CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title:	**Gamified Mobile Pronunciation Tutor for Language Learners**
Sponsor Information:	Dr. Okim Kang Department of English (TESL/Applied Linguistics) Northern Arizona University Okim.Kang@nau.edu

Project Overview:

Mobile language learning apps such as Duolingo, Babbel, and Busuu are exploding in popularity. The best of which employ a gaming model for teaching a new foreign language or motivating someone to practice a second language. Despite millions of users, little of their efforts focus on pronunciation or are informed by research in applied phonology even though advancing ASR abilities are presently available. Therefore, there is an optimal gap for innovation in leveraging technological affordances of mobile devices to provide a gamified platform for learners to practice pronunciation. Such an application would allow for a course designer to detail delivery of ASR-enabled speaking tasks in a gamified environment to optimize learning.

Our team has been working in Computer-Assisted Pronunciation Training (CAPT) for several years and has noticed the lack of mobile software for foreign language learners that both focuses on pronunciation and encourages learning through gamification. These projects include using audio analysis software with learners for practicing features of intonation while others employ MAPT for phonemic (individual sounds within a word) training. Our research to date has focused on investigating the learning gains and interaction patterns with CAPT-based software. However, the software available falls short in a number of ways:

1. They are closed, commercial systems that can be both costly to the learner and prohibitive for researchers.
2. They do not scale easily to allow course designers to create tasks relevant to the needs of learners.
3. They provide no or very limited feedback on speaking tasks despite a wealth of research done on ASR and non-native speakers.
4. They do not provide relevant feedback on supra-segmental features of pronunciation (i.e., word stress on the correct syllable, intonation to mark questions or emotions, contractions or reduced forms).
5. They do not implement gamification to motivate the practice and acquisition of pronunciation.

We are now ready to explore how the insights gained can be applied in the real-world in a novel software product that prioritizes the needs of learners, course designers, and researchers of applied phonology. We envision a mobile app that serves as a delivery platform for language learning tasks in a gamified environment. The pronunciation target item (i.e., words or phrase, sequencing, and feedback) would be designed by pedagogical experts on our team. In terms of the gamification elements, successful gamification in mobile language learning has included a strong narrative (see playbonnechance.com), strategic task repetition (see Duolingo), a social element (see Busuu). It seems clear that a gamified presentation/practice framework would be useful for motivation, and we would look forward to ideas from the team in developing this element.

Ideally, the mobile app would be cross-platform in nature, i.e., able to support Android, iOS and other mobile platforms. The app must also be accompanied by a simple web application that allows instructors to configure/deploy the exercises, register instructors and learners, and provide a simple dashboard for tracking learner progress.

Basic core (minimum viable product) needed to prove the concept

- User management: User accounts that can be created on a mobile app or through the dashboard

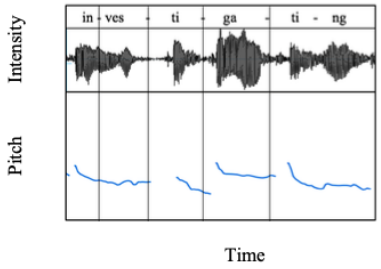
- Dashboard website: A website dashboard for our team that allows for user management, learning task creation, task organization into courses (or levels), and learning tracking of users
- Mobile deployment: A mobile app for either iOS or Android platforms that can deliver the language tasks and provide feedback on user pronunciation.
- Learner tasks: A flexible design and deployment of learner tasks in a gamified context and tracking repeated attempts as well as scores for the content developer site.
- ASR evaluation feedback: The use of ASR to evaluate the accuracy of a user audio response (assistance from Okim Kang's team will be provided).

A complete, usable software product:

- Deployment in a gamified context, as designed with design led by senior capstone students. Elements could include levels, points, scoreboards, and / or achievements for mastery of learning tasks.
- Adaptive structure that promotes repetition of difficult tasks until mastery is achieved.
- Management of gaming aspects on the dashboard design area. (i.e., instructors or researchers can see the scoreboard and sent prizes/messages to learners, can install/edit "awards" to be granted at certain achievement levels)
- Ability of instructors to set up "courses" which compile a series of exercises at a particular level or on a particular topic; control offering visibility of such courses.
- Ability of instructors to easily use the web app to edit content: add/edit exercises, delete exercises, associate exercises with various "courses".
- Improved look and feel for all elements, to make both mobile app and web app easy and aesthetic to interact with.

Stretch goals: Features that are peripheral and very cool

- Support for extension to support other languages besides English.
- Deployed iOS and Android versions of the app, demonstrated to prove equivalent functionality.
- Audio analysis feedback: Pitch and intensity visuals from user audio response similar to the figure to the right.
- Adjustable settings for ASR feedback on each task for dichotomous (correct / incorrect) feedback or percentages of accuracy of a predetermined target form.



The final product of this project would allow for immediate deployment for language learners on the NAU campus and global implementations of research on the nature of language learning. As our team has deep connections with NAU's Program in Intensive English for international students and the Department of Global Languages and Cultures, partnerships would be formed with interested instructors and

Knowledge, skills, and expertise required for this project:

- Modern Web2.0 techniques and technologies
- Mobile application development, preferably with a multi-platform mobile development framework like Ionic or React-Native.
- Knowledge of database design, to build backend DB to hold exercises, results, and user data.
- Our team can assist with ASR testing and implementation in terms of speech science variables.
- Creativity for the gamification elements is also strongly preferred.

Equipment Requirements:

- There should be no equipment or software required other than a development platform and software/tools freely available online. Our team can lend you an Android and iOS device if needed for testing.

Software and other Deliverables:

- The mobile and webapp software applications as described above, deployed and tested successfully with real data. Must include a complete and clear User Manual for configuring and operating the software.

- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.
- System deployed on a platform of the client's choice (to be negotiated, probably cloud-based), and demonstrated to prove function of all key functionalities.