

# AI-Powered Ear Training Tutor – Progress Update

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## Work So Far

### Interactive Staff Interface

- Implemented a fully functional musical staff using **HTML Canvas**
- Users can interact with the staff via **mouse hover** and **click actions**
- Notes are rendered with proper **musical notation**, including **accidentals** (sharps/flats)
- Visual feedback:
  - **Yellow** for base notes
  - **Blue** for selected notes

### Adaptive Learning System

- Four proficiency levels: **Easy**, **Medium**, **Hard**, and **Mastery**
- **Dynamic difficulty adjustment** based on user performance
- Intelligent interval selection with **weighted distributions**:
  - **Easy Level**: 100% easy intervals (Unison, Perfect Fourth, Fifth, Octave)
  - **Medium Level**: 80% medium, 20% easy intervals
  - **Hard Level**: 80% hard, 10% medium, 10% easy intervals
  - **Mastery Level**: Even distribution (~33% each)

### Progress Tracking and Analytics

- Tracks user performance for **each interval type**
- Calculates **accuracy rates** by interval category
- Automatically advances user to next level upon:
  - Reaching **80% accuracy**
  - Completing **at least 10 attempts**

### Comprehensive Feedback System

- **Immediate feedback** on answers
- **Multi-level hint system**:
  - **Level 1**: Auditory comparison with step-by-step playback
  - **Level 2**: Interval name and semitone count
  - **Level 3**: Direct note name revelation
- Intuitive visual dialog system for user feedback

### Audio Playback Features

- **High-quality note synthesis** using Tone.js
- Playback for both **base note** and **interval note**
- **Step-by-step semitone playback** for better learning
- Accurate **frequency calculations** including accidentals

# Changes from Original Proposal

## Focused Implementation

- Focus narrowed to **interval training only**
- Rationale:
  - Enables a **more polished and effective** experience
  - Mastery of intervals is foundational for developing **chord and key recognition**

## Enhanced Adaptive System

- More **sophisticated** than originally proposed
- Added:
  - **Level unlocking requirements**
  - **Detailed progress tracking**
- Justification: Clearer goals and **stronger user motivation**

## Modified Feedback Approach

- Replaced purely AI-driven feedback with a **structured hint system**
  - Justification: Offers **consistent and correct** sound assistance
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# Remaining Tasks

Here's hoping that I have time to finish implementing the following.

## Note Recognition Module

- Individual note recognition exercises
- Would use a similar framework to interval training

## Chord and Key Identification

- Chord type recognition (major, minor, diminished, augmented)

## AI Enhancement Opportunities

- **BIG MAYBE ON ALL OF THESE DEPENDING ON TIME**
  - **Bayesian knowledge tracing**
  - **Pattern recognition** for error analysis
  - **NLP-driven personalized feedback**
  - **Advanced analytics** for learning path optimization
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Overall, I'm pretty pleased with what I've accomplished so far and hopeful I will be able to get the rest of it working.