# Mobile iOS Scheduling Application for Individuals with Aphasia

December 4th, 2019

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# Introduction

## Project Overview

This Capstone project is a visual-focused iOS calendar App for individuals affected by aphasia. The application prioritizes finding the balance between user-customizability and a powerfully intuitive user experience. The MVP primarily enables this balance by replacing the majority of text with images; users will be able to create events by either choosing a preset image or uploading their own as to maximize the utility of any pre-existing associations that the patient may have. Throughout this Capstone project, the Time+ team coordinate closely with our client, a therapist from a VA hospital in Virginia, and plan to test our app with aphasia patients she directly treats; Doing so allows us to test initial releases of the application for QA and UX purposes and make appropriate changes prior to the final release. Additionally, as an official QL+ team we also report weekly to the Project Manager of the local QL+ branch at Cal Poly SLO.

## Client/Customers

The primary client is the Project Manager of the local QL+ branch at Cal Poly SLO, Vanessa Salas. The secondary customer is the therapist we are directly working with, Jackie Melson, who contacted QL+ to request aid in developing a calendar app for individuals with aphasia. The primary customer is the user with aphasia. Project logistics and top-level implementation details are to be discussed with the Project Manager and product requirements are communicated from and with the Therapist. The central customer will aid the development process by providing key QA and alpha-testing feedback on the application once the MVP is built. The third type of customer are the family members and support groups for these individuals with aphasia. It is expected that this group will assist individuals with aphasia in navigating the user interface and coordinate onboarding between the interface and the patient. The MVP will be developed in the second quarter of this Capstone project and then released on the iOS store for simple accessibility.

## Stakeholders

As a software-based capstone project there are two primary stakeholders: The Computer Engineering department and QL+. The CPE department assembled the development team and is the main source of funding for this project and thus hold the most at stake with regards to Time+ and its corresponding work. At play here are the school's reputation, finances, and other resources dedicated to the success of the development team. The second stakeholder is the Quality of Life Plus Association, which is the supervision group serving as the primary client. They have similar interests as the CPE department in that their money, reputation, and other resources are at stake. Lastly, the therapist could be viewed as a stakeholder as she is dedicating

her time and resources to this project and has promised her patient a working application which can be considered as a commitment of her reputation as well.

## Framed Insights and Opportunities

Time+ has three layers of clients: the QL+ Project Manager, Vanessa Salas, the Therapist who submitted the idea for the project, Jackie Melson, and the patient with Aphasia who will test our prototypes. All project requirements and specifications were gathered through communications with therapist and the QL+ coordinator.

The QL+ coordinator specified the overarching deliverables of each quarter, namely the wireframing alpha prototype and the functioning application. She also imposed the specification that the application be reproducible, and thus have strong technical documentation so that teams in the future could continue development if they wish to do so.

Our main technical insights came from speaking with the therapist:
- Create an iOS application
- Application will have a look to other calendar apps, elegant and modern
- Minimal text
- Photos/Icons will represent events
- Have the same function as other calendar app such as making, editing, and checking events.

The therapist communicated certain elements of the customer archetype, and advised the team to "approach [the app] with the assumption that the patient is familiar with basic smartphone operations, but also make the app simple enough so that a less tech savvy person can easily pick it up as well". It was also strongly recommended that the application take on an "adult" feel as the users still have the want to remain independent.

## Goals and Objectives

The team will deliver a Minimum Viable Product by the end of this quarter in early December. This product will include a fully working calendar with a focus on pictures and with minimal text. We will include a wide selection of pictures in-app which users can scroll through and select for their event images. These images will be sorted similar to how emojis are categorized in phones (small pictures which show the categories of the pictures). We will also include the ability for users to take and use pictures from their phone camera as well.

From a more technical standpoint, the app will have an inviting logo and a working splash screen. Further down in the application's life cycle, we will include features such as notification and alarm support, the ability to 'tap and drag' to create event times, and colorblind support.

## Outcomes and Deliverables

For Capstone 350, the primary deliverable is our working wireframe. For Capstone 450, the main deliverable will be the finished product itself, the phone application. In addition, a detailed user guide would be delivered along with the finished product for QL+ to help maintain the application after we finish work on it. This guide is expected to be used to help train users and on boarders for this application, being therapists, family, and loved ones of the users that will be assisting with operating the application. Finally, the actual documented source code for the application would be provided to QL+ for the purposes of maintaining the application and possibly extending its functionality for future clients.

# Background Research

This team has met with both clients since the beginning of the project to better understand aphasia, gather marketing requirements, refine existing project parameters, and receive feedback on planned features. This process is to continue throughout the lifetime of this project.

## Existing products

There are no existing products marketed toward individuals with aphasia or similar communication handicaps on the market today. The most similar existing products are aimed at helping young children with ADHD; however, these have an oversimplified UI with little to no space for customization by the customer. The most similar existing product to our designed app is the default iOS calendar app and the popular Google calendar app. Both apps have phenomenal functionality; however, in discussing them with our client, we uncovered several disadvantages that could arise in an interaction between an individual with aphasia and these tools.

These calendar applications rely heavily on the fact that the end-user can quickly read small text, utilize fine motor controls, and understand a layout which is often cluttered and confusing. An aphasia patient often will not be able to understand the times associated with each slot --we found that they prefer to read an analog clock -- and such users would much prefer images to text, regardless of the size. Additionally, color-coding is preferred by aphasia patients for grouping events together, and the ability to add one's own images is crucial for simplifying the user interface.

## General Aphasia Information

The application is aimed at individuals with aphasia, of which there are three main categories: global, fluent, and nonfluent aphasia. On this proposed spectrum, individuals with global aphasia experience severe difficulty comprehending and expressing information. Opposite is fluent aphasia in which an individual may be able to string together long complex sentences but will still have a hard time socializing and communicating to those around them through speech. Our application will be built to accommodate all users with aphasia, however through our talks with the client we discovered that due to similarities in human limitations, this application may also be useful for individuals with other disabilities such as ADHD and autism.

## Ethical Development

Our team also researched ethics regarding the development of mobile health applications and found an industry-standard moral code used by developers. The four main points of the code are as follows:

1. *Beneficence and Nonmaleficence,* in that apps can improve the daily experience of those who are suffering and can improve the standard of care that is provided to clients;

2. *Responsibility,* which asserts that it is the duty of psychologists to provide the best care possible and, when necessary, consult with professionals outside the field of psychology (e.g., app developers);

3. *Justice,* which implies that psychologists ought to ensure that accessibility features are available for those who struggle with mobile devices when developing apps for the purpose of measuring treatment outcomes and enhancing client treatment, or else provide equivalent treatment (i.e., paper versions) to clients with special needs; and

4. *Respect for People's Rights and Dignity,* which requires psychologists to be aware of the issues related to privacy and confidentiality, as well as the proper preventative measures that can be taken to ensure that privacy and confidentiality are maintained, which is of primary concern to the current discussion.

## Mobile App Development Lifecycle

Regarding application development, it was found that the most popular application development framework used in industry is the agile process. This process heavily emphasizes the optimization of work done between team members and individuals. It calls for separation of tasks into what are called "stories", which encourages independent work, and then for cross-group collaboration through weekly meetings called "scrums". In an agile development process, there is often constant feedback from the end-user such that he/she become an integral part of the QA process. Lastly, our team will be developing an iOS application using Swift and the XCode environment. There is a plethora of online resources for aid in guiding us through the learning process.

# Customer Requirements & Engineering Specifications

The following table describes the marketing and engineering specifications for this project, including a plan on how each design requirement is to be met. The risk factor for each design requirement is included and are ranked from Low to High with corresponding capital letters. The usability category describes the relationship between the engineering requirement and the end-user's experience. The requirements were assembled by collecting and analyzing meeting notes taken from communications with both our client (QL+) and the customer (therapist). The compliance methods used are: Analysis (A), Testing (T), Existing Design (S), and Inspection (I).

**Marketing and Engineering Requirements Table**

| Spec # | Customer/Marketing | Engineering Parameter | Engineering Requirement | Usability | Risk | Compliance |
|---|---|---|---|---|---|---|
| 1 | Limited Mobility | Only swipe and tap functionality | Limited mobile actions | Accessibility for user | M | A,S,I |
| 2 | Little text | Reduce amount of text on each window | Replace text with images | Accessibility for user | H | A,T,I |
| 3 | Reliable | Lossless and consistent database | Use on-device storage | No front-end impact on user. | H | A,T,S |
| 4 | Intuitive | Self-explanatory UI/UX | Logic-flow intuitive | User won't get lost in logical flowchart | M | A,T,S,I |
| 5 | Professional | Clean UI | Intentional UX. | Feel's adult for user | L | A, I |
| 6 | Customizable | Modular | Robust settings for custom UX. | Personalized end-user's condition | L | S |
| 8 | Upgradable | Expandable code base | Strong technical docs | No front-end impact on user. | M | A, I |
| 9 | Device | iOS compatible | iOS version | User must | H | S |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Compatibility | | 11+, iPhone 8-12 support | own device to operate | | |
| 10 | Software Availability | Served on App Store | Follow Apple development guidelines | User downloads from app store | H | S |

*Table 1: Relational table mapping customer requirements to engineering specifications*

The goal of this project to create a calendar app that is accessible to people with aphasia. This is done under the supervision of QL+, which will maintain and possibly expand the application beyond our team's development timeline. To make the app aphasia friendly, it needs to be picture based instead of text-based, thus emphasizing the visual aspect of the user experience. The MVP must also demonstrate customizability, as each aphasia patient will have specific needs. In communicating with our clients and doing thorough research it was concluded that there are three main archetypes as detailed in the table below; The therapist, the user, and the user's family members/loved ones are all archetypes for our end-product. Each of these archetypes has an individualized use-case which is also detailed below.

**Customer Archetypes and Use Cases Table**

| Customer: | Therapist | Aphasia Patient | Personal Caretaker |
|---|---|---|---|
| Specifications: | Therapist whose focus is in aphasia therapy.<br><br>Speech-Language Pathologist, works at Hunter Holmes McGuire VAMC (Virginia, USA)<br><br>Specializes in long-term patients who are >6 months after injury-inducing event.<br><br>Interested in product's applications beyond Aphasia | A person diagnosed with some form of aphasia, meaning they have trouble with verbal and non-verbal communications<br><br>Age range typically varies between 30-65, min. 18.<br><br>Smartphone (iOS) Owner<br><br>Acute conditions, communication improvement not drastic.<br><br>Striving for independent lifestyle. | A person in kinship with the patient in some form<br><br>Varying levels of responsibility regarding patient's schedule. |

| Details: | Wants to help their patients. | Would benefit from a schedule, especially one they can create themselves | Someone who cares about the patient and wants to help them organize their day schedule. This ranges from creating events for the patient, to checking the app and ensuring events are entered. |
|---|---|---|---|
| | Will most likely be the one to introduce the app to the patient. | | |
| | Will be responsible for initial onboarding and overseeing of Out-of-box-experience. | Cognitive ability is still intact, just cannot communicate, thus current apps are insufficient | |
| | | Wants an app that feels as modern and elegant like other calendar apps | |
| Marketing Detail: | Possible future expansion by sharing with other organizations aimed at helping individuals with limited text comprehension. | This app has the possibility to help people with other conditions. | Could share with more aphasia organizations and groups |

*Table 2: Detailed table showing requirements and specifications needed for each client/customer*

## Use Cases

Time+ is similar to pre-existing calendar apps but with several key differences. The product's main customers are individuals with aphasia, their therapist, and any relevant support members. The MVP focuses on making the app aphasia-friendly, however there are plans to make it customizable as to open the potential market to non-aphasia affected individuals. The patient will use this app to further their independence and help organize their lives both in and out of therapy. The general need for a calendar app is simple: organize our life's activities, help keep track of daily to-dos, and avoid missing important deadlines.

In gathering requirements, it was determined that the app must be intentionally straight-forward, as to be understood with minimal onboarding and using basic intuition. The out-of-box-experience will likely be supplemented with a quick overview by the therapist and/or supporting family members, so it is important that they can convey the logic flow to the user with ease and simplicity. The app's main functionality is the ability to make, edit, delete, and view one's events in a daily, weekly, or monthly calendar. All events will have the option of uploading or using a preset image to represent the event as to avoid confusing text. Time slots are represented using analog time as this has a strong logical representation in the minds of the patients. Additionally, the traditional format of a calendar will be used as to build off pre-existing familiarity that the patients may have with technology-based scheduling applications.
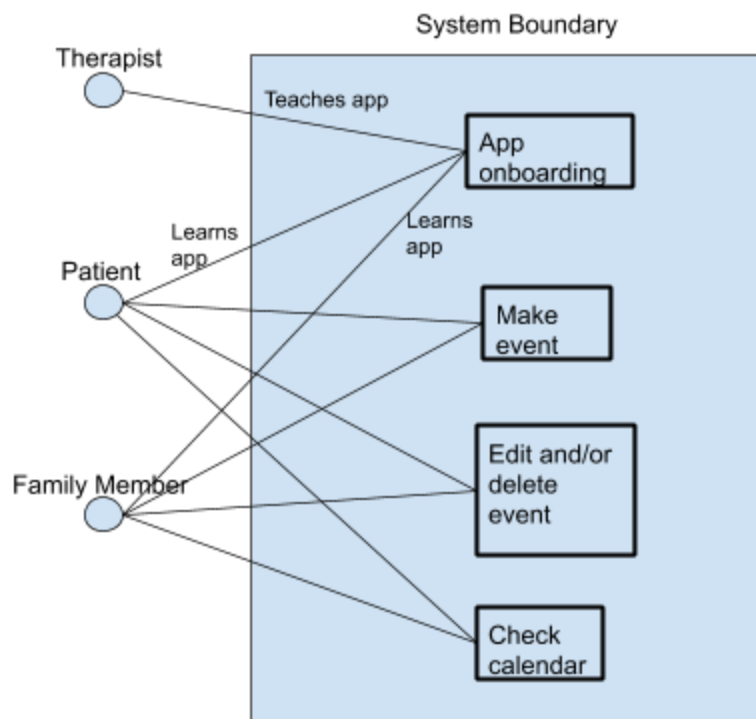


*Figure 1: Diagram showing the various use-cases of the mobile iOS App*

# Design Development

## Method of Approach

A technical timeline has been proposed by the group to the client and customer with two notable milestones. First, a presentational version of the wireframe, including a planned logic-flow is to be ready by December 5th in time for an "Alpha Prototype" presentation to the President of QL+. Then, at the end of the second section of Capstone a fully functional application based on

our gathered engineering requirements and wireframing work will be demo-able. It is planned to have an action-enabled wireframe in the hands of the end-customer by the beginning of next quarter as to receive feedback from him on our design. Additionally, both the bi-weekly meetings with the therapist and the QL+ Project Manager will allow us to further refine our requirements list, fix implementations, and better understand the needs of the customer. The QA process will include automated testing of the application to provide stability and reliability.

## Lessons from iterations

There have not been major updates to our design approach nor the actual prototype design since we began developing the wireframes. Most changes have been small user-experience adjustments implemented based on new customer requirements. These include adding the capability for both analog and digital clocks and adding a feature allowing multiple images to be used per event. Additionally, the team has decided to transfer work from the whiteboard to a digital wireframing tool called Figma[1] which allows us to work collaboratively in real-time with advanced graphic design features and tools. We have begun exploration of development methods for mobile applications and have decided to use an Agile system to increase productivity, accountability, and modularity. Additionally, a consensus was reached on focusing first on the backend (i.e. database object modeling), then the frontend components, and ultimately the integration. Essentially each member of the team will be working full-stack and eventually transitioning into a specialization once the groundwork for the application has been built.

## Project Schedule

In terms of workload balancing it was found that we can optimize work output by splitting our group into two sub-teams: UI/UX designers and Technical Writers/Developers. The UI/UX team is working on completing the wireframes for the demo on December 5th and the technical writers are refining customer requirements (for the design report due November 10th) and beginning to lay the groundwork required for the software development phase of the project. The last two weeks of the first quarter were unique in that the group prioritized the presentation over the application itself, however this proved useful as it taught us more about our development timeline (see above). The expected hours of contribution per team members is slightly more than the number of hours spent in class every week, ranging from 4-5 hours per week. Moving forward into the development phase of this capstone project the entire team will work full-stack, taking responsibilities ranging from backend to frontend development. It is believed that this will produce the highest quality work, will encourage accountability, and build team cohesion.

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[1] https://www.figma.com - Collaborative Interface Design Tool
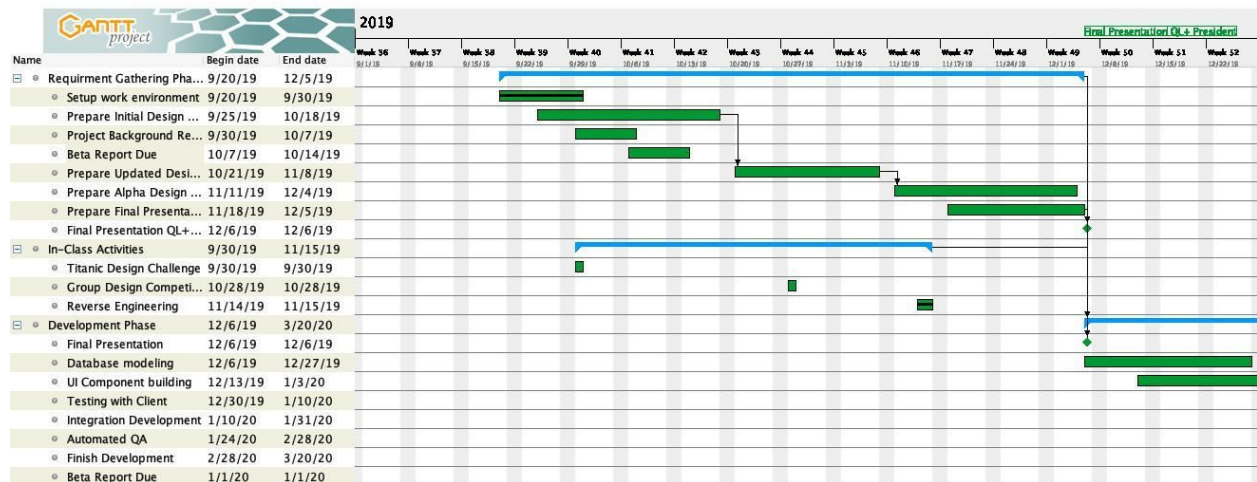
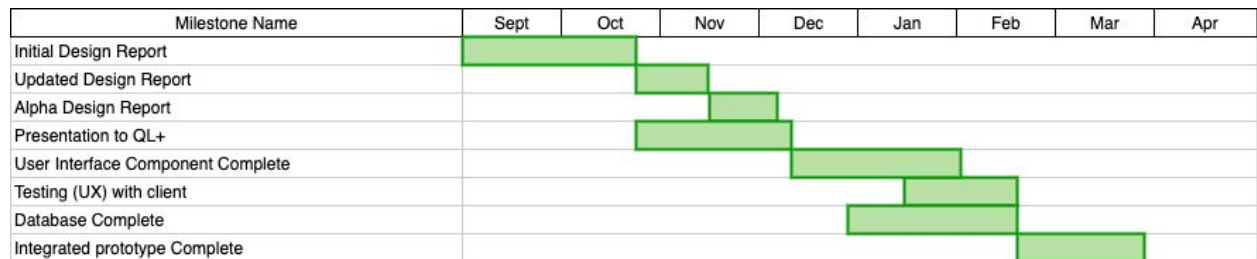*Figure 2: Updated Gantt chart depicting the project schedule*



*Figure 3: Milestone Chart depicting key deliverables*

# Management Plan

## Team Breakdown

The goal of this project team is to deliver a robust product to our customers that meets their proposed requirements. Additionally, this is a learning process for us, and as such we expect to become better developers, team-members, and engineers throughout this process. To streamline our project's achievements, we have created a basic method of approach and divided our team into individual roles.

A. Project Manager – Roee Landesman

This role is responsible for scheduling goals and timelines, setting action items, scheduling group check-ins, and ensuring that each member is working comfortably at their maximum potential. During regular meetings the project manager will bring updates and ensure that progress is made on all accounts.

B. Liaison and QA Lead – Chase Earhart

This role is responsible for keeping clear communication channels with all clients and customers involved. Additionally, as the QA Lead, this role will ensure proper testing at all stages of

development spanning from initial automated tests to end-to-end testing with the customer once an MVP is released and beyond.

    C.  System Architect and Software Designer – Raf

This role is responsible for maintaining strong code guidelines, designing the back-end infrastructure, and governing the overarching implementation of features in the application. This role is also responsible for assigning features to specific agile sprints and as such will also work closely with QA to ensure proper testing throughout the development timeline

    D.  UI/UX and HCI Specialist – Amber Jaitrong

This role is responsible for ensuring a sleek and modern user interface and ensuring that the user experience is of the highest quality. The UI/UX and HCI Specialist is also responsible for designing all relevant graphics and ensuring that all aspects of the application are both functional and aesthetically pleasing.

# Appendices

## Team+ Expense Sheet

| Quantity | Product | Manufacturer | Price Per Unit | Use |
|---|---|---|---|---|
| x1 | Apple Development License | Apple Inc. | $99 | Distribution of Application on App Store |
| x4 | Shirts | TBD | TBD | Professional presentation gear |
| x1 | iOS device | Apple Inc. | Typical $300-$1400 | Use of application |
| TBD | Software maintenance development team | N/A | N/A | Updating application to maintain reliability and stability |
| x4 | Development Costs | N/A | N/A | Production cost of Application |

*Table 3: Diagram showing the total expense report (updated as of this version's release)*

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