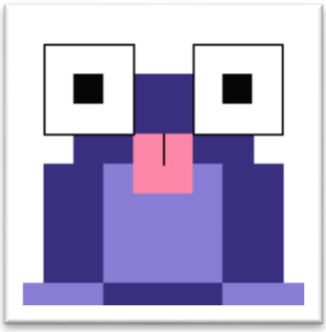
Ribbit

A Cost-Effective iOS Hearing Aid App



Project Plan v3.4

Computer Science Department
Texas Christian University
May 2, 2016

Revision Signatures

By signing the following, the team member is stating that he has read the entire document and has verified that the information contained within this document is accurate, relevant to the project, and void of errors.

Name	Signature	Date
Duy Dang		
Robert Kern		
Esteban Kleckner		

Revision History

Version	General Description of Changes	Date Completed
V1.0	Initial Draft	10/8/15
V1.1	Grammar, format, and wording of document	10/25/15
V2.0	Fixed Schedule and colors	1/31/16
V3.0	Updated Schedule and fixed wording	4/19/16
V3.1	Updated title	4/20/16
V3.2	Updated schedule, resources, and version number	4/24/16
V3.3	Updated schedule and team responsibilities	5/1/16
V3.4	Updated wording	5/2/16

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1 Introduction

1.1 Purpose

This document is a detailed plan describing the steps for completing the Ribbit Senior Design Project. This plan gives the reader an overview about the background of the project, the scope and objective of the project, and the resources and management strategies that will help the team fulfill the project requirements.

The project plan is designed to help the project team define and visualize the planned and expected progress of the project. In addition, the project plan will enable the team to better communicate with clients about expectations and constraints. The final objective of the project plan is to give the team and clients a way of visualizing and verifying project progress.

1.2 Overview

- In section 2, we discuss the scope of the project and the contribution it to makes to the current work in the hearing aid area.
- In section 3, we discuss the software and hardware resources required by the project, as well as the contact information of the developers.
- In section 4, we discuss the planned schedule for milestones and deliverables for the project, the roles and titles of team members, as well as risk management strategies and reporting mechanisms.
- In section 5, we give a glossary of the terms used in this document.

2 Project Overview

2.1 Scope and Objectives

The objective of this project is to create an iOS application that functions similarly to a physical hearing aid device, but at a fraction of the cost. The application, from here on named as “Ribbit”, will work within the federal regulations concerning hearing aid use. The application is used to correct the user's hearing by changing the sound to fit their inability to hear certain frequencies.

2.2 Project Background

Hearing aids process and modify sounds into the most desirable forms for hearing impaired people to receive. With hearing aids, the hearing impaired population can, to some extent, regain the ability to hear normally and integrate back into everyday life with minimum inconvenience. However, due to multiple reasons—including unaffordable price, inconvenience, and limited quality—only 20 percent of the people in the US who could benefit from a hearing aid wear one. This figure is likely to be much less in other less developed countries. As a result, a better and more widespread alternative is in demand.

Recently, there have been great advances made in handheld devices such as smartphones. These advances bring new features such as powerful computation capability without sacrificing mobility, and wireless connection. We developed a smartphone based intelligent sound processing and fusion system. The system collects all the sounds in the vicinity and processes them on the spot according to the customized needs and prescriptions of a specific user. More specifically, the system should be able to selectively amplify and shift sounds to within the frequency range that is unique to the user. The system is also able to adjust sound processing functionalities based on different scenarios. For example, the sound processing at home should be different from the sound processing in a restaurant.

3 Resource Specification

3.1 Software and Hardware used in development

Mac OS X Yosemite
Apple XCode 7.3.0
MatLab vR2015b
Microsoft Visio 2013
Microsoft Project 2013
Microsoft Word 2013
Microsoft PowerPoint 2013
Apple iPhone 6/6 Plus running iOS 9

3.2 Software and Hardware used in operation

Mobile Devices:

- Apple iPhone running iOS 9

Desktop Devices:

- Apple MacBook Pro
- Apple iMac 27in Retina Display

3.3 Contacts

Name	Role	Contact Information
Duy Dang	Algorithm and App Testing	duy.t.dang@tcu.edu
Robert Kern	App Development and Testing	r.r.kern@tcu.edu
Esteban Kleckner	Algorithm and App Testing	e.kleckner@tcu.edu
Liran Ma	Faculty Sponsor	l.ma@tcu.edu

4 Project Management

4.1 Milestones and Deliverables

Task	Completion Date
Website Skeleton	October 13, 2015
Project Plan v1.0	October 13, 2015
Requirements Document v1.0	October 26, 2015
Design Documentation	December 5, 2015
Iteration 1: Working Application	December 7, 2015
Iteration 1 Demo and presentation	December 15, 2015
Iteration 2: Completed Application	January 31,2016
Faculty Presentation	February 2, 2016
IRB Paperwork Done	February 28, 2016
SRS Abstract Due	March 3, 2016
SRS Poster Submission	March 31, 2016
NTASC Registration Due	April 1, 2016
SRS	April 8, 2016
NTASC Wichita Falls	April 16, 2016
Iteration 3: Final Tweaks	April 21, 2016
Final Presentation	April 28, 2016
Users Manual	May 1, 2016
Developers Manual	May 1, 2016
Final meeting	May 2, 2016

4.2 Team Member Roles and Responsibilities

Duy Dang - Lead Platform Programmer, Application Programmer

Duy will be responsible for working on the sound gathering algorithm, which gathers sound and sends it to the gain adjustment algorithm. Once the application is completed, Duy will be assisting in product testing and debugging.

Robert Kern - Project Lead, Web Programmer, Document Lead, Application Programmer

Robert will be responsible for developing the iOS application, including implementation of security into the application. He will also be responsible for website upkeep and updates, as well as maintaining the documents.

Esteban Kleckner - Lead System Programmer, Testing Lead, Application Programmer

Esteban will be responsible for working on the filtering and gain adjustment algorithm, with assistance from Duy, on translating existing work into usable material. Once the application is completed, Esteban will be assisting in product testing and debugging.

4.3 Monitoring and Reporting Mechanisms

4.3.1 Meetings

Tuesday afternoons at 2:30pm will be used as team meetings. Meetings will be used for updating members on project status: development status, bugs, and their possible solutions. Friday afternoons may also be used as needed.

4.3.2 Communication

Slack, SharePoint, and BitBucket will be used to store all documents related to the project. Smartphones will be used as the primary form of communication amongst members. Emails will supplement cell phones as a form of communication.

4.3.3 Requirements Control

All team members, as well as the faculty sponsor, will sign off on all changes before they occur. This will ensure that the documents portray everyone's intended interests. Team members will have weekly meetings with the client. When requirements need to be changed, it will be agreed upon by team members, discussed with the customer, and finally brought to Dr. Payne for ratification.

4.3.4 Weekly Action Reports

During the weekly meetings the team will discuss the weekly action reports. These reports will be used to gauge the status of the project and keep everyone informed of said progress.

4.3.5 Walkthroughs

Requirement walkthroughs will take place with all team members and sponsors involved to make sure the deliverable meets the requirements.

4.4 Risk Management

4.4.1 Risk Identification and Analysis

ID	Risk	Probability	Effects
1	Real time phase shifting delivers warped sound.	High	The phase shift algorithm must be adjusted to overcome.
2	iOS platform changes in the future.	Low	The application may not be supported on future iOS versions.
3	Latency in sound change is too long.	Medium	Algorithm, or implementation of the algorithm, needs to be streamlined.
4	Learning curve is too steep.	Medium	Requirements may need to be checked to maintain realistic timeframe.
5	Algorithm does not work as intended.	Medium	End goal may need to be adjusted.

4.4.2 Risk Mitigation

ID	Strategy
1	Team will work with customer, as well as outside experts, to better isolate the problem in algorithm.
2	Future changes in Apple Development languages may limit the number of supported devices.
3	Team will work with the customer to understand the constraints surrounding the latency limits on the sound. Team will be monitoring the latency during the development and testing of the application.
4	Team will push the learning of the needed technologies early. Team will communicate and work with customer early to reassess the requirements to make them more realistically attainable if the learning process is found to be too long.
5	Team will work with customer to discuss the progression of the application with an altered algorithm.

5 Glossary of Terms

Amplitude - the power of the air vibration that can be perceived as volume

Audiogram - graphical hearing diagnosis produced by audiologist

Clipping - a situation in which the peaks and/or troughs of the sound wave are cut off

DSP - Digital Signal Processor; a microprocessor specially designed to handle continuous analog signal

Decibels - a unit to represent a signal's amplitude

FFT - Fast Fourier Transform; an algorithm used to transform a signal from time domain into frequency domain

Frequency - equivalent to the inverse of the period, frequency is a rate. Frequency is generally measured in Hz (hertz)

iOS - the operating system for Apple's mobile device product line

QR code - a data encoding mechanism in which bits are transformed into camera-recognizable (camera friendly) visual representation

Sound Profile (prescription profile, user profile) - a system that manages user's preferences and hearing prescriptions

Touch ID - a security mechanism to maintain exclusive access based on a user's fingerprint