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ACTIVE NOISE CANCELLING (ANC)

CIRCUIT

PROJECT REPORT

COURSE NAME: ANALOG ELECTRONICS

COURSE CODE: BEEE208L

Under the guidance of

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SLOT: A2 **CLASS: TT413**

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ABSTRACT

Active Noise Cancelling (ANC) is a technique used to reduce unwanted ambient sound using active sound control. This project focuses on designing an ANC circuit using operational amplifiers (op-amps) along with other electronic components. The circuit consists of a pre-amplifier, an all-pass filter for signal delay, and a summing amplifier. An external microphone captures the noise, which is inverted and superimposed onto the audio signal, resulting in effective noise cancellation. The designed system can be used in headphones, aviation, and industrial applications.

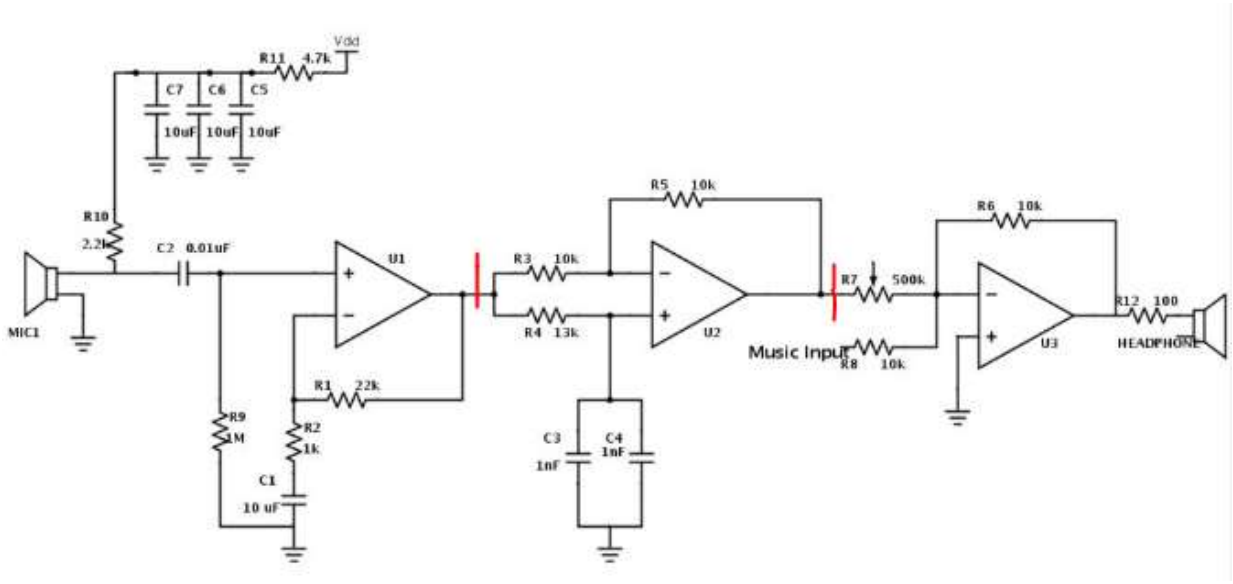
INTRODUCTION

Noise pollution is a major concern in various environments, including homes, workplaces, and public spaces. ANC technology helps mitigate unwanted noise by using destructive interference. Conventional noise-canceling headphones rely on a combination of analog and digital signal processing; however, this project explores a fully analog approach to noise cancellation. The circuit consists of:

1. **Pre-Amplifier:** Amplifies the input noise signal captured by the external microphone.
2. **All-Pass Filter:** Delays the noise signal to synchronize with direct environmental sound.
3. **Summing Amplifier:** Combines and inverts the noise signal with the desired audio signal for cancellation.

This analog ANC circuit provides a foundation for understanding noise cancellation principles and serves as a stepping stone for more advanced digital ANC systems.

CIRCUIT DIAGRAM

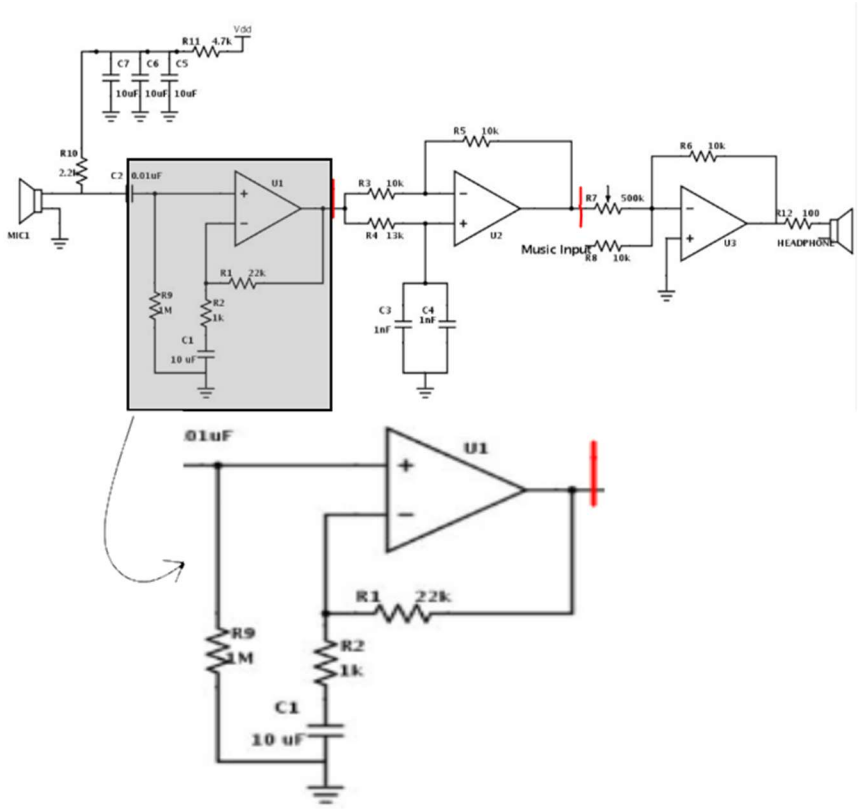


The schematic above represents the complete ANC circuit, divided into three sections: pre-amplification, signal delay, and summing amplification. The microphone input, resistor-capacitor networks, and op-amps play a critical role in achieving effective noise cancellation.

IMPLEMENTATION

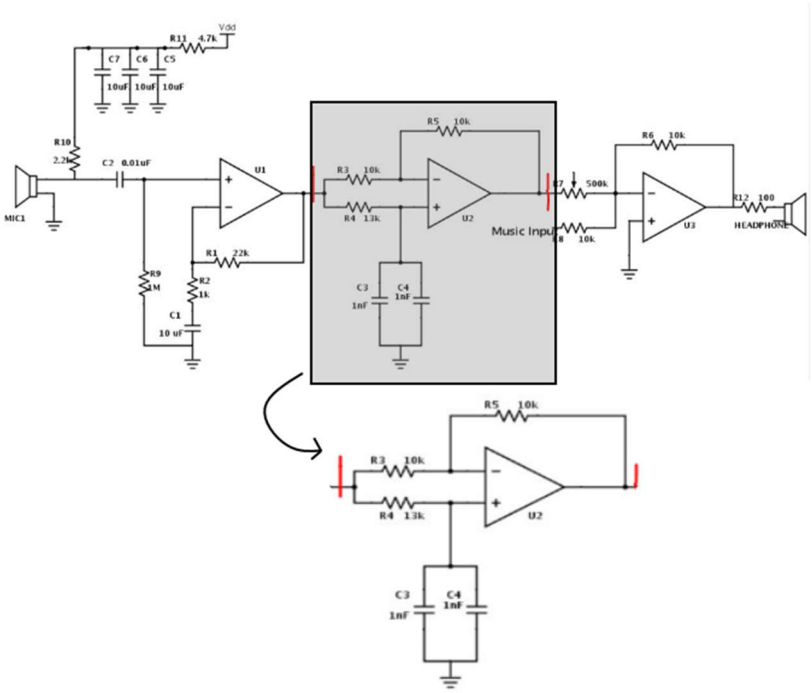
1. Pre-Amplifier Stage

- **Purpose: Amplifies weak noise signals captured by the microphone.**
- **Components Used: Op-amp (LT1056/LM741), resistors, capacitors.**
- **Calculation: Gain is determined by the ratio of resistances.**



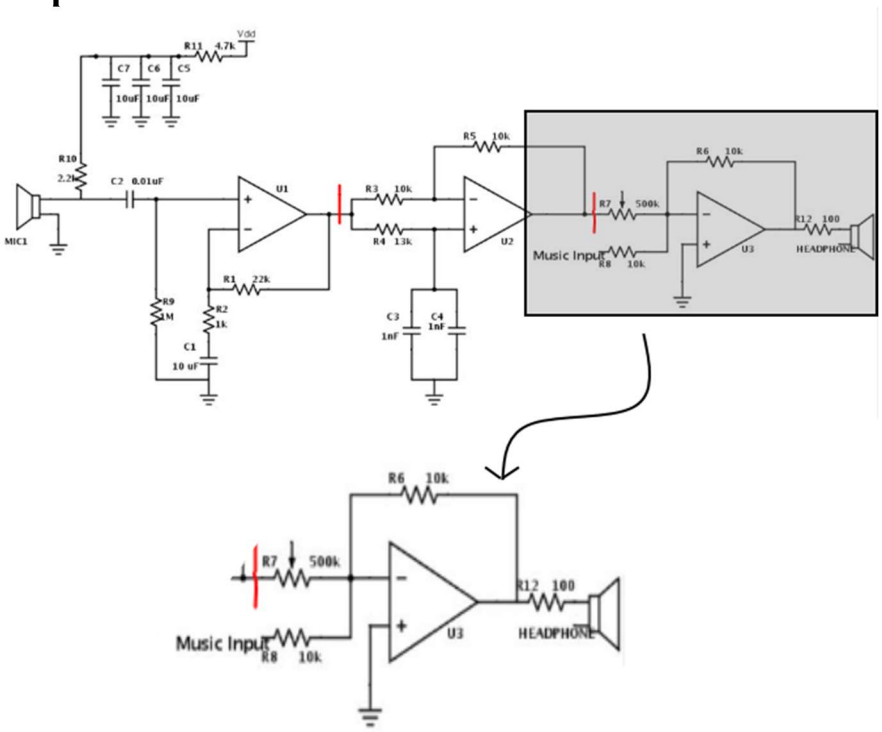
2. All-Pass Filter (Delay) Stage

- **Purpose: Introduces a time delay to align the noise signal with direct sound.**
- **Key Formula:**
  - **Delay = L / Vs (where L = distance, Vs = speed of sound)**
- **Adjustment: Components like R4, C3, and C4 control the delay phase shift.**



3. Summing Amplifier Stage

- **Purpose: Combines the inverted noise signal with the original audio signal.**
- **Key Components: Op-amp, potentiometer for fine-tuning signal amplitudes.**



4. Power Supply Considerations

- **Optional Power Supply Filter: Uses capacitors and resistors to remove high-frequency noise.**
- **Headphone Integration: Ensures proper impedance matching and safe current levels.**

CONCLUSION

The ANC circuit successfully demonstrates the principles of active noise cancellation using an analog approach. By incorporating pre-amplification, signal delay, and summing amplification, unwanted noise is effectively reduced. The system is suitable for integration into noise-canceling headphones or small-scale ANC applications.

Future Work:

- Implementation of digital ANC using DSP.
- Adaptive filtering for improved noise cancellation.
- Miniaturization for practical use in consumer electronics.

REFERENCES

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4. Electronic Circuit Design for ANC Systems – Online Resources