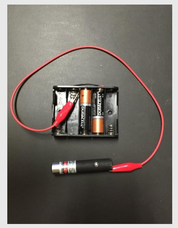
1. Connect the solar panel to the audio input cable of the speaker.
2. Insert two AA 1.5 volt batteries into the battery pack in series.
3. Connect the positive end of the battery pack to the frame of the laser with an alligator clip.
4. Connect the spring inside the laser to the white wire on the audio transformer using an alligator clip.
5. Connect the negative end of the battery pack to the red wire on the audio transformer using an alligator clip.
6. Connect the red and green wires on the other side of the transformer to the audio input cable.
7. Connect the audio input cable to a music source (e.g. phone) and turn on some music.
8. Turn on the laser and the speaker. Carefully point the laser onto the solar panel and music should start to play from the speaker.

Step 1



Step 2

Step 3



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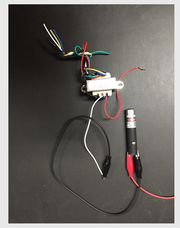

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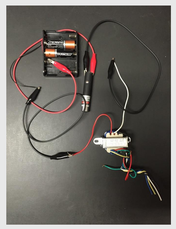

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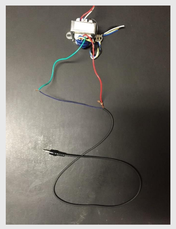

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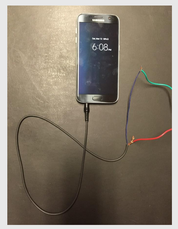
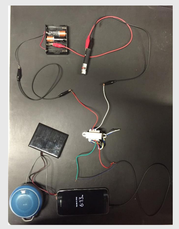


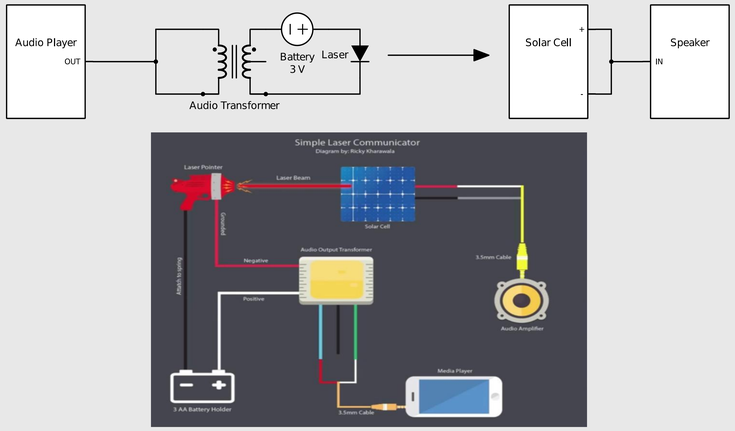
Step 8



Materials

Materials	Quantity
Speaker	1
Solar Panel	1
Diode Laser	1
Battery Pack	1
Audio Transformer	1
Alligator Clips	5
AA Batteries	2
Audio Cable	2

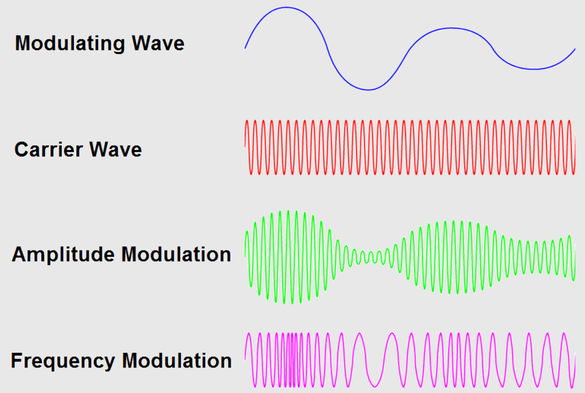
Schematics



Conclusion

The project works well. I tested the laser at a maximum of about 30 feet and it worked successfully. The sound quality is not amazing as there is a good amount of static noise coming out of the speaker. Although I expected fluctuations in the laser beam because of the amplitude modulation, I did not physically notice a difference. The fluctuations are most likely happening so fast that it is not noticeable with the human eye. I plan to upgrade the speaker in the future with hopes of having better quality sound. I also want to further test this project by plugging the solar panel into an oscilloscope to directly observe the amplitude modulation.

Modulation Types



Introduction

This project takes advantage of a process called amplitude modulation (AM). The input audio signal serves as a modulated wave while the diode laser acts as a carrier wave. When the audio signal wave mixes with the laser wave we get a amplitude modulated wave being transmitted by the laser beam. Depending on the changing amplitude, this causes the laser to become brighter or dimmer. The laser then hits the solar panel and causes an electrical signal to be sent to the speaker which then plays sound.

An audio transformer was needed because of our laser. A laser requires a lot of power to operate. Sending the audio signal directly into the laser would cause almost no modulation to occur because of the weak audio signal. Thus, I needed an audio transformer to amplify our audio signal so that it would be strong enough to cause modulation to occur in the laser. I used an 8 ohm to 1000 ohm transformer.

References and Acknowledgements

Acknowledgements

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References

- http://treehouseprojects.ca/audiolight/
- https://en.wikipedia.org/wiki/Amplitude_modulation
- https://www.youtube.com/watch?v=jvrXXQGXYg4