Harmonious:

Pitch Training for Musicians

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**Define Project Success**

Music is an art form with mathematics and physics at its core. As sound waves travel from the throat of a singer or an instrument, their analysis reveals many different qualities including pitch, volume, and timbre. Musicians train for years, often lifetimes, to hone their skills, especially skill in recognizing and producing notes that are on pitch. The human ear can detect variations in pitch of less than 1 Hz, so performance quality musical expression must be very precise.

This system will be able to detect and analyze musical notes sung, played, or synthesized. As a training tool, it will be able to analyze these notes in real time to show a user if their voice or instrument is off pitch and help them be in tune. The functionality of the system will start with single notes, extend to short musical phrases, and end with whole songs.

The target hardware platform is Windows, and the language used will be Java. Determining pitch from a microphone source is mathematically intensive, with many different methods and algorithms to accomplish this task. The system will be built using an autocorrelator for pitch detection accuracy.

**Target Users**

The target users for this product are music instructors and their students. The product will be a valuable training tool for one of the critical objectives of music training- accurate pitch determination and expression vocally or instrumentally.

**Project Backlog**

\*All stories apply to vocal or instrumental music unless otherwise noted.

1.) As a vocal student or musician user of this program, I would like to determine how accurate my ear is during warm-up exercises. I will sing or play a pitch and the system will give feedback on its accuracy based on its closest frequency.

Acceptance Criteria:

* I can start and stop my input.
* I can sing into the microphone and the system accepts it.
* I can see how accurate I was by a message in text.

2.) A vocal student or musician would like to train to recognize intervals. They will be given a pitch and will sing or play the specified interval. The system will give feedback on accuracy.

Acceptance Criteria:

* I can start and stop my input.
* I can select which musical intervals to train on.
* I can sing into the microphone and the system accepts it.
* I can see how accurate I was by a message in text.

3.) A vocal student or musician would like to train to recognize a note played. They will be given a pitch and will specify the name of note they heard. The system will give feedback on accuracy.

Acceptance Criteria:

* I can select a range of notes.
* I can hear a note played.
* I can indicate what note I thought was the one played.
* I can see how accurate I was by a message in text.

4.) A vocal student is training to have perfect pitch, meaning they would like to envision a note in their mind and sing it accurately without any auditory prompting. The student enters how many random notes to try and the range of those notes. The system presents the name of a note to the student; the student sings the note and receives accuracy feedback based on the correct frequency.

Acceptance Criteria:

* I can start and stop my input.
* I can select which musical range to train on.
* I can hear a note played.
* I can sing into the microphone and the system accepts it.
* I can see how accurate I was by a message in text.

5.) A music instructor would like to evaluate a student’s pitch performance on a musical phrase or song. The system captures the student’s performance; it analyzes the performed music and displays accuracy feedback for the instructor and student based on closest frequency comparisons. The instructor saves the session for further review.

Acceptance Criteria:

* I can start a new session.
* I can select a user.
* I can select a musical range.
* I can sing into the microphone and the system accepts it.
* I can see how accurate I was by a message in text.