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CS 145 - Embedded Software - Project 5
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Overview

This project uses the ATmega32 MCU, four discrete indicator LEDs, and sound decibel detector to provide immediate visual feedback for monitoring ambient sound levels in real-time. The device assists gamers—often unaware of their own volume due to noise-canceling headphones—in self-regulating their speaking volume during gameplay. It offers a simple, non-intrusive cue system to help maintain household harmony.

Hardware Setup

- ATmega32 MCU
- Four LEDs: Green, Yellow, Red (for volume level), and RGB (for flashing alert)
- SparkFun Sound Decibel Detector – detects presence and amplitude of sound
- Power Supply – 9V battery-powered, regulated to 5V
- 3D-Printed Circuit Housing

System Functionality

The sound detector continuously captures real-time audio levels and sends amplitude data to the ATmega32. Based on this audio input:

- The green LED activates for an acceptable volume level
- The yellow LED activates for an elevated volume level
- The red LED signals excessive volume
- If the user remains in the red zone for an extended period of time or frequently re-enters it, the system activates the RGB LED in a white flashing pattern to interrupt gameplay and encourage behavioral correction.

This feedback loop helps the gamer recognize when their voice exceeds acceptable levels and promotes quieter behavior during gaming sessions.

Future Implementations

We initially planned to use a WS2812 RGB LED strip to represent sound levels more dynamically, but encountered library and microcontroller timing incompatibilities when attempting to integrate with the ATmega32. As a workaround, we replaced the LED strip with individual LEDs for this version.

For future implementations, we plan to:

- Streamline the circuit with a more compact design by using a LilyGo MCU that supports the Arduino and WS2812 libraries for simplified LED control
- Enclose the circuit within a 3D-printed housing enclosure featuring an ON/OFF switch and USB to USB-C power for better user convenience
- Extend functionality with a reward-based system that tracks user sound history, incentivizes quiet behavior, and potentially integrates with cloud storage for cross-session feedback and customization