Senior Design Project Report

for

Want2Remember

Version 2.1 approved

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Revision History

Name	Date	Reason For Changes	Version
Amy Guttman, Alexandra Strong	1/24/2022	Initial Access	1.0
Amy Guttman, Alexandra Strong	3/19/2022	Cross-Reference with Past Project Report	1.1
Amy Guttman, Alexandra Strong	5/09/2022	First Draft Completed	2.0
All Project Members	5/13/2022	Final Draft Approved	2.1

1. Introduction

1.1 Background

Michael C. Malone served in the United States Army for over 30 years. He sustained a traumatic brain injury (TBI) while performing an Airborne Jump in 2012. It was not until he started pursuing his master's degree in 2014 that he realized he was having trouble learning new things, remembering conversations, even recognizing faces. Michael went on to found We2Link to find a solution to the persistent challenges he faced with memory loss. However, before he could start building out his idea for a mobile application, he was deployed to the Middle East for another combat tour. He fell ill, and while receiving treatment at Walter Reed National Military Medical Center, he endured another brain injury. During his recovery, he met many other service members who were also undergoing treatment for TBIs. Michael realized that he was not alone in needing more support and started working on his idea for Want2Remember.

Want2Remember is a mobile application that assists those with cognitive impairments to remember day-to-day tasks and memories. The CDC estimates that 1.5 million Americans sustain a TBI each year; an estimated 5.3 million Americans are living with a permanent TBI-related disability. Memory impairments, whether from TBIs or from progressive memory issues such as Alzheimer's or dementia, puts a strain not only on the individual, but also on their social and familial relationships. This app helps to support those with memory impairments as well as their caregivers by providing a simple user interface to log the user's memories and other important information. This app hopes to give more autonomy back to its users, supporting them through social interactions, independent living, return to work, all while providing greater personal safety and medical support. In turn, it will also help to relieve caregiver burnout and decrease social isolation and stigma.

1.2 Design Principles

It was important to choose a stack of technologies that would complement each other, help the developers build out the application, and provide additional functionalities for the user. We chose to develop this app with React Native, Google Firebase, Redux, and Node.js.

Want2Remember uses the React Native framework to provide the user with basic templates to log their memories, passwords, to-do lists, medications, appointments, interactions, and other important notes. These templates reduce the need for the user to figure out setup and organization of their entries to their mobile devices. All screens and templates within the app are composed of React Native components. For backend development and database support, we chose Google Firebase services and Google Cloud User Authentication. These technologies allow the app to have multi-platform support beyond the local user data on the device. In addition, Redux and Node.js work together to perform data storage on the local device and run backend operations.

1.3 Design Benefits

Due to the need for simplicity and reliability, we chose the respective technologies because of the support and modularization they offer. This allows us to take feedback from our beta testers and quickly refactor the code to reflect improvements.

React Native is an open-source framework that enables cross-platform mobile development. By using React Native, we can develop a single codebase in JavaScript for both Android and iOS, without the needing to switch between languages and development environments. All screens and templates within the app are composed of React Native components. This allows us to keep things simple and modular – adding new features can be built out of the basic templates allowing us to quickly respond to evolving user requirements. It decreases the development time by allowing the developers to repurpose code throughout the entire application.

React Native also has a multitude of well-maintained, open-source libraries, allowing us to find prebuilt components to quickly fix any bugs or add new features. It works well for tight deadlines and small teams, especially on small budgets. Redux is a managed library from React Native that helps the developers manage the current state throughout the application. It allows for control of the data flow from the user's native device. Want2Remember uses a component-based architecture that allows for the reusability of components so that it reduces the size and complexity of our codebase.

Firebase lets developers grow and develop applications in a way that is effective and secure, supporting the security measures required for sensitive medical data. Google Cloud User Authentication provides user verification and an immediate secure authentication process to encrypt user data.

1.4 Achievements

Our dedicated team spent two semesters developing Want2Remember, building off the efforts of last year's Senior Design project. Our time with the project is limited – approximately 9 months of development with this team. We implemented bug fixes and additional user requirements based off the existing design. We follow their same methodology; we used the Agile Development Process. We broke down tasks and assigned them to sub-teams in Sprints of one-to-two-week durations. Agile architecture allowed us to pivot and adapt quickly to new changes, which allowed us to respond swiftly to any bug fixes or feedback from beta testers. We also visualized the task board using Atlassian's Jira software to improve workflow.

The major hurdles associated with this project were learning the JavaScript mobile application framework and React Native and working as a group remotely through the COVID-19 pandemic. We were given online resources to solve both challenges. We were given access to the Udemy

course “React Native - The Practical Guide” to guide us through the framework and language. To collaborate, we formed sub-teams to break down the project objectives into manageable pieces. We met virtually twice weekly for status updates and sprint retrospectives on Zoom while we communicated over Slack and email.

During our time on this project, we have accomplished refactoring the codebase, adding calendar integration for Android and iOS, extending color palettes for color vision deficiencies, incorporating dyslexia-friendly fonts, adding new memory types, implementing a customization tool, improving the sort and filter functionalities, including a new site map revision, and adding full cloud support for user data.

2. Related Technologies

2.1 Existing Solutions

While Want2Remember includes some features found in calendar-type and reminder-type applications, it is a unique product that will be brought to market. We investigated existing memory applications, but many are more memory exercises rather than an entire platform of memory support.

Calendars within iOS and Android allow users to add events to specified dates, with capabilities for recurrence, reminders, and rescheduling. However, they are best for keeping track of future events rather than for memory keeping or recording notes about an interaction. These applications have useful features to keep track of date, time, location, and subtasks within the event, but some of the usability is limited for those with cognitive impairments. Many users would need a simpler, more straightforward task to add details to an event.

2.2 Our Approach

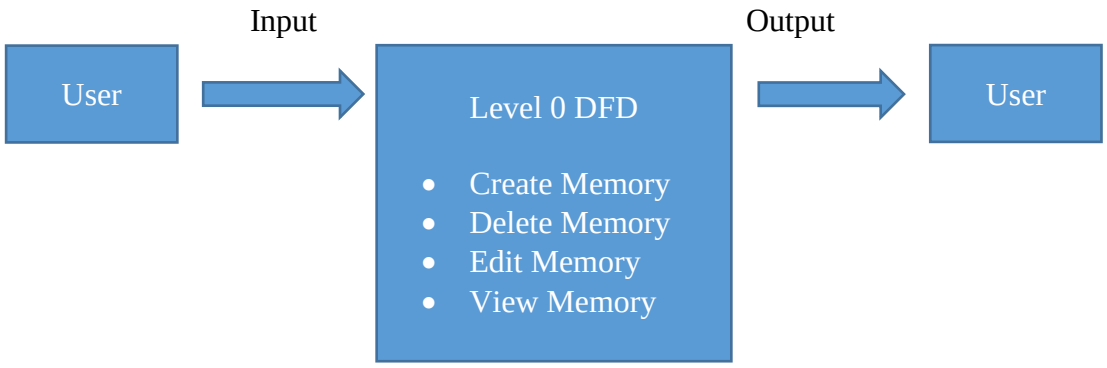
The application supports the user through additional features, such as cataloguing memories, organizing detailed interactions with other people, tracking moods that correlate to events, and other things like providing a more customized use of the software. The user would not have to worry about the organization of a memory or event as they create each instance; the templates already exist for them. These features are helpful for the users themselves and for caregivers or family members who are assisting the users. The hope is that by supporting the user through the creation of memories and reminders, they are able to maintain a sense of independence and autonomy.

While the application is currently free as a beta test, we plan to add advertising, introduce premium features behind a paywall, and find other integrations to increase the value of the app and add to its revenue stream.

3. System Architecture

3.1 Overview

Figure 1: The Application



- The User: This section represents the individual using the application, i.e., the user. Only the user can provide input for the mobile application.
- The Application: React Native encapsulates all Screens and Components which the user interacts with.

3.2 Data Flow

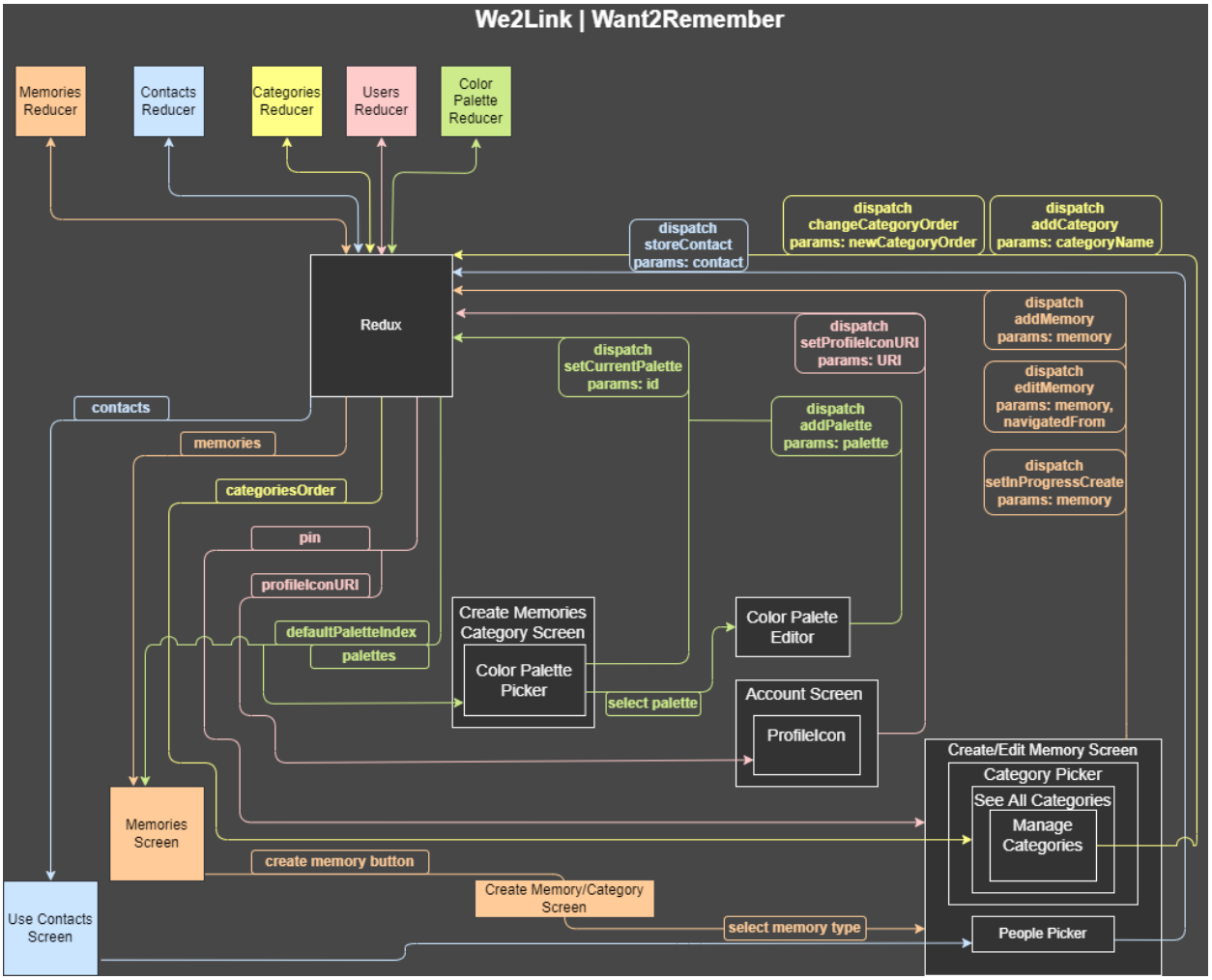


Figure 2: Redux Flow Diagram

Want2Remember mobile application consists of eight major screens:

3.2.1 HomeScreen

The HomeScreen provides the initial landing site for users. It provides a brief overview of all existing memories. It connects to the other screens below, allowing the user to navigate to other sub-screens.

3.2.2 CreateScreen

The CreateScreen allows the user to choose from different entry templates. Each memory template layout is unique based off the needs of that memory type.

3.2.3 MoreDetailsScreen

The MoreDetailsScreen displays all available metadata associated with a selected memory.

3.2.4. ContactsScreen

The ContactsScreen synchronizes Want2Remember's contact address book with the user's native address book. All contacts are displayed on this screen in the form of ContactTiles. ContactTiles show the contact's first name, last name, and memories the contact is associated with. The user can directly call, message, and/or email the chosen contact from this tile.

3.2.5 SearchScreen

The SearchScreen allows users to search through entries and display results.

3.2.6 SettingsScreen

The SettingsScreen allows user to change application settings, import or export app data. The user may also create and edit app reminders, customize the app, edit their secure pin, send feedback to developers (help screen), or clear all user data.

3.2.7 HelpScreen

The HelpScreen allows user to send feedback and report a bug.

3.2.8 FiltersScreen

The FiltersScreen has two tabs labeled "Memories" and "Date". The "Memories" tab can filter memories by memory type, while the "Date" tab can filter user memories by a specific date range. This date range can be a preset value, or a value selected by user input through the in-app calendar.

3.3 Software Development and Implementation

Because this application is built off the last Senior Design project, our first task was to understand their existing model and UI design. We started by refactoring the code and fixing bugs, followed by updates and new features based off user feedback. Some of these include but are not limited to Calendar support, cloud infrastructure design, new memory templates, and user customization.

4. Conclusions

4.1 Results

The purpose of the Want2Remember app is to improve the daily lives of those with cognitive impairments. We have accomplished refactoring the codebase, adding calendar integration for Android and iOS, extending color palettes for color vision deficiencies, incorporating dyslexia-friendly fonts, adding new memory types, implementing a customization tool, improving the sort and filter functionalities, including a new site map revision, and adding full cloud support for user data. Living with cognitive impairments or memory loss affects all aspects of a person's life and that of their families; with the improvements that we have made on Want2Remember, we hope that it will reduce the impact and challenges and increase the ease of daily living.

4.2 Future Goals

While we are proud of the work we have done to increase accessibility for those with memory impairments, there is always more to uncover. Want2Remember will continue to update based on beta testers' feedback and changing requirements.

Our team was able to investigate the use of machine learning within the app; we hope future teams can fully integrate it into a later version. In addition to this, we want to see additional customization features to give users more ability to customize the layout, font size, and position of custom templates, as well as being able to share their custom templates with other users. Including caregiver permissions would give the app the ability to add multiple caregivers for one person or allow a caregiver to add multiple people in their circle of care. This implementation would also include the ability for users to request to be a user's caregiver or request to connect another user as their caregiver. The addition of a medication tracker template would allow users to input their medication data into the app and receive reminders for their medication.

The team should continue researching the best method for integrating mobile advertising into the app so that they are the least intrusive. Tiered pricing would disable ads and give access to premium features in the app as well as provide greater storage options. Proximity support would use a combination of GPS services and Bluetooth connection to connect the user to someone who is connected to their account or in their contacts. It will also ping the user if they are close to a specified location. There are also plans in the works to add invitations to the app, giving users the ability to share with others through text, social media, proximity, or QR code.

References

Title: 2019 Alzheimer's Disease Facts and Figures
Authors: Alzheimer's Association
Date: 2019
https://www.alz.org/media/Documents/alzheimers-facts-and-figures-2019-r.pdf

Title: React Native - The Practical Guide
Authors: Academind by Maximilian Schwarzmüller, Maximilian Schwarzmüller
Date: (First Accessed) August 31, 2021
https://www.udemy.com/course/react-native-the-practical-guide/

Title: Software Requirements Specification Template
Author: Professor Jiang Guo
Date: (Accessed) August 24, 2021

Title: Software Design Document for Want2Remeber (Ver 2)
Authors: Kevin Benavente, Thomas Weatherell, Alejandro Salazar, Jesus Roman, Leon/Liangbin Huang, Jesus B. Osuna, Edward Ramirez, Tanya Kitchaiskulrit
Date: May 13, 2021

Title: Software Design Document for Want2Remeber (Ver 3.1)
Authors: Antonio Campos, Alec Kaczmarek, Amy Guttman, Alexandra Strong, Vincent Li, Saiyang Liu, Ricardo Marroquin, Miguel Nonoal-Garcia, Jonathan Sum, Edwin Zapata Minero
Date: May 13, 2022

Title: Software Requirements Specification for Want2Remeber (Ver 3.1)
Authors: Antonio Campos, Alec Kaczmarek, Amy Guttman, Alexandra Strong, Vincent Li, Saiyang Liu, Ricardo Marroquin, Miguel Nonoal-Garcia, Jonathan Sum, Edwin Zapata Minero
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Date: May 13, 2021

Title: Traumatic Brain Injury
Authors: Alan Georges; Joe M. Das
Date: January 5, 2022
https://www.ncbi.nlm.nih.gov/books/NBK459300/