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Optical Audio Transmitter

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Optical Audio Transmitter

Abstract

A visible light emitting diode (LED) is used to transmit audio signals from an audio source (radio) through a transmitter circuit to a receiver circuit. The constructed system demonstrates optical audio transmission. The purpose for this demonstration is to show how audio signals can be transmitted through a free space optical link using an illuminating LED. All signals being transmitted are analog. The transmitter circuit is excited with an audio signal that is level shifted and output using a visible light LED. In the receiver circuit located at some distance from the transmitter, a photo-diode sensor detects the light from the illuminating LED, whose signal is then reconstructed and amplified using an LM386 audio amplifier. The reconstructed signal is then output through a speaker to near or exactly as the original input audio signal. The system is designed to operate within 4 KHz-20 KHz frequencies that are high for the human eye to observe the flickering of the LED. The flickering of the LED is the mechanism through which the photo-diode is detecting the LED light transmitting the signal. Both circuit designs contain resistors and capacitors that contribute to the protection components and filtering of the analog signals.

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Customer: Mr. Bill Molina, Discovery Center of Idaho
Faculty Advisor: Dr. Hao Chen

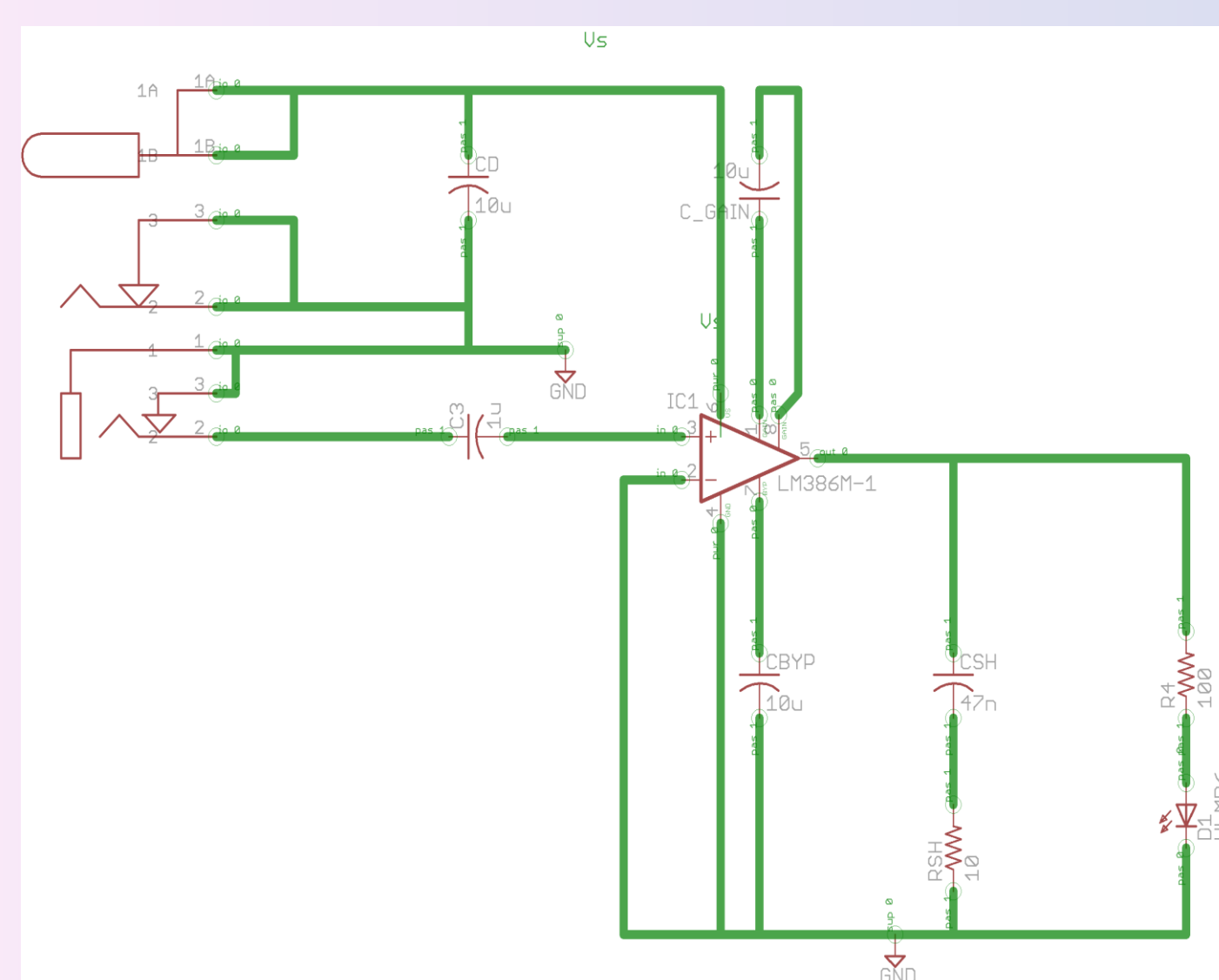
Problem Statement:

Design a Transmitter circuit that transmits an audio signal through free space using a visible light emitting diode (LED). The optical signal is sensed and output via a speaker by the receiver circuit.

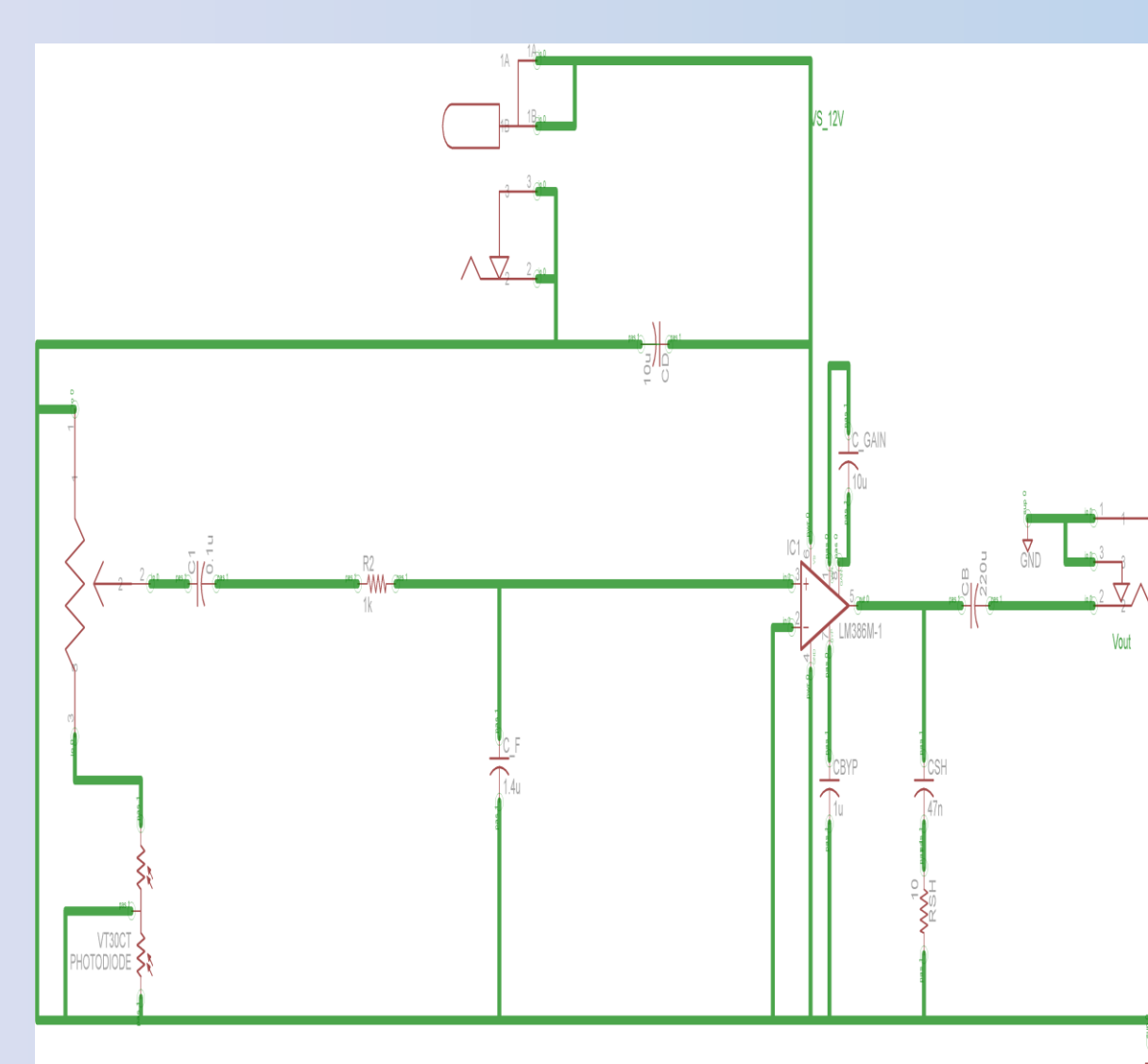
Project Goal:

- Design an optical transmitter and receiver circuit
- Implement both circuits individually on Printed Circuit Boards (PCBs)
- Test for successful transmission and reception across at least 1 foot

Transmitter Circuit Schematic



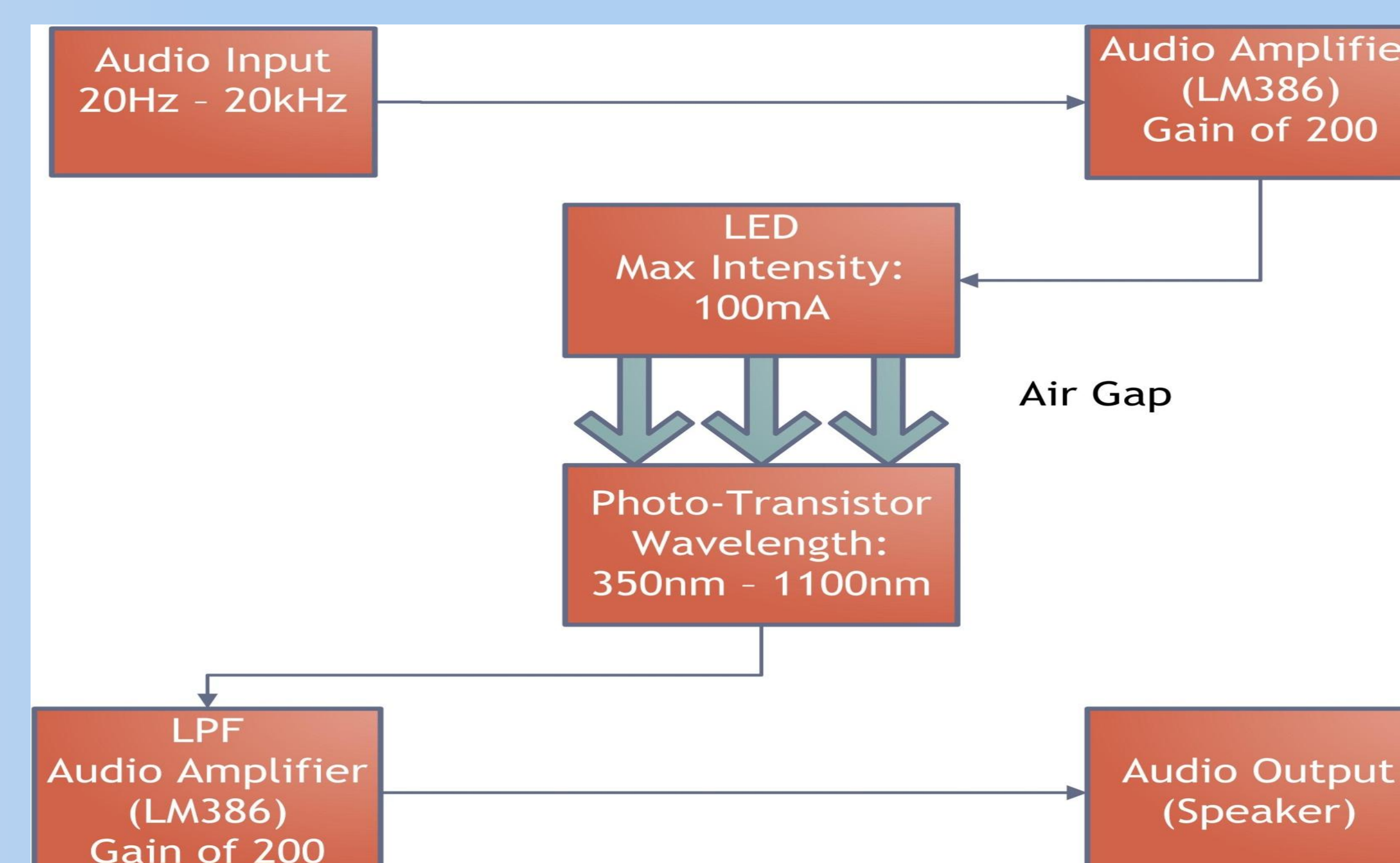
Receiver Circuit Schematic



Key Features:

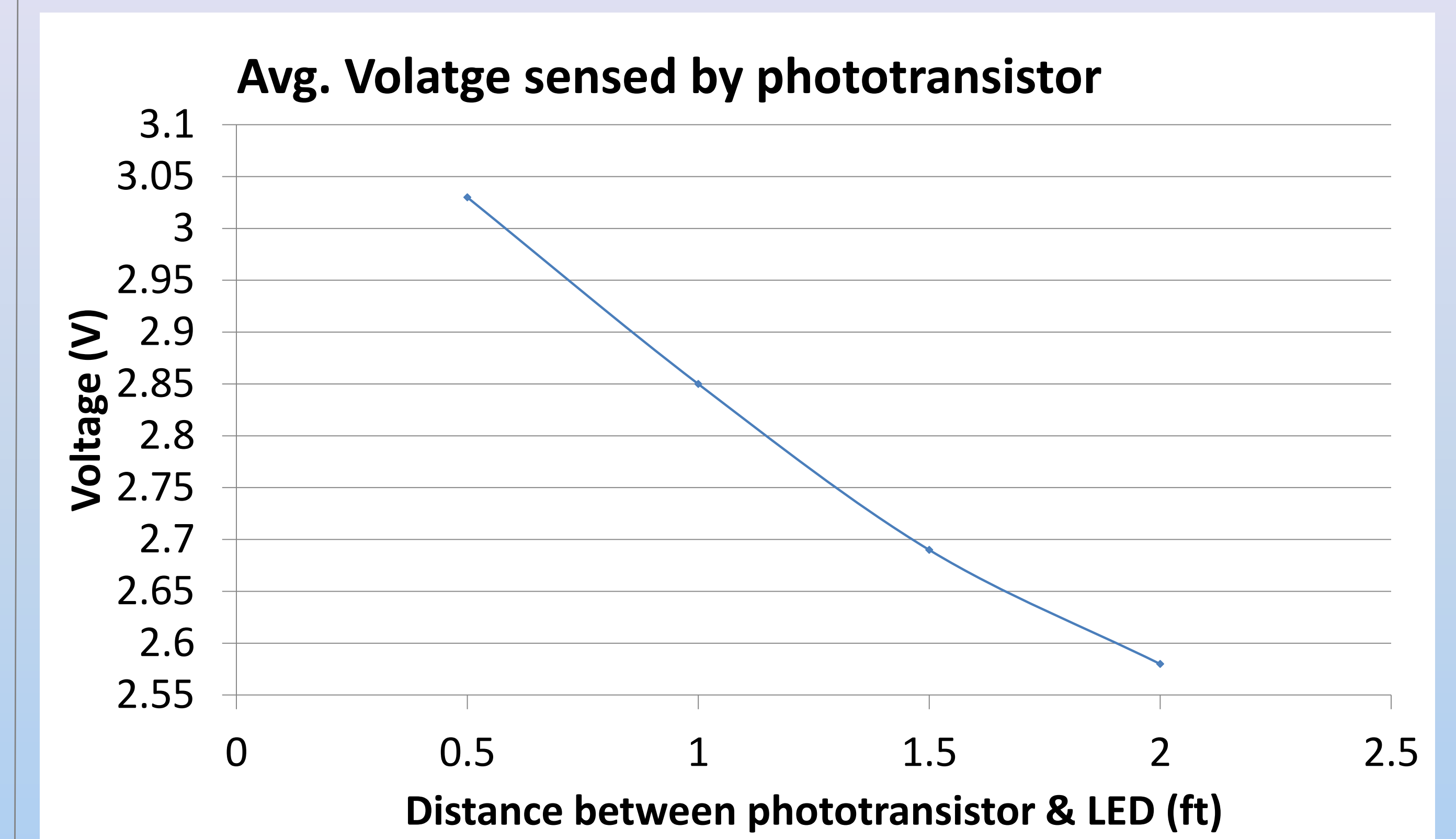
- LTW-2S3D7 Visible white light LED
- THORFDS 100 phototransistor sensitive to wavelengths 350nm - 1100nm
- Lm386 Audio Amplifier, used with a gain of 200

System Flow Diagram



Approach:

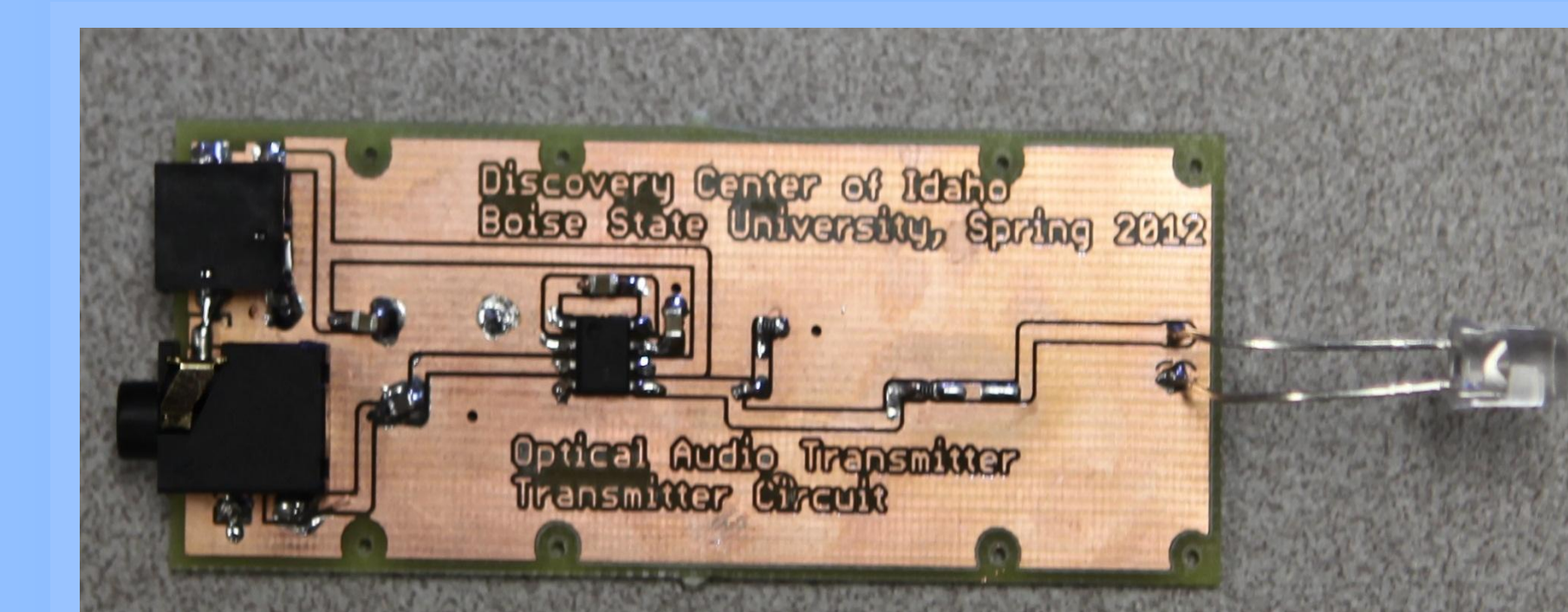
- Input audio signal
- Amplify signal
- Transmit signal via an LED
- Transmission across 1 foot of air
- Sense signal via photo transistor
- Filter, amplify received signal
- Output signal via speaker



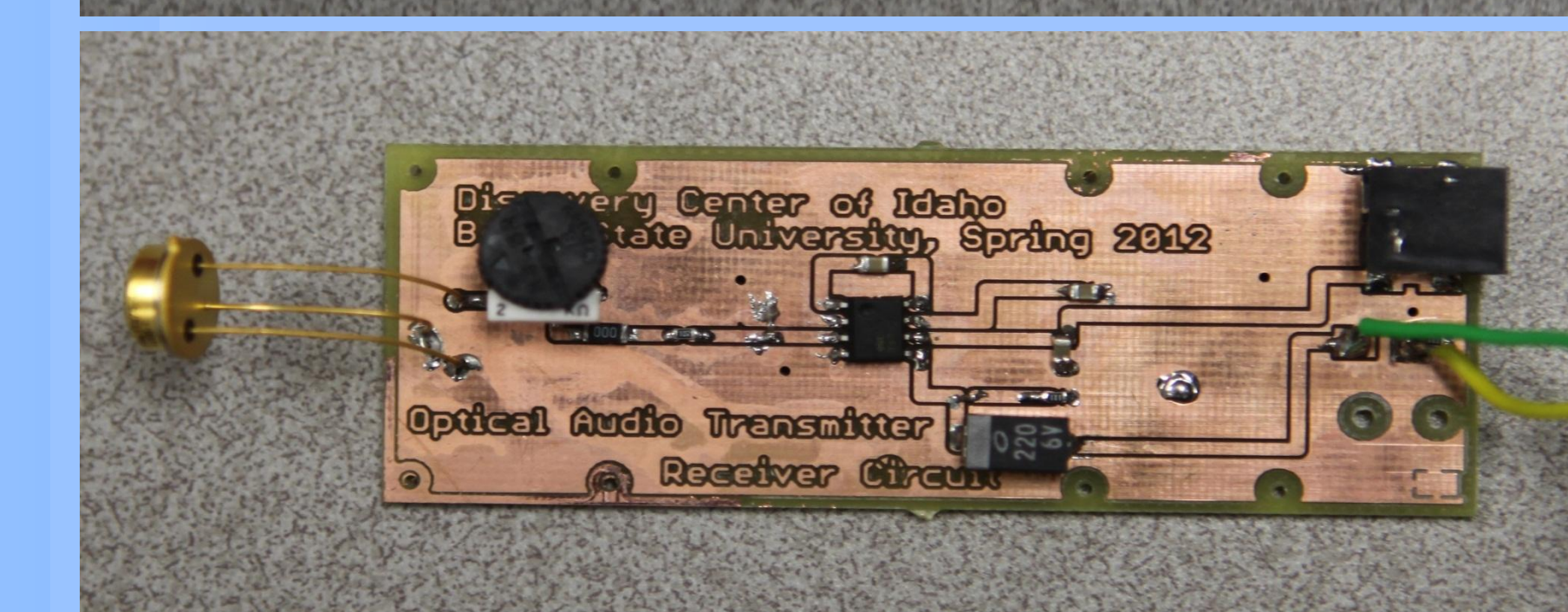
Results:

- Graph shows volume/amplitude/sensed voltage decreases with distance
- User Interaction with blocking light from the LED to observe transmitting effect
- 12V DC supply voltage for each circuit
- Adjustable speaker volume
- Can sense up to approximately 1 foot gap

Printed Circuit Boards



Transmitter Circuit



Receiver Circuit