CptS 484: Software Requirements

WRS Evolution

Requirements Elicitation

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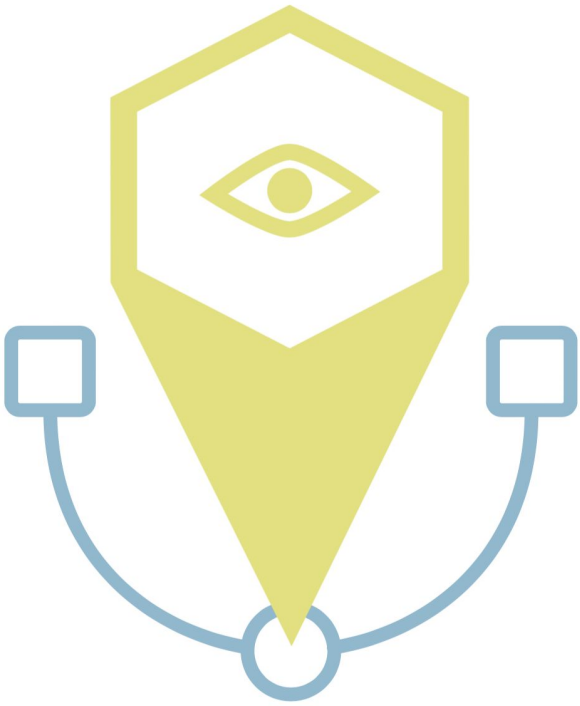

Revision History

Date	Version	Changes	Editor
09/18/19	1.0	Phase I Rough Draft	Moderamen Team
10/13/19	1.1	Phase I Final Submission	Moderamen Team
12/8/19	2.0	Phase II Final Submission	Moderamen Team

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[1] Introduction

1.1. Purpose

Navigating the world as a blind or visually impaired individual poses many problems that visually abled individuals do not experience. These problems are so prevalent that many of these visually impaired people choose to stay close to home, feeling as though the "world is not made for them"[4]. Without proper assistance, the visually impaired community struggle to ensure their safety and even risk endangering themselves when traveling through a variety of unique terrains. Some of these risks include unforeseen obstacles on the ground, doorways opening and closing, and even getting lost while trying to navigate a building. The Moderamen team wants to reduce the problems that the visually impaired community encounter while navigating the world through our user-friendly mobile application. We hope that through the use of our, alongside other effective measures, users can feel safer and more confident as they navigate through unfamiliar buildings.

1.2. Scope

Our project's scope can be broken down into the following milestones...

- Develop or use an indoor navigation API that will be the backbone of how our system gets users from point A to B.
- Create a carefully crafted GUI that is usable for any visually impaired or visually abled user. We hope to achieve this feat by...
    - meticulously designing the placement of buttons and other elements.
    - providing accessibility information about our app's user interface elements.
- Provide an VUI for a blind or visually impaired user to easily interact with our application through vocal commands and responses.

1.3. Objectives and Success Criteria

The overall objectives and success criteria for the Moderamen team would be to create a mobile application which...

- Maintains a budget of zero dollars, so that we do not need to pay for any tools or equipment we use.
- Follows the agreed-upon timeline broken down in our project specification document.
- Passes all usability tests performed, indicating that our application meets user requirements.

1.4. Definitions, Acronyms, and Abbreviations

Voice Command

Voice commands allow the user to control an application by speaking directly to their mobile devices rather than being forced to use our app's GUI; thus, giving the user hands-free control of the application.

Moderamen

Management or Direction.

Mobile App (Application)

A mobile application, most commonly referred to as an app, is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer.

API (Application Programming Interface)

A set of subroutine definitions, and tools for building software.

GUI (Graphical User Interface)

A form of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation, instead of text-based user interfaces, typed command labels or text navigation.

VUI (Voice User Interface)

Makes human interaction with computers possible through a voice/speech platform in order to initiate an automated service or process.

OS (Operating System)

An operating system is system software that manages computer hardware, software resources, and provides common services for computer programs.

API (Application Programming Interface)

A set of subroutine definitions, and tools for building software.

1.5. Overview

Our goal at Moderamen is to reduce that manifested fear of exploring new terrains for blind and visually impaired individuals by providing them with a platform that will increase the efficiency and safety of their navigation indoors. We understand that navigating indoors provides many safety concerns with obstacles such as doorways, tables, stairs, and many more; and, we hope to provide a solution to all these problems with our app, Moderamen. Our app provides both visual and vocal directions for anyone who requires assistance while navigating indoors. It will not only provide clear and precise navigation instructions but also warns users of documented obstacles that other users have logged. We hope that anyone who uses our app feels less anxiety when it comes to navigating the world and makes it to all their destinations unharmed and unphased.

[2] Preliminary Definition

2.1. Preliminary Domain

PD_ID	Preliminary Domain Description
PD1	People suffering from blindness and rely on other senses to navigate.
PD2	Caretakers setting up the application for their patient, and passerby who wish to help.
PD3	To be used in pre mapped indoor areas with an ability to map out buildings that aren't already.

2.2. Preliminary Functional Requirements

P FR_ ID	Preliminary FR Description
AR1	Generating desired sentences and representing them with text as well as associating with a sound/voice.
AR2	Recognizing vocal commands from the user and communicating the software's trouble of understanding if it cannot understand the commands.
AR3	Listing the options out for audio commands.
AR4	Having the software voice the current status of the indoor area (from a technical perspective like not supported or from physical perspective like construction today).
AR5	Be able to warn users of obstacles.
VR1	Be able to offer a visual interface for setup for caretakers/passerby.
VR2	Be able to log obstacles.
TR1	Work Offline.
TR2	Allow connection with 3rd party translation software.
TR3	Allow Routes to be added to map database.
TR4	Allow the ability to search routes.
TR5	Allow the ability to request routes.

2.3. Preliminary Non-Functional Requirements

PNFR_ ID	Preliminary NFR Description
PNR1	Generating desired sentences and translating them to interpretable commands, supporting variations of commands.
PNR2	People suffering from blindness and rely on other senses to navigate.
ANR1	To support additional languages that can be added.
ANR2	The app's voice should be clear and give easily understood commands/directions.
VNR1	The app's visual interface should be clear to users who have never seen the app before.
TNR1	Scalability so that more maps and more locations can be added/verified as time goes on.
TNR2	If routes are changed or added we should notify the users of such changes.
TNR3	The app's performance should be consistent.
TNR4	The app should always be available and maintained without shutting service down.
SNR1	The app will take the best measures possible to prevent leading users to possible harm.
SNR2	The app will not share personal identifying information. Any information shared is clearly communicated to the user.

[3] Issues with Preliminary Definition Given

3.1. Domain Issues

Domain Issue ID	Domain Issue Description	
DI1	PD_ID	PD1. People suffering from blindness and rely on other senses to navigate.
	1. Ambiguous or incomplete. What other senses are being used to help navigate	
	Option 1	Consider only using sound
	Option 2	Make the app usable by caretakers and volunteers able to assist.
	Choice	Option 1 + 2
	Rationale	Makes the scope of the project far more realized and something that can be accomplished.

Domain Issue ID	Domain Issue Description	
DI2	PD_ID	PD3. Caretakers setting up the application for their patient, and passerby who wish to help.
	2. Ambiguous: What is the background of the volunteer. Should they have access to the direct users information? Do they know how to use the app?	
	Option 1	Only allow specialized caretakers to access the app through a login
	Option 2	Make the app available to all users. Design the app for universal usability (even to those whom have never used the app before). Keep any volatile or identifying information secure and off the screen

	Option 3	Make the app usable only to the direct user through a secure login and locked/secured against all other users. Design the app to be only directly usable by those whom are visually impaired.
	Choice	Option 2
	Rationale	Provides a set user-group and determines design principles. Ex :What security should be put in place for the app, what information should be available through the app, how should usability be designed.

3.2. Functional Requirements Issues

FR Issue ID	Description	
FRI1	PFR_ID	PFR1. Generating desired sentences and representing through text as well as associating with a sound/voice.
	1. How to decide between text and sound for that particular sentence?	
	Option 1	Have all visual screen components associated with a respective text to voice capability
	Option 2	Allow the user to select text and/or visual based UI/VI at runtime.
	Option 3	Have the application play only sounds and vocal text - knowing that both visually impaired/capable can understand and navigate the application.
	Choice	Option 1
	Rationale	The application is primarily targeted towards the visually impaired and as such should be designed for their benefit. Similarly the application should be able to be easily navigated by a visually capable.

		Having both capabilities with an emphasis on vocal components provides more universal usability
Satisfied by	VNR1 and ANR2	

FR Issue ID	Description	
FRI2	PFR_ID	TR3. Allow Routes to be added to the map database.
	How will people add the maps? How will we verify the information?	
	Option 1	Allow people to add the maps through a OpenStreetMaps/Wikipedia style of verification.
	Option 2	Check that the person who submits a map to us through email is the registered landowner or a proven representative.
	Option 3	Maps will be added as the individual walks along their respective route, no login necessary
	Choice	Option 3
	Rationale	We cannot guarantee the quality of the Routes provided by non-stakeholders in option 1, however within the initial release we will not be able to add a secure login, or user-tied routes.
Satisfied by	TNR1	

FR Issue ID	Description	
FRI5	PFR_ID	TR5. Allow the ability to request routes.
	What does requesting mean in this context?	
	Option 1	A request is a route that the user has personally request.
	Option 2	Allow the user after searching the ability to request the same route if it wasn't in the database.
	Choice	Option 2
	Rationale	This allows the users to be easily able to request something important like a route without having nested functions.
Satisfied by	TR4	

FR Issue ID	Description

FRI3	PFR_ID	VR2. Ability to warn users of obstacles that could impede the users pathway or lead to harm.
	What is defined as an obstacles? How will the app know there are obstacles?	
	Option 1	Objects are defined as anything that is not part of a recognized hallway minus people. Objects are inputted by the users or landowners.

	Option 2	Objects are defined as anything in the hallway that is not registered in the map minus people. App will use a camera held by the user to detect objects.
	Choice	Option 1
	Rationale	The application is designed to be used within the buildings that have mapped out Routes saved. When a user recognizes that there is an unlogged obstacle then they can add it to the buildings Routes to warn other users.
Satisfied by	AR5 + TR3 + VR2	

FR Issue ID	**Description**	
FRI4	PFR_ID	TR4. Allow the ability to search routes.
	How can we search something as vague as a route?	
	Option 1	Create a fixed form to be made.
	Option 2	Allow abstract definitions
	Choice	Option 1
	Rationale	By having a definition of a route be fixed, like start, end we can create a fixed way of making sure that each route has a clear defined way.
Satisfied by	AR5 + TR3 + VR2	

3.3. Non-Functional Requirements (NFR) Issues

NFR Issues ID	Description	
NFI1	PNFR_ID	ANR1. To support additional languages that can be added.
	Domain too large: What languages should be supported?	
	Option1	Allow connection with a 3rd party translation app for a larger variety of languages
	Option2	Translate only popular languages
	Option3	Add only english in initial deployment
	Choice	3 (with possibility of 1 in later updates)
	Rationale	Offloading translation capabilities to a 3rd party software saves time and money for the project and allows more varied usability for the user-base. Additionally costs are kept low as any language updates are done on the end of the 3rd party software. However, this will not be possible in the initial release - the initial prototype will have english only.
Satisfied by	ANR1	

NFR Issues ID	Description	
NFI2	PNFR_ID	SNR2. The app will take the best measures possible to prevent leading users to possible harm.
	Vague: What harm is meant? How does the application keep users from harm? How 'able' must the application be to avoid harm to the users.	

	Option1	Prevent harm to the users by recognizing paths with high variability and/or calculated risk and warning the user.
	Option2	Only guiding the user through paths that are well-understood or tested by the software.
	Option3	Provide more robust algorithms that are able to more readily guide users through high-risk paths.
	Option 4	Require the user to agree to terms of service that warn the user of the app limitations.
	Option 5	Add a feature for users to log route dangers and obstacles.
	Choice	4 + 5
	Rationale	We cannot implement the necessary functionality to allow for automatic obstacle detection, however we can implement a volunteer obstacle logging system. Because the application is lacking is said functionality, we will notify the users upon downloading of the dangers.
Satisfied by	VR2	

NFR Issues ID	**Description**	
NFI3	PNFR_ID	VNR1: The app's visual interface should be clear to users who have never seen the app before.
	Vague: What is defined as clear? How will it be judged as clear?	
	Option1	Clear will be defined by user experience testing.
	Option2	Clearness will be defined as having all the functionality of the application visible and not hidden/nested

	Option3	It will be clear by relying on similar UIs of popular applications.
	Choice	Option 1 and Option 2
	Rationale	Since the person who uses the application will not be able to communicate what visuals of the application looked like, the application should not have nested functionality or rely on popular UIs so that the caretaker could understand eventually just by reading the application.
Satisfied by	VR1	

NFR Issues ID	Description	
NFI4	PNFR_ID	ANR2: The app's voice should be clear and give easily understood commands/directions.
	Vague: What is defined as clear? How will it be easily understood?	
	Option1	Use the voice of a commonly trusted voice tool. Developers define the voice as easily understandable.
	Option2	Test by using User Experience testing to see what is defined as clearer.
	Option3	Let the User access the help/audio command menu at any time.
	Choice	Option 1
	Rationale	Sound is going to be the most important part of the application, if the sound can not be understood by the user than the application will lose its main purpose. That being said, voice tools currently on the market are highly reliable and should perform pur requirements. Developers can test and choose the best voice tool.

Satisfied by	AR1-AR5

[4] WRS

4.1. W

4.1.1. Problem

Problem ID	Problem Description	Corresponding Goals
P1	People with imparied sight have trouble navigating through indoor areas.	G1, G5
P2	Areas can fluctuate between good or bad internet connection.	G2
P3	Some areas may not be mapped out, including rooms, hallways or entire buildings.	G1, G55
P5	Unforeseen changes to building layout may occur.	G4, G5
P6	Others might need to assist our visually impared user.	G6
P7	Building owners will want to register their buildings in our application.	G7
P8	People may not want their travel information shared	G8

4.1.2. Goals

Goal ID	Goal Description	Backward Traceability	Forward Traceability
G1	Our application allows users with imparied sight to navigate through supported indoor areas.	P1	ID1, FO1, FO2, SH3

G2	Our application should not be hindered in it's functionality by internet connection.	P2	NFO1,FO4
G4	The application should help users even with unsupported areas.	P5, P3	FO2,FO6
G5	Our application should detect obstacles not listed in a buildings routes. (i.e. boxes on the floor or wet floor warnings)	P1, P3	NFO2
G6	Our app should also provide a nice UI for those who want to help our visually impared users navigate our app without voice commands.	P6	SH2
G7	Our app should be able to process new building routes when a building owner wants to include their building within our database.	P7	SH1
G8	Our application will not threaten the privacy of its users.	P8	NF07

4.1.3. Understanding of Objectives, Domain & Stakeholders

Improved Understanding of Domain, Stakeholders, Functional & Non-Functional Objectives

4.1.3.1. Improved Domain

Improved Domain ID	Improved Domain Description
ID1	Allow users to navigate indoor in supported buildings through navigation API.
ID2	Allow users to add new buildings to our database by creating routes for them.
ID3	Users with impared vision will experience easier navigation through buildings.

ID4	Caretakers will be able to more easily assist their visually impared dependents.
ID5	Building owners can acquire more visitors through improved accessibility.

4.1.3.2. Stakeholders

Stakeholder ID	Stakeholder	Description	Related problems	Related Goals
SH1	Building Owners	People who own building will need to provide a routes of their buildings to enable our application to assist visually impared users to navigate their buildings. If they do not provide our application with routes, then users will still be able to register a building routes themselves through our app.	P1, P3, P5, P7	G7, G5
SH2	Caretakers	Caretakers will need to be able to use our app in cases where the voice commands are having issues or just to increase speed of navigation.	P6	G6
SH3	Visually Impared	Those who are visually impared will be our main users and will use our application to navigate a building with more ease.	P1	G1
SH4	Developers	Developers who are involved in the design, implementation, maintenance, and deployment of the application.	P1-P7	G1-G7

4.1.3.3. Improved Functional Objectives

Based on the above information and our goals, the functional objectives of Moderamen are:

Improved FR Objective ID	Objective Description	Alleviates Problems	Achieves Goals
FO1	The application's features should be fully accessible without sight. (i.e. Voice Commands)	P1,P3,P5	G1
FO2	The application should have building routes that navigate indoor areas, and notify user when the application does not have a valid routes or changes to old routes.	P1,P3	G1
FO3	Application can be used without voice commands. (i.e. has a UI).	P6	G6
FO4	The application will enable users to log potential obstacles, not included in routes, so that other users can be aware of potential hazards in their pathway.	P3, P5	G4, G5
FO5	Application should maintain navigation instructions even if network connectivity is lost.	P2	G2
F06	Allow the user to request and search maps in the database	P3	G4

4.1.3.4. Improved Non-Functional Objectives

Improved NFR Objective ID	Objective Description	Alleviates Problem	Achieves Goal
NFO1	Application's performance works regardless of internet.	P2	G2

NFO3	Application increases efficiency of navigation for our visually impared users.	P1	G1, G5
NFO4	Application properly interacts with users through voice commands	P1	G1
NFO5	Application provides easy to use visual interface.	P6	G6
NFO6	Application is scalable to changes in the amount of routes stored.	P7	G7
NFO7	Users identify and other personal information will not be shared without notice to user beforehand.	P8	G8

4.2. RS

4.2.1. Functional Requirements

FR ID	Description
FR1	If a user makes a sound to the system, the system shall make a sentence from the detected sound. Along with voicing any changes to the application.
Satisfies Functional Requirement Issue	FRI1
Satisfies Objectives	FO1, FO3, FO4, NFO4, NFO3
Satisfied by prototype feature	Voice

FR ID	Description
FR2	The Application will support Routes to be added to a database
Satisfies Functional Requirement Issue	FRI2

Satisfies Objectives	FO2, NFO6
Satisfied by prototype feature	Map/Map Database

FR ID	Description
FR3	The Application will provide users the ability to add unlisted obstacles to the building's routes so that other users traveling that same way can be warned of potential hazardous obstacles in their pathway.
Satisfies Functional Requirement Issue	FRI3
Satisfies Objectives	FO6,NFO3
Satisfied by prototype feature	Obstacle Logging

FR ID	Description
FR4	The Application will have full functionality offline, being online only updates routes database and voices any changes to current routes.
Satisfies Objectives	FO2,FO7
Satisfied by prototype feature	Online Functionality

FR ID	Description
FR5	The Application will provide a UI for its caretakers/passerbys.
Satisfies Objectives	FO5

Satisfied by prototype feature	UI

FR ID	Description
FR6	The Application will allow the ability to search and request a route.
Satisfies Functional Requirement Issues	FRI4,FRI5
Satisfies Objectives	FO6
Satisfied by prototype feature	UI

4.2.2. Non-Functional Requirements

NFR ID	Nonfunctional Requirement 1	
NFR1	The system can assess risk using logged obstacles not already included in the routes.	
Operationalized Functional Requirements	OFR1	Assessing risk algorithm.
	OFR2	Voicing the results of the risk algorithm.
Satisfies Nonfunctional Requirement Issue	NFI2	
Satisfies Non-functional Objective	NFO2,NFO3	
Constrains	FO2, FO6	
Satisfied by prototype feature	Obstacle Logging by Users	

NFR ID	Nonfunctional Requirement 2

NFR2	The application's functionality will all be visible from the screen shown to a caretaker/passersby.	
Operationalized Functional Requirements	OFR3	One Screen UI
Satisfies Nonfunctional Requirement Issue	NFI3	
Satisfies Non-functional Objective	NFO5	
Constrains	FO2, FO5	
Satisfied by prototype feature	Main View	

NFR ID	**Nonfunctional Requirement 3**	
NFR3	The application will use a voice software that gives instructions that are tested to be clear.	
Operationalized Functional Requirements	OFR4 OFR5	Connected to Speech API Have the voice voice the response.
Satisfies Nonfunctional Requirement Issue	NFI4	
Satisfies Non-functional Objective	NFO4	
Constrains	FO1, FO2, FO3, FO4	
Satisfied by prototype feature	Voice	

NFR ID	**Nonfunctional Requirement 4**

NFR4	The application's functionality is not limited by internet.	
Operationalized Functional Requirements	OFR6	None
Satisfies Non-functional Objective	NFO1	
Constrains	F07	
Satisfied by prototype feature	N/A	

NFR ID	**Nonfunctional Requirement 5**	
NFR5	The application will not share info and protect the info of its users.	
Operationalized Functional Requirements	OFR7	All information will be temporary/not stored.
Satisfies Non-functional Objective	NFO7	
Constrains	N/A	
Satisfied by prototype feature	N/A	

4.2.3. Specifications

Functional Specification ID	**Functional Requirement**
FS1	If a textual sentence is entered to the system, the system shall make a sound corresponding to the input sentence.

Satisfies Functional Requirement	FR1
Satisfies Objectives	FO1
Satisfied by prototype feature	Voice

Functional Specification ID	**Functional Requirement**
FS3	Whenever the Application goes offline, let the user know.
Satisfies Functional Requirement	FR1
Satisfies Objectives	FO4
Satisfied by prototype feature	Voice, Internet connectivity.

Functional Specification ID	**Functional Requirement**
FS4	Support routes being added along with verification.
Satisfies Functional Requirement	FR2
Satisfies Objectives	FO2
Satisfied by prototype feature	Database

Functional Specification ID	**Functional Requirement**

FS5	Voice any changes to old routes, or if routes is not found
Satisfies Functional Requirement	FR2
Satisfies Objectives	FO2
Satisfied by prototype feature	Voice/Database

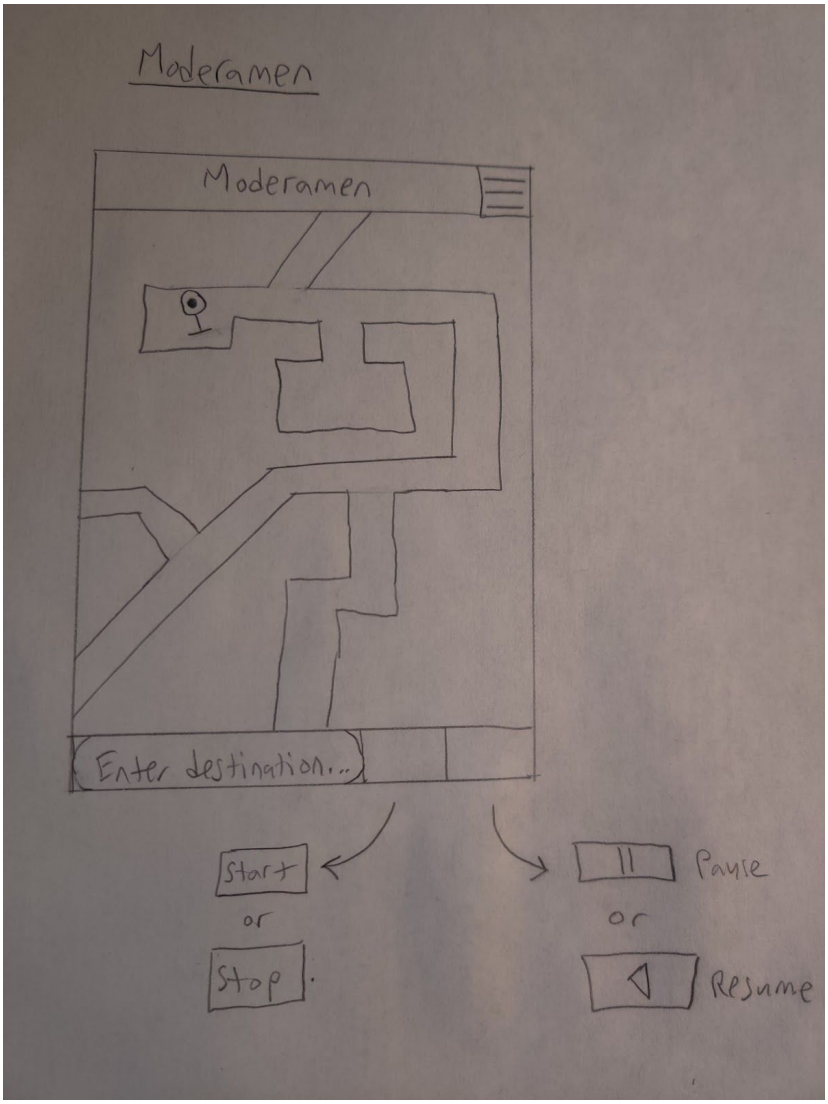
Functional Specification ID	**Functional Requirement**
FS6	When the logged obstacles are forthcoming, it will let the user know of any objects in the hallway and voice them.
Satisfies Functional Requirement	FR3
Satisfies Objectives	FO6
Satisfied by prototype feature	Voice/Obstacle Logging

Functional Specification ID	**Functional Requirement**
FS7	When the application goes online, update the Route database
Satisfies Functional Requirement	FR4
Satisfies Objectives	FO2, FO7
Satisfied by prototype feature	Voice/Obstacle Logging

Functional Specification ID	Functional Requirement
FS8	Display a UI on the main screen.
Satisfies Functional Requirement	FR5
Satisfies Objectives	FO5
Satisfied by prototype feature	Screen

Functional Specification ID	Functional Requirement
FS9	Have a search bar to search database and a request database
Satisfies Functional Requirement	FR6
Satisfies Objectives	FO6
Satisfied by prototype feature	Screen

[5] Phase I Preliminary Prototype



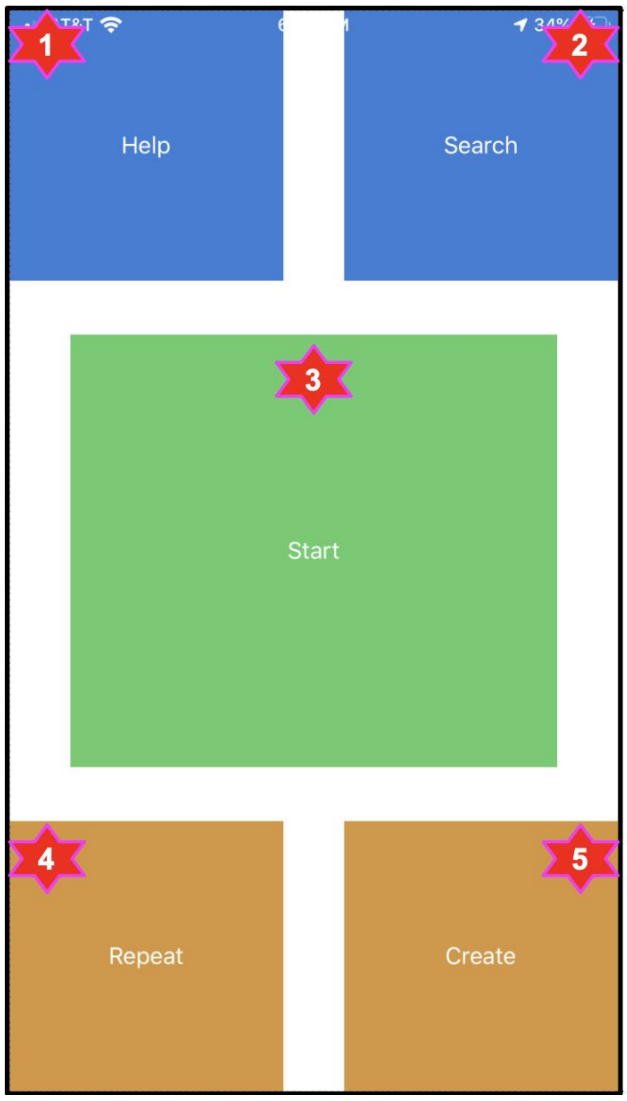
[6] Phase I Prototype Interface Mock-ups

Main View (For Caretakers)

- 1*: The caretaker enters the full address of where they would like to navigate their dependent too.
- 2*: The caretaker selects the search icon to initiate a navigation session to the address entered in the text box. A voice message will be played indicating that navigation has started.
- 3*: The caretaker selects “Stop Navigation” to end the current navigation session if one is active. The address text box and map components are both reset. A voice message will be played indicating that navigation has ended.
- 4*: The caretaker selects “Pause Navigation” to pause the current navigation session if one is active. A voice message will be played indicating that navigation has been paused.
- 5*: The major component of the user interface is a dynamic and interactive map, which will display the current area and the destination location to the caretaker.
- **: The user can toggle the visibility of the application’s UI.
    - If the screen is visible and the user double taps anywhere on the screen that is not a text box or button, then the screen will turn to black.

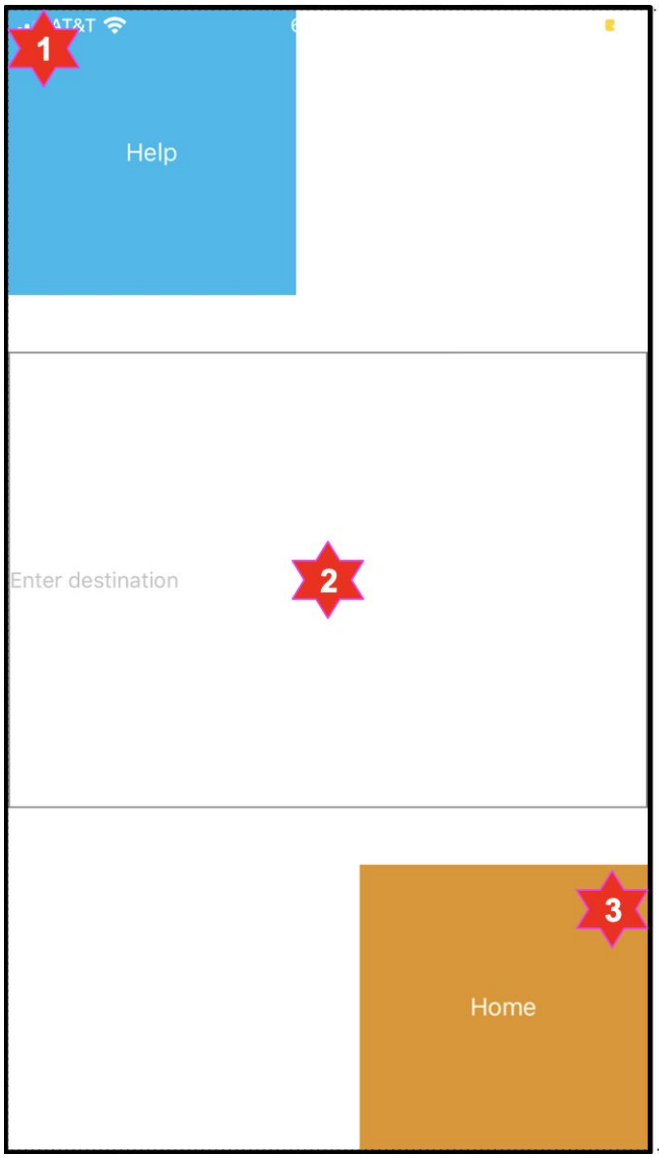
- If the screen is not visible, then the user can single tap anywhere on the screen to make the application visible once again.

[7] Phase II Prototype Interface Mock-ups



1. This button will provide a breakdown of all the UI elements the user can interact with and what they will do.
2. This will bring up a screen that allows the user to enter the destination they would like to navigate to.
3. If a route has been selected by the user then this button will begin providing the route necessary to guide the user to their destination.
4. This will repeat the last direction provided to the user.
5. This will direct the user to a new screen to be able to create a new route so that other users can use it.

1. This button will provide a breakdown of all the UI elements the user can interact with and will also inform the user what is currently requested.
2. This button will log that the route being created contains a doorway in the next step.
3. This input field allows the user to input further details about the most recent step in the route.
4. This button will log a new step in the route.
5. This input field allows the user to provide a name for the new route.
6. This button will log that the route being created contains a stairway in the next step.
7. Takes the user back to home screen and saves the new route.



1. This button will provide a breakdown of all the UI elements the user can interact with and what they will do.
2. This input field allows users to input their desired destination.
    - They can input a destination through speech or by using the keyboard.
3. This will take the user back to the home page to begin the navigation to their desired destination if it existed in our system.

[8] Phase I Function Point Calculations

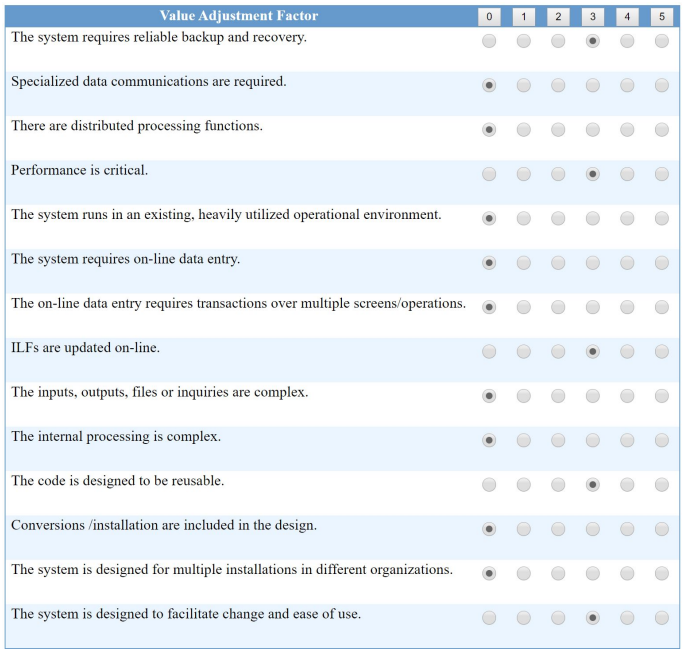
Function Points

- External Inputs (EIs)
    - User interaction with the mobile application's user interface (low)
    - User interacts with the mobile application through voice commands (high)
    - Mobile application interacting with the backend API server (avg)
- External Outputs (EOs)
    - Backend API server interacting with the remote relation database (avg)
- External Inquiries (EQs)

    - Backend API server interacting with Google Maps (avg)
    - Backend API server interacting with the remote relation database (avg)
- Internal Logical Files (ILFs)
    - Mobile application local map storage (avg)
    - Backend API server cache (high)
- External Interface Files (EIFs)
    - Remove relational database (avg)
    - Remote map file storage (avg)
    - Google maps public data (API access) (avg)

72 FPs * 0.8 Factor = **58**

Direct Measure	Count			Weighted Measure
	Simple	Average	Complex	
External Inputs (EIs)	1	1	1	13
External Outputs (EOs)	0	1	0	5
External Inquiries (EQs)	0	2	0	8
Internal Logical Files (ILFs)	0	1	1	25
External Interface Files (EIFs)	0	3	0	21



Value Adjustment Factor	0	1	2	3	4	5
The system requires reliable backup and recovery.	○	○	○	●	○	○
Specialized data communications are required.	●	○	○	○	○	○
There are distributed processing functions.	●	○	○	○	○	○
Performance is critical.	○	○	○	●	○	○
The system runs in an existing, heavily utilized operational environment.	●	○	○	○	○	○
The system requires on-line data entry.	●	○	○	○	○	○
The on-line data entry requires transactions over multiple screens/operations.	●	○	○	○	○	○
ILFs are updated on-line.	○	○	○	●	○	○
The inputs, outputs, files or inquiries are complex.	●	○	○	○	○	○
The internal processing is complex.	●	○	○	○	○	○
The code is designed to be reusable.	○	○	○	●	○	○
Conversions /installation are included in the design.	●	○	○	○	○	○
The system is designed for multiple installations in different organizations.	●	○	○	○	○	○
The system is designed to facilitate change and ease of use.	○	○	○	●	○	○

[9] Final Project Plan

See Appendix A

[10] Process Specification

See Appendix B

[11] Vision Document

See Appendix C

[12] Final Presentation

See Appendix D

[13] KAOS Models

See Appendix E

[14] Reference

[1] Erickson, W., Lee, C., & von Schrader, S. (2012). 2010 Disability Status Report: United States. Ithaca, NY: Cornell University Employment and Disability Institute(EDI).
[2] Erickson, W., Lee, C., & von Schrader, S. (2012). 2011 Disability Status Report: United States. Ithaca, NY: Cornell University Employment and Disability Institute(EDI).
[3] L. Chung (2014). *CS/SE 6361 Advanced Requirement Engineering, Spring 2014, Project Phase 1: Requirements Elicitation: Initial Understanding*. [Online]. Available: [material url]
[4] Crawford, Susan. “The Challenge of Helping Blind People Navigate Indoors.” Wired, June 25, 2019. https://www.wired.com/story/challenge-helping-blind-people-navigate-indoors/.

Appendix A

See Next Page for the Final Project Plan...

CptS 484: Software Requirements

Software Project Management Plan

Team Moderamen

Austin Marino

Cole Bennett

Freya Varez

Sean Cornia

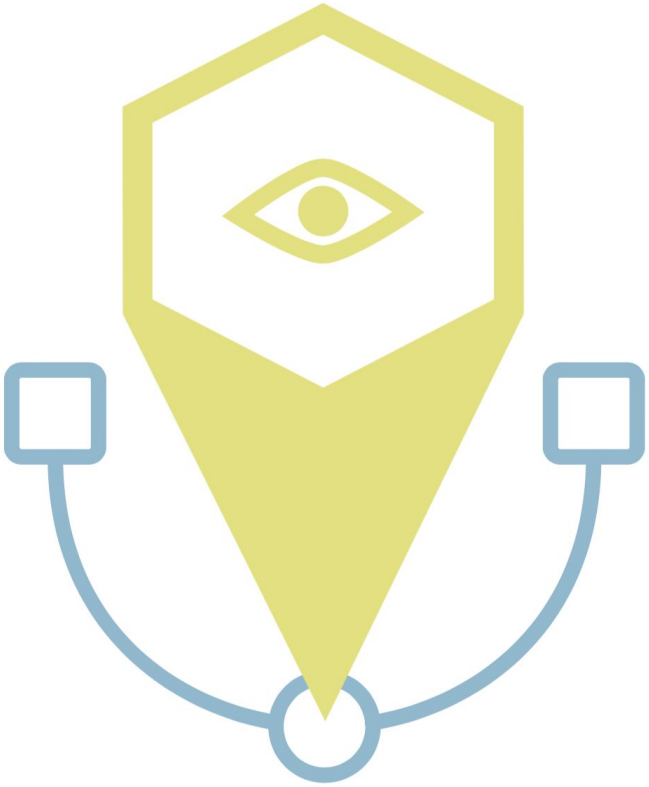


Table of Contents

Introduction

The Software Project Management Plan (SPMP) describes the planning, organization, and staff involved in the Moderamen mobile application. This document provides an overview of how our team will manage the project; including, deliverables, schedules, dependencies, and assumptions. The SPMP will also break down the people behind the application, their roles, and ideas for the project.

Project Overview

We are team Moderamen, and our goal is to provide a service for the visually impaired that will increase their ability to navigate inside of buildings safely. We hope to achieve this goal by developing a mobile application for both iOS and Android, which will provide both visual and audio cues that will direct our users to their desired location with ease.

Project Deliverables

The project has had various deliverables for Phase I and Phase II, which include...

Phase I Deliverables

Deliverable	Due Date	Grade Weight
Project Plan & Meeting Records	October 13th, 2019	15%
World Requirement Specification (WRS) Document	October 13th, 2019	25%
Software Project Management Plan	October 13th, 2019	25%
Prototype & User Manual	October 13th, 2019	15%
Prestation	October 13th, 2019	20%

Phase II Deliverables

Deliverable	Due Date	Grade Weight
Final Project Plan	December 8th, 2019	10%
Process Specification	December 8th, 2019	10%
Vision document	December 8th, 2019	20%

WRS document for the product	December 8th, 2019	30%
Final presentation Functional Prototype	December 8th, 2019 December 9th, 2019	30%

Evolution of Document

The SPMP is now in its final stage, version 2.0, and will include the final specifications and breakdown of our current system and how it came to be. The SPMP now holds within its scope a full description of the Moderamen application, scheduling of deliverables, a clear description of the team structure, and our overall evaluated risks. The scope of the plan establishes a clear outline for the members responsible for a particular stage of the project development, as a reference document for the entire development of the project. Additionally, the document has great importance in providing a basis for the history of activity reports; since this plan is an active document and has been revised during all development stages of the project.

Revision History

Version	Date	Notes
1.0	September 8th, 2019	Project Phase I: Preliminary Plan
1.1	October 13th, 2019	Phase I: Revised Preliminary Plan
2.0	December 8th, 2019	Phase II: Final Project Plan

References

Our references are listed as footnotes at the bottom of pages where one or more have been used.

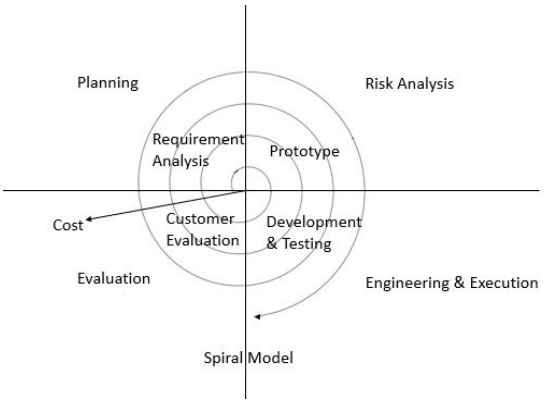
Definitions, Acronyms, & Abbreviations

SPMP: Software Project Management Plan
WRS: World Requirement Specification
RE: Requirements Engineering
iOS: Mobile operating system created and developed by Apple Inc. exclusively for its hardware
Android: Mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

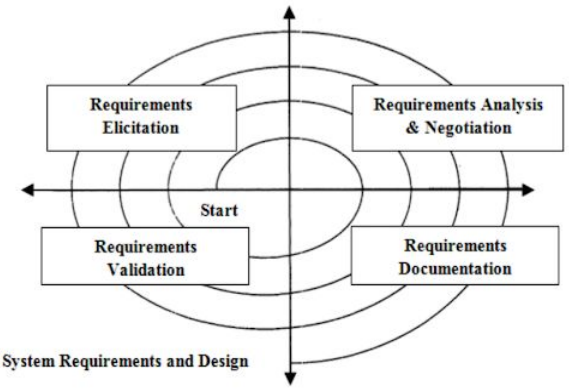
Project Organization

Process Model

The Moderamen team uses the Spiral software development method because it is iterative by nature, like the requirements engineering process. This fundamental structural similarity between the two processes allows them to work well in unison during the development of software. Our team follows the RE (featured on the right) process during the "Planning: Requirements Analysis" section of the Spiral method (featured on the left). Additionally, the Spiral method emphasizes risk analysis in order to reduce any unwanted or unforeseen adverse outcomes from arising. There is also a review period at the end of each iteration to reevaluate what new features or updates should be proposed for the next iteration, RE, which avoids wasted resources and money.



Spiral Model[1]



RE Process[2]

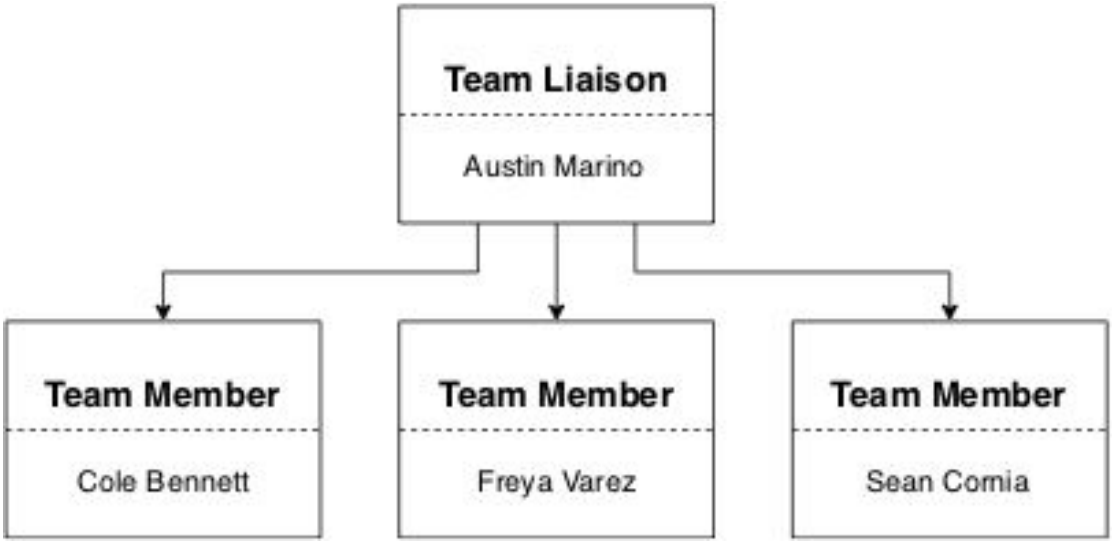
Organizational Structure

The Moderamen team is composed of four individuals and thus does not need a complex hierarchy. We rely on all four individuals working in tandem with one another to ensure we produce the highest quality of work possible. The central oversight comes from the team liaison, Austin, who ensures that the whole team is staying on pace with the outlined schedule the team unilaterally agreed on. Each significant milestone is broken up into separate tasks and equality partitioned amongst the group. During our weekly meetings, we conduct code/document reviews to ensure that each member of the team met their goals. The image below shows the minimalist structure the group is broken up into.

---

[1] Naveen. "What Is Spiral Model in Software Testing and What Are Advantages and Disadvantages of Spiral Model." Testing Freak, January 30, 2015. http://testingfreak.com/spiral-model-software-testing-advantages-disadvantages-spiral-model/.

[2] "Requirements Engineering Processes, Tools/Technologies & Methodologies." Google Sites. Accessed August 5, 2019. https://sites.google.com/site/richchihleese/home/se-research/requirements-engineering-processes-toolstechnologies--methodologies?tmpl=/system/app/templates/print/&showPrintDialog=1.



Organizational Boundaries & Interfaces

Austin Marino - Team Liaison / Developer

Austin's role is as the team liaison and software developer. He communicates with all stakeholders, such as Bolong Zeng, and parlays project information back and forth between his team and outside clients. When Austin is not communicating with clients, he is assisting his team in the development of their project's documents such as the SPMP, Process Specification, and IDEF0.

Cole Bennett - Developer

Cole's role is as a software developer. He spends most of his time working alongside his other teammates, developing software and creating and revising the documents that guide their development process. His main tasks for Phase II include working on the Moderamen mobile app, the final presentation, non-functional requirements modeling using KAOS, and on the IDEF0.

Freya Varez - Developer

Freya's role is as a software developer. She spends most of his time working alongside her other teammates, developing software, and creating and revising the documents that guide their development process. Her main tasks for Phase II include working on the KAOS Model and Vision document.

Sean Cornia - Developer

Sean's role is as a software developer. He spends most of his time working alongside his other teammates, developing software, and creating and revising the documents that guide their

development process. His main tasks for Phase II include working on the Moderamen mobile app and the final presentation.

Project Responsibilities

<table>
<tr><th>Project Phase</th><th>Deliverable</th><th>Component Breakdown</th></tr>
<tr><td>Project Phase I</td><td>Preliminary Plan</td><td>
<table>
<tr><th>Component</th><th>Assignee</th></tr>
<tr><td>Introduction</td><td>Sean Cornia</td></tr>
<tr><td>Project Organization</td><td>Austin Marino</td></tr>
<tr><td>Managerial Process</td><td>Freya Varez</td></tr>
<tr><td>Technical Process</td><td>Cole Bennett</td></tr>
<tr><td>Work Elements, Schedule & Budget</td><td>Austin Marino</td></tr>
</table>
</td></tr>
<tr><td>Project Phase I</td><td>Final Submission</td><td>
<table>
<tr><th>Component</th><th>Assignee</th></tr>
<tr><td>WRS Introduction</td><td>Austin Marino</td></tr>
<tr><td>WRS Preliminary Definition</td><td>Sean Cornia
Freya Varez</td></tr>
<tr><td>WRS Issues with Preliminary Definition Given</td><td>Sean Cornia
Freya Varez</td></tr>
<tr><td>W and RS</td><td>Austin Marino
Cole Bennett
Sean Cornia
Freya Varez</td></tr>
<tr><td>Preliminary Plan Revisions</td><td>Austin Marino</td></tr>
<tr><td>User Manual</td><td>Austin Marino
Cole Bennett</td></tr>
<tr><td>PowerPoint Presentation</td><td>Freya Varez
Cole Bennett
Austin Marino</td></tr>
<tr><td>Hand Drawn Prototype</td><td>Cole Bennett</td></tr>
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<table>
<tr><td></td><td></td><td><table><tr><td>Digital Mockups</td><td>Cole Bennett</td></tr></table></td></tr>
<tr><td>Project Phase II</td><td>Final Submission</td><td><table>
<tr><th>Component</th><th>Assignee</th></tr>
<tr><td>Final Project Plan</td><td>Austin Marino</td></tr>
<tr><td>Process Specification (IDEF0)</td><td>Austin Marino</td></tr>
<tr><td>Vision document</td><td>Freya Varez</td></tr>
<tr><td>Updated WRS Document for Product</td><td>Austin Marino
Cole Bennett
Sean Cornia
Freya Varez</td></tr>
<tr><td>KAOS Modeling</td><td>Cole Bennett</td></tr>
<tr><td>User Manual</td><td>Austin Marino
Sean Cornia</td></tr>
<tr><td>Final presentation</td><td>Cole Bennett
Sean Cornia</td></tr>
<tr><td>Functional Mobile Application Prototype</td><td>Cole Bennett
Sean Cornia</td></tr>
</table></td></tr>
</table>

Managerial Process

Management Objectives & Priorities

Moderamens is, first and foremost, a medical device - classified under FDA guidelines of a *Mobile Medical Application*.[3] With this classification comes various regulations that we must abide by before deployment; in addition to the requirements set forth by stakeholders. As team liaison, Austin, will remain in contact with all dependent parties to assure new information and guidelines are communicated with the development team.

The development team must design and implement a user-friendly, extensible application within the allocated budget, time, and specified quality. The Moderamen team will be less focused on agility - and more on testing and redesign.

[3] "Mobile Medical Applications" (United States Food & Drug Administration, September 4, 2018), https://www.fda.gov/medical-devices/digital-health/mobile-medical-applications.

Assumptions, Dependencies, & Constraints

Assumptions

1. Moderamen will be usable for visually impaired users (primary stakeholders) as well as non-visually impaired users, including caretakers, emergency response, etc. (secondary users).
2. Moderamen is to be used strictly indoors or between buildings, in its current state.
3. Funding has been approved for research and development.
4. Necessary equipment and software are available for use by the Moderamen team.
5. A team of 4 is available for development and communication.

Dependencies

1. Moderamen must have access to blueprint layouts of buildings in order to ensure the safe navigation of the user.
2. Moderamen app can successfully locate the user's device through a viable internet connection.
3. The Moderamen team has enough members to complete the tasks assigned.
4. The Moderamen team has enough time to complete the tasks assigned.
5. The tasks assigned experience little change/creep.

Constraints

1. Moderamen must be available for use by consumers using iOS and Android devices.
2. Moderamen must be available across language barriers and as ubiquitous as possible for users.
3. Moderamen must follow FDA guidelines.

Risk Management

Risk Type	Risk	Probability	Description
Market Risks	Market saturation	Medium	One or more applications are available that compete with ours causing financial non-viability.
Financial Risks	Over-budget	Low	Insufficient planning or changes in requirements cause the project to run over-budget.
Technology Risks	Data corruption or loss	Low	Unforeseen loss of proprietary resources caused by system corruption or improper use of version control tools.

	Insufficient hardware or OS	Low	The final app is unsupported on a customer's phones due to operating system issues or unforeseen hardware restrictions.
People Risks	FDA disapproval	Low	The application does not follow FDA regulations and guidelines - it is not approved for deployment.
	Software leads to injury	Medium	Software is unable to warn users of potential obstacles around them causing possible injury/harm.

Monitoring & Controlling Mechanisms

Risk	**Monitoring & Controlling Mechanisms**
Market saturation	Significant preemptive research will be done before development is progressed to assure that this product has a financially viable customer base.
Over-budget	Planning is conducted before and throughout the development lifecycle to ensure the requirements and budget is stable.
Data corruption or loss	Git-based version control will store codebase and documents to a globally accessible server, in addition to local repositories.
Insufficient hardware or OS	Using an open-source mobile application framework, React Native, our app will be designed and tailored to successfully run on devices using the iOS or Android operating systems.
FDA disapproval	The research will be done at all stages of the Moderamen development cycle to determine the feasibility of the app concerning FDA restrictions. The team liaison will keep track of all FDA guidelines to ensure these regulations are met.
Software leads to injury	Significant (re-)testing will be done to ensure the application has a low failure rate.

Technical Process

Methods, Tools, & Techniques

The project will be implemented using the Spiral software process model. Following the methodologies of Spiral, we will perform a review process at the end of each deliverable lifecycle. Version control systems (GitLab) will be utilized as a primary means for enforcing code reviews through pull requests and branches. Semantic Versioning 2.0.0 will be utilized as the versioning scheme for the project, which entails that we conform to the *MAJOR.MINOR.PATCH* format.[4] Each phase, feature, and bugfix will hold their own branch:

- Each phase, indicating a major version increase, will have its own branch. All features (minor version increase) and bug fixes (patch version increase) associated with a phase will be merged into this branch.
- A formal review process will be performed for each feature and bugfix: A pull request to merge (or rebase) a feature/bugfix into a phase branch must be opened. All team members must review and approve the request for it to be accepted.
- At the end of each phase, an additional pull request must be opened to merge the phase branch into master.

Software Documentation

Documentation of the project will be present in the following ways:

1. All functions, classes, and variables of importance will be associated with concise and descriptive comments, formatted according to the industry standard conventions of the programming language(s) chosen for the project.
2. Markdown and PDF files will be utilized as the formats for documentation files in the project repository. The following documents will be included:
    a. A readme document containing general information and installation/build steps.
    b. A user manual document describing how to use the application from an incoming user's perspective.
    c. Software Requirements Specification defining functional and non-functional requirements, and also use cases of the application.
    d. WRS document outlining all requirements, stakeholder and general inputs that will play a part in the formation of our application.
    e. Any other documents that will further provide insight on our developmental process and deliverables.

[4] Preston-Werner, Tom. "Semantic Versioning 2.0.0." Semantic Versioning. https://semver.org (accessed September 6, 2019).

Project Support Functions

Technical support of the project will include testing, configuration control, and quality assurance:

1. Testing of the application will be derived from the project's requirements specifications.
2. Software configuration control will be facilitated by Git for program, requirement, design, and version release changes.
3. Quality assurance measures will be taken to validate that our application is adhering to the requirement specifications.

Work Elements, Schedule & Budget

Schedule

The Moderamen team has methodically planned out our schedule to ensure we remain on track to meet all deadlines and requirements to minimize unforeseen scope creep.

Team Meetings

We have meetings from 5:00 pm to 6:00 pm every Wednesday; however, we continuously communicate using Slack.

Project Phase I

Preliminary Project Plan	September 8th, 2019
Checkup Meeting	September 18th, 2019
Final Submission	October 13th, 2019

Project Phase II

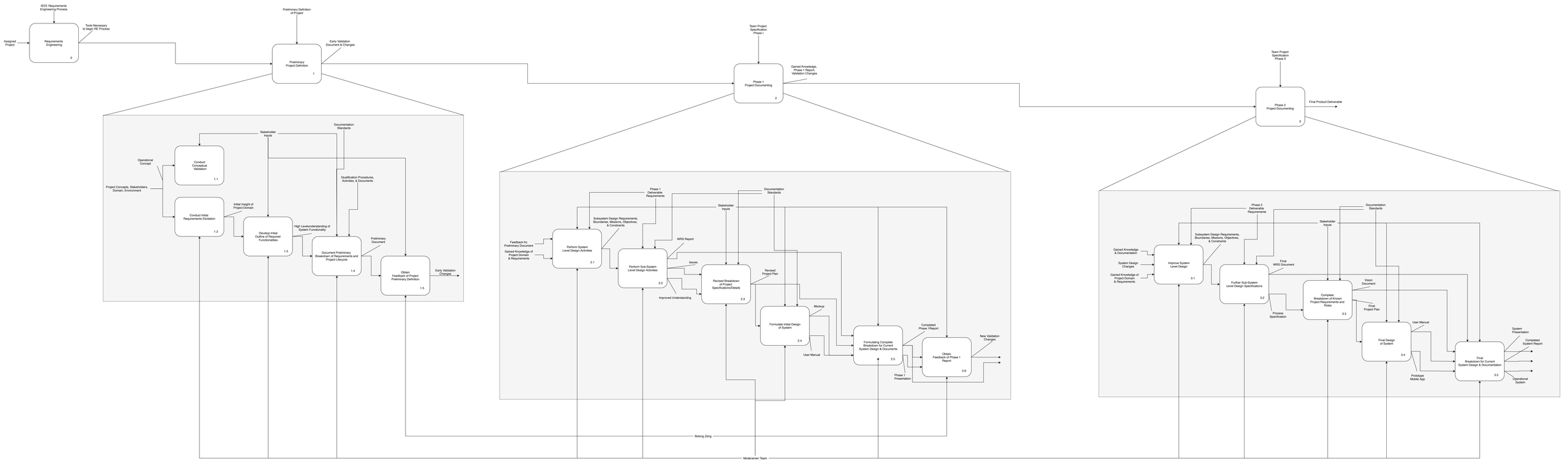
Final Submission	December 8th, 2019
Final Presentation	December 9th, 2019

Budget

The Moderamen team is happy to report that we maintain a budget of zero dollars throughout the entirety of the semester. We achieve this feat by only using open source tools and software that we discovered through word of mouth or research conducted by team members.

Appendix B

See Next Page for the Process Specification...



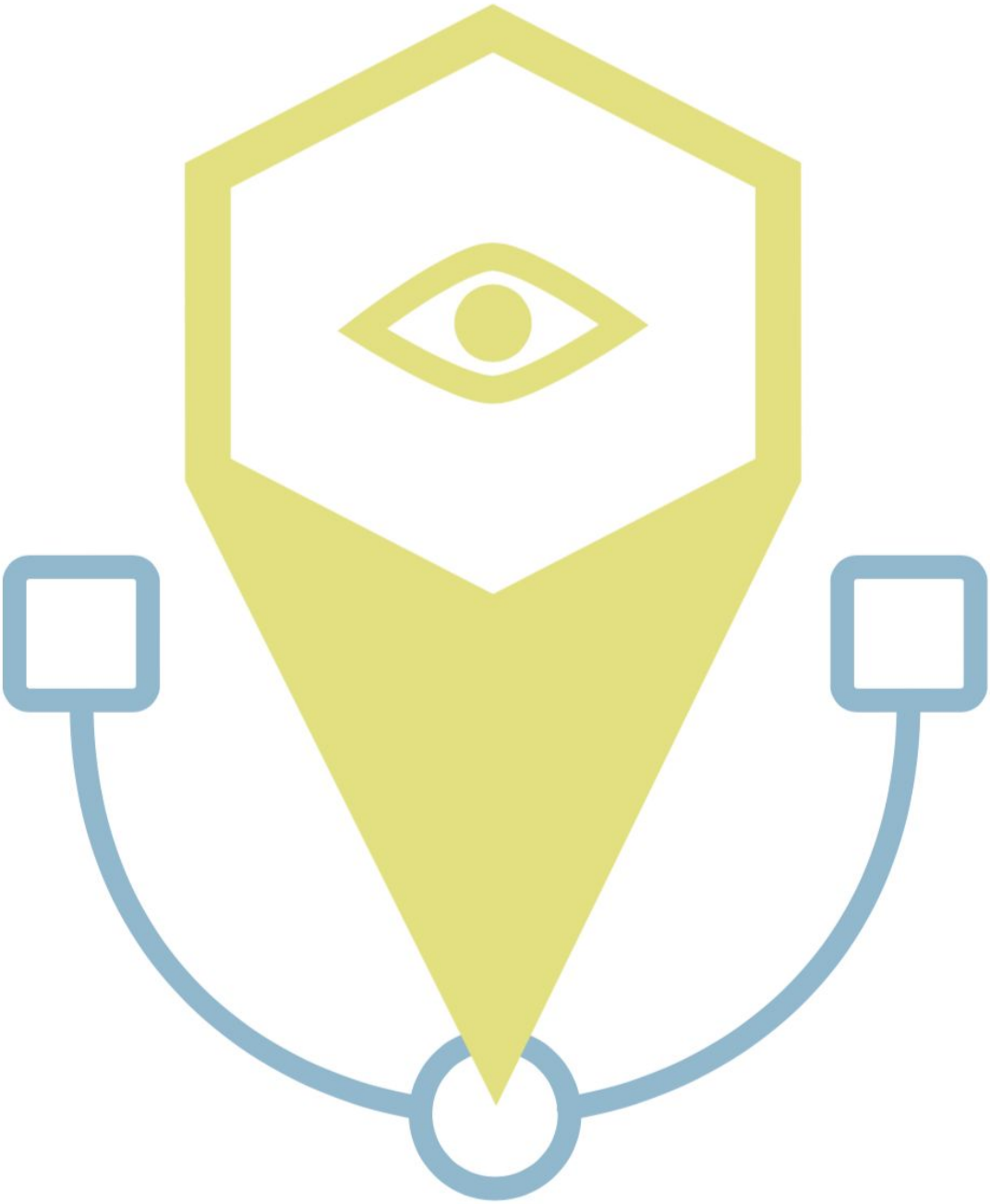
Node:	Title:	Number:
0	Phase II Process Specification	P.2

Appendix C

See Next Page for the Vision Document...

Vision and Scope Document

Moderamen



Moderamen

Prepared by Freya Varez, Austin Marino, Cole Bennett, Sean Cornia

12/2/2019

Table of Contents

Revision History

Date	Reason For Changes	Version
11/22/2019	Initial release	1.0
12/2/2019	Final modifications and review	1.1

1. Business Requirements

1.1. Background

The market for disability assistance, especially for those who are visually impaired is sparse to say the least. Market research has shown that those with visual impairments often choose to stay at home, feeling as though "[the] world is not made for them"[1]. Those with visual impairments are often forced to navigate through treacherous environments without proper assistance – running into unforeseen obstacles and getting lost while navigating through buildings.
The Moderamen team seeks to reduce the problems that the visually impaired encounter while navigating the world through a user-friendly mobile application.

1.2. Business Opportunity

	Cane	*Guide Dog*	*Moderamen*	*Cane + Moderamen*	*Cane + Guide Dog*	*Guide Dog + Moderamen*	*Cane + Guide Dog + Moderamen*
See	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Feel	*Yes*	*Yes*	*No*	*Yes*	*Yes*	*Yes*	*Yes*
Hear	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Talk	*No*	*Yes (Bark)*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Think	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Smell	*No*	*Yes*	*No*	*No*	*Yes*	*Yes*	*Yes*

Figure 1: Comparison of modern tools for the visually impaired (1)

The application seeks to assist the visually impaired with daily navigation, primarily indoors. The number of those with blindness (those with central visual acuity of 20/200 or less)[2] total about 7,675,600 (2.4% of the population) in the United States alone[3].

[1] Susan Crawford, "The Challenge of Helping Blind People Navigate Indoors," *WIRED*, n.d., https://www.wired.com/story/challenge-helping-blind-people-navigate-indoors/.

[2] Jeffrey H. Levenson and Alan Kozarsky, "Chapter 115 Visual Acuity," *Boston: Butterworths*, Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition., n.d., https://www.ncbi.nlm.nih.gov/books/NBK219/.

[3] "Blindness Statistics" (National Federation of the Blind, January 2019), https://www.nfb.org/resources/blindness-statistics.

Additionally, most of these people use sighted guides or guide dogs. In fact, “only an estimated 2 percent to 8 percent [use white canes]. The rest rely on their usable vision, a guide dog or a sighted guide.”[4] Making this app a useful tool for the visually impaired in place of a guide dog which can cost upwards of “$40,000 – $60,000”[5]; or a sighted guide which may not be available.

	Cane	*Guide Dog*	*Moderamen*
Ease of Usability	*High*	*Low*	*Very High*
Cost	*Low*	*Very High*	*Low*
Reliability	*High*	*Medium*	*Medium*
Functionality	*Low*	*Very High*	*High*

Figure 2: Comparison of modern tools for the visually impaired (2)

From *figure 1* and *figure 2* we can see that by functionality alone - guide dogs are the most useful to clients. However, taking into consideration the high cost for a trained guide dog[6], Moderamen would have a much larger client attainability with similar functionality. Similarly, a smartphone is much more convenient, that is – it can be carried on the person and stored nearly anywhere.

1.3. Success Metrics

Initial success metrics will be based heavily on accurate requirements gathering, the completion of these requirements and most importantly feedback from the user(s). During development, requirements gathering can be done through market research of interviews with users. Prototypes can be tested with stakeholders and feedback can be assessed and implemented in further versions. Success metrics will be loosely based on user feedback as well as assurance that the project passes all usability test performed, indicating that our application meets user requirements.
Additionally, we will attempt to maintain a budget of $0, so that we do not need to pay for any tools or equipment we use, and assure that the project follows the timeline outlined by the project’s specification document.

---

[4] Bill Winter, “10 Fascinating Facts about the White Cane” (Perkins School for the Blind, n.d.), https://www.perkins.org/stories/10-fascinating-facts-about-the-white-cane.

[5] Colby Morita, “How Much Does A Guide Dog Cost?,” n.d., https://puppyintraining.com/how-much-does-a-guide-dog-cost/.

[6] Colby Morita.

Upon deployment, success metrics will be based on the respective marketplace review score, and furthermore based on each written review in the products marketplace profile.

Achieving success based on these metrics means assessing and improving the product based on user reviews. For initial deployment, we aim to see an average user score in the 60th percentile of the respective marketplace. Within 2 months we aim to increase this *to at least* the 75th percentile based on user reviews.

1.4. Vision Statement

"To provide blind with the means to navigate life."

1.5. Business Risks

Based on the requirements and features mentioned below, we wish to safely assist visually impaired persons through possibly risky and dynamic environments. Because of our user-base and functionality, it will be difficult to completely take away any risk that the app will harm the user due to faulty software and/or non-complete logic. The team will emphasize safety during development and complete regular, extensive testing. In addition, the product will notify the user of these risks to minimize legal troubles that may arise.

The next major risk the team needs to asses is that of competing applications. Based on research through popular marketplaces such as Google Play and Apple Store, there seems to be very little competition for indoor navigation especially for English speakers. The more popular navigation apps either involved connecting a non-visually-impaired volunteer to connect with the user and complete tasks[7] or relied on outdoor google maps[8] technology and did not have the functionality for indoor navigation[9]. As such, the risk of competition for this type of application is relatively negligible.

In order to minimize the risk of competition further, market research will be done extensively before and during the development process. After deployment, the team will add various features to make the product stand apart from any competition.

---

[7] *Be My Eyes - Helping the Blind* (Be My Eyes, n.d.), https://play.google.com/store/apps/details?id=com.sails.buildngo&hl=en.

[8] *Maps - Navigate & Explore* (Google LLC, n.d.), https://play.google.com/store/apps/details?id=com.google.android.apps.maps&hl=en.

[9] Lew Lasher, *GetThere GPS Nav for Blind*, n.d., https://play.google.com/store/apps/details?id=com.LewLasher.getthere&hl=en.

1.6. Business Assumptions and Dependencies

The largest assumption we are making assumes that the users have the required software and hardware to run the application.

There is very little data correlating blindness with the use of a smartphone. Thus, we are assuming that enough visually impaired users have and use their smartphone in order to download our application from their respective app marketplace.
Making the above assumption, we must also assume that the users own a popular IOS or Android based device (at least initially, as the software will only be available for these devices). This is a relatively supported assumption as visually impaired individuals depend on software (text-readers, voice-recognition etc.) that is only widely available on more popular smartphones.

Next, we must assume that there are libraries available to complete the necessary functionality. This was supported with initial research done during requirements gathering. As such we can safely assume that there are IOS and Android independent software libraries for features such as text readers and directional assistance.
Finally, we must assume that the application can be successfully deployed to the Apple and Google Play marketplace.

2. Scope and Limitations

2.1. Major Features

According to market research[10], the two of the biggest challenges to independence for blind individuals are difficulties in accessing printed material[11] and the stressors associated with safe and efficient navigation[12]. Thus, as a development team we want to focus on independence from readable text (we will instead focus on a text-to-voice reader to convey information to the user).

The second challenge will be assessed through the main application software and are described below:

---

[10] Nicholas A. Giudice and Gordon E. Legge, *Blind Navigation and the Role of Technology*, Engineering Handbook of Smart Technology for Aging, Disability, and Independence (pp. 479 500, n.d.).

[11] National Research Council, “Front Matter - Visual Impairments: Determining Eligibility for Social Security Benefits. Washington, DC” (The National Academies Press, 2002).

[12] Pierluigi Caddeo et al., “Wayfinding Tasks in Visually Impaired People: The Role of Tactile Maps,” *Springer-Verlag*, Cognitive Processing, 7, no. 1 (September 2006): pp 168–169, https://doi.org/10.1007/s10339-006-0128-9.

- Generate desired sentences and represent them with text as well as associating with a sound/voice.
- Be able to offer a visual interface for setup for caretakers/passerby.
- Allow Blueprints to be added to map database.
- Navigate the user through indoor spaces with the use of compass directional and specified number of steps (through smartphone pedometer).
- Ability to recalculate based on the user's movements.
- Accurately calculate routes and adjust based on the user's average step-length.
- Clearly notify the user of directions.
- To support additional languages that can be added.
- The app's voice should be clear and give easily understood commands/directions.
- The app's visual interface should be clear to users who have never seen the app before.
- Scalability so that more maps and more locations can be added/verified as time goes on.
- Notify the users of such changes to available blueprints (routes).
- Consistent application performance with consistent maintenance without service shut-down.
- The app will take the best measures possible to prevent leading users to possible harm.
- The app will not share personal identifying information. Any information shared is clearly communicated to the user.

2.2. Scope of Initial Release

All of the above requirements will be included in the initial release. Due to the nature of this project, only the prototype will be released.

3. Business Context

3.1. Stakeholder Profiles

Stakeholder	***Major Value***	***Attitudes***	***Major Interests***	***Constraints***
executives	*increased revenue, streamlined business processes*	*see product as source of income/market share*	*richer feature set than competitors, cost of development, time to market*	*maximum budget*
editors	*fewer errors in work and documentation*	*Assume the product has high usability*	*Error correction; ease of use; high reliability*	*Time constraints, must push out documentation regularly.*

Software developers	*Product development*	*compilation of requirements*	*Development of all features and requirements.*	*Time constraint, budget constraint. Hardware constraint (must work on personal computers). Software restraint (must work with non-provided IDE's, libraries etc.)*
QA Testers	*Minimize bugs, increase usability, reduced frustration level compared to current applications*	*Source of bugs*	*Amount and importance of bugs in the software*	*Time constraint, budget constraint. Hardware constraint (must work on personal computers). Software restraint (must work with non-provided IDE's, libraries, testing platform/modules etc.)*
Visually disables person(s)	*Provide market and financial viability for product*	*Tool for navigation*	*Features available, lack of bugs/issues, cost, reliability*	*Budget constraint*

3.2. Project Priorities

Dimension	***Driver (state objective)***	***Constraint (state limits)***	***Degree of Freedom (state allowable range)***
Schedule	*(prototype) release 1.0 to be available by 12/8*	*Primary development team size is 2 people. Development team is working under severe time constraints*	*None*
Features	*All requirements discussed above (see section 2.1) will be made available through the release 1.0*	*Primary development team is under time, software and hardware constraints*	*±1 of high priority features must be included in release 1.0*

Quality	*Software must include basic use-cases without failure*	*Primary development team is under time, software and hardware constraints* *QA testing is minimal*	*90-95% of user acceptance tests must pass for release 1.0, 95-98% for release 1.1*
Staff	*N/A*	*maximum team size is 1 Team lead, 3 developers, 3 QA testers, 2 documentation assistants*	*Team size cannot change, team members may be allocated to different jobs*
Cost	*No cost for application development*	*$0*	*None*

3.3. Deployment Considerations

The users for this application, as mentioned above in section 1.6 must have an Android or IOS based smartphone with access to a respective software marketplace (Apple store and/or Google Play).

The user may need network access to add public route blueprints, but the base app does not require network access.
For the initial deployment, the user will need to understand English.

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Colby Morita. “How Much Does A Guide Dog Cost?,” n.d. https://puppyintraining.com/how-much-does-a-guide-dog-cost/.

Crawford, Susan. “The Challenge of Helping Blind People Navigate Indoors.” WIRED, n.d. https://www.wired.com/story/challenge-helping-blind-people-navigate-indoors/.

Jeffrey H. Levenson, and Alan Kozarsky. “Chapter 115 Visual Acuity.” Boston: Butterworths, Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition., n.d. https://www.ncbi.nlm.nih.gov/books/NBK219/.

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Pierluigi Caddeo, Ferdinando Fornara, Anna Maria Nenci, and Amelia Piroddi. "Wayfinding Tasks in Visually Impaired People: The Role of Tactile Maps." Springer-Verlag, Cognitive Proccessing, 7, no. 1 (September 2006): pp 168–169. https://doi.org/10.1007/s10339-006-0128-9.

Appendix D

See Next Page for the Final Presentation...

Cpts 484: Phase II Presentation

Moderamen

Austin Marino

Cole Bennett

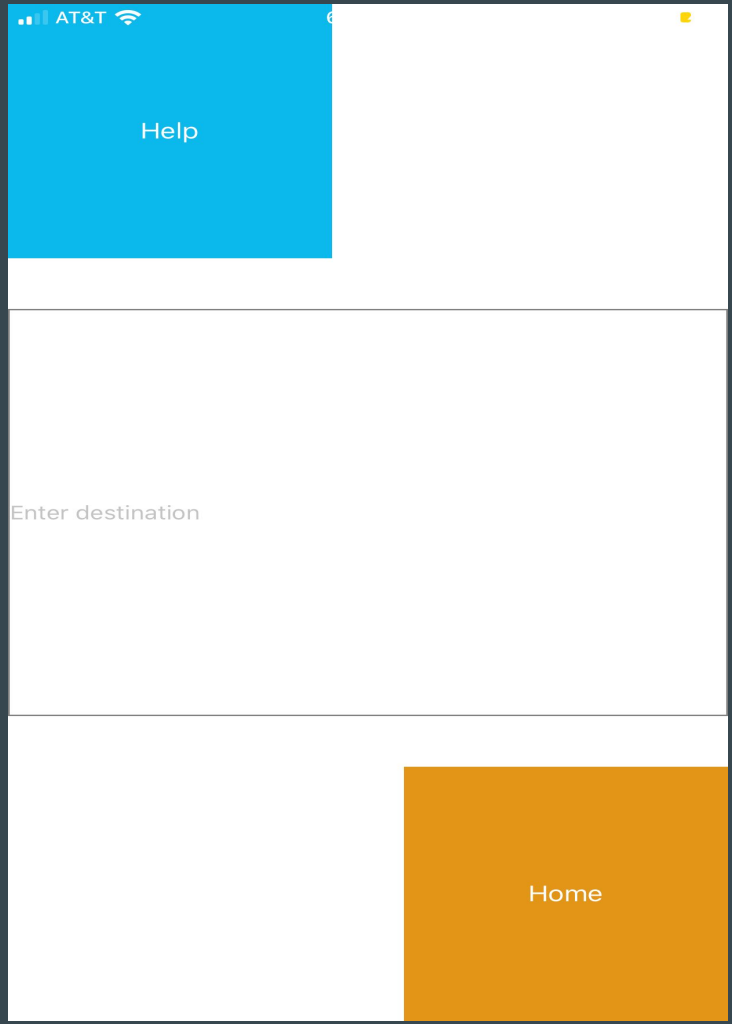
Freya Varez

Sean Cornia

...

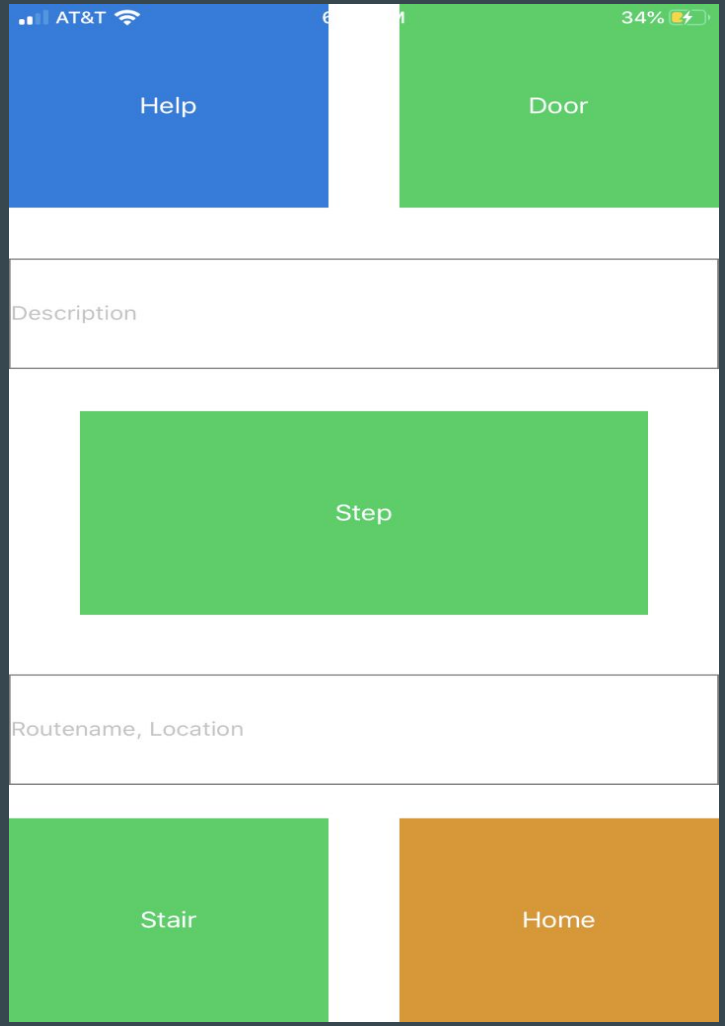
Search Route View

- This view allows users to search for a route and start a navigation session to the end destination.
- The “Enter destination” text field is primarily intended for caretakers to fill out. Voice commands are a second method of input for the visually impaired to search for a route.
- Once a route is selected, the system will check to see if it is in the system and relay the information to the user, if a route is found it can now be started on home screen. If not it is added to requests.



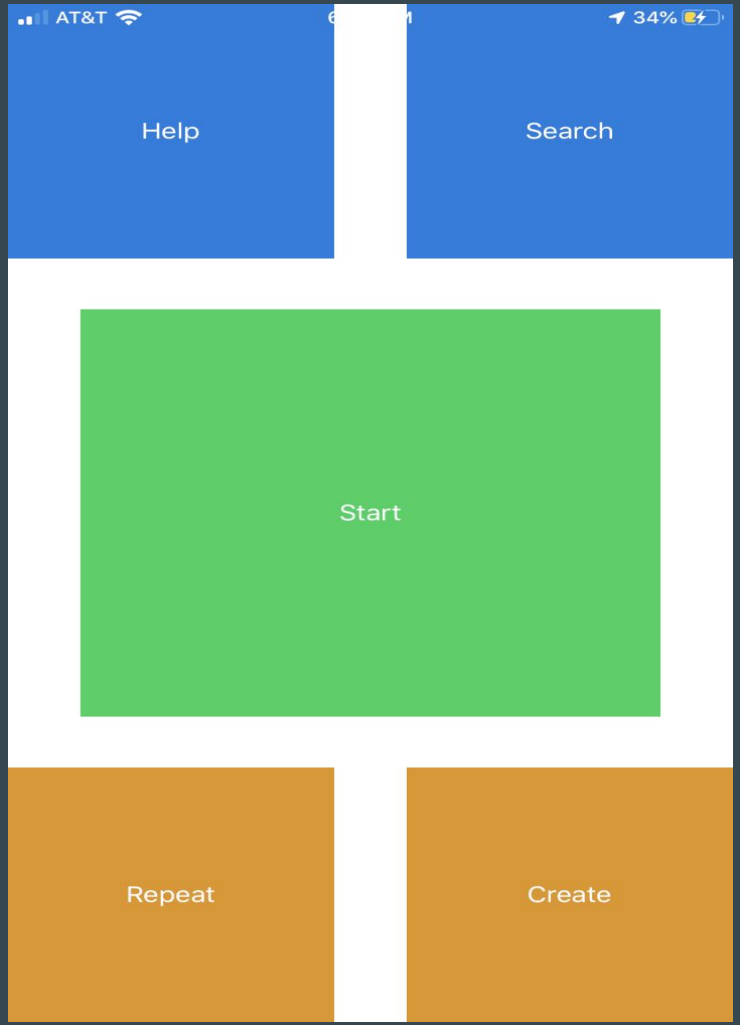
Create Route View

- This view allows users to create a new route which will be shown in search results on the *Home View*.
- Primarily intended for caretakers or building owners, however the enlarged buttons and layout allow for the visually impaired to create routes as well.
- The user can also add an optional description for a step to indicate an obstacle exists at that position.
- Requests can be viewed in help.



Active Navigation View/Home View

- Home Screen for the application.
- Top left gives help, right goes to search screen, create goes to *Create Route View*.
- Start can be done after a route was searched.
- Repeat goes backwards a step.
- Search become Stop once a route starts, Start becomes the step button.
- Voice feedback will be continually played to the user to give step and orientation commands along with optional descriptions.



Prototype Demonstration: As-Is Scenario One

Situation: Stevie has a vision imparity and needs to navigate to his next class. He is new to the school and thus doesn't know the layout of the building.

Decision: Stevie ends up asking a classmate for help but they inform him they have somewhere else to be and just give Stevie some vague directions that he tries to follow.

Result: He proceeds to to his next class slowly but ends up getting lost and doesn't know where he is or what to do next. He ends up getting help from another student a few minutes later and arrives at his next class late and embarrassed.

Prototype Demonstration: To-Be Scenario One

Situation: Stevie has a vision imparity and needs to navigate to his next class. He is new to the school and thus doesn't know the layout of the building.

Decision: Stevie ends up asking a classmate for help but they inform him they have somewhere else to be and just give him some vague directions. Stevie then decides to use the Moderamen app to help him reach his next class safley.

Result: The Moderamen app calculates the route from Stevie's current location to his next class. The app then directs stevie how to proceed to his destination through vocal directions. Stevie is able to easily follow the route and safely makes it to his class on time.

Prototype Demonstration: As-Is Scenario Two

Situation: Jane gets dropped off, by an Uber, at the County Hospital for her doctor's appointment.

Decision: She has navigated the building before and thus feels comfortable proceeding with just the help of her cane.

Result: While walking through the hallway, her cane narrowly misses hitting some toys that have been left out on the ground by children. She ends up stepping on the toys which results in her losing her balance and falling to the floor.

Prototype Demonstration: To-Be Scenario Two

Situation: Jane gets dropped off, by an Uber, at the County Hospital for her doctor's appointment.

Decision: She has navigated the building before and thus feels pretty comfortable doing it again with just her cane; but, ultimately decides to pull out her phone and load the Moderamen app as a secondary assistant.

Result: While walking through the hallway her cane narrowly misses hitting some toys that have been left out on the ground by children. Luckily, another Moderamen user had logged the toys as an obstacle into the app and Jane is provided a vocal warning by the app and safely continues her route around the toys.

Prototype Demonstration: As-Is Scenario Three

Situation: Peter is a caretaker for a visually impaired woman named Jan inside a retirement community. Peter is taking a week off from work but Jan still wants to get around while he is gone and doesn't want a temporary caretaker.

Decision: Peter tells Jan to try and not move around too much while he is away and to simply ask for help when she needs it.

Result: While Peter is away Jan begins to get restless and wants to leave her apartment and go down the hall to the indoor sauna. She wants to be independant and tries to make her way to the sauna alone since she remembers the path quite well. Unfortunately she forget there is a small stairway in the path and trips once she gets to them.

Prototype Demonstration: To-Be Scenario Three

Situation: Peter is a caretaker for a visually impaired woman named Jan inside a retirement community. Peter is taking a week off from work but Jan still wants to get around while he is gone and doesn't want a temporary caretaker.

Decision: Peter decides to download and use the Moderamen app on Jan's phone to create routes for all the places he knows Jan would want to go while he is away.

Result: While Peter is away, Jan frequently opens the Moderamen application on her phone and uses the routes Peter created for her to navigate around her retirement community and frequently visits the sauna.

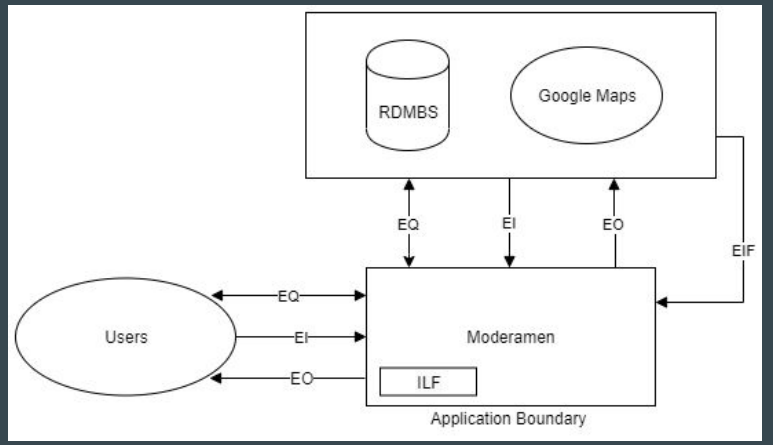
Phase I Creeping Rate

Phase I Final Submission Development Function Point Count (DFP1): 58

Creep Rate (estimated rate we can handle):

(((DFP2 - DFP1) / DFP1) * 100) / 3 months = ((100 - 58) / 58) * 100 = **24.1% per month**

Direct Measure	Count Simple	Count Average	Count Complex	Weighted Measure
External Inputs (EIs)	1	1	1	13
External Outputs (EOs)	0	1	0	5
External Inquiries (EQs)	0	2	0	8
Internal Logical Files (ILFs)	0	1	1	25
External Interface Files (EIFs)	0	3	0	21



Was our Creeping Rate estimation reasonable?

Our creep rate estimation of 24% so far has been reasonable as we have been able to complete the significant ILFs, EIs, and EOs necessary for the prototype to function, and have set up the structure so our EIFs could be implemented in the future:

- We have successfully created ILFs for maintaining created routes inside of our application.
- EIs have been implemented through our accessible user-interface by using a corner-based layout with large buttons.
- EOs have been implemented by having voice output and feedback to the user in all aspects of the application.
- EIFs such as a remote database, remote map file storage, and Google maps public data API access are out of the scope of the final deliverable, but each can be easily implemented based on our initial prototype.

How Moderamen Compares to Alternatives (Part 1)

	Cane	Guide Dog	Moderamen	Cane + Moderamen	Cane + Guide Dog	Guide Dog + Moderamen	Cane + Guide Dog + Moderamen
See	No	Yes	Yes	Yes	Yes	Yes	Yes
Feel	Yes	Yes	No	Yes	Yes	Yes	Yes
Hear	No	Yes	Yes	Yes	Yes	Yes	Yes
Talk	No	Yes (Bark)	Yes	Yes	Yes	Yes	Yes
Think	No	Yes	Yes	Yes	Yes	Yes	Yes
Smell	No	Yes	No	No	Yes	Yes	Yes

How Moderamen Compares to Alternatives (Part 2)

	Cane	Guide Dog	Moderamen
Ease of Usability	High	Low	Very High
Cost	Low	Very High	Low
Reliability	High	Medium	High
Functionality	Low	Very High	High

Analysis

- A dog in perfect conditions is the best option, it provides a full array of senses and abilities that can really only be matched by having a human iterate the details. That said a dog can have multiple scenarios where it ends up failing(let's say get agitated by another animal) along with a high or impossible barrier to entry in cost and allergies. While Moderamen can not compete with all functionality that a dog can provide, it can provide a stable/free(if they already have a compatible phone) alternative.
- The current stable/free alternative is a cane, which is what our application is currently aiming to compete or replace with. Our application offers similar reliability as it takes account of the orientation and of added descriptions to make sure the user is aware of the environment as much as needed along with added functionality like saving route and requesting. It is also much easier to use then the cane as it requires simply holding a phone, touching easy buttons that are always told to you and listening. Both are virtually free in the right scenarios.

Conclusion - *Why Moderamen is the Best Solution in the Market*

By functionality:

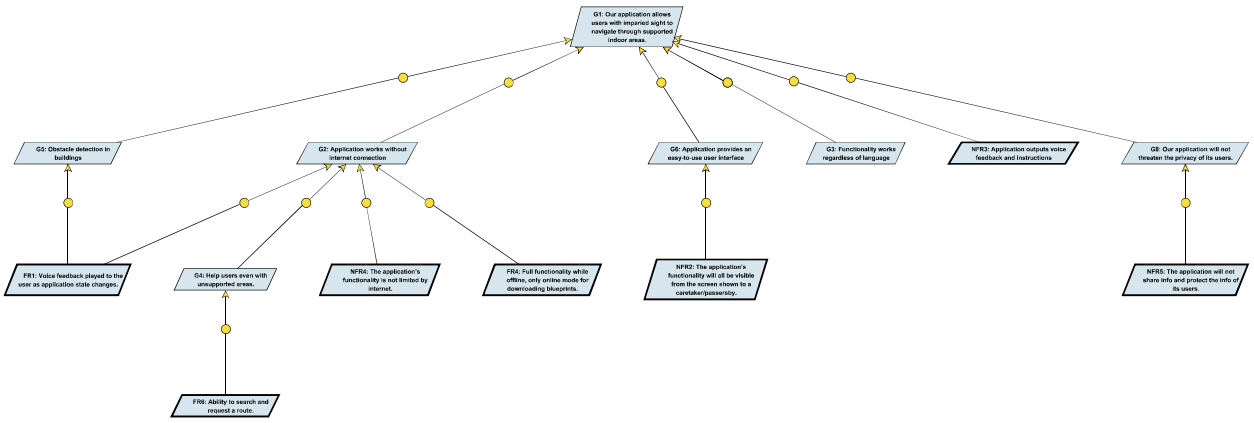
Cane < Moderamen < [Cane + Moderamen] < Guide Dog < [Cane + Guide Dog] < [Moderamen + Guide Dog] < [Moderamen + Guide dog + Cane]

By functionality alone - guide dogs are the most useful to clients. However, taking into consideration the high cost of $40,598 for a trained guide dog [1], Moderamen would have a much larger client attainability with similar functionality.

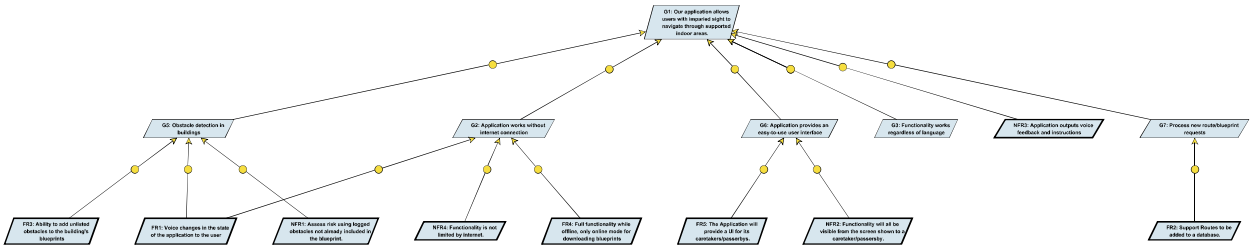
[1] https://www.cdc.gov/visionhealth/pdf/dog_guides.pdf

Appendix E

See Next Page for the KAOS Model...



Visually Impared - Goal Model



Caretakers/Building Owners - Goal Model