

# Final Demo: Trumpet Analyser

Group 2

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# Reminder - What is it?



Live Display of Valve  
Combinations



Audio  
Recording/Playback

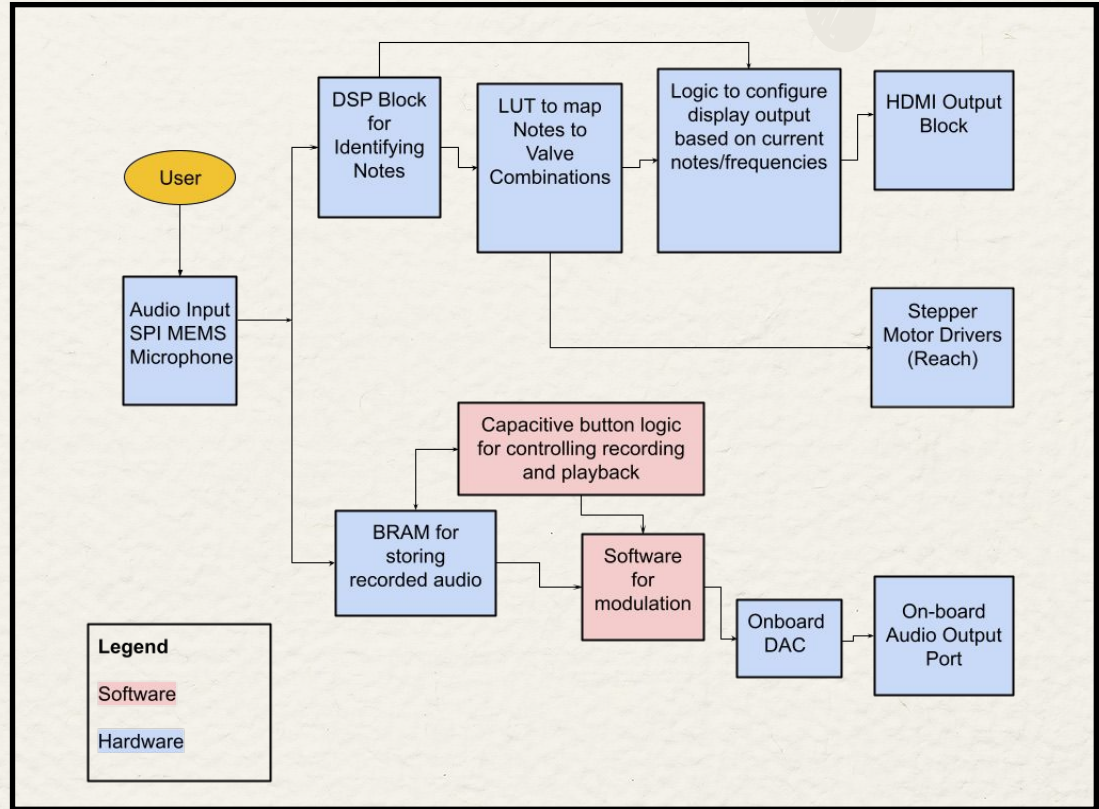
Tuner





# Initial Goals with Proposed System

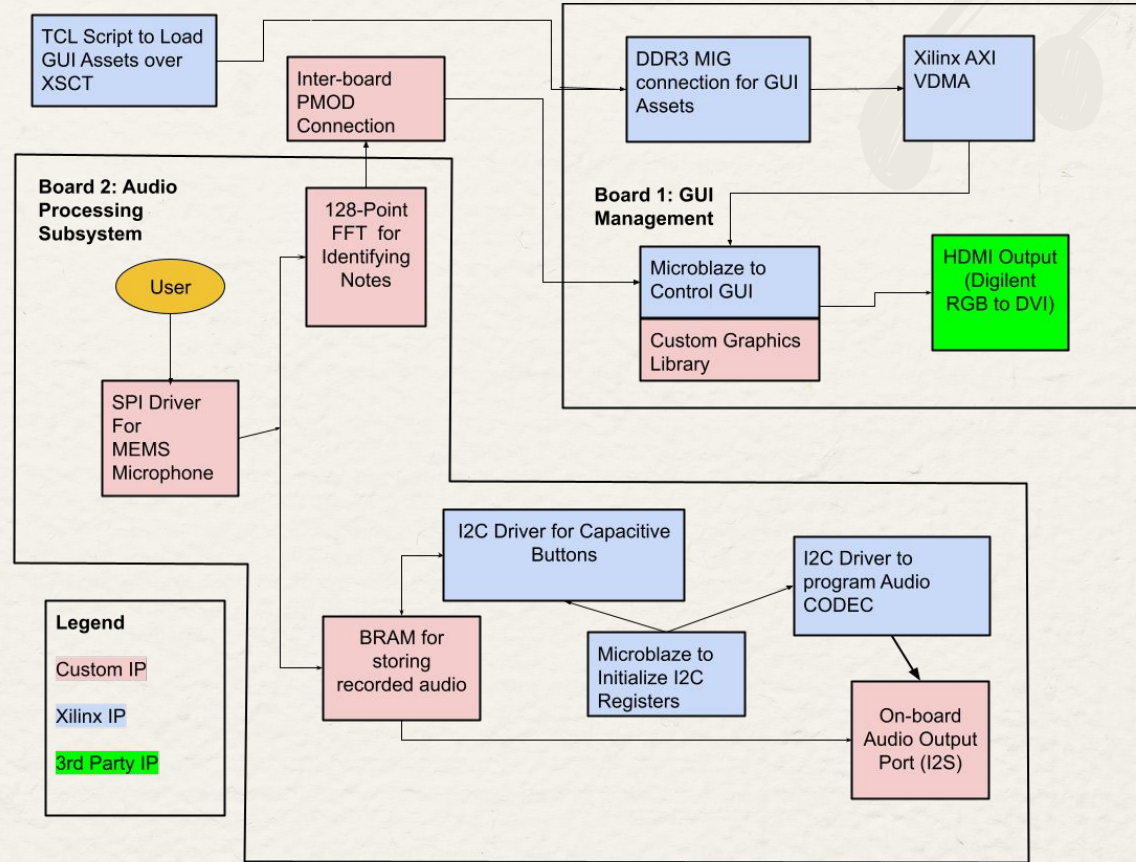
- Two main signal paths
  - Drive speakers
  - Compute trumpet note and display
- Comms: I2S, I2C, SPI, HDMI
- Video: HDMI
- Microblaze:
  - Configuration
  - Audio control logic
  - HDMI frame generation



# 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

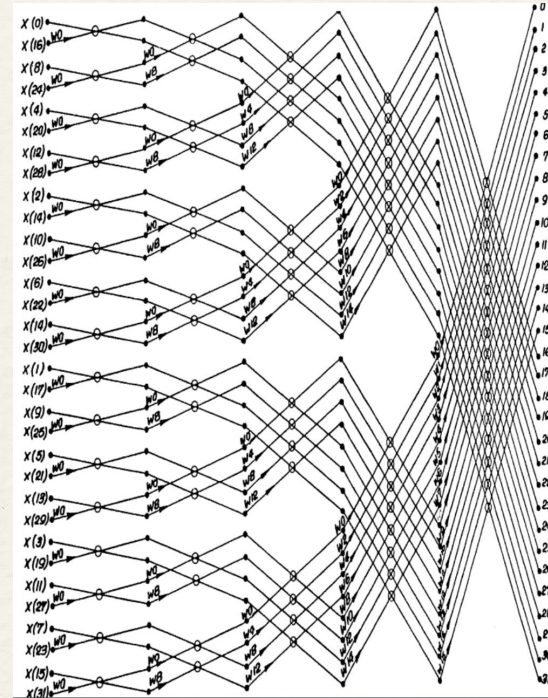
- SPI MEMS Microphone (PMOD)
  - SPI Interface (Custom IP)



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)



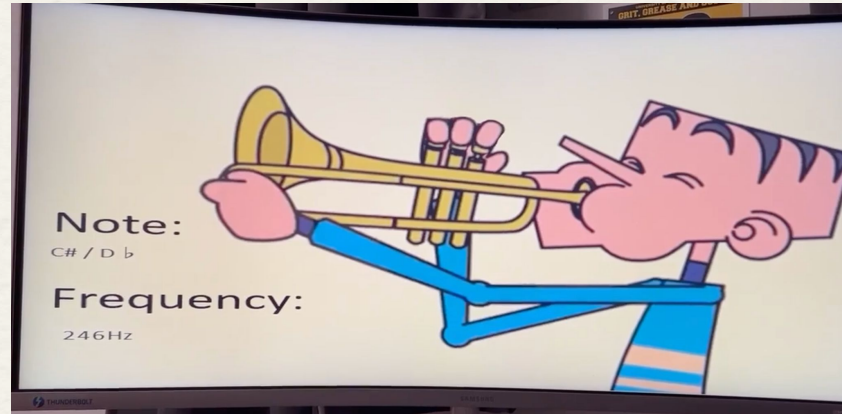
I<sup>2</sup>C capacitive buttons



I<sup>2</sup>S audio

# HDMI side

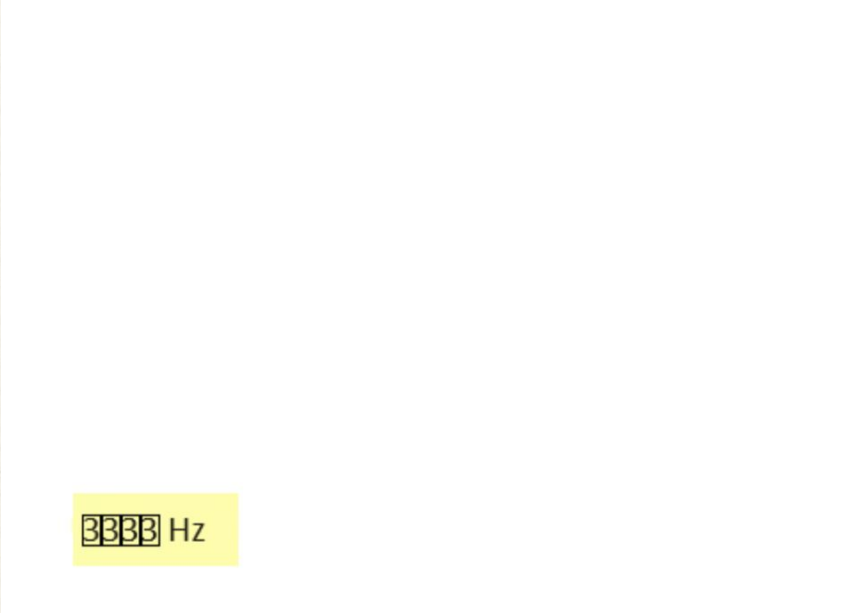
- Non-Passthrough HDMI setup (Xilinx/Digilent IP)
- Animation of Trumpet Valve Combinations (MicroBlaze + Custom Firmware)





# HDMI side

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



3333 Hz



Note:

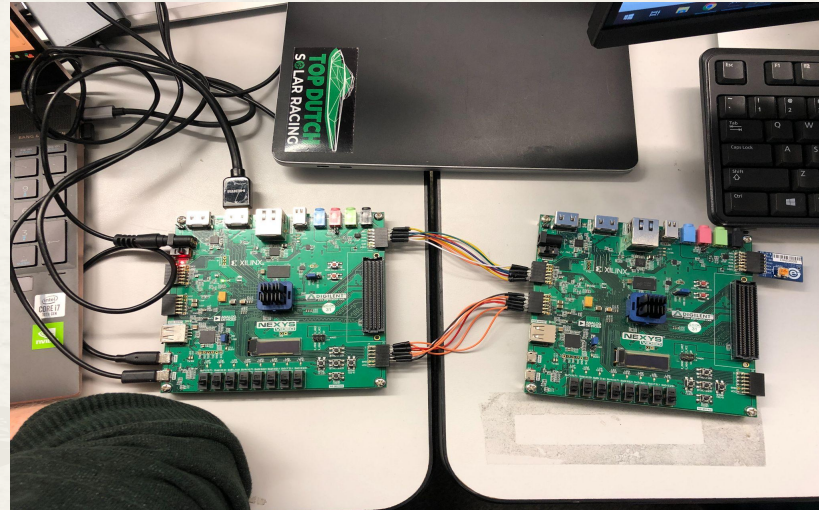
D

Frequency:

261Hz

# HDMI side

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



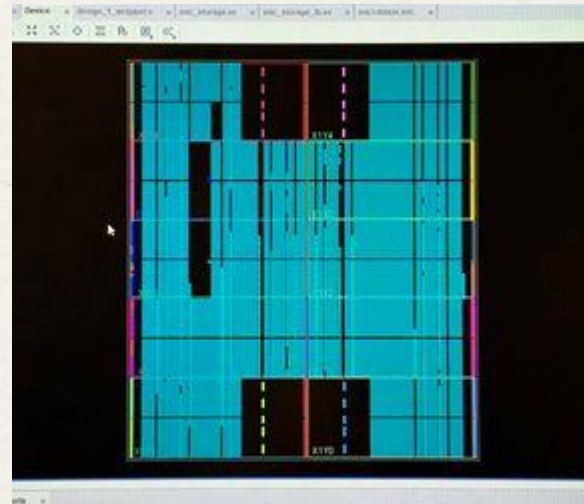


# Final Complexity

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

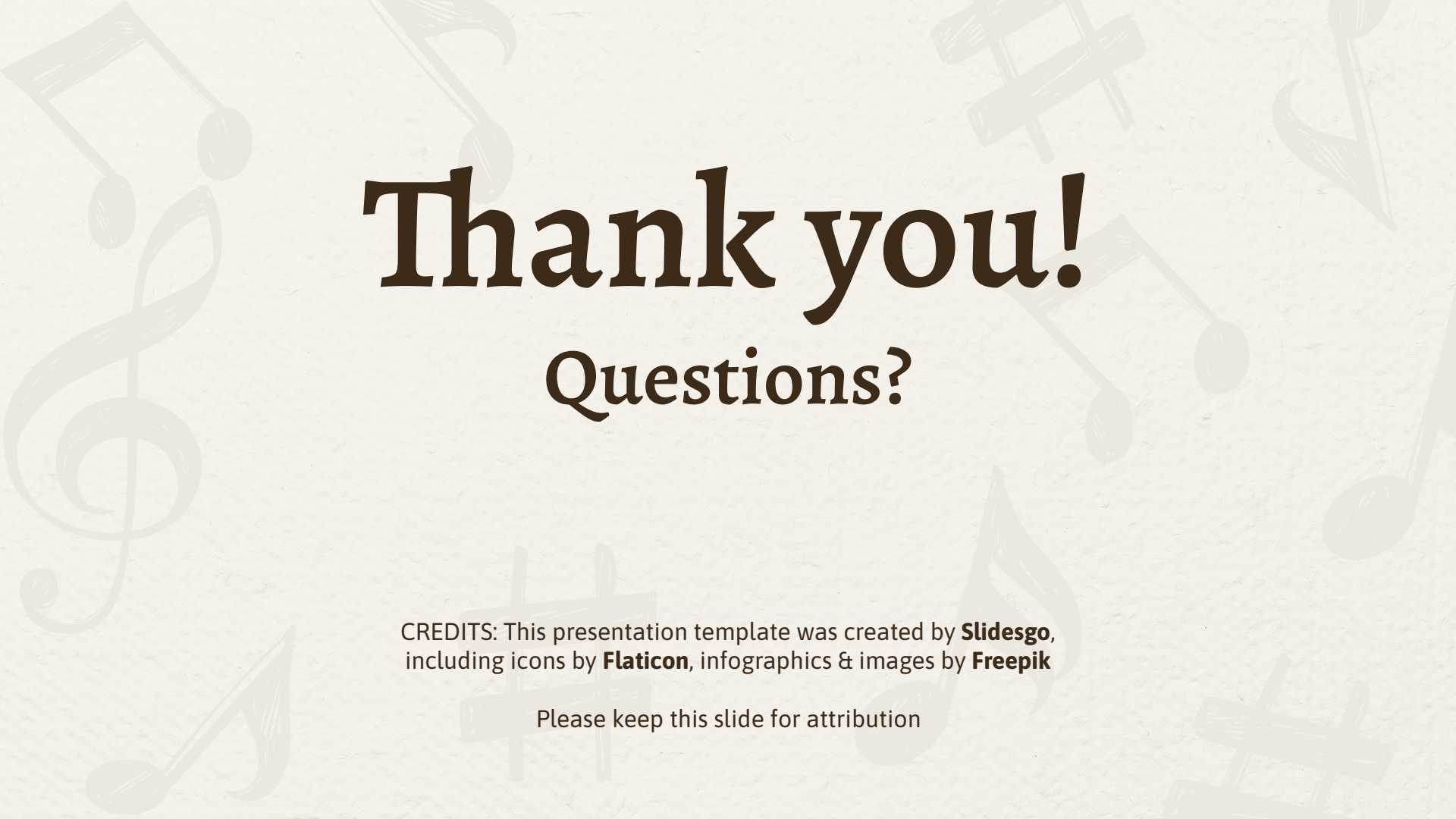
The background is a light beige, textured surface. Faint, stylized musical notes and a sharp symbol (#) are visible in the corners, rendered in a light gray or beige tone that blends with the background.

# Demo



# Audio Recording and Playback



The background of the slide is a light beige color with a subtle, repeating pattern of musical notes and treble clefs in a slightly darker beige tone. The notes are scattered across the slide, some appearing as eighth notes and others as quarter notes, with treble clefs interspersed among them.

# Thank you!

## Questions?

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