Team D0: KaraoKey
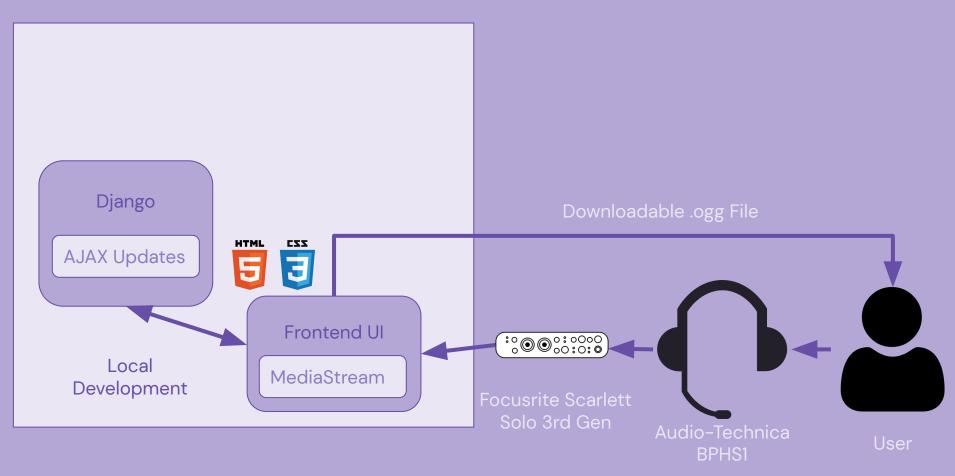
Anna Gerchanovsky, Anita Ma, Kelly Woicik
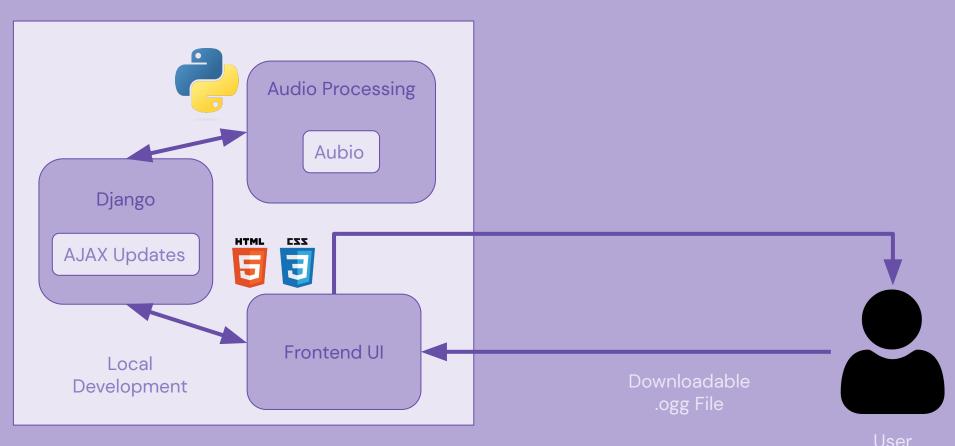
Use-Case Requirements

Requirement	Result	Quantitative Limit
Latency in real time feedback (AJAX)	0.05s	Under 0.25s
Latency in inputted song processing	0.51s	<= 10s
Latency in analysis	0.26s	< 5s
Pitch accuracy	99.4%*	>= 90%
Headset Microphone	Audio-Technica BPHS1	Audio-Technica BPHS1
Audio Interface	Focusrite Scarlett Solo 3rd Gen	Focusrite Scarlett Solo 3rd Gen

*ignores octave errors

Solution Approach - User Recording

Django

AJAX Updates

Local
Development

Frontend UI

MediaStream

Downloadable .ogg File

Focusrite Scarlett
Solo 3rd Gen

Audio-Technica
BPHS1

User

Solution Approach - User Visualization

Audio Processing

Aubio

Django

AJAX Updates

HTML5 CSS3

Frontend UI

Local Development

Downloadable .ogg File

User

Complete Solution

Testing Practices

How do you test?

    Latency: Use python's built-in time module

    Accuracy: Use our scoring algorithm

How do you measure success

    Latency: <10s for song processing, <5s for analysis

    Accuracy: >= 90%* of notes correct

*ignores octave errors

Pitch Detection and Feedback Algorithm Testing

Requirement	Test Input	Expected Test Output	Actual Output
Latency in inputted song processing	Happy Birthday MIDI file (20 seconds)	<= 10s	0.51s
Latency in analysis	Happy Birthday MIDI file (20 seconds)	< 5s	0.26s
Pitch accuracy	108 known pitches	>= 90%	100%
	Happy Birthday MIDI file (20 seconds)	>= 90%	99.4%*

*ignores octave errors

What We Tried and What Didn't Work

Problem	Fix	What Happened
Sending .wav File to PDA	Set Mime Type in MediaRecorder	No RIFF Header
No RIFF Header	Add RIFF Header Manually	Noisy output
Noisy Output	Update MediaRecorder Track Settings	Noisy output
File exports as Ogg not Wav	Convert to Ogg to Wav	Ogg file corrupted, no header

Design Tradeoffs

Pitch Detection Algorithm: Homegrown vs. Module

- More control with a homegrown algorithm.
- It is very complex and difficult to create a fast algorithm to detect pitch.
- Lack of signals experience.

Backend Language: C++ vs. Python

- Most heavy computation is handled by modules.
- With initial tests, we predicted Python would be fast enough.

Web Application Framework: Django vs. Flask

- MVC more intuitive in Django
- Previous experience with Django

Project Management - Division of labor

Web application

Kelly

Audio tracking

Testing, comparing, evaluating

Anna

Web framework

Song playing backend

Kelly

UX – UI

Integrating audio processing in with backend

Anita

Feedback generation and integration with web app

Feedback graphics

Ordering equipment

Demo

Audio processing

Project Management - Schedule/Qantt Chart

category	specific	schedule phase 1 (groundwork)					phase 2 (in depth)				phase 3 (combine)				
		01/30-02/05	02/06-02/12	02/13-02/19	02/20-02/26	02/27-03/05	03/06-03/12	03/13-03/19	03/20-03/26	03/27-04/02	04/03-04/09	04/10-04/16	04/17-04/23	04/24-04/30	05/01-05/07
pitch detection	research algs														
	demo with a hardcoded scale														
	implement audio tracking in aubio														
	find/craft midi files														
	test out best pitch tracking algorithm														
	test out pitch tracking on wav file														
	feedback generation														
	integrate with feedback algo														
	slack														
web app	figma ui														
	basic login and page navigation														
	research + try graphics packages														
	song can be selected + played														
	record while song plays														
	display target graphics while song plays														
	integrate with pitch detection														
	add feedback during/after song														
	slack														
deliverables	create blog	02/04													
	proposal presentation	02/05													
	design presentation (FIXME)			02/19											
	design report (FIXME)					03/03									
	Interim Demo										04/03				
	final presentation												04/23		
	final report														
other	decide on + order headset + interface														

Remaining Steps

User Experience

- Polish UI and navigation
- User testing and feedback

Add More Songs for Demo

- Currently "Happy Birthday"

Add More Analysis Afterwards

- Add more statistics (i.e. sharp, flat, how close, etc)