

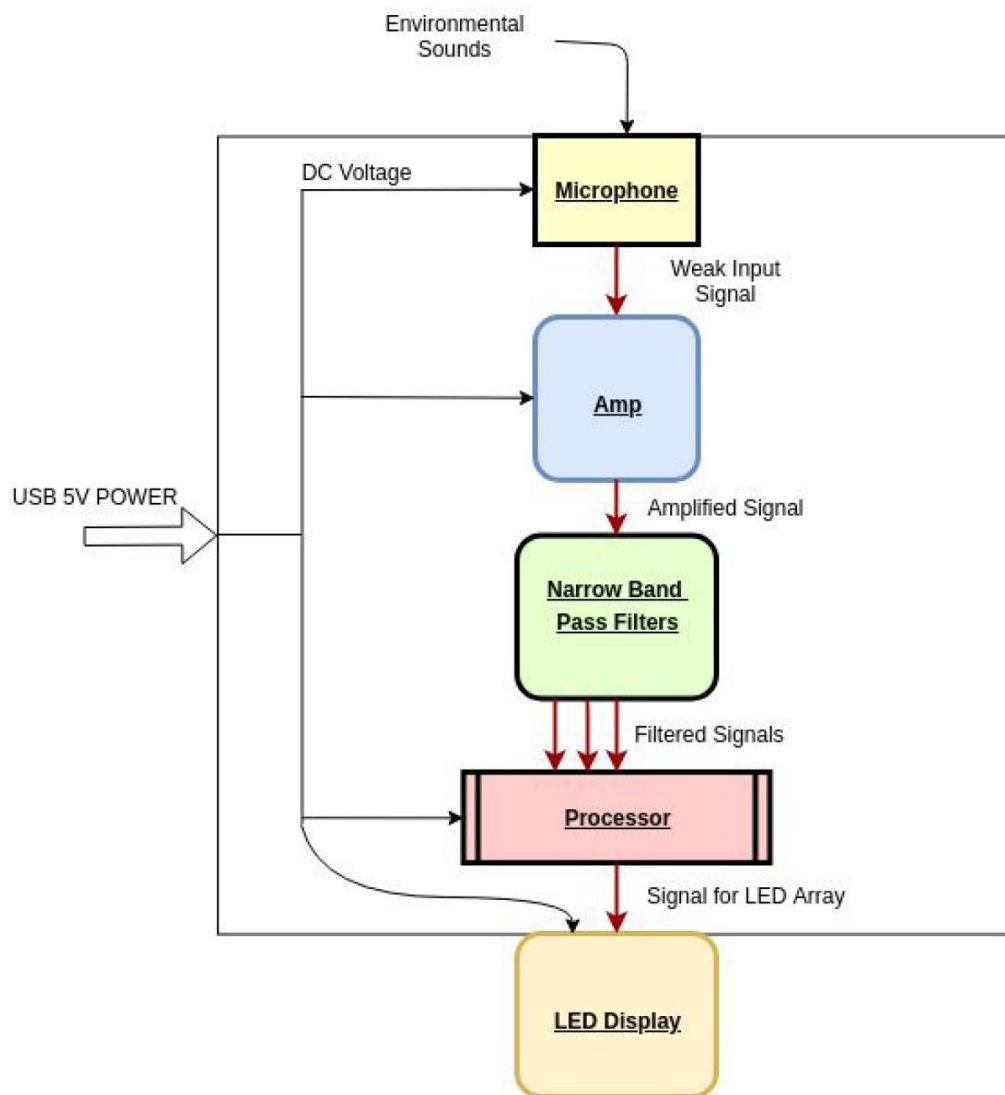
Homework 7 - Audio Spectrum Visualizer: System Test Plan
Authors: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad
EC411- Team #2
12/3/2019 - Revision 1.0

Table of Contents

1. Introduction
2. Reference Documents
3. System Tests
 - 3.1 Unit Tests
 - 3.1.1 Microphone
 - 3.1.2 Preamplifier
 - 3.1.3 7 Band Bandpass Filter
 - 3.2.4 Atmel ATmega32U4
 - a. Matrix Array Signal
 - 3.2.5 LED Matrix Array
 - 3.2 Integration Tests
 - 3.2.1 1st Stage (Microphone + Preamp)
 - 3.2.2 2nd Stage (Atmel ATmega32U4 + 7 Band Bandpass Filter)
 - 3.2.3 3rd Stage (Atmel ATmega32U4 + LED Matrix)
 - a. Signal to LED Matrix
 - 3.2.4 1st + 2nd Stage (Atmel ATmega32U4 + 7 Band Bandpass Filter + Preamp)
 - 3.3 Acceptance Tests
 - 3.3.1 Frequency Sweep Mapping to LED Matrix
4. Resources
 - 4.1 Tektronix Oscilloscope
 - 4.2 Arbitrary Waveform Generator
 - 4.3 Computer
 - 4.3.1 Software: Atmel Studio, Arduino IDE.
 - 4.4 Testing Cables/Probes
 - 4.4.1 Female - Male BNC Cable
 - 4.5 8 Ohm Speaker

Introduction

The Audio Spectrum Visualizer is a device that takes in audio input and displays the frequency bands with their related signal strength on an LED matrix. Each frequency band is associated with a certain color. Below is a block diagram that illustrates the Audio Spectrum Visualizer on an abstract level.



Reference Documentation

Below are links to all of the documents needed to thoroughly test the Audio Spectrum Visualizer.

Product Design Specifications (PDS)

[Product Design Specifications](#)

Board Schematic & Layout

[Ver1.3 Schematic](#)

[Ver1.3 Layout](#)

Datasheets

[Microphone Preamplifier](#)

[MSGEQ7 - Seven Band Graphic Equalizer](#)

[SK6812 - Programmable LED](#)

[Atmel ATmega32U4 - 8-bit microcontroller](#)

[WS2812B - Intelligent Control LED](#)

System Tests

Acceptance Test Example:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad						
Test Case Name:		Frequency to LED Mapping	Test ID #:		ACC-01	
Description:		Making sure each frequency is displayed on the correct row of an 8x8 LED matrix with their associated color.	Type:		Black Box Testing	
Tester Information						
	Name of Tester:	Ali Saad, Nick Long	Date:			
Hardware Version:		1.3	Time:			
Equipment Needed:		Audio Spectrum Visualizer (device being tested), Arbitrary Waveform Generator, BNC Speaker,				
Setup:		Power on the Audio Spectrum Visualizer. Make sure the system is reset and all LEDs have no input. Set the arbitrary waveform generator to a frequency sweep from 50 Hz - 16 kHz. Using a BNC Female - Male cable, connect the arbitrary waveform generator to a speaker. Make sure the volume is up on the speaker. Start the frequency sweep on the waveform generator.				
Step:	Action: Audio Input Frequency	Expected Result	Pass	Fail	N/A	Comments
1	Minimum 63 Hz - Maximum 159 Hz	Column 1: LED should light up red				

2	Minimum 160 Hz - Maximum 399 Hz	Column 2: LED should light up green				
3	Minimum 400 Hz - Maximum 999 Hz	Column 3: LED should light up blue				
4	Minimum 1.0 kHz - Maximum 2.4 kHz	Column 4: LED should light up yellow				
5	Minimum 2.5 kHz - Maximum 6.2 kHz	Column 5: LED should light up purple				
6	Minimum 6.25 kHz - Maximum 15.9 kHz	Column 6: LED should light up white				
7	16.0 kHz	Column 7: LED should light up Aqua				
Overall Test Result:						

Unit Test Example:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad						
Test Case Name:		Matrix Array Signal		Test ID #:		ATM-01
Description:		Custom communication protocol for WS2812b LED Array is in the correct frequency range to control LEDs. Frequency must be greater than 400 Hz as per the WS2812B data sheet.		Type:		White Box Testing
Tester Information						
	Name of Tester:	Ian and Marc		Date:		
Hardware Version:		1.3		Time:		
Equipment Needed:		Atmel ATmega32U4, Oscilloscope, BNC Female - Male Cable				
Setup:		Attach USB Power and wait 5 seconds for bootloader to initialize. Hook up BNC Female - Male cable from the oscilloscope to the output pin PE6 of the ATmega32U4. This pin can be seen on the Ver1.3 Schematic.				
Step:	Action	Expected Output	Pass	Fail	N/A	Comments
1	Minimum 400 Hz - Maximum 800 Hz	Frequency greater than 400 Hz and less than 800 Hz.				
Overall Test Result:						

Integration Test:

Test Writers: Nicholas Long, Marcus Chalona, Ian Taylor, Ali Saad						
Test Case Name:		Signal to LED Matrix		Test ID #:		STG3-01
Description:		LED Matrix Array responds to the signal that was developed in the unit test ATM-01.		Type:		White Box Testing
Tester Information						
	Name of Tester:	Ian and Marc		Date:		
Hardware Version:		1.3		Time:		
Equipment Needed:		Atmel ATmega32U4, Oscilloscope, BNC Female - Male Cable				
Setup:		Attach USB Power and wait 5 seconds for bootloader to initialize. Make sure the LED Matrix Array is attached to pin PE6 of the ATmega32U4. This pin can be seen on the Ver1.3 Schematic.				
Step:	Action	Expected Output	Pass	Fail	N/A	Comments
1	Turn on Atmel ATmega32U4.	LED Matrix Array lights up in response to the signal sent from the ATmega32U4.				
Overall Test Result:						