# ARD

# The Problem Domain

In the world of music education and cultural heritage, there is a growing demand for personalized tools to enhance singing abilities, especially for individuals preparing for significant cultural milestones like a Bar Mitzvah. Our project's problem domain centers around developing an application that serves as a dedicated solution for Rabbi-led vocal instruction, guiding young learners in reading from the Torah during their Bar Mitzvah preparations.

The primary focus remains on helping users to practice and enhance their singing capabilities through interactive methods. The app enables users to select songs and voice samples for personalized practice sessions, aligning with the requirements of Torah reading. Real-time feedback, analysis, and visualization features are designed to improve pitch accuracy, timing, and overall vocal expression.

# Context

Our system operates in the world of tuning and voice coaching with focus on Torah reading and improving. We want our users to have access to a learning app that helps them practice voice and tuning in the most comfortable way that we can provide. Our system will work in the following manner:  
תמונה שמכילה תרשים, טקסט, שרטוט, קו

התיאור נוצר באופן אוטומטי

# Vision

With our app we aim to give users the ability to express themselves confidently and skillfully through singing. Our app aims to improve vocal learning with personalized guidance and real-time feedback, creating a fun and engaging experience for users.

## The main goals for our app are:

**Personalized Learning:** Voice Coach allows users to pick or upload songs for a personalized learning experience. The app actively listens in real-time, offering instant feedback on tuning and voice changes.

**Real-time Improvement:** Guiding users on how to improve as they sing, Voice Coach ensures they sound as close as possible to the original sample, fostering continuous progress and confidence.

**Comprehensive Analysis:** After each session, Voice Coach provides a detailed analysis, including graphs and charts, along with a score reflecting the user's performance and growth over time.

**User-Centric Features:** Registration enables users to track voice projects and improvements. With a selection of songs or voice samples, users can choose from a range of options to learn and improve upon.

**Rabbi's Teaching Torah:** Voice Coach extends beyond individual singing lessons to help Rabbi teaching Torah to students.

# Software context

The app will combine real-time voice recognition technology with a comprehensive feedback system to provide users with personalized guidance and analysis. Utilizing Unity with C# for the frontend and Flask with Python for the backend, the app will help to create an environment for users to practice and track their progress over time.

**Major Inputs:**

1. **User-Selected Songs/Voice Samples:**
   * Users can choose songs or upload voice samples they wish to learn and improve upon.
   * Accepted formats include popular audio file formats (e.g., MP3, WAV).
2. **Real-Time User Singing:**
   * Users provide input through their singing during practice sessions.
3. **User Registration Information:**
   * Users have the option to register, providing necessary details to track their progress and save preferences.

**Functionality:**

* Real-Time Voice Recognition:
* Feedback Generation:
* User Progress Tracking:
* Song/Project Management:

**Processing:**

1. **Real-Time Audio Processing:**
   * Unity processes real-time audio input from the user's microphone during practice sessions.
   * Voice recognition libraries and algorithms, integrated into the backend, assess the singing performance.
2. **Feedback Generation Algorithm:**
   * Frontend Unity will processes user input and generates real-time feedback.
   * Backend Flask server will provide a more comprehensive analysis of the voice sample.
   * Libraries and Algorithms analyze the discrepancies between the user's singing and the selected song/voice sample.

**Outputs:**

1. **Real-Time Feedback Display:**
   * Real-time feedback is displayed on the app's user interface during practice sessions.
   * Visual cues, such as graphical overlays, highlight specific areas for improvement.
2. **Performance Analysis Report:**
   * At the end of each session, users receive a detailed analysis report.
   * Graphs and charts illustrate accuracy, pitch variations, and other key metrics.
   * A final performance score is provided, allowing users to track their overall improvement.

**Use-Cases:**

1. **User Registration:**
   * User registers an account to access personalized progress tracking and additional features.
2. **Song Selection and Practice:**
   * User selects a song or uploads a voice sample.
   * User practices singing along with real-time feedback.
3. **Progress Tracking:**
   * Registered user reviews historical data and tracks improvements over time.
4. **Performance Analysis:**
   * After completing a session, the user receives a detailed performance analysis report.
5. **Project Management:**
   * User manages multiple projects, switching between songs and voice samples for varied practice.

**Interaction with the Environment:**

* The app interacts with the user's microphone for real-time voice input.
* Users can interact with the app's graphical user interface to select songs, manage projects, and view feedback.

**Interaction with Other Systems:**

* The app interfaces with a Flask server on the backend for processing user input and generating feedback.

# Functional Requirements

## 1. User Registration and Profile Management:

* Users should be able to create accounts to access personalized features.
* Profile management functionality should allow users to update personal information, track progress, and manage preferences.

## 2. Song/Voice Sample Selection:

* Users should be able to choose from a variety of songs or upload their own voice samples for practice.
* The app should support a diverse range of musical genres and difficulty levels.

## 3. Real-time Audio Feedback:

* The app should provide real-time feedback on the user's singing performance.
* Feedback should include pitch accuracy, timing, and other relevant metrics.

## 4. Voice Comparison and Analysis:

* Users should be able to compare their singing to the original voice sample.
* Detailed analysis should be provided, highlighting areas for improvement in pitch, tone, and rhythm.

## 5. Visualization of Performance:

* Graphs and charts should be generated to visually represent the user's performance throughout the song.
* Visual feedback can include pitch graphs, waveform comparisons, and other relevant metrics.

## 6. Scoring and Progress Tracking:

* The app should assign scores to the user's performance based on various criteria.
* Progress tracking features should allow users to see improvements over time.

## 7. Customization of Practice Sessions:

* Users should be able to customize practice sessions, adjusting playback speed, pitch, and difficulty.
* Customization options should cater to users of different skill levels.

## 8. Voice Project Library:

* A library of songs or voice samples should be available for users to choose from.
* Regular updates to the library can keep content fresh and engaging.

## 9. User Community and Social Features:

* Users should have the option to share their achievements and progress with a community of fellow singers.
* Social features like comments, likes, and sharing can enhance user engagement.

## 10. Data Security and Privacy:

* Ensure that user data, especially voice recordings, is stored securely and adheres to privacy regulations.
* Implement secure authentication mechanisms to protect user accounts and sensitive information.

# Special usage considerations

**Multi-Language Support:**

Ensure that the app can analyze and provide feedback on singing in different languages with focus on Hebrew and torah reading, allowing a broader user base to benefit from the application.

**Offline Mode:**

Implement an offline mode that allows users to download specific lessons or songs for later practice without requiring a constant internet connection. Without internet connection the their can't be Realtime speech recognition.