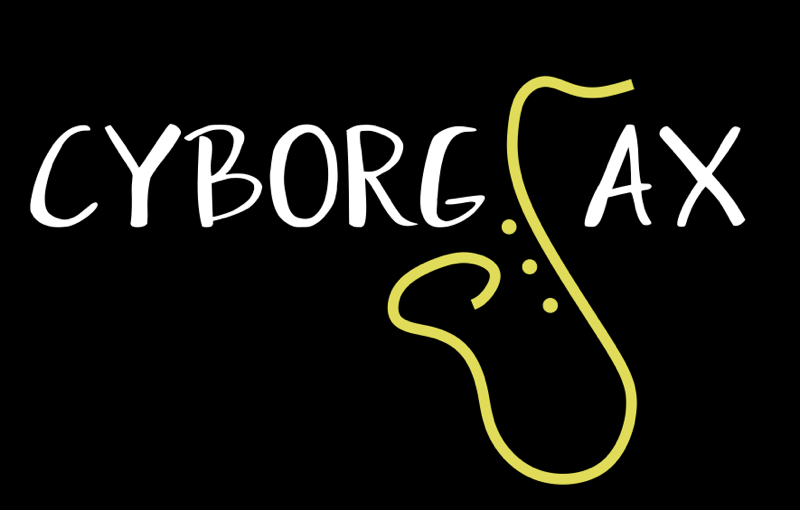
CyborgSax Test Report for Final Project

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Equipment and Setup

The main hardware equipment that was utilized during the prototype testing session consisted of a Teensy 3.6 microprocessor with an attached audio shield, a computer to program the Teensy, a 5V battery pack , two 8 x 8 LED matrices , a TFT LCD screen, 2 encoder knobs, a 4 position switch, a potentiometer and a speaker. Several electrical cables were used to transfer power between the Teensy and the matrix, and a lavalier microphone with a TRS termination is used to transfer a real time audio signal to the Teensy audio shield.The controlling unit was enclosed in a 3D printed case.

The audio shield was attached below the Teensy microprocessor so that all the pins from the audio shield would align with the corresponding pins from the Teensy 3.6. The cables used to connect the LED matrix to the microprocessor were +5V, digital input and ground connections. These were attached to the Teensy’s +3.3V pin, GND pin, and pin 26 (assigned as the digital input in the code), respectively. The +5V and ground connections served to power the LED matrices while the digital input was used to control the parameters of the matrix pattern of the LEDs. There was also an XLR/TRS combo input that was soldered to the audio shield for the Teensy to process the input signal that the microphone was receiving and 2 encoders to control the parameters of the LED matrices. There were 3 electrical wires for the user interface knobs - to send clock, data and push button signals to the Teensy and a ground wire for those signals to pass through. The 4-position switch passes a logical one whenever there is signal passing through one of any 3 of the paths that allow current and a one when there is no current passing through any of the 3 paths that allow current to pass through and this is going to be the 4th position where there is no current passing through at all.

For the software setup, the latest version of the software was loaded to the Teensy microprocessor, which was used to make the real-time frequency spectrum patterns display in the matrices. When running the actual test, the microcontroller was powered with a battery pack so that it could receive the audio signal from the microphone and further output as a visual pattern and output it as a sound with audio effects. The microphone would take the audio signal and the microprocessor would perform FFT analysis on it to output FFT values. The LED lights will then light up in a range of different amplitudes based on the FFT algorithm and its FFT outputs. The encoders and 4 position switch controlled different settings of the CyborgSax system.Not only can the system do analysis on a real time microphone signal, but also a WAV file stored on the SD card of the Teensy.

Measurements Taken

For the hardware measurements, it was determined the computer could communicate with the Teensy as the computer was able to identify the Teensy when plugged in. Utilizing our code, FFT values were recorded based on the microphone signal input. Based off the FFT values, the microphone was confirmed to work. The power cables, Teensy and audio shield were determined to have been soldered properly, as the LED matrices lit up based upon the corresponding FFT values (and algorithm) within the software. The code mapped out 16 columns, and assigned FFT bins (unique frequency bandwidths) to each column - should the FFT value be high for a certain frequency bandwidth, the corresponding column will light up a number of LEDs - the number of LEDs lit to FFT values is based on an algorithm that we created. This was consistent with our expectations of the code that we utilized to program the LED patterns. The 2 rotary encoders worked. When turned, the values that were read from the encoder would either increase or decrease - and subsequently the parameters of the system would change. Also, the rotary encoder push function worked, as when pressed, the setting on the GUI would be either selected or deselected.

In terms of software, the program was loaded successfully because the code worked as the LED matrices lit up to form a spectrum-equalizer pattern based off of the FFT function that was used for analyzing the sound input from the microphone. The LEDs had different colors to look like that of an SPL meter. The higher the FFT value for a column, the more LEDs lit in that column starting from the bottom and maxing out at the top. There was also success in the operation of the TFT screen because the screen would display the user interface in a desired manner. Depending on the rotation direction of the knobs and switches the screen would display different values and parameters. The switch would change to the different modes of the CyborgSax system and display a different screen for each one.

For the debouncing feature test, the measurement numbers shown on the simulator did not get fluctuated and reacted based on the position the rotary encoder is rotated. In addition, the push counter only changed its state once when the encoder was pushed down.

Improvements in the future

Even though the prototype presentation was a success, there are still a couple more tasks that need to be done before ECE day which include adding more sound effects parameters and fixing the glitching on the mode selection of the TFT screen. On the other hand, a graphical horizontal bar needs to be designed and implemented to the system to indicate the percentile of the parameters. An ON and OFF screen switch mode needs to be implemented to the system as well. By pushing the encoder, the user may turn the tft screen ON or OFF. Another technical issue needs to be fixed is the encoder. When it is rotated either clockwise or counter-clockwise, the readings is not always precise.

Conclusion

The prototype presentation went according to the test plan that was written prior to the presentation. The majority of the improvements were made to the system that were mentioned in the test plan. The project is about 85-90 percent complete, and the team is very confident that the minor errors will be fixed before the ECE day. When it comes to meeting the requirements that the customer wanted, everything has been satisfied. The system included sound effects, visual effects, a microprocessor, a power supply,a microphone and a controlling unit.