Digital Language Training System

Software Requirements Specification

<Version 1.3 >

<10-13-2019>

Tanay Ghosh

Todd Hricik

Reneel Pamarthi

Prepared for: Dr. Samir Padalkar

CS 683 Project Management

Fall 2019

Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Description | Author | Comments |
| 09/23/2019 | 1 | Tanay  Todd  Reneel | Initial Version |
| 09/30/2019 | 2 | Tanay  Todd  Reneel | Added –  Functional requirements  Non-functional requirements  Activity/Data flow diagrams |
| 10/07/19 | 3 | Tanay  Todd  Reneel | Added-  System Architecture Diagram and Summary  Use Cases  POS edits |

Document Approval

|  |  |  |  |
| --- | --- | --- | --- |
| Signature | Printed Name | Title | Date |
|  |  |  |  |

Table of Contents

1. Overview
2. Project Goal and Solution
3. Functional Requirements
4. Non-functional Requirements
5. System Architecture
6. Use Cases
7. Algorithms
8. [References 26](#_Toc21349652)

|  |  |  |  |
| --- | --- | --- | --- |
| **Project Overview Statement** | Project Name:  Digital Language Training System | Team: Red |  |
| Problem/Opportunity: Our world is becoming ever increasingly connected across social and business landscapes as a result of internet-based technologies that can bring together individuals from disparate communities which have traditionally been localized according to geographic constraints. Today individuals and business firms are able to connect and interact within a radius of coverage that covers most of the developed world. As a result, communities have become more diverse as people coming from all cultures and locations can more easily connect, interact and transact with one another. While geographical boundaries have been broken via such technologies, there still exists language barriers amongst the many connected individuals who are unable to speak and understand the native tongues of those to whom they are connected.  The online language arts learning market is expected to be between $4-$8 billion during by 2024 [1] [2]. Indeed there is a recognizable demand for language training products worldwide who’s market majority is currently shared between two firms: Rosetta Stone Ltd. [3] and Duolingo Inc. [4] [2]. Rosetta Stone Ltd. offers a subscription based digital training platform that covers 30 languages through an online classroom styled delivery and also offers live one-on-one online tutoring via virtual web meetings [5] and has developed a social network presence within which users can interact on Facebook [6] and Twitter [7]. Duolingo Inc. covers 26 languages (including Klingon for avid Star Trek Fans) using a gamification styled delivery which is based on both an ad-free and fee based subscription models and provides an integrated social community that allows users to follow and compete with others in their Duolingo network [4].  Although the market for digital language arts training applications have been reached by several competing entities, we view opportunities to be captured within the space. Our analysis of the products offered by Rosetta Stone and Duolingo are disjoint along both the personal tutoring and gamification components. In our view there is room for significant improvement to the level of interactivity and engagement possible through a digital language art learning platform. Namely we recognize the potential for value to be added by offering, in addition to language arts training via traditional modalities offered in existing solutions, a cognitive computing based solution that creates an intuitive virtual tutor than can be available to the user on demand via an audio-visual-text-social media based interface. Our aim is to 1.) hybridize traditional digital language arts learning modalities having demonstrated market success, 2.) expand upon current platform technologies offered using cognitive computing based solutions, and 3.) integrate said technologies into a uniquely defined product that offers market leading high quality and engaging language arts training that is cognizant of each individual user. | | | |
| Goal: Provide a multi-platform digital language training system that engages the user through a cognitively aware gamified interface. | | | |
| Objectives:   1. Provide a language arts training regimen via an interactive digital interface which implements the following modalities 2. Support for text and pictographic based multiple-choice exercises 3. Support for text and pictographic based fill in the blank exercises 4. Support for “listen” and “respond” based exercises where user responses may be speech or written text 5. Maintain user engagement via the following modalities 6. Support for modular learning where modules are used a micro-course focusing on one aspect of the language learning process 7. Support for beginner, intermediate and advanced levels of difficulty for each language learning task 8. Support for gamified based user performance-based reward system that considers the level of difficulty, consistency, frequency of and performance of the user’s engagement with the learning system exercises 9. Support for in app community connectivity allowing for users to connect, socially interact and compete in user group created learning competitions 10. Support for an individualized virtual cognizant tutor and learning companion 11. Support for user to set and adjust weekly goals for performance and engagement and continuously have access to feedback metrics related to user goals. | | | |
| Success Criteria:   1. Aggregate and stratified user performance according to goals set by the user (See Objectives: section D) being met and exceeded. We will consider our product to be successful if users consider themselves to be successful during their learning journey. We aim to have at least 90% of our users reach at least 90% of the goals they set. 2. Size of user base compared to current market leaders 3. User learning system usage metrics from (aggregate and stratified) based upon 4. Frequency of weekly usage on daily scale > 5 days per week 5. Number of lessons attempted vs completed across all users > 90% 6. Frequency of exercises receiving correct response within the first attempt > 80% 7. User progression metrics that track for language skills development within and among beginner, intermediate and advanced levels: We aim to see all users progress through all modules of each level of difficulty consistently according their achievement of the short- term goals they set weekly. | | | |
| Assumptions:   1. The development and QA team are well equipped to build and deliver the software that can run even on the low-end devices with relatively slow internet speed. 2. There is a bug reporting system in place where users can report issues that they run into while using the application. These bug reports need to be read, analyzed and assigned to the correct team so that the issues can be fixed in a timely manner. 3. There will exist teams of composed of senior management, product/project managers, language experts, gamification experts, and social media designers who will work within cross-functional groups including all relevant UI, machine learning and database developers throughout the adaptive agile development and launch processes. | | | |
| Risks:   1. All requirements not being identified at the beginning of the development phase leading to a requirement inflation at the later stages of the project and could threaten the budget estimates and deadlines. 2. The system might be prone to hacking and can lead to theft of user information and loss of data. 3. Server breakdown could lead to loss of data if there are no backup servers in place. | | | |
| Obstacles:   1. Designing the application in such a manner that the reading, writing and speaking skills of the user learning a new language is fully tested. 2. Designing the translation algorithm such that it presents the most appropriate translation to words and phrases depending on the context. 3. Monitoring and analyzing the usage metrics and figure out if user activity has dropped and coming up with new features to make the application more engaging for the users. 4. Designing the system in such a manner that it can be used offline. 5. Making the system platform independent so that the user experience is uniform regardless of the device the user is using to run the application. | | | |
| Prepared By:  Team Red | Date: | Approved By: | Date: |

1. Overview

The purpose of this document is to present the pre-planning related project components that composes the software requirements (functional and non-functional), use cases, system architecture and hardware requirements of the language learning system. This document will compose a detailed description of the planning phase of the language learning system development process and includes details of how cross-functional teams will be organized and which deliverables each will be responsible for. This document analyzes and quantifies the factors/events that may exist at any point during the planning and launch processes.

1. Definitions

3. Functional Requirements

3.0 Application launch and entry point

3.0.1 Splash screen will appear upon application launch (Diagram 1)

A picture containing object

Description automatically generated

Diagram 1: Splash Screen

3.0.2 A new user will be presented with the New User Account Setup Interface

3.0.3 An existing user will be presented with the training program interface (Diagram 2)(See 3.4)

A screenshot of a cell phone

Description automatically generated

Diagram 2

3.0.3.1 Lower button bar of main interface will provide access buttons to

3.0.3.1.1 User training program interface

3.0.3.1.2 User social media tools interface

3.0.3.1.3 Weekly League Standings interface

3.0.3.1.4 App Store interface

3.0.3.1.5 The identity of the interface in which the user currently resides will be

indicated by the coloring of the appropriate lower button bar access button. All other lower button bar access buttons will be colored grey while User remains in the current interface:

Case 1) User is in Training Program Interface (Purple)

Case 2) User is in Social Media Interface (Orange)

Case 3) User is in Weekly League Standings Interface (Yellow)

Case 4) User is in App Store Interface (Black)

3.0.3.2 Upper button bar of main interface will provide

3.0.3.1.1 Language selector access button

3.0.3.1.2 Button to access Health and Practice interface

3.0.3.1.3 Button to access Trophy Collection interface

3.0.1.1.3 Graphical icon displaying number of Rewards Points earned

3.0.3.3 The area between the Upper and Lower Button Bars will be referred to as the Main Window (Diagram 3)

A screenshot of a cell phone

Description automatically generated

Diagram 3

3.0.3.4 Upon first entry to the Language Training Application, User will be allowed to navigate among Interfaces as shown in (Diagram global\_interface\_navigation\_paths)

A close up of a map

Description automatically generated

Diagam global\_interface\_navigation\_paths

3.1 Language(s) Selection Interface:

3.1.1 This interface will present the collection of all available language Training Programs

available within a scrollable action window

3.1.2 Each language Training Program will be represented by a Training Program selector button

that contains a picture of the corresponding country’s flag.

3.1.3 Selection of a language Training Program via tapping on a given Training Program selector button within the Language Selection interface will bring User to the Training Program interface for the selected language

3.2 Training Program Interface

3.2.1 Training Program Conceptual Organization

3.2.1.1 A Training program will consist of levels

3.2.1.2 Each consecutive level will represent a higher degree of learning difficulty.

3.2.1.3 Training program levels will consist of modules.

3.2.1.4 Each module will contain a set of lecture notes related to the module topic.

3.2.1.4 Each Module will consist of a collection of Parts

3.2.1.5 Each Part will consist of a collection of Lessons

3.2.1.6 Each Lesson will consist of a collection of interactive Exercises related to the Module topic.

3.2.2 Training program progression concepts

3.2.2.1 Progression from one training level to the next more difficult level will be allowed once all modules at the lower level(s) of difficulty have been completed satisfactorily.

3.2.2.2 Satisfactory completion of any module is defined as satisfactory completion of all lessons within the module.

3.2.2.3 Satisfactory completion of a lesson is defined as user having provided correct responses to all exercises within a single lesson attempt.

3.2.3 Graphical Representation of a Training Program (Diagram 4)

A screenshot of a cell phone

Description automatically generated

Diagram 4

3.2.3.1 A Training Program will be represented as a collection of mutually exclusive directed acyclic graphs where each graph will represent a recommended learning path for each Level of difficulty.

3.2.3.2 Each module will be represented as a node in a graph having an in degree of one and an out degree of one.

3.2.3.3 Recommended learning path will be represented as edges connecting each consecutively recommended module (node) within a graph for a given level.

3.2.4 Training Program Interface Functions and Behaviors: The Training Program Interface will

present all Levels of a Training Program within a scrollable view of the Main Window.

3.2.4.1 Completed module nodes will be marked as completed graphically via a “check mark” graphic place in the upper right-hand corner of each completed module.

3.2.2.2 Edges between a pair of two completed modules will be graphically distinct from edges between all other possible module pairs.

3.2.4.3 User may select any training module within their current Training Program Level by tapping on a node within the accessible graph. After tapping a module (node) a pop up window will provide the following (Diagram selected module pop\_up\_window)

A screenshot of a cell phone

Description automatically generated

Diagram selected\_module\_pop\_up\_window

3.2.4.3.1 Textual information informing the user of the Lesson Part and Lesson Number which is about to begin

3.2.4.3.2 An access button to the Introductory Notes Interface applicable for the current lesson.

3.2.4.3.3 An access button that will trigger the Current Lesson Attempt Interface to begin.

3.2.4.3.4 See Section 3.4.5 for detailed Lesson Functional Requirements.

3.2.5 Training Program Lesson:

3.2.5.1 Lesson Introductory Notes Interface

3.2.5.2 Lesson Attempt Interface: Upon triggering a Current Lesson Attempt to begin, User will be presented with a set of Lesson Attempt Global Components and a sequence of interactive Exercises.

3.2.5.2.1 Lesson Attempt Interface Global Components: During any point of a Lesson, the User will be presented with the following elements (Diagram lesson\_attempt\_global\_elements).

A screenshot of a cell phone

Description automatically generated

Diagram lesson\_attempt\_global\_elements

3.2.5.2.1.1 Lesson Exit Button

3.2.5.2.1.2 Lesson Progress Bar

3.2.5.2.1.3 Life Status Meter: Displays the number of Health Points the User has remaining.

3.2.5.2.1.4 Interactive Exercise

3.2.5.2.2 Interactive Exercises: Each Exercise Interface will be structured according to one of the following Exercise Types

3.2.5.2.2.1 Textual Challenge/Textual Response: User will be asked to read a Challenge Sentence and provide the correct translation via the keyboard. The Challenge Sentence may be written in either the Training Program Language or the user’s native language

3.2.5.2.2.1.1 User will be notified as to whether their response is correct or incorrect as shown in (Diagram exercise\_textual\_challenge\_textual\_response\_results).

A close up of a device

Description automatically generated

Diagram exercise\_textual\_challenge\_textual\_response\_results

3.2.5.2.2.2 Textual Challenge/Multiple Choice Response: User will be asked to read a Challenge Sentence and several potentially correct textual translations, each embedded within a button. User will select their guess as to the correct translation by tapping the button containing the text representing the correct translation. The Challenge Sentence may be written in either the Training Program Language or the user’s native language.

3.2.5.2.2.2.1 User will tap the translation button which they believe is correct which will be highlighted.

3.2.5.2.2.2.2 User will click NEXT button and will then be notified as to whether their response is correct or incorrect as shown in (Diagram exercise\_textual\_challenge\_mult\_choice \_results). Correct answer will be highlighted.

A screenshot of a cellphone

Description automatically generated

Diagram exercise\_textual\_challenge\_mult\_choice \_results

3.2.5.2.2.3 Audio Challenge/Textual Response: User will be asked to listen to an audio clip of a phrase spoken in the Training Program Language. User will then enter their translation via the keyboard.

3.2.5.2.2.3.1 Audio recording may be played by User via tapping an Audio Challenge Button which activates the audio clip based Challenge Sentence.

3.2.5.2.2.3.2 Audio clip may be played repeatedly via tapping the Audio Challenge Button until User inputs their response and submits their answer.

3.2.5.2.2.4 Textual Challenge/Audio Response: User will be asked to read a textual Challenge Sentence and provide the correct translation via the microphone (Diagram textual\_challenge\_voice\_response).

A screenshot of a cell phone

Description automatically generated

Diagram exercise\_textual\_challenge\_mult\_choice \_results

3.2.5.2.2.4.1 User will tap the Microphone Button when prepared to record their translation. User will speak their translation into the microphone and tap the Microphone Button again to finish recording. If recording is verified to contain machine translatable speech, a SUBMIT button will be activated and User may proceed to receive results. If recording is not verified to contain machine translatable speech, USER will be brought back to initial Exercise state so that User may repeat the recording process.

3.2.5.2.2.5 Audio Challenge/Audio Response: User will be asked to listen to an audio clip of a phrase spoken in the Training Program Language. User will then enter their translation by speaking their translation into the microphone. Requirements 3.2.5.2.2.3.1, 3.2.5.2.2.3.2 and 3.2.5.2.2.4.1 apply.

3.2.5.3.2 Exercise Tools: Once User has submitted their response and received the results for a particular exercise, two Exercise Tools Buttons allowing User to access the Cognizant Language Tutor and or flag the exercise to the application maintainers for potential problems (Diagram Exercise Tools).

3.2.5.3.2.1 Cognizant Language Tutor

3.2.5.3.2.1.1 USER can tap the Cognizant Language Tutor button to flag an exercise as being difficult or worth revisiting later as a review.

A screenshot of a cell phone

Description automatically generated3.2.5.3.2.2 Flag for Problematic Exercises Button will bring up a popup window having a text container within which User may provide textual details related to the Exercise and a Post Flag button which will submit the Flag to the system database.

Diagram exercise\_tools

3.3 Trophy Collection Interface This interface will provide a collection of Trophy icons that the user may earn while using the app.

3.3.1 Description of Trophies which can be earned

3.3.1.1 Accuracy Master: An Accuracy Master trophy will be awarded when User

completes a given number of Lessons without getting any Exercises wrong.

3.3.1.1.1 Level I: Complete one lesson without getting any Exercises wrong

3.3.1.1.2 Level II: Complete five Lessons consecutively without getting

any Exercises wrong.

3.3.1.1.3 Level III: Complete twenty Lessons consecutively without getting

any Exercises wrong.

3.3.1.2 Consistency Master: A Consistency Master trophy will be awarded when User

satisfactorily completes at least one Lesson each day over the course of a number of

consecutive days.

3.3.1.2.1: Level I: Seven consecutive days

3.3.1.2.2: Level II: Fourteen consecutive days

3.3.1.2.3: Level III: Thirty consecutive days

3.3.1.3 Weekend Warrior: A Weekend Warrior Trophy will be awarded when User

completes at least one lesson each day over the course of a consecutive Friday,

Saturday and Sunday weekend.

3.3.1.4 Night Hawk: A Night Hawk trophy will be awarded when User satisfactorily completes a Lesson between the hours of 10:00 p.m. and 12:00 a.m.

3.3.1.5 Morning Glory: A Morning Glory trophy will be awarded when User satisfactorily

completes a Lesson between the hours of 5:00 a.m. and 9:00 a.m.

3.3.1.6 Social Butterfly: A Social Butterfly trophy will be awarded when User connects

with a given number of other users via the in-app Social Network Interface

3.3.1.6.1 Level I: User connects with three new friends

3.3.1.6.2 Level II: User connects with five new friends

3.3.1.6.3 Level III: User connects with ten new friends

3.3.1.7 High Scoring Star: A High Scoring Star trophy will be awarded when….

3.4 League Standing Interface: Weekly league competitions will be held every week. Each league competition will begin on Sunday at 12:00 a.m. GTC and end on 11:59 p.m. UTC the following Sunday.

3.4.1 There will exist a finite number of leagues. All new USERs will automatically start in League 1. The top 10% of league members having the most XP points at the end of the week will be promoted to the next league up for the following week’s competition. The bottom 10% of each league will be demoted to the league below for the following week’s competition. All other users will remain in their current league for the next week’s competition.

3.4 League standings for USER’s League will be presented in the action window of the League Standing Interface. There a scrolling list of all other USERs within the USER league will be provided along with the number of XP points each has accumulated in the current week’s competition. USERS in top and bottom 10th percentiles will be separated within the list by a cutoff line demarking those who would be promoted to the next higher league (and those who would be demoted to the next lower league) if the week’s competition were to end today. This standings list will be updated in real-time as each USER completes a lesson and thus triggers their weekly accumulated XP point score to be updated.

3.5 Health and Practice Interface: Each new USER will be given three health points. One health point will be deducted for each Exercise USER answers incorrectly.

3.5.1 Once USER’s health points reach zero, their progress in the Language Training Program is reset to the initial state of a new USER.

3.5.2 USER may increasing their health score by completing a block of Practice Exercises. One additional health point will be given for each block of exercises completed while answering all Practice Exercises correctly within the block.

3.6 Weekly XP Points tracking: Beginning on Each Sunday at 12:00 a.m. GTC, a weekly XP point tally will be

set to zero and a running tally of the XP points accumulated by the user as lessons are completed.

3.6.1 Each lesson will allow for the opportunity to earn a maximum of 15 XP points by answering

all exercises within the lesson correctly. The User will begin the lesson having all 15 XP points and will lose one XP point for every exercise answered incorrectly during the lesson. Completion of a lesson will trigger the XP points earned during that lesson to be added to their weekly total.

3.7 Rewards Points: After a lesson is completed, USER will be presented with a “Pick A Card” game that allows them to earn “Rewards Points”. Three Cards will be presented to the USER face down. Each Card will have a number on the bottom side which constitutes the number of Rewards Points to be awarded. User will select one of the three Cards and the Card’s Rewards Points Award will be revealed to the USER. The USER will then be given the option to watch an advertisement. If the USER opts to watch the advertisement, the USER will be permitted to select another Card from the remaining face down Cards in order to receive more Rewards Points.

3.8 Advertisements: After the Rewards Points game has been played, The USER will be given a An advertisement will be played at the end of each completed lesson.

3.9 App Store Interface: The App Store interface will present the USER with special privileges that can be received by trading in a given amount of Rewards Points.

3.9.1 Privilege 1: Restore Health Points to full health (3 Health Points)

3.9.2 Privilege 2: Move into the next higher league

3.9.3 Privilege 3: Unlock the next higher Training Program Level without having finished the current Training Program Level.

3.9.4 Privilege 4: Make a “Double or Nothing” bet on the XP points earned in the next Lesson taken and completed.

3.9.4.1 Purchasing this privilege will result in the USER earning 2X the XP points earned in the following lesson attempt.

3.9.4.2 Failing to complete the next lesson results in the USER’s bet being forfeited.

3.9.4.3 Completing the first lesson after placing the “Double or Nothing” bet will result in the XP points being awarded in double the magnitude.

3.9.5 Privilege 5: Set a weekly Goal: This privilege will allow the user to set a Weekly XP points goal. User will be rewarded 3X XP points for that week if the goal is met.

3.9.6 Privilege 6: Unlock Bonus Learning Modules not included within the Language Learning Program.

3.9.6.1 These modules will be outside of the scope of the Language Learning Module and will provide the USER with an opportunity to learn more language concepts in addition to those included within the Language Learning Module. Opportunities to exchange Rewards Points for unlocking bonus modules will be presented during each Level of the Language Training Program.

3.9.6.2 The requirements of these bonus modules will be the same as those requirements listed for the modules which are included in the Language Learning Program.

3.10 Cognizant Tutor: Each new USER will be associated with a personalized digital tutor/mentor that will monitor the USER’s progression through each level of a given Language Training Program and look for associations between the USER’s application usage statistics and the Language Training Program Exercises data.

3.10.1 The Cognizant Tutor will periodically send messages to the USER to let them know that an association rule had been found. The Cognizant Tutor will report the association using non-technical language and describe reasons why that association rule may have been found. For example, if the USER answers many more Exercises incorrectly during late night hours, the Cognizant Tutor will message the USER saying “Hi USER! I noticed that you answer many more Exercises correctly during the daytime hours. It shows great effort to train during the night time hours, but if you are looking to get promoted to the next league, you might score better on your lessons if you do them during the day😊”

4. Non-functional requirements

4.1 Performance: The UX should be intuitive and easy to use. The application should be fast and not put

too much pressure on the hardware.

4.1.1 Battery: The app should be able to run on background consuming the least amount of

power that is possible. User should be able to run the application from the background and

should be able to seamlessly resume using the application.

4.1.2 Network Connectivity: The app should work on poor network connectivity. If the network is

extremely poor and the app fails to run then the user should be notified with a meaningful

notification message. The app should resume seamlessly when the network improves.

4.1.3 Speed: The app should run fast and smoothly. The lectures should not take more than

700ms to 1s. The app should navigate from one page without lagging and the transition

Animation should not appear jumpy.

4.1.4 Load balancing: The server(s) should be able to handle large volume of requests and should

be able to balance the load in case of heavy traffic.

4.2 Scalability

4.2.1 The architecture of the system needs to be designed in such a way that it is scalable. It

should be easy for course creators to add new courses.

4.2.2 The frontend needs to be designed in such a manner that new added courses are displayed

without any UI distortion. Courses can be of different structure, so, the frontend should be able

to handle different types of courses with little customization.

4.2.3 The backend also needs to be designed in such a way that it allows customization.

4.3 Reliability

4.3.1 The app should be available for use 24 hours, every day. In case of technical faults, there

should be backups so there is no down time.

4.3.2 Our application offers offline support, so, there should be no difference between the online

experience and the offline experience. There shouldn’t be any continuity issue.

4.4 Usability

4.4.1 There should be a brief tutorial for new users to learn the important aspects of the

application and get acclimatized using it.

4.4.2 Users should be allowed to use Facebook and Google accounts to register for the

application.

4.4.3 The courses must get more challenging as the user’s performance gets better.

4.5 Portability

4.5.1 The application should be platform independent i.e. should run on android, iOS and web

browsers.

4.5.2 There should not be any difference in the user experience while using the application on

any of the fields. The only acceptable difference is that the UI needs to adhere with the frontend

standards that applications need to follow for these individual platforms.

4.6 Security

4.6.1 The users can create account using email and password or can create account using

Facebook or Google accounts.

4.6.2 Users allowed to use Facebook and Google accounts to login along with the email and

password combination.

4.6.3 The password should adhere to the following rules:

4.6.3.1 Should be alphanumeric

4.6.3.2 Must have at least one Upper case letter and one lower case letter

4.6.3.3 Must have a special character

4.6.4 Users should be prompted to change the password every 3 months

4.6.5 Sensitive information like name, date of birth, payment info, phone number and address

should be encrypted before being saved in the database.

4.6.6 Email should be verified using verification link and phone number needs to be verified by

send in security code to the phone number.

4.6.7 All requests need to be encrypted using an SSL certificate and the requests needs to be

HTTPS requests.

4.6.8 The system should logout a user every time the password is changed to avoid unauthorized

access.

4.6.9 The user should be able to easily recover or reset password in case the password is

forgotten.

4.6.10 The security protocol needs to implement uniformly throughout the system for all

servers and backup servers.

4.7 Privacy

4.7.1 Under no circumstances is the user information shared with anyone.

4.7.2 Password field in the frontend is masked with an option to “Show password”. Password is

encrypted first and then saved in the backend.

4.7.3 Payment info is partially masked while displaying on the frontend and encrypted before

being saved in the backend.

4.7.4 Password can only be reset by the user. The user can request a system administrator to

reset the password.

4.8 Reusability

4.8.1 Content creators can use existing course template to create new contents or can create a

new template. The system should allow that level of customization.

5. System Architecture

The language training system will implement the MVC model wherein the user will interact with the system through a mobile app front end that provides application Views. All application Views will be presented to the user according to the Presentation Logic which provides the implementation of all methods and constraints related to delivering any requested application View. Within the Middle Layer, a Controller will accept message requests from the current application View and call the appropriate local and/or remote data using the appropriate services and pass the completed request back to the User via the application View. Workflows will include the application interface navigation constraints found in functional requirement 3.0.3.4 and the methods constraining the training progression concepts (functional requirement 3.2.2). All methods connecting the training program interface (functional requirements 3.2.4-3.5) to user data and services will be defined in Components and specific instances of those Components will be stored as Entities on the User device. Local Data will consist of all User specific data related to functional requirements 3.2-3.5. Local Data Accessors will interface among Controller requests, Local Data and any Remote Data requested by local Data Services and returned by Remote Data Access functions. Remote Data Services will provide methods for the selection and aggregation of the requested. Data Utilities will ensure that all appropriate Data Service methods are properly constrained. Common application development based configurations including necessary libraries, global application parameterizations and any other application dependencies will be provided by Configuration. Additionally Security will provide all security policies and security functionalities required in non-functional requirements. Means of all communications between the User via the Front End Views, the Middle Layer and any local/remote data will be contained within communications including all audio codecs used during lessons and/or cognizant tutoring sessions, all network related infrastructure functions/configurations required for accessing Remote Server Data [8].

A screenshot of a cell phone

Description automatically generated

6. Use Cases

6.1 User management use cases

|  |
| --- |
| **Action:** New user registration |
| **Brief Description:** A new user registers for the application. |
| **Actors:** New user |
| **Pre-conditions:** The customer has downloaded the application for play store/ app store and launches the application. The user also has respectable network connectivity on the device. |
| **Basic Flow of events:**   1. The user is given the option to register either using Google and Facebook account or by entering Name, date of birth, phone (optional), email address and password. 2. If the user chooses to register using either Google or Facebook account, the application registers the user through the social networking platform selected by the user. The user lands on the language selection page. 3. If the user chooses to register by entering all the details, the user is sent an email verification link to the entered email address. Once the user verifies the email address using the verification link, the user lands on the language selection page. The user will not be able to move ahead with the application unless the email address is verified. If the user launches the application without verifying the email address, he will be shown a message saying, “Please verify the email address to use the application”. |
| **Extensions:**   1. An existing user launches the application for the first time.    1. The user can choose to login instead of register.    2. The user lands on the login page. |
| **Post Conditions:** |
| **Special Requirements:** The user has access to network and a browser, an android or an iOS phone. |

|  |
| --- |
| **Action:** Existing user login |
| **Brief Description:** An existing user logs in to the application. |
| **Actors:** Existing user |
| **Pre-conditions:** The user is registered and has network connectivity. |
| **Basic Flow of events:**   1. The user can login either using Facebook and Google accounts or by entering the email ID and password. 2. If the user chooses to login using either Facebook or Google account, he can click on the respective buttons and login to the application through the corresponding social networking account. The user lands on the language selection page. 3. If the user chooses to login using email ID and password, the user is logged in after verifying that the email ID and password entered by the user is correct. The user lands on the language selection page. |
| **Extensions:**   1. The user can select “Keep me signed in” during login. If the user chooses that option, the email ID and password is encrypted and saved on the local device. This info is used to auto-login the user. |
| **Post Conditions:** |
| **Special Requirements:** |

|  |
| --- |
| **Action:** Forgot password |
| **Brief Description:** If the user forgets the password, he can reset it. |
| **Actors:** Registered user |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user clicks on the “Forgot password” link. 2. The user is prompted to enter the registered email ID. 3. If the entered email ID exists in the system,    1. A password reset link is sent to the email ID.    2. The user clicks on the link and is redirected to enter the new password.    3. User enter the password which adheres to our rules.    4. User is redirected to the login page. 4. If the entered email ID does not exist in our system, the user is shown an info message saying “The email ID entered does not exist in our system. Please enter the correct email ID or click here to register.” The “click here to register” in the message above would be a link which redirects the user to the registration page. |
| **Extensions:** |
| **Post Conditions:**   1. The user can login using the new password. 2. The old password will NOT let the user login. |
| **Special Requirements:** |

6.2 Training program interface use cases

|  |
| --- |
| **Action:** Language selection |
| **Brief Description:** The user can select languages that he is interested to learn |
| **Actors:** Registered user |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user lands on the language selection page and sees the languages offered by the application. 2. The user selects the language that he is interested to learn. 3. The user lands on the training program page for that language. |
| **Extensions:** |
| **Post Conditions:** |
| **Special Requirements:** |

|  |
| --- |
| **Action:** Training Program dashboard |
| **Brief Description:** The user can see the exercises available, the progress on each of this exercises and performance. |
| **Actors:** Registered user |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. Initially only Level 1 lessons are active. 2. The user selects the lesson that he wants to take and completes it. He is redirected to the dashboard. 3. The lessons which have been completed are indicated with green check mark on the lesson icon. 4. A lesson can be taken multiple times for practice. 5. Once all the lessons in level 1 are completed, then the level 2 lessons are unlocked. |
| **Extensions:** |
| **Post Conditions:** |
| **Special Requirements:** The user needs to maintain a good score to progress further. If the performance on the lessons are poor, then the progress is reset, and the user needs to take the lessons from the beginning. |

|  |
| --- |
| **Action:** Lessons page |
| **Brief Description:** The user selects and take a lesson on this page. |
| **Actors:** Registered User |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user selects a lesson. 2. The user lands on the lesson page. 3. The lesson page will have interactive challenges. The challenges can be of textual type, multiple choice type, audio type and voice type. 4. The user will be able to track the progress he’s making on the challenges in an active lesson. 5. With each wrong answer a little “health” will be reduced from the “health bar”. 6. If the health bar hits zero, then the user would have to start the lesson from the beginning. 7. The user can choose to close a lesson in the middle of the challenge. The progress will be saved. |
| **Extensions:** |
| **Post Conditions:** The progress and the performance of each lesson is saved and indicated on the training program dashboard. |
| **Special Requirements:** |

|  |
| --- |
| **Action:** Trophy collection page |
| **Brief Description:** The user can win trophies by completing challenges. The user can see all the earned trophies on this page. |
| **Actors:** Registered User |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user wants to check the trophies he won. 2. Each trophy will have levels I, II and III. 3. These achievements can be shared on the social media provided the user has chosen to connect Facebook account to the application. |
| **Extensions:** |
| **Post Conditions:** |
| **Special Requirements:** |

|  |
| --- |
| **Action:** League standing page |
| **Brief Description:** Users can compare their performance with other users learning the same language. |
| **Actors:** Registered user |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user win experience point (XP) based on the lessons they are taking and their performance in those lessons. These XP add up to help users climb through the league standing. The user can tap on the league standing button to check his league standing. 2. Here he can see how many people are performing better than him and try to take more lessons and challenges to add more XP points. The higher a user finishes, the more chances of him to earn more trophies. 3. The user can share their league standing on Facebook. |
| **Extensions:** |
| **Post Conditions:** |
| **Special Requirements:** |

|  |
| --- |
| **Action:** Practice page |
| **Brief Description:** The user can practice the lessons that he has taken so far. |
| **Actors:** Registered user |
| **Pre-conditions:** The user has network connectivity and a device to access the application. |
| **Basic Flow of events:**   1. The user can choose to practice the lessons they have taken so far. 2. On this page there will be miscellaneous challenges from all the completed lessons. 3. The user can earn XP by taking more practice challenges. 4. The user can lose “health” from their “Health bar” with wrong answers. |
| **Extensions:** |
| **Post Conditions:** |
| **Special Requirements:** |

7. Work Breakdown Structure

7.1 Overall WBS

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **WBS Code** | **Element Name** | **Description** |
| 1 | 1 | Digital Language Training System | All work to implement a multi-platform digital language training system that engages the user through a cognitively aware gamified interface. |
| 2 | 1.1 | Initiation | The work to initiate project. |
| 3 | 1.1.1 | Develop Business Case | Project sponsor creates and owns the Business Case. |
| 3 | 1.1.2 | Assign a Project Manager | Assign a Project manager who will develop the Project Overview Statement. |
| 3 | 1.1.3 | Evaluation and Recommendations | The project manager will evaluate the business case and give valid recommendations. |
| 3 | 1.1.4 | Develop Project Overview Statement | Project Manager develops a project overview statement, or a project charter based on the approved business case document. |
| 3 | 1.1.5 | Project overview statement review | The project sponsor reviews the POS document and makes recommendations. |
| 3 | 1.1.6 | Sign off Project Overview Statement | The project manager works on the POS document based on the recommendations from the project sponsor and gets the sign off on the final document. |
| 2 | 1.2 | Planning | The work for the planning phase of the project. |
| 3 | 1.2.1 | Create Preliminary Scope Statement | Project manager creates a preliminary scope document. |
| 3 | 1.2.2 | Determine Core Project Team | The project manager determines the core project team and requests resources. This team includes functional managers, technical managers, business analysts, expert tutors, language experts, designers and team leaders. |
| 3 | 1.2.3 | Project kick-off meeting with the core team | The planning is officially starting. The project manager and the core team meet and discusses on the business vision, the project vision, the strategy, roles and scope of responsibility, team building and team commitments and ground rules. |
| 3 | 1.2.4 | Develop Project Plan | Under the direction of the Project Manager the core team develops the project plan. |
| 4 | 1.2.4.1 | Develop Work Breakdown Structure | The core team develops the WBS. |
| 4 | 1.2.4.2 | Develop Project Schedule | The core team analyzes all the work under their ownership and estimates the amount of time each work needs to be completed and the milestones. |
| 4 | 1.2.4.3 | Develop budget plan | The core team analyses all the work under their ownership and estimates the amount of resources needed to complete them and comes up with a budget to create the budget plan. |
| 4 | 1.2.4.4 | Develop management plan | Once the scope, schedule, and cost baselines have been established, core team create the steps in change control process the team will take to manage variances to these plans. All these management plans usually include a review and approval process for modifying the baselines. |
| 4 | 1.2.4.5 | Developing resources plan | The core team analyses the resources in hand and also if any more resources that needs to add and creates a staffing plan. The staffing plan is a chart that shows the time periods, usually month, quarter, year, that each resource will come onto and leave the project. |
| 4 | 1.2.4.6 | Develop risk management plan | The core team develops risk management plan to understand and communicate how the team will respond to the high-risk events. |
| 4 | 1.2.4.7 | Develop quality assurance plan | The Software Quality Assurance Team prepares the standards, practices and metrics are used during the overall SQA process. |
| 4 | 1.2.4.8 | Develop Acceptance plan | The core team develops the schedule of tasks and deliverables, standards and metrics that are required to gain the customers’ acceptance. |
| 4 | 1.2.4.9 | Develop Communications Plan | The core team develops the communication plan to identify the communication goals, stakeholders and strategies, activities and timeframes and to improve the communication process. |
| 4 | 1.2.4.10 | Development procurement plan | The Core team develops the procurement plan identifying the products and services obtained from external suppliers and the tasks involved in procuring the products. |
| 3 | 1.2.5 | Complete project plan covering all the aspects of the project. | Project Manager submits the project plan for approval. |
| 3 | 1.2.6 | Project plan approval | The project plan is approved, and the Project Manager Approval has permission to proceed to execute the project according to the project plan. |
|  |  |  |  |
|  | 1.3 | Launch | All work associated with application launch is provided within section 1.3. |
|  |  | Application Launch Kick-Off Meeting | Project manager meets with client, business team and development team. |  |  |  |
|  |  | Gather USER Requirements | Requirements for font end application Views, application workflows, back end data management and business requirements are collated and presented by Project Manager and Project Team to stakeholders. |  |  |  |
|  |  | Requirement Review | Stakeholder analysts and Project Team developers make any necessary adjustments to requirements. |  |  |  |
|  |  | Technical Analysis | Project Manager, stakeholder analysts and development team review functionalities of each requirement in terms of their execution. |  |  |  |
|  |  | Risk Analysis | Project Manager, stakeholder analysts and development team review technical/operational and business risks associated with requirements. |  |  |  |
|  |  | Operational Analysis | Project Manager, stakeholder analysts and development team clarify any uncertainties related to milestones, deliverables, deadlines, etc. |
|  |  | Documentation of Requirements | Business Analyst team documents all requirements finalized and agreed upon by stakeholders. |
|  |  | Software requirements review | Senior Business Analyst reviews documented requirements. |
|  |  | Software requirements document submission | Project Team submits Software Requirements for approval. |
|  |  | Software requirements approval | Project Team is cleared to begin with the design of the project according to Software Requirements document. |
|  |  |  |  |
|  |  | Language Training Program Design | Language Expert sets the learning goals for the Language Training Program used to teach the language selected. I.e. Education Specialists from the Spanish language domain set the high level goals for the USER to achieve. |
|  |  | Language Training Program Organization | High level Goals set by the Language Expert are organized into compartmentalized Modules for all Difficulty Levels. |
|  |  | Language Lesson Notes Creation | Language Expert writes the educational material that is appropriate for each module. USER’s knowledge and understanding of the content therein will be tested during the Lesson Exercises. |
|  |  | Lesson Exercise Design | Language Education Expert will write up Exercises (see Functional Requirements 3.2.5.2.2. |
|  |  | Training Program back end development | Database designers create back end to store all Exercises along with the attributes that organize them into the Lesson, Module, Difficulty Level and Training Program as designed by the Language Experts. |
|  |  | Training Program Exercise bank development | Database designers and design backend data base to house all Exercises, Exercise solutions according to the required attributes. |
|  |  | Training Program Exercise bank back end Services conceptualization | Database administrators conceptualize the methods required to send the appropriate Exercise to the Front End Exercise View when called upon by the Controller during a training lesson. |
|  |  | User Data back end conceptualization | All application usage statistics are selected for tracking including, but not limited to, Exercise outcomes, Lesson Performance, League Standing, Social Media connections, Training Program Progression, Current Health Status, Rewards Points earned |
|  |  | Architecture Design | Design Team translates System Architecture into Application Structure. |
|  |  | Front End View UI Design | Design Team Sketches Entire Layout of Workflows, Views and View Components. |
|  |  | Hardware Specific Design Constraints | Design Team presents all Front End designs with Development Team to finalize integrability of Front End designs with Software Requirements |
|  |  | Software Specific Design Constraints | Design Team provides case-based application usage scenarios of each functional requirement component within the context of Front End design. |
|  |  | Local/Remote Application Layer Communications | Passing of messages from USER to application front end Views, communication of application Front End with local and remote data are described within the context of the USER experience according to Front End View designers’ case based examples. |
|  |  | Design Review | Project Manager reviews Design and clarifies/corrects any inconsistencies with stakeholder expectations. |
|  |  | Design Approval | Senior Management and stakeholders agree on finalized design and permission to begin development according to the design is granted. |
|  |  | Application Development | All aspects of the Application are put into development phase. |
|  |  | Application back end development | All remote and local databases are constructed to satisfy design requirements of 1.) Language Training Program organization and components including Exercises, Lessons and Modules2.) all USER related performance and usage statistics. |
|  |  | Application Front End Development | All Views of Application Front End are implemented according to Approved Application Design document. |
|  |  | New User Account Setup | All buttons, text boxes, etc. that are required to facilitate the creation of a new USER Account are implemented. |
|  |  | Language Training Program, Module, Lesson and Exercise Interfaces | All buttons, text boxes, etc. that are required to facilitate the observation and navigation into Modules and Lesson Introductory Content and Exercises of the Language Training Program are placed. All representations of Exercise Components are placed. |
|  |  | Social Media Interface | All button, images, etc. that are required to facilitate the USER social media experience as described in function requirements and Design document are placed. |
|  |  | League Competition Interface | All button, images, etc. that are required to facilitate the USER weekly League Competition experience as described in function requirements and Design document are placed. |
|  |  | App Store Interface | All button, images, etc. that are required to facilitate the USER App Store experience as described in function requirements and Design document are placed. |
|  |  | Trophy Room Interface | All button, images, etc. that are required to facilitate the USER Trophy Room experience as described in function requirements and Design document are placed. |
|  |  | Application Middle Layer | All methods required to facilitate the integration of local/remote data with the expected functional  behaviours of the Application Front End. |
|  |  | New User Account Setup | New USER account request takes information from the Front End and Requests new instance to be created on appropriate local and remote databases. |
|  |  | Language Training Program Interface | All requests for access to Module, Lesson and Exercise content is taken from Front End and passed to the appropriate local/remote database services. Appropriate local/remote Data Services pass back all requested content to the Front End via Middle Layer. |
|  |  | Social Media | All methods required to facilitate the passing of requests for local/remote data services related to Social Media functional behaviours. |
|  |  | League Competition | All methods required to facilitate the passing of requests from local/remote data services and Front End related to League Competition Interface functional behaviours. |
|  |  | App Store | All methods required to facilitate the passing of requests to and from local/remote data services and Front End Components related to App Store Interface functional behaviours. |
|  |  | Trophy Room Interface | All methods required to facilitate the passing of requests for local/remote data services from Front End Components related to Trophy Room Interface functional behaviours. |
|  |  | Data Layer | All database instances and services are created by Database Designers, Database Service Developers and Database Administrators to facilitate the requests sent from Front End via the Middle Layer. All data requested is passed back from appropriate Database via Data Services and translated to Front End Via Middle Layer. |
|  |  | Cod Review and Sign Off | Code is reviewed for errors and is signed off on if no conflicts exist. |
|  |  | Software Testing | Application is tested on representative sample of hardware listed in Hardware Requirements |
|  |  | Unit Testing | Testing Team separately tests each Functional Requirement for correct behaviour and functionality using appropriate use cases. |
|  |  | Bug Identification | Bug reports found during Unit Testing are sent to appropriate Development Team Leads |
|  |  | Bug Fixing | Correction of all elements of the Bug Report are assigned by Development Team Leads to appropriate Project Development Team members. |
|  |  | Fix Report and Code Update | All fixes are documented, updated and re-tested in the Unit Testing Phase. |
|  |  | Integration Testing | System Test team applies use cases to full functionality of Application across all modules. |
|  |  | Performance Testing | Performance Test team applies performance based use case tests according to Business Team and Stake Holder expectations. |
|  |  | Security Testing | Security Team applies use case based security tests to ensure Security Policies are all met or exceeded. |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# References

|  |  |
| --- | --- |
| [1] | Technavio.com, 2018. [Online]. Available: https://www.technavio.com/report/global-online-language-learning-market-industry-analysis. |
| [2] | Research and Markets, "Global $8 Bn Cloud-based Language Learning Market 2019-2024: Growing Requirement of Technology-Enabled Tools that can Facilitate User Engagement, Motivation, and Collaboration," Research and Markets, 11 2 2019. [Online]. Available: https://www.prnewswire.com/news-releases/global-8-bn-cloud-based-language-learning-market-2019-2024-growing-requirement-of-technology-enabled-tools-that-can-facilitate-user-engagement-motivation-and-collaboration-300793002.html. |
| [3] | Rosetta Stone Ltd., "Rosetta Stone," [Online]. Available: https://www.rosettastone.com/. |
| [4] | Duolingo Inc., "Duolingo," [Online]. Available: https://www.duolingo.com/. |
| [5] | Rosetta Stone, "Rosetta Stone Language Tutoring Session," 3 11 2015. [Online]. Available: https://www.youtube.com/watch?v=kr\_A1fBRIAw. |
| [6] | Rosetta Stone, "Rosetta Stone Home on Facebook," [Online]. Available: https://www.facebook.com/RosettaStone/. |
| [7] | Rosetta Stone, "Rosetta Stone on Twitter," [Online]. Available: https://twitter.com/rosettastone?ref\_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor. |
| [8] | P. Allan, "Language Learning Showdown: Rosetta Stone vs. Duolingo," 2017. [Online]. Available: https://lifehacker.com/language-learning-showdown-rosetta-stone-vs-duolingo-1790938306. |
| [9] | J. Duffy, "The Best Language-Learning Software for 2019," PC Magazine, 11 4 2019. [Online]. Available: https://www.pcmag.com/roundup/261786/the-best-language-learning-software. |