Final Demo:

Trumpet Analyser

Group 2

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Reminder - What is it?

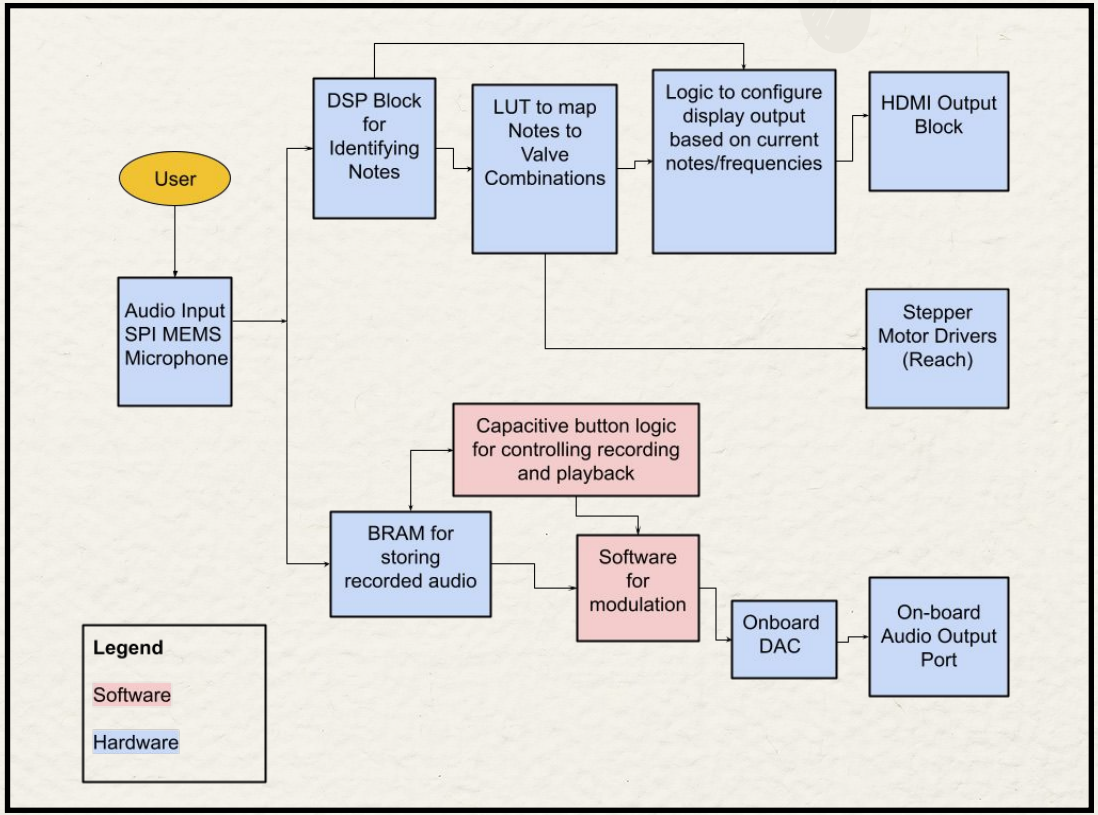
Live Display of Valve Combinations

Tuner

Audio Recording/Playback

Initial Goals with Proposed System

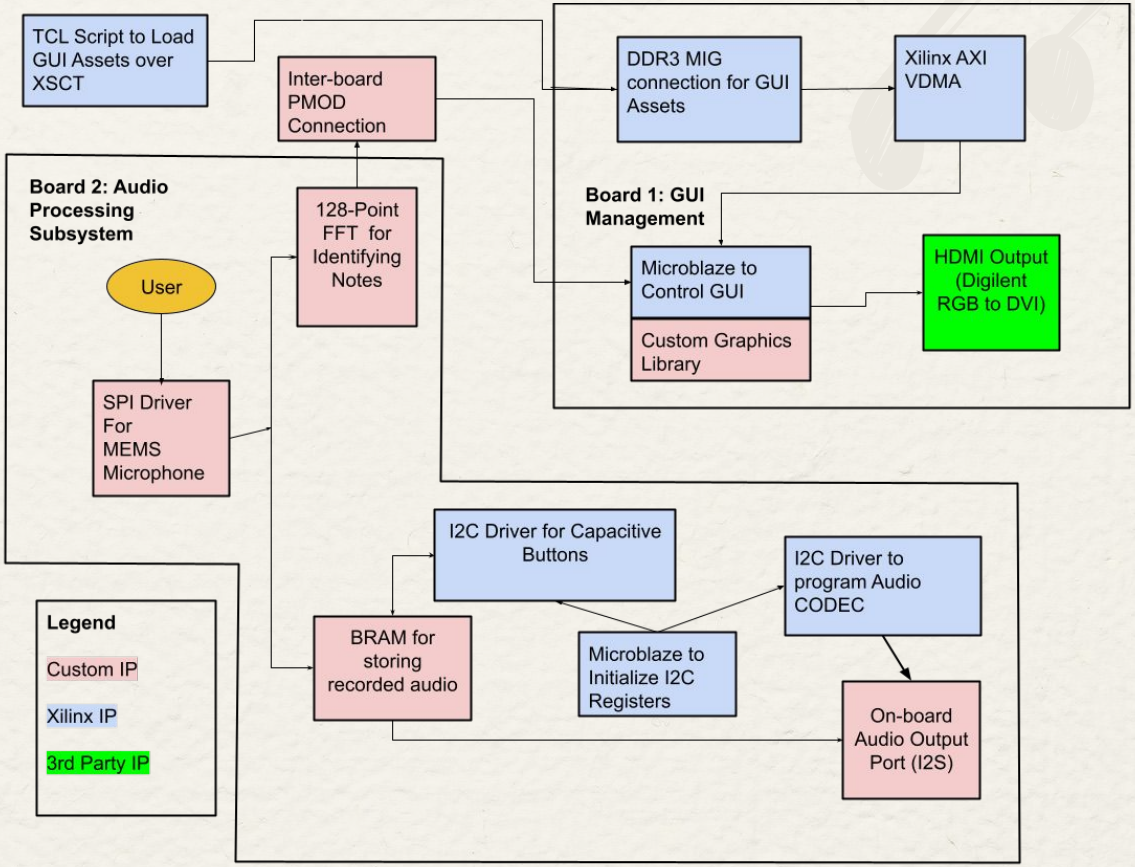
- Two main signal paths
  - Drive speakers
  - Compute trumpet note and display
- Comms: I2S, I2C, SPI, HDMI
- Video: HDMI
- Microblaze:
  - Configuration
  - Audio control logic
  - HDMI frame generation



Final System

Changes from Initial System

- Removed Modulation
- Removed Stepper Motors
- Added XSCT flow for loading GUI Images
- More software than anticipated in HDMI



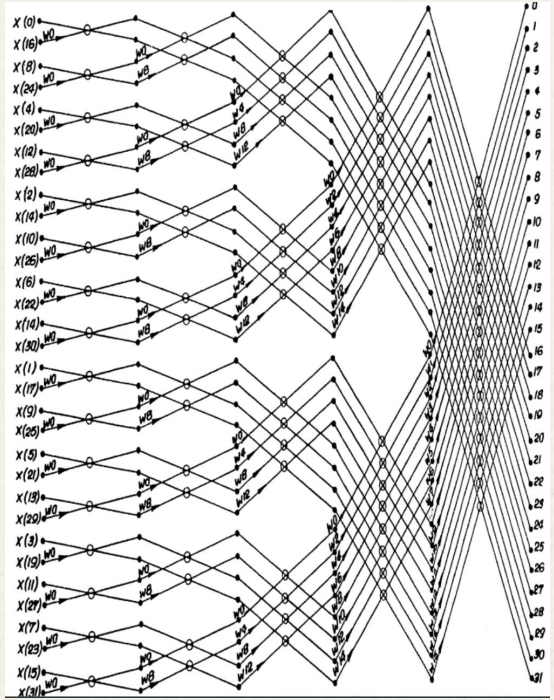
Audio Side

- SPI MEMS Microphone (PMOD)
  - SPI Interface (Custom IP)

SPI microphone

Audio Side

- Correct Identification of Pitches with FFT (Custom IP)



Audio Side

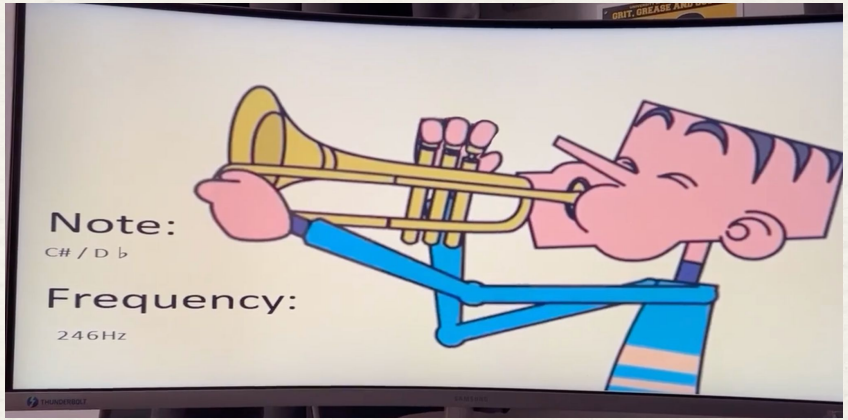
- I2S Speakers (Custom IP)
- I2C Buttons (PMOD)
  - I2C Interface (Xilinx IP)

I²C capacitive buttons

I²S audio

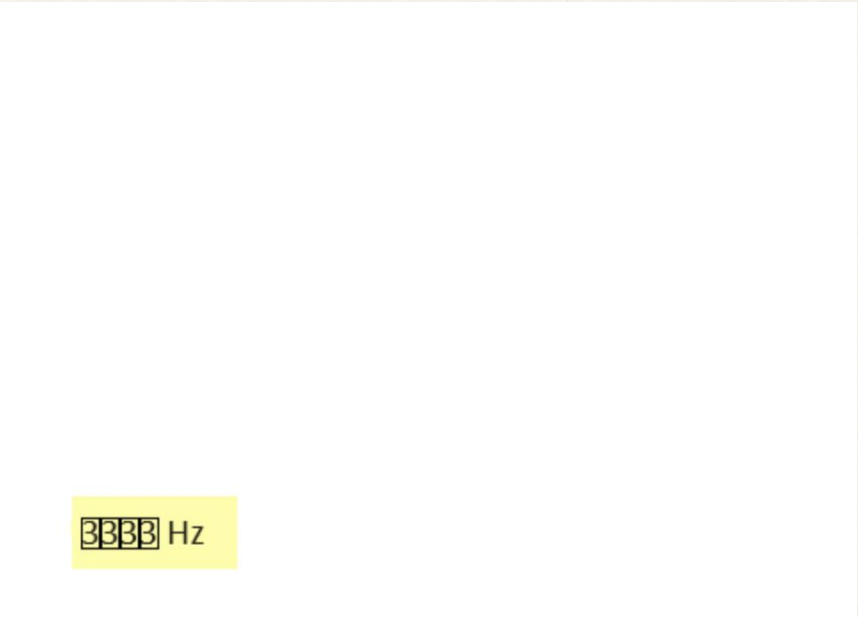
HDMI side

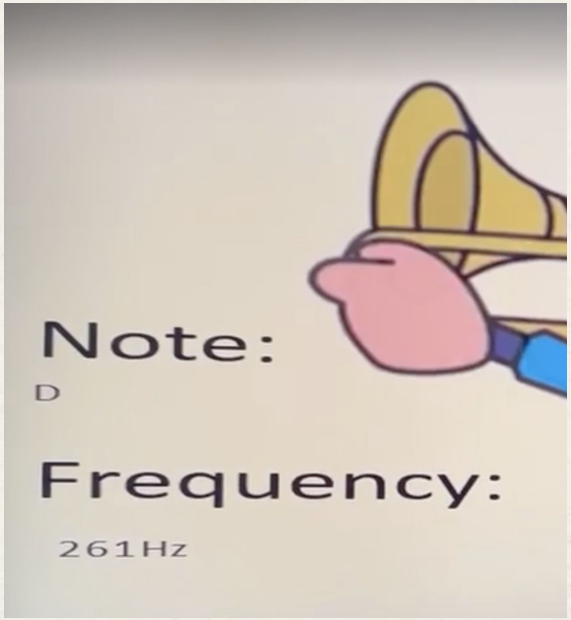
- Non-Passthrough HDMI setup (Xilinx/Digilent IP)
- Animation of Trumpet Valve Combinations (MicroBlaze + Custom Firmware)



HDMI side

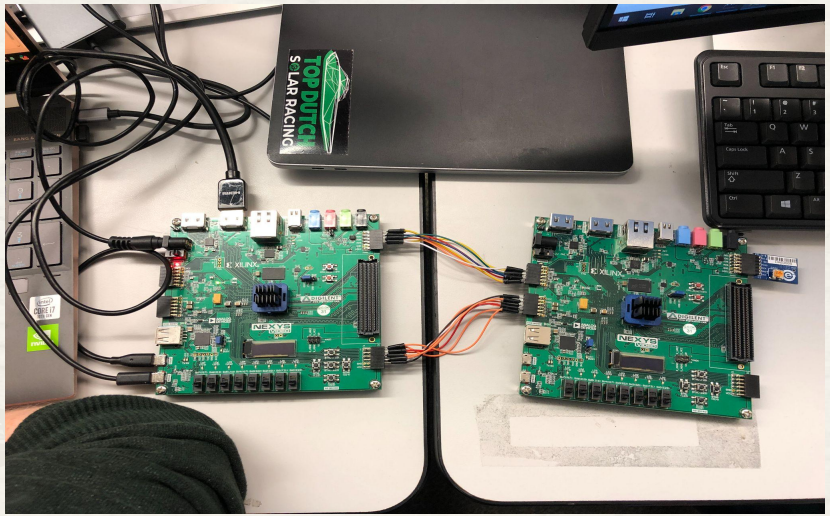
- Display Text Frequency and Note Information (MicroBlaze + Custom Firmware)





HDMI side

- Integration of GUI with Audio Processing (Wire PMODs + Microblaze)

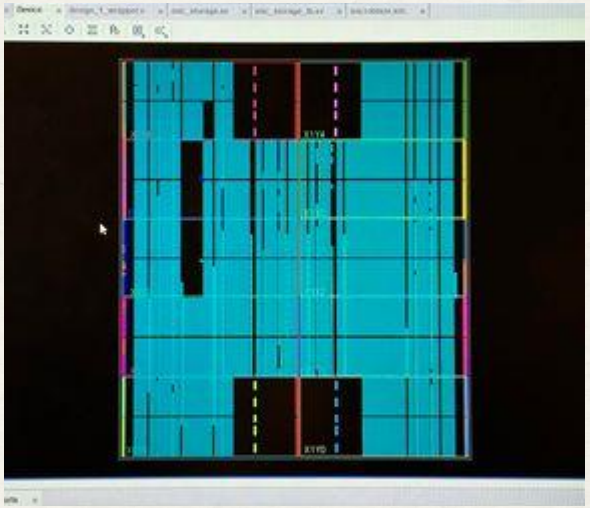


Final Complexity

Feature	Complexity points
Data Transfer from Desktop to FPGA	0.1
On-Board Audio Output Port	0.5
HDMI Output on Nexsys-Video	1.0
Visualize Meaningful Results with GUI	0.75
SPI Protocol-Based PMODs	0.75
I2C Protocol-Based PMODs	0.5
Custom IP for Record and Playback	~0.4
Custom IP for FFT (128 point)	~1
Total	~5

Challenges

- FFT is Humongous
- One PMOD VCC Pin has retired
- Audio CODEC is Challenging
- Integration of Audio Recording and Playback with Tuning Flow



Improvements for the Future

- Fit onto One FPGA
- Faster Load of GUI Assets on Startup
- Help User Tune their Instruments
- More Robust Audio Recording and Playback integrated with Tuning flow

Demo

Audio Recording and Playback

Thank you!

Questions?