Technical Design Document

Memory Magic App

Release 1.0

Version 1.1

Prepared by Team Mesmerize.

|  |  |  |  |
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# INTRODUCTION

## Purpose

The purpose of this Technical Design Document (TDD) is to provide a comprehensive look at the design and architecture of the Memory Magic application (app) intended to assist people with Short-Term Memory Loss (STML). The following sections in this document will detail the application's architectural design, data design, component design, and human interface design. The intended audience to read this document includes Software Developers/Testers, Project Managers, Stakeholders, Business Analysts, future developers, and any other required personnel that could add value to improve the application.

## Overview

The purpose of Memory Magic is to be an assistant for people with STML with daily note-taking and reminders for various events. The impairment of STM involves forgetting information to which the subject has been recently exposed (Cascella, Ai Khalili, 2021). Memory Magic is intended to help this population by supporting the user (STML victims) on keeping notes and reminders utilizing speech/voice recognition by levering the mobile phone capabilities and external services. Cherry's (2021) article mentioned the following:

Some information can last in short-term memory for up to a minute, but most information spontaneously decays quite quickly unless you use rehearsal strategies such as saying the information aloud or mentally repeating it. (para. 2)

Memory Magic will be designed to assist people with STML by developing a tool that will simulate some of the rehearsal strategies mentioned by Cherry, like saying the information aloud and repeatedly to the user. The application shall be able to recognize voice speech and commands and transcribe them to text for future uses like for example, remind the user of something when a trigger word is captured by the app and repeat it to the user for assistance on reminding something.

## Scope

The scope of this document is to provide a detailed description of the technical design and architecture of Memory Magic to the intended audience of the document. The document is broken down into sections that will cover in detail each aspect of the app. The in-scope areas that this document will address are the following:

### In Scope

* **Architectural Design:** This section will represent the app design and the structural properties of the system.
* **Data Design:** This section indicates the storage and data design for the app.
* **Component Design:** This section will provide an overview of the components in the app.
* **Human Interface Design:** This section will provide a walkthrough of the human interface with the Memory Magic app.

## Definitions, Acronyms, and Abbreviation

See the most used acronyms/abbreviations and their definitions below:

**Table 1**

*Acronyms, Abbreviations, and Definitions*

|  |  |
| --- | --- |
| Word/Abbreviation | Meaning |
| TDD | Technical Design Document |
| APP | Application |
| UI/UX | User Interface |
| API | Application Programming Interface |
| STML | Short-Term Memory Loss |
| STM | Short-Term Memory |
| FAQ | Frequently Asked Questions |
| NLU | Natural Language Understanding |

## REFERENCES:

Cascella, M., & Khalili, Y. A. (2021). *Short Term Memory Impairment*. Treasure Island, FL: StatPearls Publishing LLC. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK545136/

Cherry, K. (2021, April 25). What is short-term memory?. In *Verywell Mind*. Retrieved from

https://www.verywellmind.com/what-is-short-term-memory-2795348

# SYSTEM OVERVIEW

The Memory Magic Application shall serve as short-term memory (STM) assistant. This application will be able to provide individuals who suffer from short-term memory loss note-taking capabilities such as reminder and contextual notes. The Memory Magic App will include state-of-the-art natural language processing and cloud-based technologies, notifications, and support for language internationalization. In addition, it will allow users to activate and deactivate listening mode by voice, listen and act (add, modify, and delete) on trigger words, save and act (add, modify, and delete) on transcribed notes.

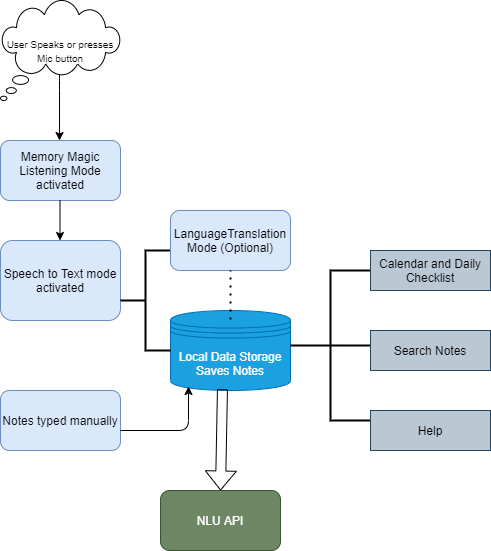
# ARCHITECTURAL DESIGN

The architectural design will show how the components of the Memory Magic Application are organized in the system. The design will also show how the different components will work together within the application.

The components of the application include a listening mode, speech to text conversion component, data storage component, language translation component, Natural Language Understanding (NLU) component, calendar component, search component, and guided help component. Figure 1 depicts the flow between the components of the architectural design.

**Figure 1**

*The flow of Components in Architectural Design of the Memory Magic Application*



## Decomposition Description

When the Memory Magic app is opened, there are several phases in its operation. The first phase is the listening mode. The next phase is the speech-to-text conversion, which creates the notes, which saves them in the data storage phase. These phases consist of the main functioning of the application. Other phases such as language translation, NLU component, calendar option, search, and help are options for the user. The phases are further described below:

### Listening Mode

The listening mode consists of the application's ability to listen for speech. After getting mic-access permission, the application will have the ability to react when the wake word is said by the user or if the microphone button is pressed.

### Speech to Text Conversion

When the listening mode is activated and the start phrase has been said by the user, the speech-to-text conversion will begin. This will continue until the stop phrase is said by the user. The resulting phrase will be analyzed and converted to text, which will be saved on the device in data files.

### Language Translation.

A language setting will exist that will translate the app's text into different languages.

### Data Storage

Data will be encrypted and stored on the device in JSON files. The data will be transferred by the NLU API to a Dynamo database managed by Team Tongue Twisters.

Also, users shall be able to back up their data to the cloud using Google Drive if they have a Google account. Since all the data is also being copied to the Dynamo database, the data files will contain a unique app ID and will be used as a reference to the files in the Dynamo database such that a user can use the data stored in Google Drive as a backup to their notes, even if they change devices.

### Natural Language Understanding (NLU) Component

The NLU component will make calls to the NLU application being developed by Team Tongue Twisters. The note will be sent to an API and the response will return to the app.

### Calendar Feature

The calendar shall display upcoming events on the dates and times at which they should occur.

### Daily Checklist

The user shall have the ability to create and manage a daily checklist of items they would like the app to remind them of.

### Search

The user shall have the ability to search by date or keyword. The search feature shall integrate with the NLU AI service to search for notes with the context of the user's text (the text may be typed or voice-transcribed)

### Guided Help

This consists of a help area. The help area will be contextually sensitive when accessed for various screens. It will also have onboarding help to assist with the application set up when the user first logs on.

# DATA DESIGN

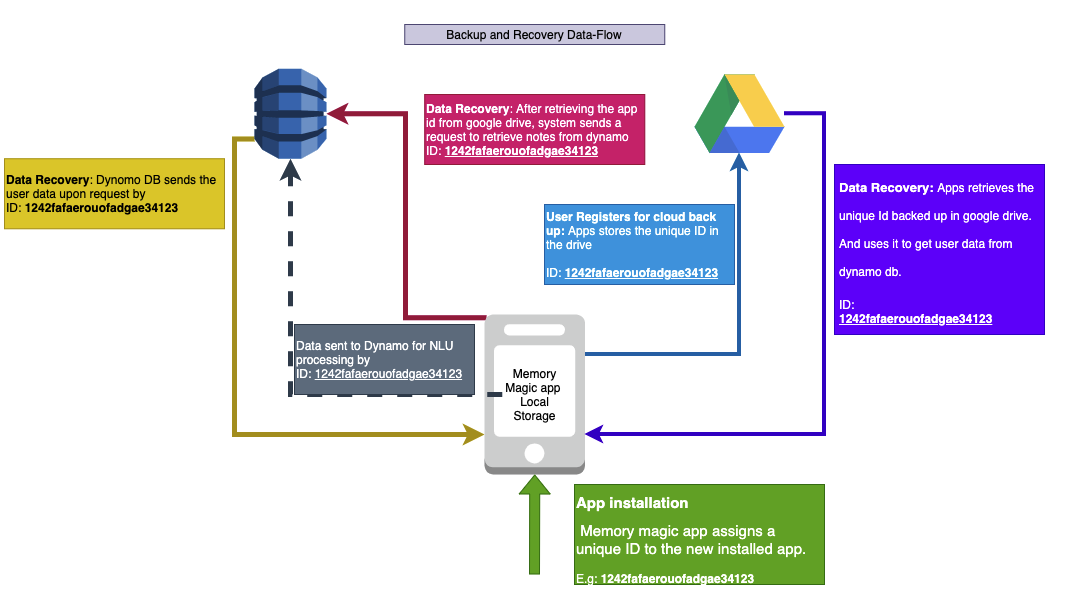
The app shall utilize the device’s file system for data storage. It shall store the user's notes in JSON files. And properties files shall be used for "user-preferred settings" and "language support storage".

## Notes JSON

The user's notes shall be saved on the device in a JSON file. It will then be synced to the Dynamo database by the NLU component to the database managed by Team Tongue Twisters. There will also be an option for the user to back up their data to Google Cloud by storing a reference to the data in the database. Figure 2 depicts the data design and backup strategy.

**Figure 2**

*Memory Magic data flow and backup/recovery strategy*



The system shall have the following JSON files:

The Note JSON shall store the user's notes. JSON note object in this file shall have the following fields:

**Device ID**- **This is a** unique ID that will identify the app instance. This will be the primary key

**ID – This is a** unique ID that will identify the app instance.

**Timestamp –** The timestamp on which the note was created.

**Category –** The category of the note.

**Text –** The text of the note.

**Locale –** The location of the user (if available).

**RecordedLanguage –** The original language that was set when the note was taken.

**PreferedLanguage –** The user’s current preferred language.

## Setting Properties File

This file shall store all the users' preferred settings as set by the user through the UI.

## Language Supported Properties File

This file shall store a configurable list of languages the app supports.

# COMPONENT DESIGN

As previously described in the Architectural design section, the following are components of the Memory Magic application.

## Listening Mode Component

The component of the application that will listen for speech. This will be triggered by a wake word or pressing the microphone button in the application.

## Speech to text conversion component

The component that will process the speech and transcribe it to text.

## Data Storage component

The component that stores the data on the device.

## Language Translation component

The component that converts text in the application to other languages is based on the user’s preference setting.

## NLU component

The app shall communicate with the Natural Language Model via an API, that shall send data from the Memory Magic Application to the NLU for context-level processing.

## Calendar component

The calendar component shall display a calendar with users upcoming events alongside their date and time.

## Search component

The component where the user can do a search using a keyword or date.

## Guided Help component

The component shall provide context-sensitive help and can be used when onboarding new users.

# HUMAN INTERFACE DESIGN

## Overview of User Interface

The Memory Magic User Interface (UI) shall be implemented using Flutter and Dart library. When the user opens the Memory Magic application for the first time, multiple pop-up permission messages shall appear. The messages shall ask the user to select a language for the application, permission to use the microphone on the device to get the user's voice, connect Memory Magic to the cloud, and view a tutorial to get familiar with the application and the features it provides.

The bottom navigation bar shall be on each screen of the Memory Magic application with icons that guide the user to different screens. These icons shall be, from left to right: note screen icon, menu screen icon, notification screen icon, and home screen icon. Also, there shall be a settings icon in the app bar next to the title of each page. The user shall be able to record his voice and save it in to an encrypted note. The application shall handle the translation from voice to text, then translate the text to an encrypted note.

Upon installing and first launching the app, the user shall be welcomed by an onboarding screen with voice-over-text speech support while assisting the user through the initial onboarding process. The onboarding screen will support voice commands for users who prefer voice input to button clicks, provided they permit access to the mic resources.

* + - * As the first step in the onboarding process, the app shall ask the user to select their primary language. All information presented from then shall be in the user’s language of preference.
      * Following the language selection, the app shall ask the user to permit it to access the device’s mic resources (and other resources needed by the app, if any).
      * Next, the app provides the user with an option to sign up for cloud back up service.
      * At the final step in the onboarding process, the app presents the user with a brief walkthrough tutorial on how to navigate the application.

On the home screen, the user shall have the option to record a note or add the note as a text. The first button is the mic icon with a text under it that says, "Speak." When the user presses on this button, it will take him to a screen with a large mic icon to press and record the note. The second button is to allows the user to add the recorded note as text.

On the note screen, the user shall be able to view all the notes that were recorded. Each one of these notes shall have a date when the note was recorded. Such as; “one day ago”, “35 minutes ago”, or “a month ago”. The user shall have the option to edit the note by clicking on it. Each note shall have an X at the top right of the note to delete. When the user clicks on the X, a pop-up message shall appear to confirm if the user wants to delete the note.

On the edit note screen, the user shall have the option to change the note by typing on the keyboard. After the user edits the note, he has the option to save the changes by clicking "Save changes" or reset to the original note by clicking "Reset changes".

On the setting screen, the user shall have the option to select one of the four buttons: Sync to Cloud, Trigger, General Settings, and Help. Each one of these buttons shall take the user to a different page to perform a new function.

On the settings screen, there is a “sync to cloud” button, which shall allow the user to go to the sync to the cloud screen. This screen shall allow the user to upload his notes into the cloud to protect his data. The notes will be encrypted and safe for the user to access at any time.

The second button in the menu screen is the trigger button, which shall allow the user to go to the trigger screen. In this screen, the user shall be allowed to enter a trigger word or phrase when he wants Memory Magic to start recording, or he can review existing one(s). The trigger screen shall also allow the user to enter a word or phrase that allows the user to stop recording. Memory Magic shall also allow the user to pick a word or trigger phrase to play their notes.

The third button in the menu screen is the general setting screen. This screen shall allow the user to change the settings of the Memory Magic app, such as the font size of the icon's label, the notes, and how long Memory Magic shall keep the notes before automatically deleting them. In the general settings screen, the user shall have the option to change the language of the application. Currently, we have seven languages that the user can choose from, and more will be added in the future. After the user changes the settings, the user has the option to save the changes of the settings or reset to the default settings of the application.

In the general settings, there is a security setting for the user. The security setting is a biometric setting where the user records his fingerprint to access the notes. The user has the option to enable this service or disable it. If the user wants to enable the service, the user shall place his fingerprint on the sensor of the device after opening the security screen and press save. Then Memory Magic will ask for the user's fingerprint before accessing the notes.

The fourth button on the menu screen is the menu button. This button shall take the user to the help screen, which shall answer most of the questions the user has about the Memory Magic application and how to use it.

## Screen Images

The screens of the user interface are showing below, followed by an explanation of how the user's experience shall be while using Memory Magic. The list of screens is:

* Onboarding Language Screen.
* Onboarding Permission Screen.
* Onboarding Limited permission Screen.
* Onboarding Cloud Screen
* Onboarding Walk Through Screen.
* Home Screen.
* Mic Screen.
* Menu Screen.
* Note Screen.
* Delete a Note Screen.
* Edit a Note Screen.
* Trigger Screen.
* Help Screen.
* Sync to Cloud Screen.
* General Setting Screen.
* Security Setting Screen.
* Calendar Screen.

**Onboarding Language Screen.**

In Figure 3, the Onboarding Language Screen shall ask the user to select a language for Memory Magic. The user shall have multiple languages to choose from.

Graphical user interface, text, application

Description automatically generated

FIGURE 3: ONBOARDING LANGUAGE SCREEN.

**Onboarding Permission Screen.**

In Figure 4, the Onboarding Permission Screen shall ask the user for permission to access the microphone service on his device to record the user's voice.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 4: ONBOARDING PERMISSION SCREEN.

**Onboarding Limited permission Screen.**

In Figure 5, the Onboarding limited access permission shall pop up if the user declines the microphone access permission. This pop-up message shall say that because he declined the microphone access permission, he will have limited access to Memory Magic's features.

Graphical user interface, text, application

Description automatically generated

FIGURE 5: ONBOARDING LIMITED PERMISSION SCREEN.

**Onboarding Cloud Screen.**

In Figure 6, the Onboarding Cloud Screen shall ask the user if he wants to connect to the cloud. The user has the option to skip this permission and access the cloud later from the menu screen.

Graphical user interface, application

Description automatically generated

FIGURE 6: ONBOARDING CLOUD SCREEN.

**Onboarding Walk Through Screen.**

In Figure 7, the Onboarding Walk Through Screen shall ask the user if he wants the view the walk-through tutorial to get to know the Memory Magic application and get familiar with the features it provides.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 7: ONBOARDING WALKTHROUGH SCREEN.

**Home Screen.**

In Figure 8, the Home Screen shall allow the user to pick between two options. The first option is speaking, which shall allow the user to add a note by recording their voice. The second option is text, which shall allow the user to add a note by typing it in.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 8: HOME SCREEN.

**Menu Screen.**

In Figure 9, the Menu Screen shall allow the user to pick between four options: Sync to Cloud, Trigger, General Setting, and Help. Each one of these buttons is a separate screen.

A close-up of a cell phone

Description automatically generated with medium confidence

FIGURE 9: MENU SCREEN.

**Note Screen.**

In Figure 10, the Note Screen shall allow the user to edit a note by clicking on it, delete a note by clicking on the top right "X," or create a note by clicking on "Create a Note." Each note will have a time when it was saved, such as 45 minutes ago, two days ago, or a week ago.

Graphical user interface, application

Description automatically generated

FIGURE 10: NOTE SCREEN.

**Delete a Note Screen.**

Figure 11 shows a message that pops up when the user decides to click on the "X" to delete a note. If the user confirms the deletion process, the note will be deleted. If the user changes his mind on deleting the note, he can click on the "Cancel" button, and the note won't be deleted.

A screenshot of a phone

Description automatically generated with medium confidence

FIGURE 11: DELETE A NOTE SCREEN.

**Edit A Note Screen.**

Figure 12 shows when the user tries to edit a note. The user shall be allowed to edit a note by clicking on it. The edit note screen shall have the note, keyboard, and two buttons. The user shall use the keyboard to edit the note; then, he can save the changes by clicking on "Save changes." The user also has the option to reset the changes he made to the original note by clicking on "Reset Changes."

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 12: EDIT A NOTE SCREEN.

**Trigger Screen.**

Figure 13 is the Trigger screen, in which shall be three fields. The first field shall allow the user to pick a trigger word for the application to start recording. As soon as the application hears the word, it shall automatically start recording. The second field shall allow the user to pick a trigger word for the application to stop recording. As soon as the application hears that word, it shall stop recording. The third field shall allow the user to pick a trigger word for the application to playback the notes the user previously entered.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 13: TRIGGER SCREEN.

**Help Screen.**

Figure 14 is the help screen that shall answer most of the questions the user has about Memory Magic.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 14: HELP SCREEN.

**Sync to Cloud Screen.**

Figure 15 is the Sync to Cloud screen. This screen shall allow the user to connect to the cloud and upload their notes. Also, if the user gets a new device and he wants his old notes, he can log in to Cloud and get his old notes from the cloud.

Graphical user interface, text, application, chat or text message

Description automatically generated

FIGURE 15: SYNC TO CLOUD SCREEN.

**General Setting Screen.**

Figure 16 is the General Setting screen. This screen shall allow the user to edit how many days he wants to keep the notes before automatically deleting them. Also, the user shall have the option to edit the font size of the notes and the icon titles. The user can change the settings and click on "Save" to save the changes or reset to the default settings by clicking on "Reset Settings." The user has the option to select a language for the application from multiple languages that Memory Magic provides. The user also has the option to create a security setting that allows them to protect their notes by enabling the biometric fingerprint setting.

Graphical user interface, text, application

Description automatically generatedGraphical user interface, application

Description automatically generated

FIGURE 16: GENERAL SETTING SCREEN.

**Security Setting Screen.**

Figure 17 is the Security Setting screen. This screen shall allow the user to enable the fingerprint biometric security setting to protect their notes. After the user enables this setting, Memory Magic shall ask the user for his fingerprint before accessing the notes.

Icon

Description automatically generated with medium confidence

FIGURE 17: SECURITY SETTING SCREEN.

**Calendar Screen.**

Figure 18 is the Calendar screen. In this screen, the user can view the agenda that he has for each day based on the notes that were saved. Also, Memory Magic will send a notification before each created agenda to remind the user of their doctor appointments or dinners that he's having with his friend.

Graphical user interface, calendar

Description automatically generated with medium confidence

FIGURE 18: CALENDAR SCREEN.

## Screen Objects and Actions

Icon

Description automatically generatedThis is the mic icon. It's a part of the navigation bar that will take the user to the home screen. It will also allow the user to start recording or stop recording.

This is the notes icon, also located on the bottom navigation bar. Memory Magic shall take the user to the notes screen when he presses on it.

 This is the menu icon, also located on the bottom navigation bar. Memory Magic shall take the user to the menu screen when he presses on it.

This is the notification, also part of the bottom navigation bar. Memory Magic shall send a notification to the user about their agenda for the day.

 This is the setting icon. It's part of the App bar. Memory Magic shall allow the user to go to the setting screen when he presses on it.

This is the calendar icon. It's also part of the App bar. Memory Magic shall allow the user to go to the calendar screen when he presses on it.

This is a button on the home page. It shall allow the user to add a note if the user doesn't want to use the mic to record a note.

This is the Sync to Cloud button, which shall be a part of the menu screen. It shall allow the user to go to the Sync to Cloud screen when he presses it.

This is the Trigger button, which shall also be a part of the menu screen. It shall allow the user to go to the Trigger screen when he presses it.

This is the General Setting button, which shall also be a part of the menu screen. It shall allow the user to go to the General Setting screen when he presses it.

This is the Help button, which shall also be a part of the menu screen. It shall allow the user to go to the Help screen when he presses it.

# REQUIREMENT MATRIX

The requirement matrix below provides a list of mandatory and optional requirements for the Memory Magic App:

**Table 2**

*Requirement Matrix*

|  |  |  |
| --- | --- | --- |
| Requirement | Code | Mandatory/Optional |
| The application shall listen to speech when the user taps on the microphone button | R.01 | Mandatory |
| Upon recognizing of user's voice and phrases, the system shall begin recording a text memo/transcribe the user's speech | R.02 | Mandatory |
| The application shall recognize and ignore background voices and environmental noises | R.03 | Mandatory |
| The application shall transcribe speech when key trigger phrases are mentioned | R.04 | Mandatory |
| The system shall save transcribed notes on the user's device | R.05 | Mandatory |
| The system shall identify notes by date or subject category | R.06 | Mandatory |
| The application shall allow notes to be typed and edited | R.07 | Mandatory |
| The application shall allow personal information to be saved as notes | R.08 | Optional |
| The application shall allow the user to customize and manage start, stop, and recall trigger words and phrases | R.09 | Mandatory |
| The application shall have a flexible and functioning Graphical User Interface (GUI) with large, user-friendly icons | R.10 | Optional |
| The application shall allow notes to be searchable by keyword and date | R.11 | Mandatory |
| The application shall provide a help menu | R.12 | Mandatory |
| The application shall support cloud storage via google drive | R.13 | Mandatory |
| The application shall allow the users the ability to use biometrics capabilities from their mobile to increase security | R.14 | Mandatory |
| The application shall support reminder notifications | R.15 | Mandatory |
| The application shall have a language settings option to support language internationalization | R.16 | Mandatory |
| The application shall allow the user to add, edit, update, and delete a note | R.17 | Mandatory |
| The application shall keep track of event dates and times and remind the users, within a one-hour interval, when the event is due | R.18 | Mandatory |
| UI responses to user interaction shall not exceed 2 seconds | R.19 | Optional |
| The system shall comply with 508 specifications and HIPPA Rules | R.20 | Mandatory |
| All data shall be encrypted (in transit and at rest) | R.21 | Mandatory |
| The application must work with IOS and Android Operating Systems | R.22 | Mandatory |
| Settings shall be made possible to allow either caregiver or user to set up the application | R.23 | Optional |
| Data storage shall be in files | R.24 | Mandatory |
| The application shall support voice interaction with the user | R.25 | Optional |
| The application shall use the "Time Ago" feature | R.26 | Mandatory |
| The application shall include caregiver instructions | R.27 | Mandatory |
| The application shall include onboarding options | R.28 | Mandatory |
| The application shall include a calendar and daily checklist | R.29 | Mandatory |
| The application shall include games to stimulate the user's memory | R.30 | Optional |
| The application shall allow a caregiver to develop a scrapbook and include photos and music | R.31 | Optional |
| The application shall provide a profile screen with the user's personal information | R.32 | Optional |

# Appendices

## Credits

Below are the members that contributed or will contribute to the development of this application:

* Dr. Mir Mohammed Assadullah
* Roy Gordon
* Johnny Lockhart
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* Michelle Monfort
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* Didimus Kimbi
* Damion Sevilla
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