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# Practicum

## *ViSound Project Design Specifications*

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ECE 411  
INDUSTRY DESIGN PROCESSES

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# 1 Project Summary

ViSound is a device that when powered by a USB 2.0, will listen to the environment through a microphone, and produce a visual display through an array of colorful LED lights. The USB 2.0 feature allows for the device to be portable. This is the perfect product for music listeners, as all they have to do is:

1. Power the device with a USB 2.0.
2. Play their favorite soundtrack.
3. Enjoy the visual LED display.

This product is not only great for music, but also is an item that electronic enthusiasts can tinker with. The USB 2.0 input powers the device, and can be accessed to reprogram the microprocessor. The initial code for this device is provided at <https://github.com/ian7aylor/ECE411Practicum> and is commented in a user-friendly manner. In order for a user to program the LED display, they should:

1. Plug the device into their computer via USB 2.0.
2. Go to <https://github.com/ian7aylor/ECE411Practicum> for examples.
3. Reprogram the LED display.
4. Enjoy their unique device.

## 2 Market Analysis

The intended customer base for ViSound are:

- music listeners
- electronic enthusiasts

This is the targeted customer base, but this device can ultimately be used by anyone. There are a few competitors out there that have similar products to ViSound . A couple of these companies are:

- Nobsound
- Nanoleaf

Nobsound has a frequency spectrum analyzer for high fidelity. This is a handheld spectrum analyzer that does a frequency sweep and displays the power for each frequency band with LEDs. The LEDs are monochromatic. This device costs \$139.

Nanoleaf light panels are smart lights, meaning they can connect to the user's WiFi. They sell an attachment called a rhythm module that can be attached to their light panels. The user can program the rhythm and color scheme of the LED panels through the Nanoleaf mobile app. When there are environmental sounds, the lights will dance. The minimum cost for this setup is \$200.

Companies like Nanoleaf and Nobsound are competitors because their products create an LED visual display in response to environmental sounds. The main difference between ViSound and its competitors, is that the LED visualizations provide information about which frequency band is being displayed, and the user can program the device to create different visual representations for each frequency band. ViSound is also priced at \$69.99 which covers the cost of materials, labor, and approximately \$40 to put back into the business. This puts this device at close to half the price of our competitors.

### 3 Requirements

#### Must

- Have a microphone as a sensor (input).
- Have an amplifier stage to boost the input signal.
- Have Neopixel LEDs as actuators (outputs).
- Have a two layer PCB.
- Have 25% or more surface mount components that can be hand or reflow soldered.
- Have a digital or analog processor.
- Be safe
- Have bandpass filters to isolate each frequency band.
- Use USB 2.0 for power and programming.
- Have comments that describe the code in detail.

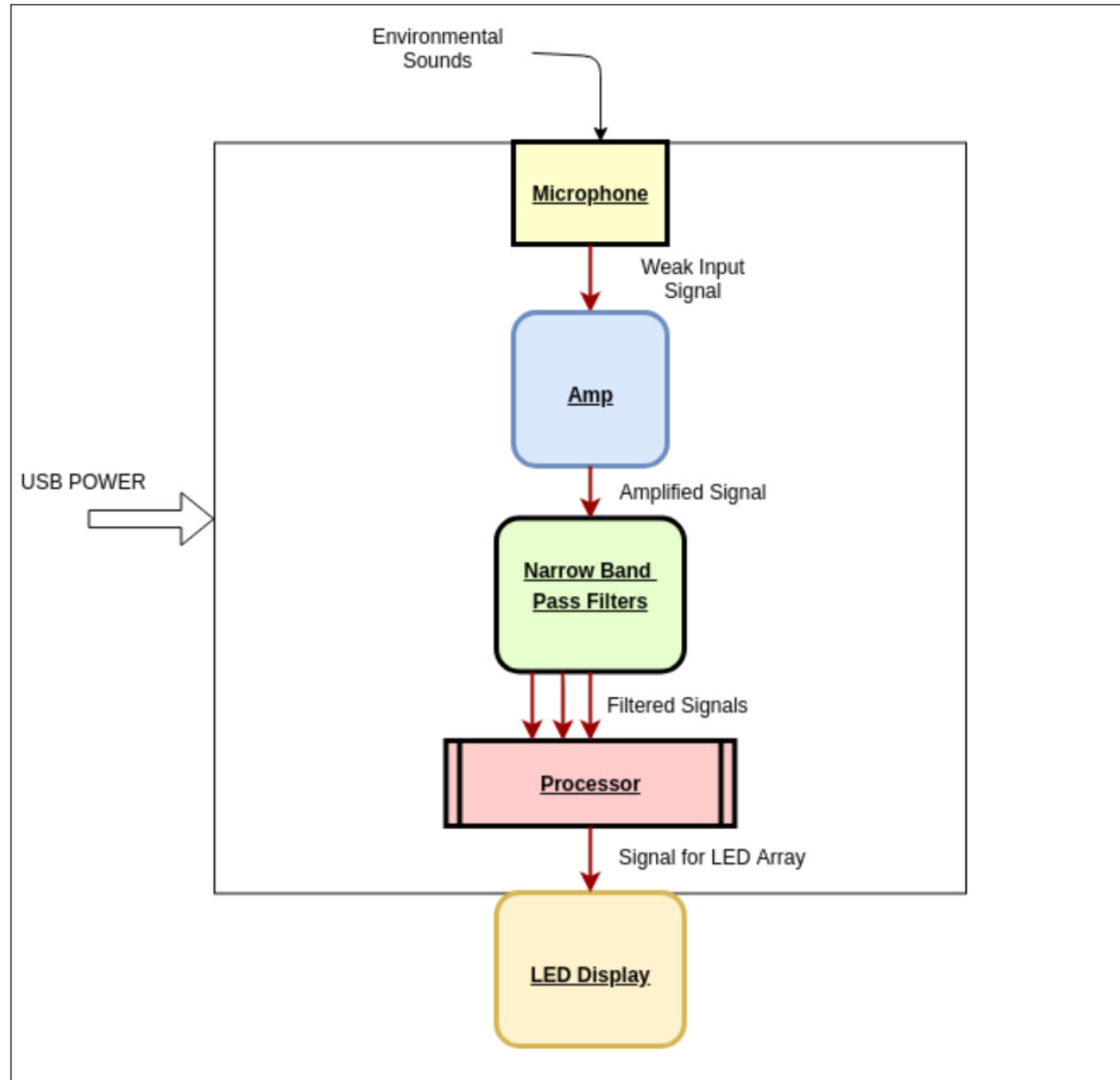
#### Should

- Be portable.
- Have a translucent case.
- Be easy to setup.
- Have a wide range of colors.

#### May

- Be easy for an inexperienced individual to reprogram.
- Be expandable to add or remove pixels.

## 4 System Architecture



**Figure 1:** ViSound - System Architecture

## 5 Design Specification

What is the sensor?

- Microphone (INGHAI GMI6050P-46db)

What is the processor?

- ATMEGA32U4-AU

What is the actuator?

- WS2812 5050 RGB LED with Integrated Drivers

What provides the power?

- USB 2.0 - 5V source(removable male micro-B to male standard type A cable)

What is the mechanical design?

- Translucent Polycarbonate Project Box

What is the firmware?

- Bootloader

What is the programming language?

- AVR C++

Is an Arduino being used? (Y/N)

- Yes

What is the development environment?

- Arduino IDE