CptS 484: Software Requirements

WRS Evolution

Requirements Elicitation

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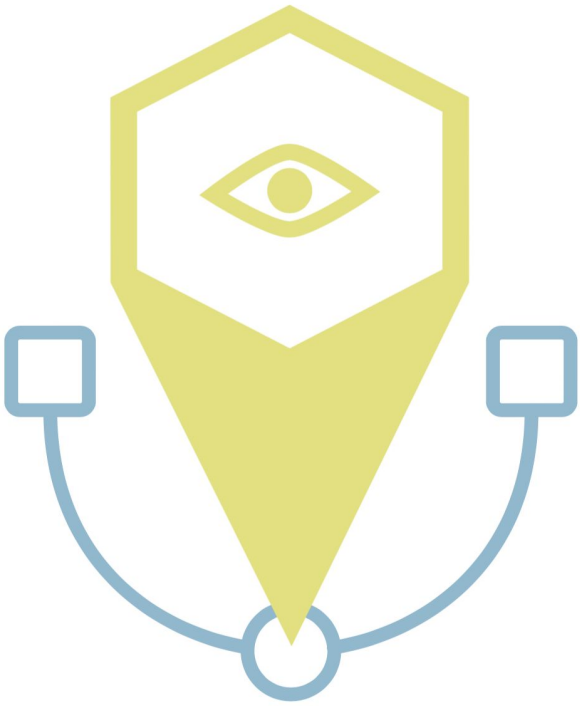

Revision History

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

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[1] Introduction

1.1. Purpose

Navigating the world as a blind or visually impaired individual is no easy feat. So much so, that many of these individuals choose to stay close to home, feeling as though the "world is not made for them"[4]. Without proper assistance, the visually impaired risk exposing themselves to a variety of threatening 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 encounter while navigating the world through our user-friendly mobile application.

1.2. Scope

The scope of our project can be defined by the following milestones...

- Develop or use an indoor navigation API that will be the backbone of our navigation system.
- Create a GUI that is easily usable by any caretaker or individual trying to assist a blind or visually impaired person using our application.
- 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 that...

- Maintains a budget of $0, so that we do not need to pay for any tools or equipment we use.
- Follows the timeline outlined by the project specification document hosted on Blackboard.
- Passes all usability test 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 commands through an audio input device rather than by using the mouse or keyboard, 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.

Camera Module

A camera module is just a more technical way of saying the camera on the back of your mobile device.

Blueprint

In architecture and building engineering, a blueprint or floor plan is a drawing to scale, showing a view from above, of the relationships between rooms, spaces, traffic patterns, and other physical features at one level of a structure.

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 by providing blind and visually impaired individuals 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, etc.. We hope to provide a solution to all these problems with our app, Moderamen. It 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 provides collision detection through the phone's camera module. 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 along with a camera to help navigate those areas and unmapped areas.

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 communicate the things it views within its camera.
VR1	Be able to offer a visual interface for setup for caretakers/passerby.
VR2	Able to detect objects with its camera.
TR1	Work Offline.
TR2	Allow connection with 3rd party translation software.
TR3	Allow Blueprints to be added to map database.

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 blueprints 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 blueprints 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.
	Choice	Option 2
	Rationale	We cannot guarantee the quality of the blueprints provided by non-stakeholders in option 1, having the actual landowner puts responsibility on them to generate a high quality blueprints as they are a stakeholder.
Satisfied by	TNR1	

FR Issue ID	Description	
FRI3	PFR_ID	VR2. Able to detect objects with the camera.

	What is defined as an object? How will the camera recognize objects?	
	Option 1	Objects are defined as anything that is not part of a recognized hallway minus people.
	Option 2	Objects are defined as anything in the hallway that is not registered in the map minus people.
	Choice	Option 1+Option 2
	Rationale	The application is designed to be used within the buildings that have blueprints uploaded and ones that don't so the application should take advantage when a blueprint is provided but should not be tied to it. If people were recognized as objects then application could take too long to voice them all out.
Satisfied by	AR5 + TR3	

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	Complete timed market research and add additional languages as necessary with additional app updates.
	Choice	1

	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.
Satisfied by	TR2	

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.
	Choice	1 + 3
	Rationale	Having a more robust algorithm to trach 'risk' and 'variability' of a path is necessary to keep the user safe - however, when unavoidable the user should be notified of the possible risk.
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 Microsoft Sam and allow to select other Microsoft voices.
	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	All Options
	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. All the options above will help achieve a voice that is more understood.
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
P4	Users of our application speak different languages.	G3
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
G3	Our application should provide functionality regardless of their language.	P4	FO3
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 blueprint. (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 blueprints 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 navigate indoor in unsupported buildings through phone camera detection.
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 blueprint of their buildings to enable our application to assist visually impared users to navigate their buildings. If they do not our application will still be able to assist visually impared users navigate through camera detections.	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	P6	G6

		issues or just to increase speed of navigation.		
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 blueprint that navigate indoor areas, and notify user when the application does not have a valid blueprint or changes to old blueprint.	P1,P3	G1
FO3	The application should connect with 3rd party translation software.	P4	G3
FO4	Application notifies users when its offline.	P2	G2
FO5	Application can be used without voice commands. (i.e. has a UI).	P6	G6
FO6	The application can use the camera module to detect unforeseen obstacles not included in blueprint.	P3,P5	G4,G5

FO7	Application should maintain navigation instructions even if network connectivity is lost.	P2	G2

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
NFO2	The application can assess risk or danger of a certain room, hallway, building that it has not previously mapped.	P5	G4, G5
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 amount of blueprints 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 Blueprints to be added and verified before being uploaded into the Database
Satisfies Functional Requirement Issue	FRI2
Satisfies Objectives	FO2, NFO6
Satisfied by prototype feature	Map/Map Database

FR ID	Description
FR3	The Application's camera will detect things not on the hallway's Blueprint, or everything minus people if no Blueprint is provided.
Satisfies Functional Requirement Issue	FRI3
Satisfies Objectives	FO6,NFO3
Satisfied by prototype feature	Camera

FR ID	Description
FR4	The Application will have full functionality offline, being online only updates Blueprint database and voices any changes to current Blueprints
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

4.2.2. Non-Functional Requirements

NFR ID	Nonfunctional Requirement 1	
NFR1	The system can assess risk using it's camera in unmapped rooms.	
Operationalized Functional Requirements	OFR1 OFR2	Assessing risk algorithm. 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	Camera

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 Microsoft 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
FS2	The application can connect with Third Party Translation software to help with non-english speakers
Satisfies Functional Requirement	FR1
Satisfies Objectives	FO3
Satisfied by prototype feature	Settings,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 Blueprints 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 Blueprints, or if Blueprint is not found
Satisfies Functional Requirement	FR2
Satisfies Objectives	FO2
Satisfied by prototype feature	Voice/Database

Functional Specification ID	**Functional Requirement**

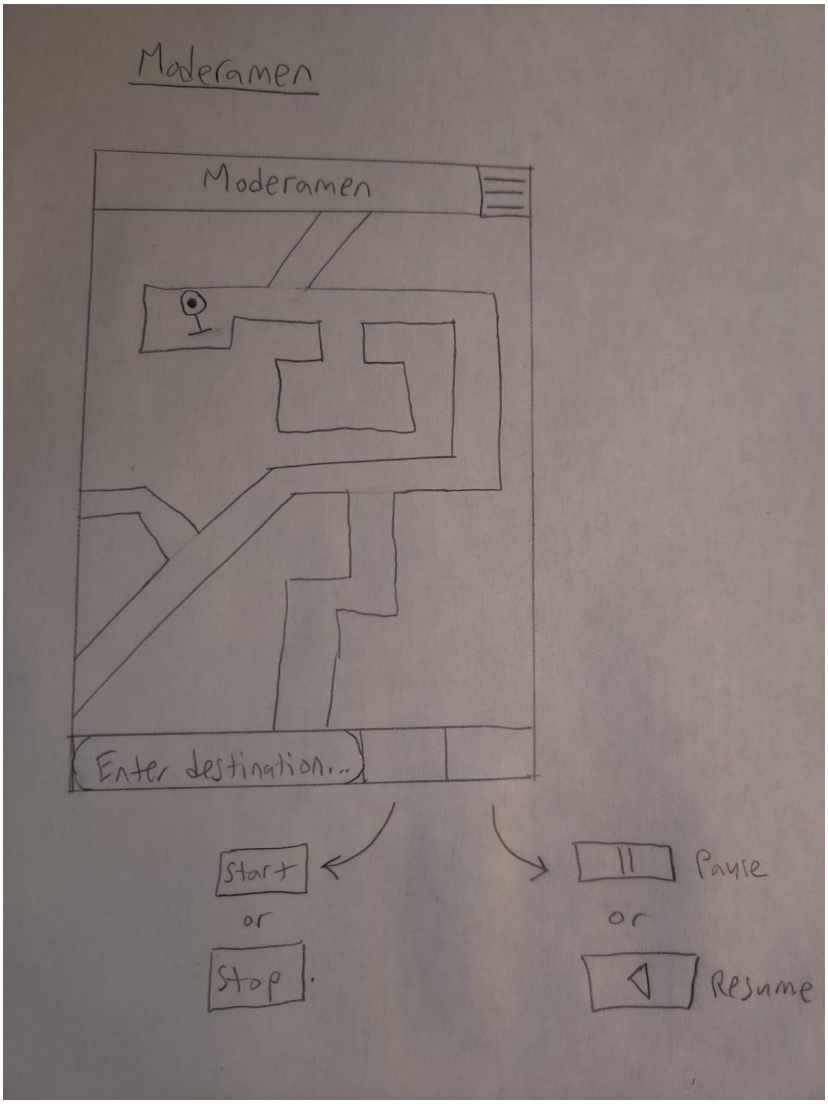
FS6	When the Camera is held to the hallway, it will let the user know of any objects in the hallway and voice them
Satisfies Functional Requirement	FR3
Satisfies Objectives	FO6
Satisfied by prototype feature	Voice/Camera

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

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 the application voice when it leaves the Application screen
Satisfies Functional Requirement	FR5
Satisfies Objectives	FO5
Satisfied by prototype feature	Voice

[5] Preliminary Prototype



[6] 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] 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 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

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.	○	○	○	●	○	○

[8] References

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