voisTUTOR: Virtual Operator for Indian Spoken English TUTORing

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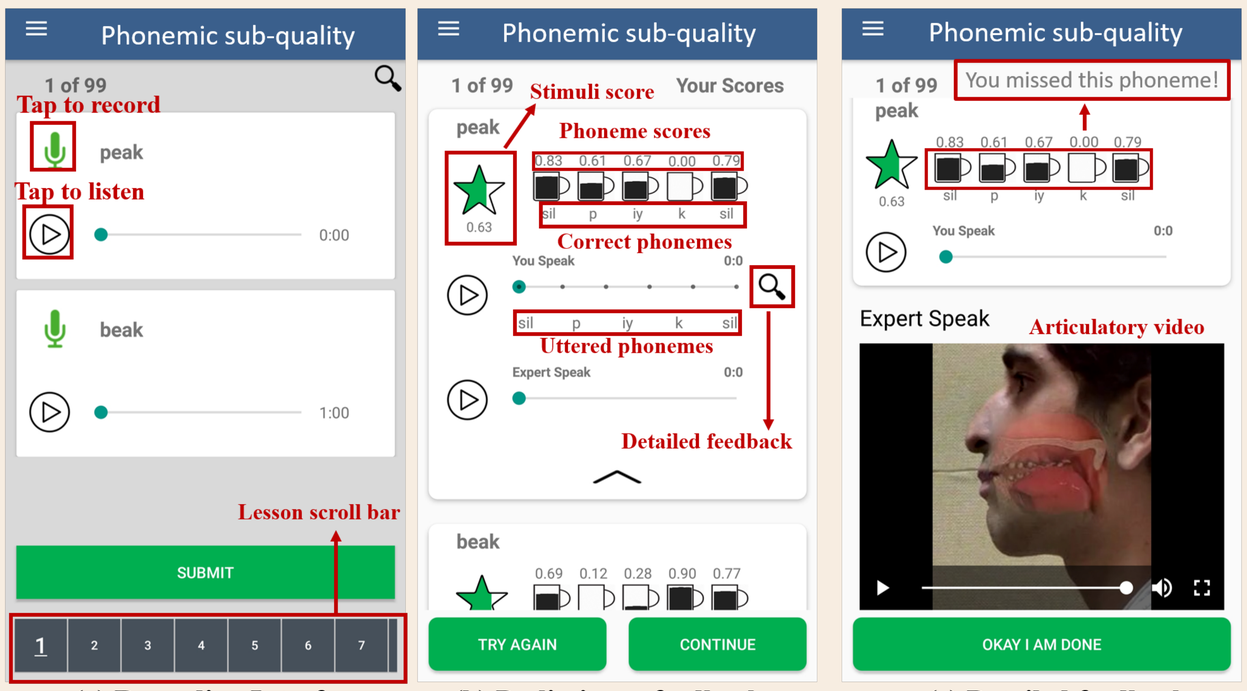
PROBLEM STATEMENT

Demonstrate voisTUTOR tool that provide detailed feedback on correct usage of phonemes as well as stress, intonation and pauses for Indian learners to learn spoken English pronunciation in a self-learning manner.

Phoneme

- **Why to learn usage of phonemes:** Correct pronunciation of phonemes is essential for second language (L2) learners to be able to speak words/sentences like a native speaker [1].



(a) Recording Interface (b) Preliminary feedback (c) Detailed feedback

- **Score computation:** Compute the scores for following phoneme categories: 1) insertions $\left(S^i_{avg}\right)$, 2) deletion $\left(S^d_{avg}\right)$, 3) substitution $\left(S^s_{avg}\right)$ and 4) remaining $\left(S^r_{avg}\right)$.
- These phoneme categories are estimated with forced-alignment.
- The overall score for a word (w) is computed as $S(w) = \frac{\sum_{j\in\{i,d,s,r\}} \alpha_j S^j_{avg}}{\sum_{j\in\{i,d,s,r\}} I_j \alpha_j}$, where $I_j \in \{1, 0\}$. $I_j = 1$ when j-th category occurs in the word (w) and α_j is a weight associated with j-th category.

Syllable stress

- **Why to learn usage of syllable stress:** In the language learning, correct usage of syllable stress patterns could minimize the localized pronunciation errors [1].

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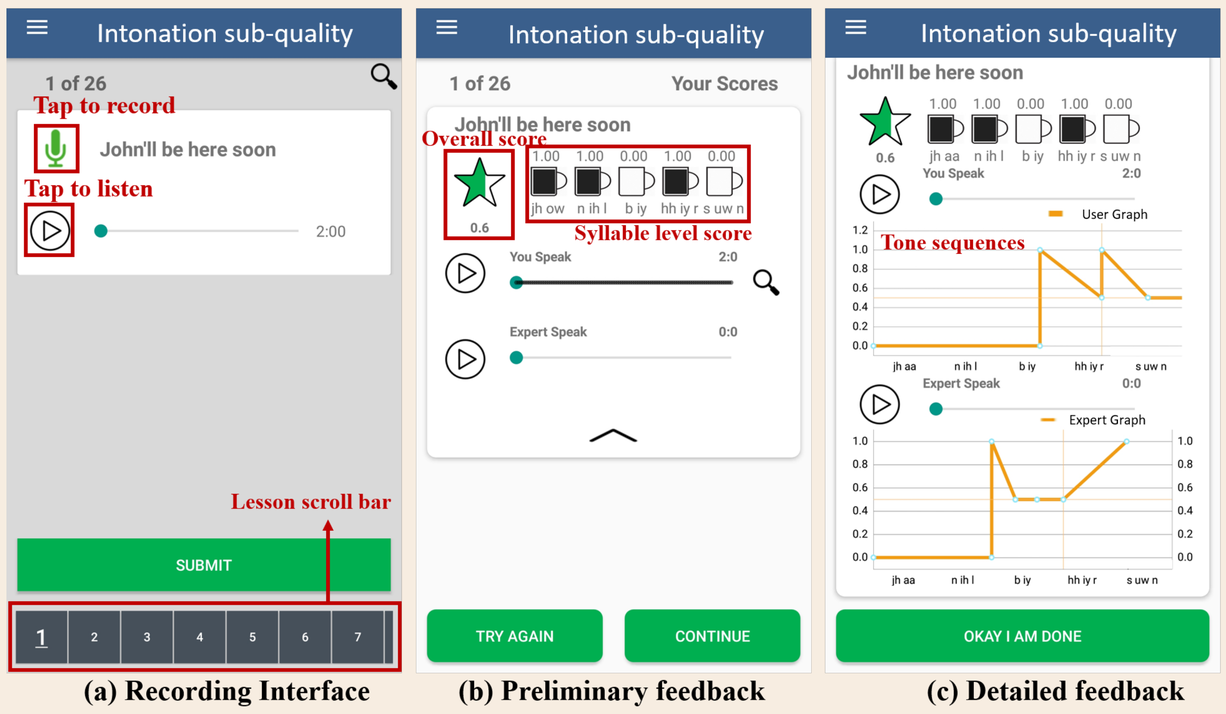
- **Syllable stress detection:** Using automatic speech recognition toolkit and syllabification software, estimate syllable transcriptions and its time-aligned boundaries.
- Following work by Yarra et al.[2], for each syllable, estimate the stress markings as well as scores representing the confidence in estimating those markings.
- Using the stress markings and the confidence scores, pronunciation quality score is computed.
- **Score computation:** $S_E(i)$ and $S_L(i)$ are the scores corresponding to the expert and the learner for i^{th} syllable in a set of N syllables in the either expert's or learner's pronunciation.
- Using the syllable level scores, compute the score for entire stimuli as: $\frac{1}{N}\sum_{i=1}^{N}\left(1 - \frac{min(S_E(i) - S_L(i), 1)}{S_E(i)}\right)$.

Intonation

- **Why to learn Intonation:** Intonation often adds meaning to words and word group in spoken English communication [1].



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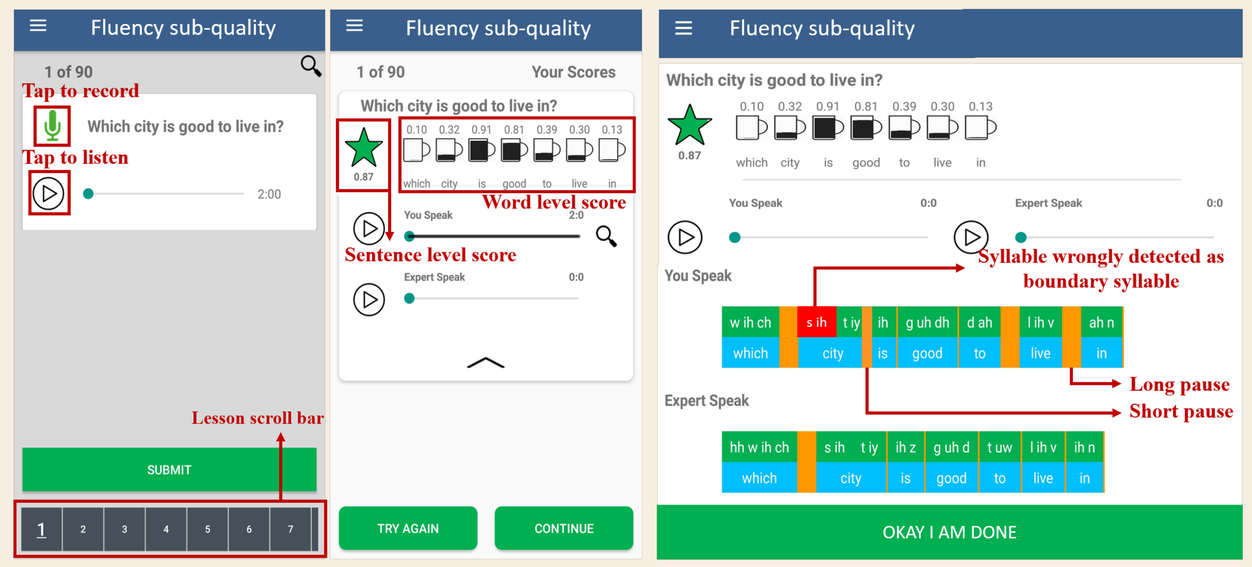
- **Pitch pattern extraction:** Stylize the pitch variations in each syllable approximated with a line by minimizing mean absolute error. m and c are slope and abscissa of each line
- Perform mean and range normalize the stylized pitch and consider $|m| \geq 1$ & $m > 0 \implies$ rise tone; $|m| \geq 1$ & $m < 0 \implies$ fall tone; $|m| < 1$ & $c < 0 \implies$ low tone; $|m| < 1$ & $c > 0 \implies$ high tone.
- **Pitch pattern graph construction:** Consecutive tones, when belong to same category, are grouped.
- For each group of rise (fall) tones, we construct a line joining the lower (upper) limit from the start to the upper (lower) limit at the end.
- For the group of low (high) tones, we consider the lower (upper) limit for the entire length covered by the syllables in that group.
- **Score computation:** Correlation co-efficient between time-aligned learner's and expert's pitch patterns.

Fluency

- **Why to learn fluency:** Oral fluency is considered as a measure of language proficiency and it can be improved by incorporating proper pause placement and correct pronunciation [1].



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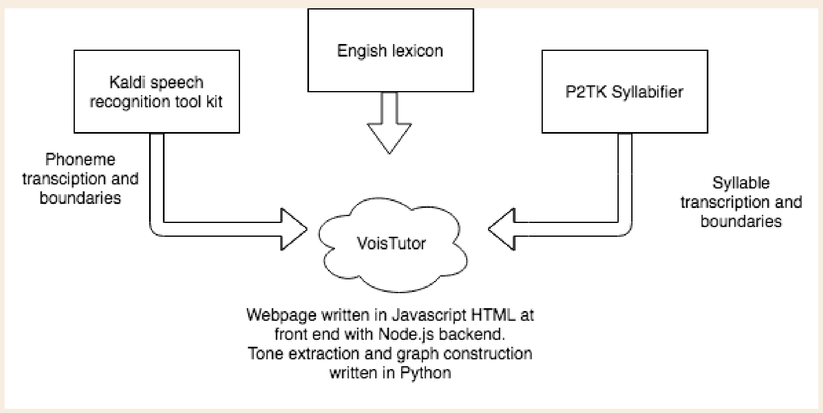
- Word level score: $1 - \tanh\left(\alpha|n^E - n^L|\right)$; where, $n = \frac{\sum_{p\in w}\left(\frac{GoP(p)}{\sum_{q\in Q} GoP(q)}\right)}{N_p}$, Q is the phoneme set, p is a phoneme in word w with N_p number of phonemes, GoP is the goodness of pronunciation [3].
- Pauses are identified based on [4] and classified as long or short.
- Pause based score: Probability that a pause belongs to the same class as that of the corresponding pause in the expert's utterance.
- Sentence level score: average of word level and pause based scores.

Demostration



- The stimuli are taken from a spoken English training material [1].

Conclusion

- We present an Android app, named voisTUTOR, for improving pronunciation skills of L2 learners.
- Feedback is provided in four categories.
- We design the front end with Android SDK and back end codes with Python programming language.
- The app provides a feedback that helps for correct pronunciation of phonemes and placement of stress, intonation and pauses.
- Further investigations are required to measure the effectiveness of the proposed tool as well as analyze sufficiency of the feedback parameters on its users.

References

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