Laser Communicator

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Introduction

• Idea:
  – Encode a signal onto a beam of light with a microphone.
  – Read this signal some distance away

• Potential Use: Surreptitious line-of-sight communication through glass or vacuum.

• Components:
  – Microphone
  – Laser
  – Op-amps
  – Photo Detector
  – Speaker
Outline

Microphone → Laser Modulator Circuit → Laser → Photo Detector → Gain → Speaker
Microphone and the Voltage Divider Circuit

- The microphone acts like a variable resistor, and it can be used in the voltage divider circuit above.
  - The voltage of the microphone (the signal) relates to the resistance of the microphone.
  - This allows us to send the signal to the laser.

\[ R_{\text{MIC}} \approx 2.2 \, \Omega \]
The Microphone Amplifying Circuit

- This circuit amplifies $V_{in}$ and it gives it a specific offset equal to $V_{offset}$.
- Section 1: High pass filter that removes the natural offset of a signal
- Section 2: Resistors set gain for the signal
Laser

- $V_{in}$ is the output from the microphone.
- Laser brightness is proportional to current.
- Current is proportional to voltage, as shown by the equation $V=IR$. 

\[ I = \frac{V_{in}}{R} \]
Receiver

• The receiver measures the brightness of the laser and converts it into a current

• $V_d = I \times R$
Amplifiers

• Used to restore signal strength
• Filters sound to remove background noise.
• 2 amps for better sound (prevent saturation)
• Gain: $\frac{R_2}{R_1}$
Speaker Buffer Circuit

• This circuit amplifies signal from the gain step and provides current for the speaker.
• Section 1: Removes extra noise from \( V_{in} \)
• Section 2: Provides the needed amount of current to drive the speaker
Conclusion

Challenges

• Finding the right level of gain and offset so that the laser signal is powerful but not too powerful for the laser detector
• Laser alignment
• Gaining up the signal enough to hear it
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