SoundSync

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A novel system that aims to autonomously turn pages in real time using eye tracking and audio processing to ensure accuracy and focused playing for the duration of practice

Use Case

PROBLEM	Disruptions and loss of focus for musicians resulting from page turning during rehearsals and performances
SOLUTION	A system that autonomously turns pages in real time using eye tracking and audio processing to ensure accuracy and focused playing for the duration of practice
AREAS	**Software** Systems, **Signals** and Systems

Use Case Requirements

Eye-Tracker Accuracy	0.5 inches	The average size of a bar of sheet music on an 11 inch tablet
Eye Tracker Precision	1.5 inches	The size of sheet music notation on an 11 inch tablet
Eye-Tracker Latency	333 ms	A beat at 180 BPM with additional processing

Use Case Requirements (1)

Eye-Tracker Field-of-View	minimum 5.5 x 8 $inches^2$	The amount of space the eye-tracker needs to identify a full human head
Audio Latency	333 ms	Time it takes to process audio signal and find position in music
Audio Accuracy	1 beat	Time between where the music actually is and where the model thinks it is

Use Case Requirements (2)

Audio Filtering	instrument specific ± 5%	Filter to remove other frequencies outside of selected instrument range
Power Budget	8Wh	Power consumed by the system + Google Board
Page Turning Success Rate	>95%	How often did the page turn when the musician expected it to?

Technical Challenges

Compact Design	Users will require a seamless experience that doesn't obstruct their view of the conductor or the environment
Eye tracking	Precise and accurate eye tracking to ensure we know where users are currently located in the score
Power Requirements	Orchestras cannot have hundreds of outlets or extension cords, therefore SoundSync must be battery powered

Technical Challenges (1)

Processing Delay (Model Delay)	The processing speed of our ML Model must be efficient and accelerated to provide real-time eye tracking with an accurately moving cursor
Audio recognition and placement	Robustness against tempo or rhythm changes, music recognition using ML algorithms. The algorithm must inevitably be able to tolerate musician and human error

Solution Approach

Eye-Tracker Filtering

Camera data is filtered through various techniques that improve precision

Compact Design

Using small but powerful peripherals such as a clip-on microphone ensures low weight

Battery-Powered

A pre-charged battery pack with enough energy to last the duration of a concert

Solution Approach (1)

Frequency Filtering

Accounting for unique harmonic series to provide instrument specific audio processing

Audio Alignment

Machine Learning algorithms to process musician idiosyncrasies and adapt relative to a pre-processed MIDI file

Edge Cases

Head gestures tracking for codas, long range repeats, and other nonlinear musical structures

Testing Verification & Metrics

Eye-Tracking Accuracy

Comparing and testing variations of eye tracking filters to find the optimal settings

Audio Alignment

Graphing the time difference between the user's audio and the MIDI file bounded by the length of a beat

Page Flip Success Rate

Verify with user that page flips felt appropriately timed

Model Delay

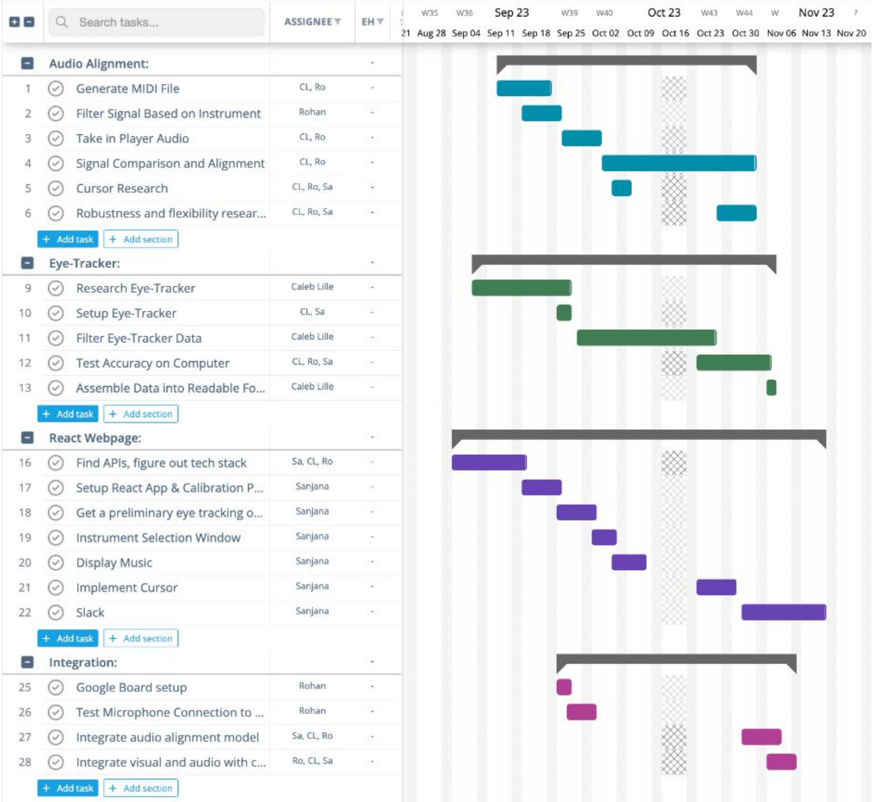
Send test data through the models and check if time to output is within the length of a beat

Tasks

Rohan
Audio Alignment Model, Instrument Frequency Calibration

Sanjana
Webpage Development, Eye-Tracker ML Model

Caleb
Data-Point Filtering, Music Processing, Audio Alignment



User Experience Flow Chart