Maestro

Team 4

Evie Kyritsis, Sabina Maddila, Janelle Wellons

The Theremin

- Early electronic musical instrument controlled without physical contact by the thereminist

- Has two metal antennas
  - Senses the relative position of the user's hands

  - Controls oscillators for frequency with one hand

  - Amplitude (volume) with the other

Overview

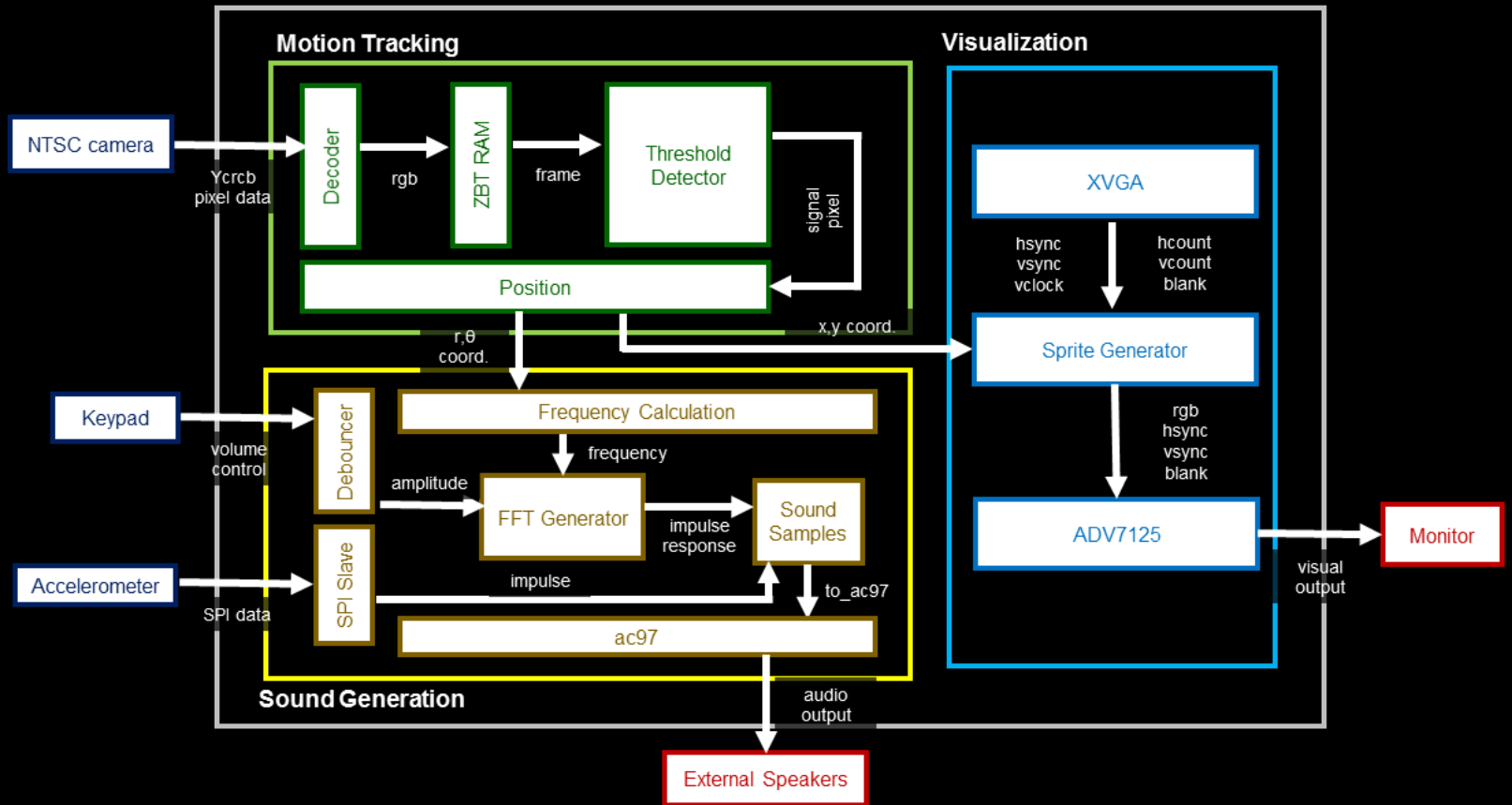
Our system is comprised of three components:

- Motion Tracking
    - Processes incoming user input data via NTSC camera
    - Outputs cartesian and polar coordinates

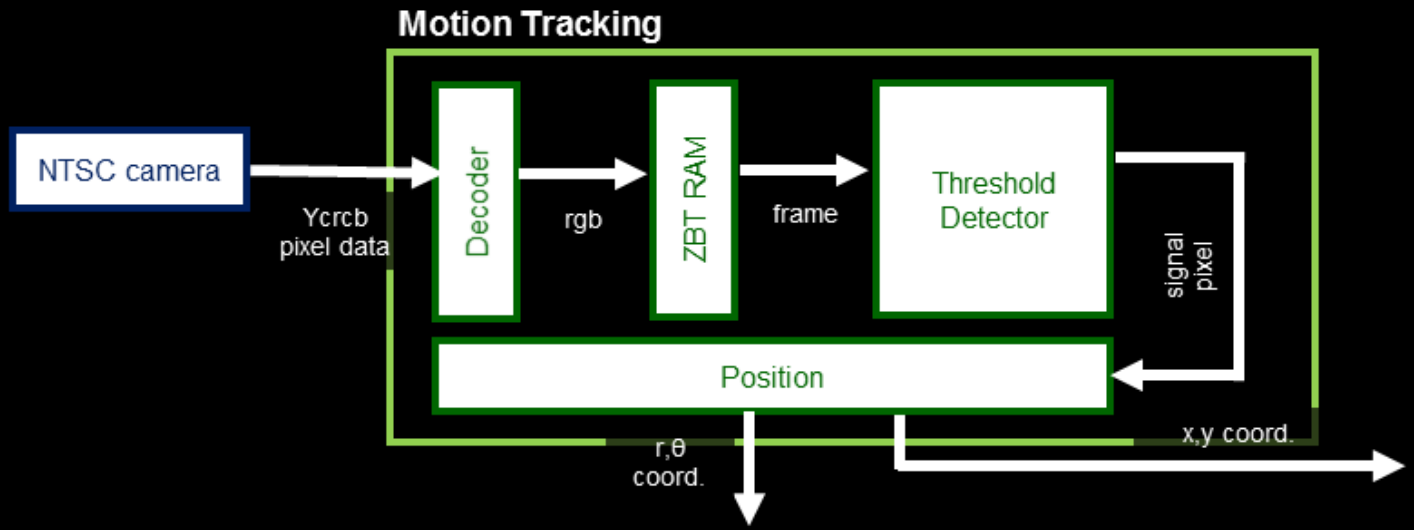
- Sound Generation
    - Takes in polar coordinate from Motion Tracker
    - Takes in data from accelerometers
    - Calculates and produces a tone
    - Outputs to ac97 on FPGA to external speakers

- Visualization
    - Takes in the cartesian coordinate from motion tracker
    - Generates objects that ‘follow’ the user’s hands on the computer monitor

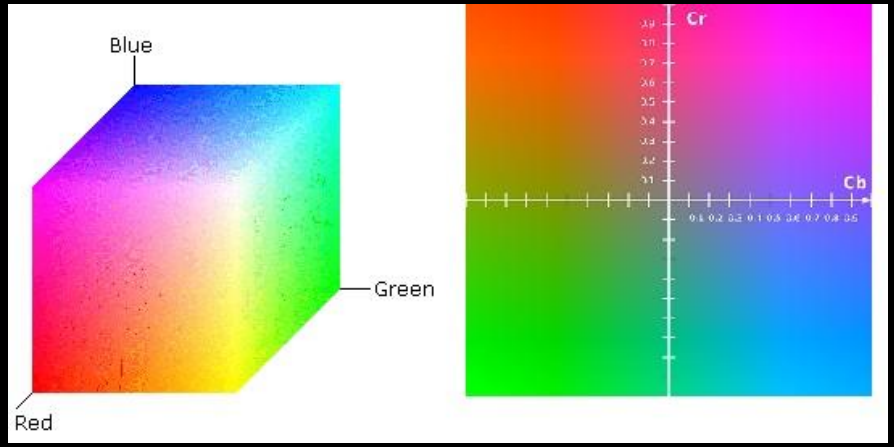
System Overview



Motion Tracking



Motion Tracking



Inputs:

- NTSC Camera Data

Outputs:

- Polar coordinate
- Cartesian coordinate

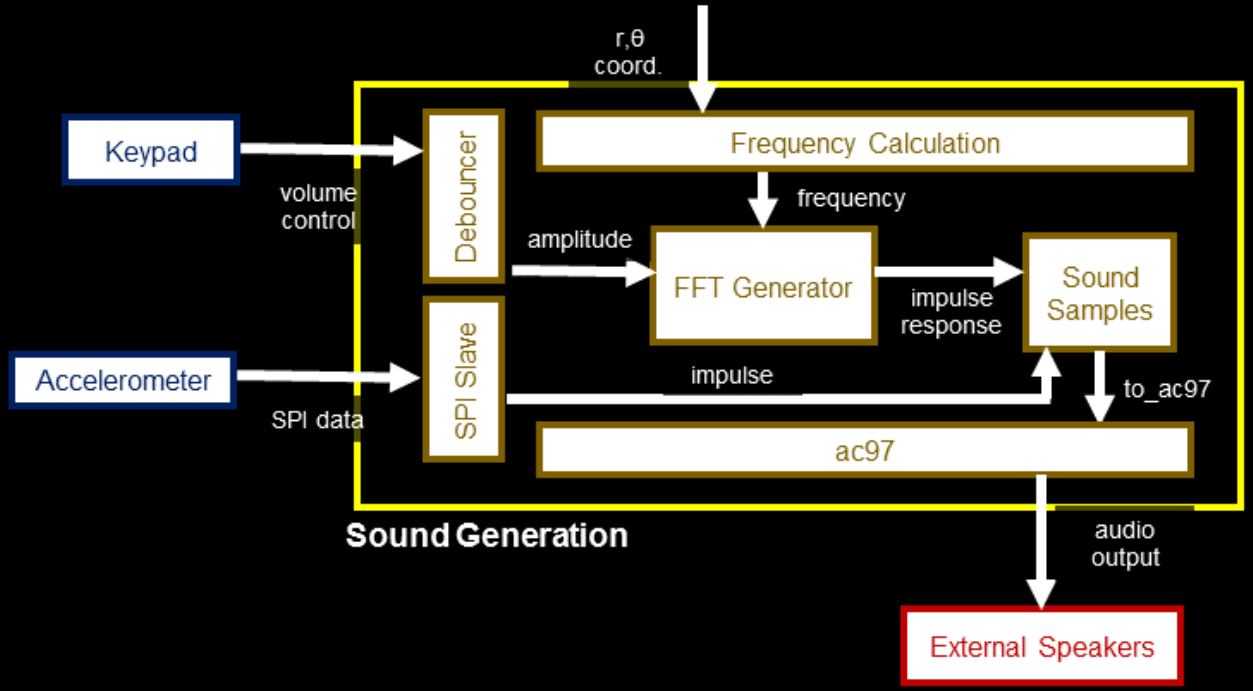
Modules:

- Decoder that takes in NTSC Data -> Ycrcb format
- Ycrcb -> RGB
- Prepare data for loading into ZBT Ram Memory
- Thresholds color values to identify object & produce coordinate

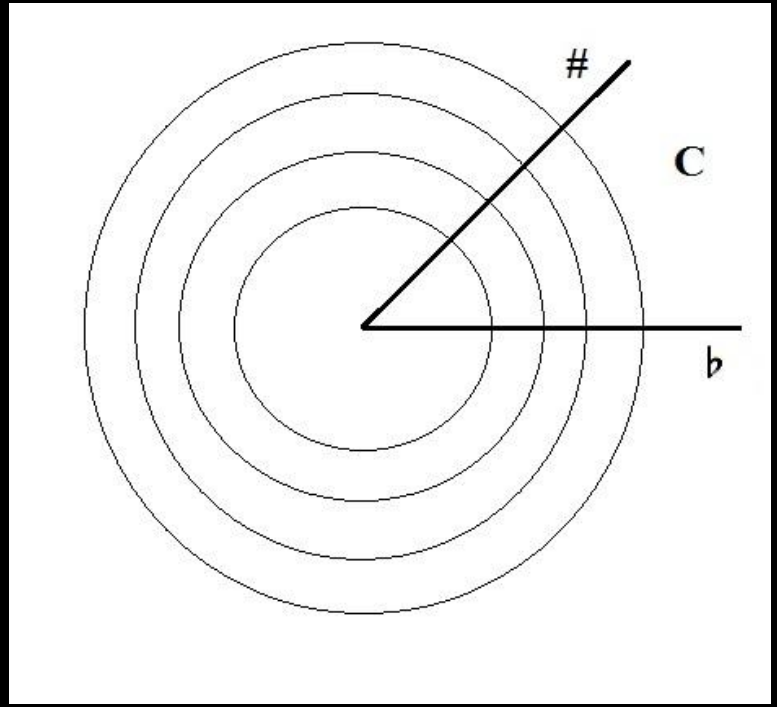
Implementation:

- Gloves, brightly colored fingers
- Begin with shading tests & crosshair tracking
- Play around with color values to identify our colored gloves

Sound Generation



Sound Generation



Inputs:

- Polar Coordinate
- Accelerometer Data
- Keypad Input

Outputs:

- Tone
- ac97 on FPGA to external speakers

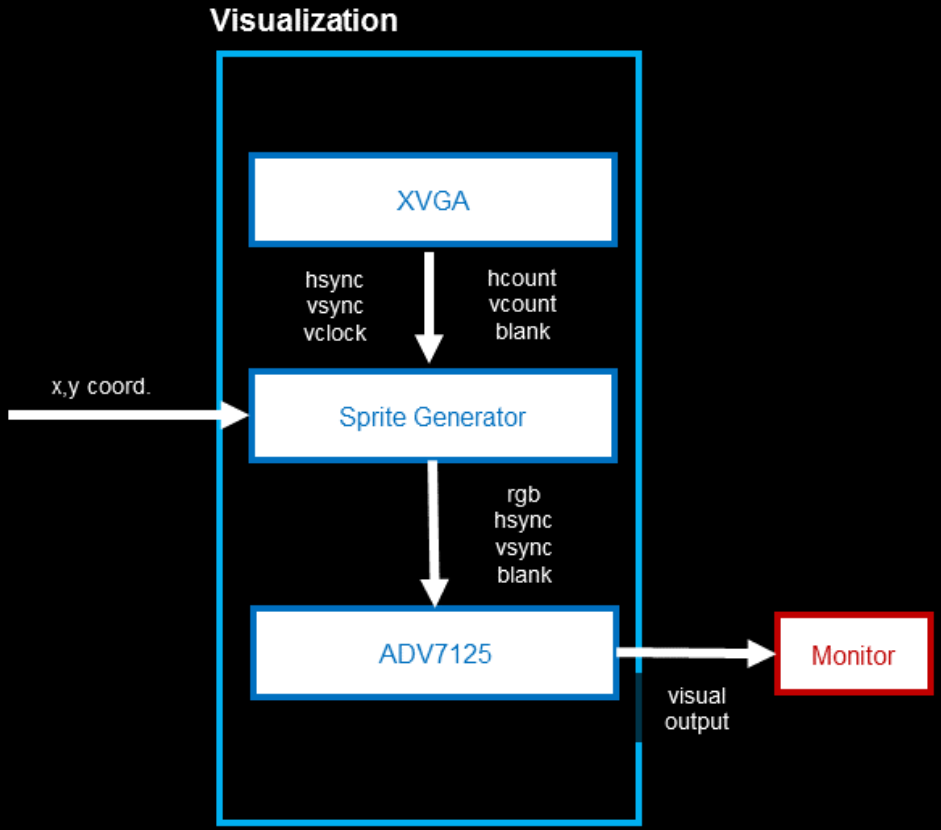
Modules:

- Frequency Calculation
- Sine Wave FFT Generator
- Output to ac97
- Debouncer

Implementation:

- Volume controlled by external keypad
- Begin by prototyping formula for sine waves in python first
- Will test not using the motion tracker but will instead have coordinates fed in by other means
- 3-axis accelerometer with SPI digital interface

Visualization



Visualization

Inputs

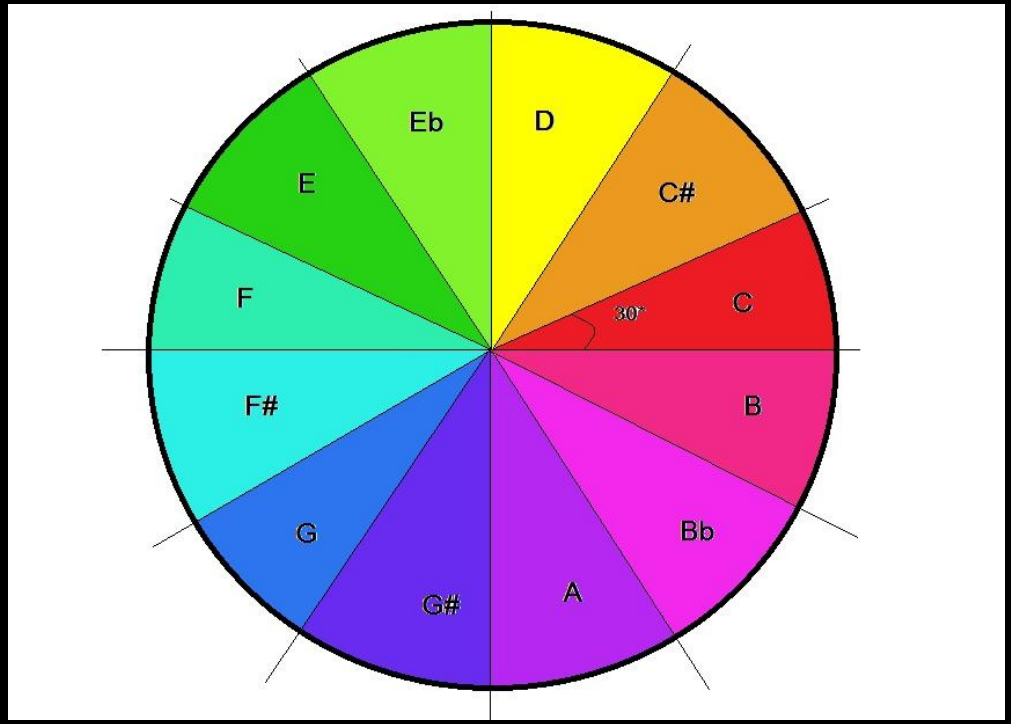
- Cartesian coord

Outputs

- VGA output to computer monitor

Modules

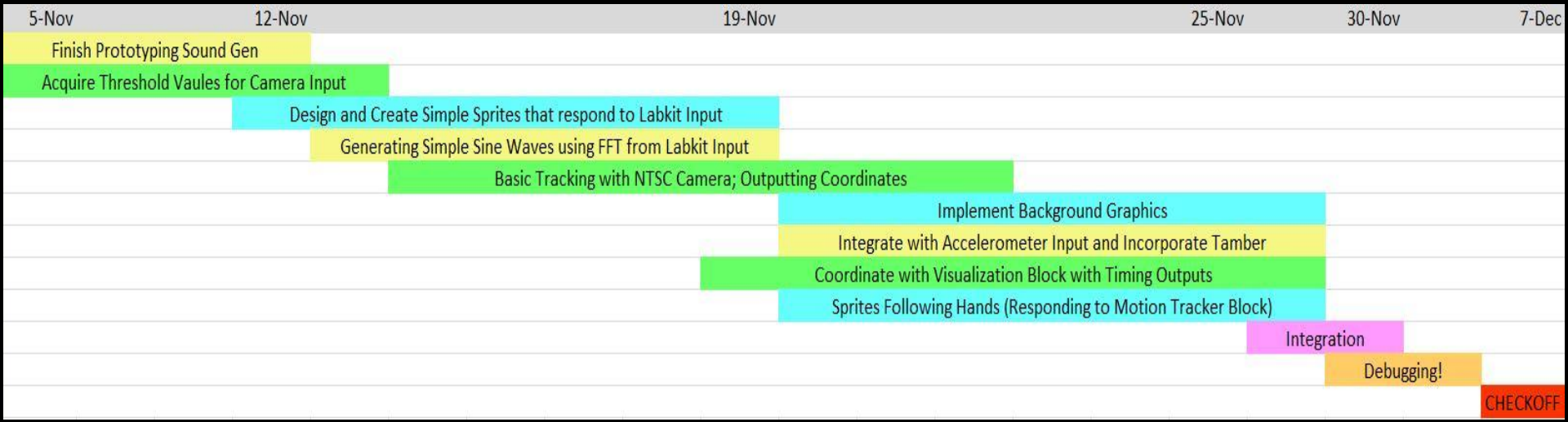
- Generate XVGA signals
- Sprite Generator
- Send to VGA output



Implementation

- Use the same wheel described in Sound Gen, in order to represent certain tones as a color
- Will have objects that follow the hands
- Start with testing separate from Motion Tracker, will integrate later on
- Tricky bit: figuring out the timing between receiving the camera input and outputting the response

Timeline


5-Nov
12-Nov
19-Nov
25-Nov
30-Nov
7-Dec
Finish Prototyping Sound Gen
Acquire Threshold Vaules for Camera Input
Design and Create Simple Sprites that respond to Labkit Input
Generating Simple Sine Waves using FFT from Labkit Input
Basic Tracking with NTSC Camera; Outputting Coordinates
Implement Background Graphics
Integrate with Accelerometer Input and Incorporate Tamber
Coordinate with Visualization Block with Timing Outputs
Sprites Following Hands (Responding to Motion Tracker Block)
Integration
Debugging!
CHECKOFF

Questions?