

CptS 484: Software Requirements

WRS Evolution

Requirements Elicitation

Revision History.....	1
[1] Introduction.....	3
1.1. Purpose.....	3
1.2. Scope.....	3
1.3. Objectives and Success Criteria.....	3
1.4. Definitions, Acronyms, and Abbreviations.....	4
1.5. Overview.....	4
[2] Preliminary Definition.....	5
2.1. Preliminary Domain.....	5
2.2. Preliminary Functional Requirements.....	5
2.3. Preliminary Non-Functional Requirements.....	6
[3] Issues with the Preliminary Definition Given.....	6
3.1. Domain Issues.....	6
3.2. Functional Requirements Issues.....	7
3.3. Non-Functional Requirements(NFR) Issues.....	10
[4] WRS.....	12
4.1. W.....	12
4.1.1. Problem.....	12
4.1.2. Goals.....	13
4.1.3. Improved Understanding of Domain, Stakeholders, Functional, and Non-Functional Objectives.....	13
4.1.3.1. Improved Domain.....	13
4.1.3.2. Stakeholders.....	14
4.1.3.3. Improved Functional Objectives.....	14
4.1.3.4. Improved Non-Functional Objectives.....	15
4.2. RS.....	16
4.2.1. Functional Requirements.....	16
4.2.2. Non-Functional Requirements.....	18
4.2.3. Specifications.....	21
[5] Preliminary Prototype.....	24
[6] User Manual.....	31
[7] References.....	32
[8] Team Resources.....	33
Appendix I: Process Details.....	33
Phase 1 Roles.....	33
Meetings.....	33

Revision History

Date	Version	Changes	Editor
9/04/25	1.0	Initial Draft	Trisha Teredesai
9/14/25	1.1	Updated requirements	Trisha Teredesai, Hannah Garcia, Akalya Sridharan
10/02/25	1.2	Elaborating requirements & WRS	Trisha Teredesai, Hannah Garcia, Akalya Sridharan
10/07/25	1.3	Finished Introduction	Trisha Teredesai
10/09/25	1.4	Elaborating FR and NFR; beginning Section 3 work	Trisha Teredesai, Hannah Garcia
10/10/25	1.5	Finished Section 3	Trisha Teredesai, Hannah Garcia, Akalya Sridharan
10/11/25	1.6	Finished Section 4	Akalya Sridharan
10/12/25	1.7	Finished Section 5, 6 and 7; review and refine WRS for submission	Trisha Teredesai, Hannah Garcia, Akalya Sridharan

[1] Introduction

1.1. Purpose

The goal of this project is to develop Theia, a smartphone app for blind and visually impaired people to be able to navigate from one location to another within a building. There are currently no mainstream applications that satisfy this niche. Thus, we aim to build an application that can assist blind and visually impaired users to safely navigate to their destination.

Using this, our target users will be able to pick a destination, and the app will provide real-time verbal directions while avoiding obstacles on the way. Additionally the app will be adapted for the use of visually impaired people, having features such as voice recognition and audible feedback. For additional safety, another feature of this application is emergency notifications to caregivers.

1.2. Scope

The main functionality of this application is indoor navigation. Users will be able to enter a destination location (within the same building or in another connected building) and the app will determine the most appropriate route from the user's current location to the destination. To be accessible to the user, the application will receive input from the user using voice commands and also provide verbal directions to the user, instructing the user on the appropriate actions to take. The application will also have safety features in case the user falls or gets injured. The app will send an emergency notification to the user's emergency contact, which would be their caregiver. Lastly, the app will also be able to store the users daily schedule, as frequent routes, and will send the user reminder notifications based on that schedule.

1.3. Objectives and Success Criteria

The success criteria for the application are as follows:

1. Get user's destination input & current location
2. Determine directions to that destination
3. Use smartphone's voice recognition features
4. Store user's profile with emergency contact information
5. Send notifications to emergency contacts
6. Store user's schedule and frequent routes

7. Give reminder notifications to user

1.4. Definitions, Acronyms, and Abbreviations

Term	Definition
Accessibility	The design of products, devices, services, vehicles, or environments to be usable by disabled people. In the context of this project, <i>Theia</i> is an accessible app that must be usable by blind and visually impaired people. Accessibility features for blind and visually impaired people include voice recognition, audio assistance, high-contrast themes, magnification options, and much more.
Caregiver	A family member or paid helper who regularly looks after a disabled person.
Estimated Time of Arrival (ETA)	The prediction of when a user will reach their destination, calculated with real-time data such as distance and possible obstacles.
First Responder	A person with specialized training who is among the first to arrive and provide assistance or incident resolution at an emergency scene.
Navigation	The process of safely moving through a building from one point to another using the interpretation of sensory information. The process is aided by the use of tools, such as canes or GPS apps, for blind and visually impaired users.
Visual Impairment	The partial or total inability of visual perception, classified by six categories. Category 0 to 2 are no/mild to severe visual impairment. Category 3 to 5 is blindness.

1.5. Overview

In Section 2, we outline the preliminary domain, functional requirements, non-functional requirements.

Section 3 will identify the issues with the preliminary domain and requirements, and provide revisions.

In Section 4, we will define the WRS. We will break down the project into problems and goals. Along with the refined requirements from the previous section, this will allow us to improve our

understanding of domain, stakeholders, functional and non-functional objectives. We will also establish forward and backward traceability.

Section 5 will showcase the preliminary prototype & interface.

Section 6 defines the user manual and lastly, Section 7 is references.

[2] Preliminary Definition

2.1. Preliminary Domain

PD_ID	Preliminary Domain Description
PD1	People who are blind and visually impaired.
PD2	Caregivers/Guardians of blind and visually impaired people
PD3	First responders (Police officers, paramedics, etc.)

2.2. Preliminary Functional Requirements

P FR_ID	Preliminary FR Description
PFR1	The system shall accept the destination location from the user.
PFR2	The system shall determine the route from the users current location to their destination.
PFR3	The system shall determine alternate routes to give options to the user.
PFR4	The system shall give clear instructions to the user in a timely manner.
PFR5	The system must keep track of the user's frequently used routes.
PFR6	The system must be able to detect obstacles and alert the user before a potential collision occurs.
PFR7	The system shall be able to place emergency alerts to the user's caregivers.
PFR8	The system shall save the user's schedule and give reminders to users accordingly.
PFR9	The system shall give verbal instructions to the user.
PFR10	The system shall use voice recognition features for app navigation.

2.3. Preliminary Non-Functional Requirements

PNFR_ID	Preliminary NFR Description
PNFR1	The system shall help the user safely navigate indoors.
PNFR2	The system shall lead the user through the fastest route .
PNFR3	The system shall be usable for blind people .
PNFR4	The system shall be ubiquitous, staying accessible to users at any needed time.
PNFR5	The system shall be customizable to every user according to their current needs, environment, etc. For example, options for volume, the interval of instructions, etc.
PNFR6	The system shall be easily extensible to accommodate variations in interface, language, definite needs to the user, new features, new sensors and hardware, etc.

[3] Issues with the Preliminary Definition Given

3.1. Domain Issues

Domain Issue ID	Domain Issue Description	
DI1	PD_ID	PD1: People who are blind and visually impaired.
		The term “visually impaired” is ambiguous since it can imply different levels of vision loss, ranging from mild impairment, which can be corrected with glasses, to more severe impairment, which is partial or complete blindness.
	Option 1	Offer different modes and options according to each level of visual impairment.
	Option 2	Define the level of visual impairment which our app will cater to, which would be Category 3-5 (according to WHO standards).
	Choice	Option 2
	Rationale	We wanted to focus on a smaller user group to reduce the scope of the project and to match the timeframe of this project.
Satisfied by	FR9, FR10, NFR4, NFR6	

Domain Issue ID	Domain Issue Description	
DI2	PD_ID	PD2: Caregivers/guardians of blind and visually impaired people
	Considering that caregivers and guardians are considered secondary stakeholders, the app will need a visual interface as well.	
	Option 1	Have a visual UI with voice navigation features integrated.
	Option 2	Only has voice navigation.
	Choice	Option 1
	Rationale	We want to ensure all stakeholders are able to use the app.
Satisfied by	FR7, NFR6	

3.2. Functional Requirements Issues

FR Issue ID	Description	
FRI1	PFR_ID	PFR1. The system shall accept the destination location from the user.
	Vague. How will the system specifically take in user input?	
	Option 1	Phone/app buttons or voice commands straight from the actual user, to their phone
	Option 2	From a caretaker or outside helper, assisting the actual user with their actions
	Option 3	A combination of both, according to user preference
	Choice	Option 1
	Rationale	While we would like to implement Option 3, we felt that Option 1 better fits the scope of the project.
Satisfied by	FR1	

FR Issue ID	Description	
FRI2	PFR_ID	PFR2. The system shall determine the route from the user's current location to their destination.
	How will the system find the route?	
	Option 1	Use a map API
	Option 2	Caretaker will enter in the route and directions

	Option 3	Preload specific building maps into the system
	Choice	Option 2
	Rationale	We chose Option 2 according to the professor's suggestion. It will better fit the scope of the project and allows for easy customizability.
Satisfied by	FR2	

FR Issue ID	Description	
FRI3	PFR_ID	PFR3. The system shall determine alternate routes to give options to the user.
	Vague. What are the alternate routes based off of? What type of options should the user expect?	
	Option 1	Shortest route (sorted by destination time or number of steps)
	Option 2	Preferred route (taking the elevator vs. stairs vs. ramp when getting from floor to floor, taking a specific hallway, etc.)
	Option 3	Options for providing both
	Choice	Option 3
	Rationale	According to FRI2, the caretaker will already be entering in the specific routes the user can take. Having alternate routes provides the user with more customization options to better fit the primary user's needs.
Satisfied by	FR3	

FR Issue ID	Description	
FRI4	PFR_ID	PFR4. The system shall give clear instructions to the user in a timely manner.
	What do we consider "timely"? Does it vary from user to user? <i>(How many seconds?)</i>	
	Option 1	User's caretaker will enter in the settings
	Option 2	Preset time (like 5 seconds)
	Choice	Option 1
	Rationale	The user's caretaker knows them best about their needs and preferences.

Satisfied by	FR4
---------------------	-----

FR Issue ID	Description	
FRI5	PFR_ID	PFR5. The system must keep track of the user's frequently used routes. 1. How does the system recognize frequent routes? 2. What is the time frame of which a frequent route is still considered "frequent"?
	Option 1	Based on user's schedule
	Option 2	Based on how often the user clicks a certain route
	Option 3	Weekly time basis
	Option 4	Monthly time basis
	Choice	Option 2, Option 4
	Rationale	The user's schedule may change, and a weekly time basis would be too short to determine frequent routes. Thus, we chose Option 2 and Option 4 instead.
Satisfied by	FR5	

FR Issue ID	Description	
FRI6	PFR_ID	PFR6. The system must be able to detect obstacles and alert the user before a potential collision occurs. When will the system alert the user? How far will the user be from the obstacle (<i>distance</i>) before they receive an alert?
	Option 1	1 foot
	Option 2	5 feet
	Option 3	Customizable according to user
	Choice	Option 3
	Rationale	Having customizable options will help fit the user's needs and preferences.
Satisfied by	FR6	

FR Issue ID	Description	
FRI7	PFR_ID	PFR7. The system shall be able to place emergency alerts to the user's caregivers.
		1. What do we consider an emergency? 2. When should we send out the alert?
	Option 1	When a fall is detected
	Option 2	The user manually requests it
	Option 3	No feedback or confirmation from user
	Option 4	Immediately
	Choice	Option 1, Option 2, Option 3
	Rationale	If the user falls, the app should realise that the user might be injured and alert the user for confirmation before sending the alert to the emergency contacts.
Satisfied by	FR7	

FR Issue ID	Description	
FRI8	PFR_ID	PFR8. The system shall save the user's schedule and give reminders to users accordingly.
		"Reminders" is vague. When will the system remind the user (ex: Letting them know they have a class soon)?
	Option 1	30 minutes before a class (timely basis)
	Option 2	Depending on ETA from GPS/navigation system
	Choice	Option 2
	Rationale	The app should take into account unexpected delays caused by obstacles. Thus, looking at the ETA would be the best option for our user.
Satisfied by	FR8	

3.3. Non-Functional Requirements(NFR) Issues

NFR Issues ID	Description	
NFRI1	PNFR_ID	PNFR1. The system shall help the user safely navigate indoors.

	How do we ensure the user makes it from one point to another point safely?
Option 1	Confirmation from user
Option 2	No emergency alert sent
Choice	Option 2
Rationale	This straight-forward option can easily be measured in boolean factors (true/false).
Satisfied by	NFR1

NFR Issues ID	Description	
NFRI3	PNFR_ID	PNFR3. The system shall be usable for blind people .
	What is considered “usable” for blind and visually impaired people?	
	Option 1	Including accessible audio features for the entire app
	Option 2	Complying to any regulations or standards expected for accessibility
	Choice	Option 1
	Rationale	Having to comply with specific standards (such as Section 508) is only required for federal applications.
Satisfied by	NFR3	

NFR Issues ID	Description	
NFRI4	PNFR_ID	PNFR4. The system shall be ubiquitous, staying accessible to users at any needed time.
	When should the app be accessible?	
	Option 1	Always online and active
	Option 2	Mostly online and active, with back-up information/prompts as needed)
	Choice	Option 1

	Rationale	Since this is an important tool for people who are blind and visually impaired, it must always remain available to the user/
Satisfied by	NFR4	

NFR Issues ID	Description	
NFR5	PNFR_ID	PNFR5. The system shall be customizable to every user according to their current needs, environment, etc. For example, options for volume, the interval of instructions, etc.
	What are the core, necessary customizable features that our app must implement?	
	Option 1	Haptic options (vibrations)
	Option 2	Audio options (volume, accent, speed, audio descriptions, etc.)
	Choice	Option 1 and Option 2
	Rationale	To fit each user's specific needs and preferences, our app should offer many customizable options.
Satisfied by	NFR5	

[4] WRS

4.1. W

4.1.1. Problem

Problem ID	Problem Description	Corresponding Goals
P1	Blind/visually impaired users have little to no mainstream indoor navigation systems that can provide safe guidance in real time.	G1

P2	Existing navigation tools are primarily for outdoor use and thus lack accessibility features like obstacle detection	G2
P3	Guardians have limited ways to monitor the safety of their blind/visually impaired users, especially in an emergency	G3

4.1.2. Goals

Goal ID	Goal Description	Backward Traceability	Forward Traceability
G1	Create an indoor navigation system that helps blind/visually impaired users to reach their destination safely.	P1	FO1, FO9
G2	Integrate accessibility features like obstacle detection, verbal reminders, etc.	P2	FO2, FO3, FO6, FO8, FO10
G3	Implement safety features like automatic fall detection and emergency alerts to caregivers.	P3	FO4, FO5, FO7

4.1.3. Improved Understanding of Domain, Stakeholders, Functional, and Non-Functional Objectives

4.1.3.1. Improved Domain

Improved Domain ID	Improved Domain Description
ID1	THEIA shall focus on supporting individuals who are blind/visually impaired by providing indoor navigation
ID2	THEIA shall provide both a visual interface and voice navigation features to ensure accessibility for all stakeholder groups
ID3	THEIA shall provide emergency alerts and location information to first responders (Police officers, paramedics, etc.)

4.1.3.2. Stakeholders

- Mentor: Professor Bolong Zeng
- Developers: GO SQUIRRELS Team
- Potential Users: Blind/visually impaired people, Caregivers/guardians of blind and visually impaired people

4.1.3.3. Improved Functional Objectives

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

Improved FR Objective ID	Objective Description	Alleviates Problems	Achieves Goals
IFRO1	THEIA shall accept destination input from the user through voice commands or phone buttons.	P1	G1
IFRO2	THEIA shall use the caretaker's input to determine the route from the user's current location to their destination.	P1, P2	G1
IFRO3	THEIA shall determine alternate routes to give options to the user, based on distance and preferred routes.	P2	G2
IFRO4	THEIA shall give clear instructions to the user on time based on the caretaker's input.	P1	G1
IFRO5	THEIA must keep track of the user's frequently used routes, based on how often the user uses that route within the last month.	P2	G2
IFRO6	THEIA must be able to detect obstacles and alert the user before a potential collision occurs; the specific distance is customizable by the user.	P2	G2
IFRO7	THEIA shall be able to place emergency alerts to the user's caregivers if the user falls and no user confirmation is given, or if the user requests it.	P3	G3

IFRO8	THEIA shall save the user's schedule and give reminders to users depending on the ETA from the GPS/navigation system.	P2	G2
IFRO9	THEIA shall give verbal instructions to the user.	P1	G1, G2
IFRO10	THEIA shall use voice recognition features for app navigation.	P2	G2

4.1.3.4. Improved Non-Functional Objectives

Improved NFR Objective ID	Objective Description	Alleviates Problem	Achieves Goal
INFRO1	THEIA shall help the user safely navigate indoors. Determined if no emergency alert is sent out.	P1	G1
INFRO2	THEIA shall lead the user through the fastest route .	P2	G2
INFRO3	THEIA shall be usable for blind people (includes audio features throughout the whole app).	P1	G2
INFRO4	THEIA shall be ubiquitous, staying accessible to users at all times.	P1	G1
INFRO5	THEIA shall be customizable (haptics + audio) to every user according to their current needs, environment, etc. For example, options for volume, the interval of instructions, etc.	P2	G2
INFRO6	THEIA shall be easily extensible to accommodate variations in interface, language, definite needs to the user, new features, new sensors and hardware, etc.	P2	G2

4.2. RS

4.2.1. Functional Requirements

FR ID	Description
FR1	THEIA shall accept destination input from the user through voice commands or phone buttons.
Satisfies Functional Requirement Issue	FRI1
Satisfies Objectives	IFRO1
Satisfied by prototype feature	Microphone/ Voice Commands

FR ID	Description
FR2	THEIA shall use the caretaker's input to determine the route from the user's current location to their destination.
Satisfies Functional Requirement Issue	FRI2
Satisfies Objectives	IFRO2
Satisfied by prototype feature	Caretaker Mode

FR ID	Description
FR3	THEIA shall determine alternate routes to give options to the user, based on distance and preferred routes.
Satisfies Functional Requirement Issue	FRI3
Satisfies Objectives	IFRO3
Satisfied by prototype feature	Route Options

FR ID	Description
FR4	THEIA shall give clear instructions to the user on time based on the caretaker's input.
Satisfies Functional Requirement Issue	FRI4
Satisfies Objectives	IFRO4

Satisfied by prototype feature	Caretaker Mode
---------------------------------------	----------------

FR ID	Description
FR5	THEIA must keep track of the user's frequently used routes, based on how often the user uses that route within the last month.
Satisfies Functional Requirement Issue	FRI5
Satisfies Objectives	IFRO5
Satisfied by prototype feature	Route Options

FR ID	Description
FR6	THEIA must be able to detect obstacles and alert the user before a potential collision occurs; the specific distance is customizable by the user.
Satisfies Functional Requirement Issue	FRI6
Satisfies Objectives	IFRO6
Satisfied by prototype feature	Navigation Screen 2 - Obstacle Detection

FR ID	Description
FR7	THEIA shall be able to place emergency alerts to the user's caregivers if the user falls and no user confirmation is given, or if the user requests it.
Satisfies Functional Requirement Issue	FRI7
Satisfies Objectives	IFRO7
Satisfied by prototype feature	Emergency Alert Screen

FR ID	Description
FR8	THEIA shall save the user's schedule and give reminders to users depending on the ETA from the GPS/navigation system.

Satisfies Functional Requirement Issue	FRI8
Satisfies Objectives	IFRO8
Satisfied by prototype feature	Reminders Setting

FR ID	Description
FR9	THEIA shall give verbal instructions to the user.
Satisfies Functional Requirement Issue	N/A
Satisfies Objectives	IFRO9
Satisfied by prototype feature	Navigation Screen 2 - Audio Guidance

FR ID	Description
FR10	THEIA shall use voice recognition features for app navigation.
Satisfies Functional Requirement Issue	N/A
Satisfies Objectives	IFRO10
Satisfied by prototype feature	Voice Commands

4.2.2. Non-Functional Requirements

NFR ID	Nonfunctional Requirement 1	
NFR1	THEIA shall help the user safely navigate indoors. Determined by if no emergency alert is sent out.	
Operationalized Functional Requirements	IFRO6	THEIA must be able to detect obstacles and alert the user before a potential collision occurs; the specific distance is customizable by the user.
	IFRO7	THEIA shall be able to place emergency alerts to the user's caregivers if the user falls and no user confirmation is given, or if the user requests it.

Satisfies Nonfunctional Requirement Issue	NFRI1
Satisfies Non-functional Objective	INFRO1
Constrains	P1
Satisfied by prototype feature	Obstacle Detection - Navigation 2 Screen

NFR ID	Nonfunctional Requirement 1	
NFR2	THEIA shall lead the user through the fastest route .	
Operationalized Functional Requirements	IFRO2 IFRO3	THEIA shall use the caretaker's input to determine the route from the user's current location to their destination. THEIA shall determine alternate routes to give options to the user, based on distance and preferred routes.
Satisfies Nonfunctional Requirement Issue	N/A	
Satisfies Non-functional Objective	INRFO2	
Constrains	P1, P2	
Satisfied by prototype feature	Route Options	

NFR ID	Nonfunctional Requirement 1	
NFR3	THEIA shall be usable for blind people (includes audio features throughout the whole app).	
Operationalized Functional Requirements	IFRO1 IFRO9 IFRO10	THEIA shall accept destination input from the user through voice commands or phone buttons. THEIA shall give verbal instructions to the user. THEIA shall use voice recognition features for app navigation.
Satisfies Nonfunctional Requirement Issue	NFRI3	
Satisfies Non-functional Objective	INFRO3	
Constrains	P1	
Satisfied by prototype feature	Audio Guidance/ Voice Commands	

NFR ID	Nonfunctional Requirement 1	
NFR4	THEIA shall be ubiquitous, staying accessible to users at all times.	
Operationalized Functional Requirements	IFRO1	THEIA shall accept destination input from the user through voice commands or phone buttons.
Satisfies Nonfunctional Requirement Issue	NFRI4	
Satisfies Non-functional Objective	INFRO4	
Constrains	P1, P2	
Satisfied by prototype feature	Home Screen	

NFR ID	Nonfunctional Requirement 1	
NFR5	THEIA shall be customizable (haptics + audio) to every user according to their current needs, environment, etc. For example, options for volume, the interval of instructions, etc.	
Operationalized Functional Requirements	IFRO4 IFRO6	THEIA shall give clear instructions to the user on time based on the caretaker's input. THEIA must be able to detect obstacles and alert the user before a potential collision occurs; the specific distance is customizable by the user.
Satisfies Nonfunctional Requirement Issue	NFRI5	
Satisfies Non-functional Objective	INFRO5	
Constrains	P1, P2, P3	
Satisfied by prototype feature	Accessibility Settings	

NFR ID	Nonfunctional Requirement 1	
NFR6	THEIA shall be easily extensible to accommodate variations in interface, language, definite needs to the user, new features, new sensors and hardware, etc.	
Operationalized Functional Requirements	IFRO6	THEIA must be able to detect obstacles and alert the user before a potential collision occurs; the specific distance is customizable by the user.

Satisfies Nonfunctional Requirement Issue	N/A
Satisfies Non-functional Objective	INFRO6
Constrains	P1, P3
Satisfied by prototype feature	Settings (Main Screen)

4.2.3. Specifications

Functional Specification ID	Functional Requirement
FS1	THEIA shall accept destination input from the user through voice commands or phone buttons, making the app usable for blind people and accessible with audio features throughout the whole app.
Satisfies Functional Requirement	FR1
Satisfies Objectives	IFRO1, INFR3, INFR4
Satisfied by prototype feature	Microphone/Voice Commands/Audio Guidance

Functional Specification ID	Functional Requirement
FS2	THEIA shall use the caretaker's input to determine the route from the user's current location to their destination. The system shall then generate the determined route for indoor navigation.
Satisfies Functional Requirement	FR2
Satisfies Objectives	IFRO2, INFR2
Satisfied by prototype feature	Caretaker Mode

Functional Specification ID	Functional Requirement
FS3	THEIA shall determine alternate routes to give options to the user, based on distance, fastest route, and preferred routes, while integrating accessibility features.
Satisfies Functional Requirement	FR3
Satisfies Objectives	IFRO3, INFR2
Satisfied by prototype feature	Route Options

Functional Specification ID	Functional Requirement

FS4	THEIA shall give clear instructions to the user on time based on the caretaker's input. THEIA would also be customizable (haptics + audio) to every user according to their current needs and environment.
Satisfies Functional Requirement	FR4
Satisfies Objectives	IFRO4, INFR5
Satisfied by prototype feature	Accessibility Settings

Functional Specification ID	Functional Requirement
FS5	THEIA must keep track of the user's frequently used routes, based on how often the user uses that route within the last month, while providing accessibility features to best suit the user's needs and preferences.
Satisfies Functional Requirement	FR5
Satisfies Objectives	IFRO4
Satisfied by prototype feature	Navigation Screen 1 - Route Options

Functional Specification ID	Functional Requirement
FS6	THEIA must be able to detect obstacles in the user's path and send out an audio or vibration alert to the user before a potential collision occurs. The specific detection distance shall be customizable by the user to fit their preferences and environment.
Satisfies Functional Requirement	FR6
Satisfies Objectives	IFRO6, INFR1, INFR5, INFR6
Satisfied by prototype feature	Navigation Screen 2 - Obstacle Detection

Functional Specification ID	Functional Requirement
FS7	THEIA shall be able to place emergency alerts to the user's caregivers if the user falls and no user confirmation is given, or if the user requests it, integrating safety features to help the user safely navigate indoors.
Satisfies Functional Requirement	FR7

Satisfies Objectives	IFRO7, IFNR1
Satisfied by prototype feature	Obstacle Detection - Navigation 2 Screen, Emergency Alert Screen

Functional Specification ID	Functional Requirement
FS8	THEIA shall save the user's schedule and give reminders to users depending on the ETA from the GPS/navigation system.
Satisfies Functional Requirement	FR8
Satisfies Objectives	IFRO8
Satisfied by prototype feature	Reminders Setting

Functional Specification ID	Functional Requirement
FS9	THEIA shall give verbal instructions to the user, helping blind and visually impaired users reach their destination safely.
Satisfies Functional Requirement	FR9
Satisfies Objectives	IFRO9, INFR3
Satisfied by prototype feature	Audio Guidance/Voice Commands

Functional Specification ID	Functional Requirement
FS10	THEIA shall be usable for blind people, using voice recognition features for app navigation without any visual input.
Satisfies Functional Requirement	FR10
Satisfies Objectives	IFRO10, INFR3
Satisfied by prototype feature	Voice Commands

[5] Preliminary Prototype

Our prototype was originally created in Figma and later refined by the AI Figma tool Magic Patterns. Our design was inspired by popular apps created for blind and visually impaired people, such as *Be My Eyes*. This app helps users recognize objects and manage everyday tasks through their phone camera by sending videos or connecting them to volunteers and companies for

assistance. The app contains a simple yet accessible design, through straightforward options, large buttons, and several filtering and search options. Our design for THEIA was additionally inspired by *Blind Square*, one of the most accessible GPS apps for visually impaired users, known for its navigation features. Similarly, the app has a simplistic and effective design, using large components and a wide range of customizable settings for user needs.

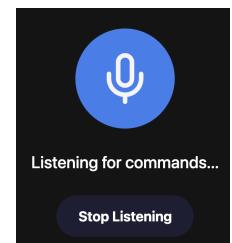
Because audio and haptics are the most important features that must be included in THEIA, and our prototype only provides the visual UI, we attempted to integrate as many audio-based features as possible. We assume that the app is in a continuous listening mode, similar to the “Hey Siri,” functionality built into iPhones, ensuring that the user’s voice is recognized at any time of app use. We have also included a globally accessible microphone button available on every screen, allowing users to easily make voice commands. However, we aim to focus more on the continuous listening functionality over the microphone button in Phase II. This will allow for easier accessibility for blind and visually impaired users.

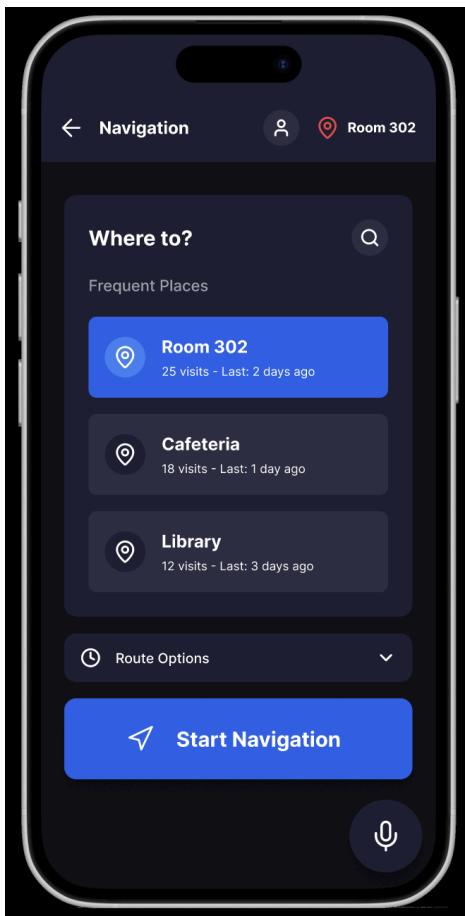


Home Screen:

The home screen the user sees when first opening the app contains the following features:

- **Navigation Button:** Largest on the screen, allowing for easy access.
- **Emergency Alert Button:** If necessary, the user can send out an emergency alert to their caretaker or first responders.
- **Settings:** Contains additional, customizable settings for voice, navigation, caretaker access, and accessibility.
- **Reminders:** Leads to the user’s schedule and reminders.
- **Microphone:** Full screen/overlay option for displaying that the app is listening to the user’s voice. Use of voice recognition features is provided through the app, fulfilling **NFR3** and **FR10**.



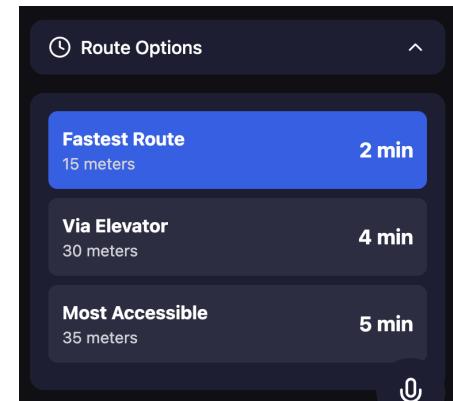
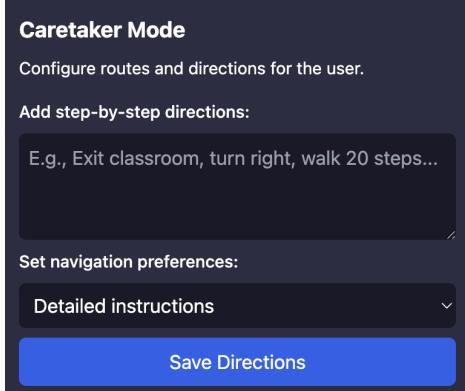
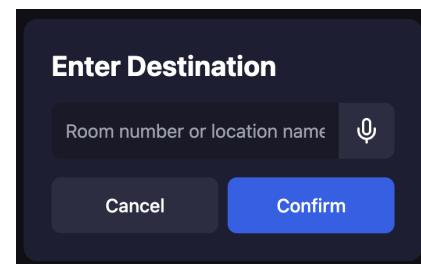


Navigation Screen 1:

The first navigation screen fulfills **FR1**: accepting destination input from the user through voice commands or phone buttons. Additionally, the navigation screen fulfills **FR5**: keeping track of the user's frequently used routes, based on their number of visits within a specific time frame.

Entering Destination:

When clicking on the magnifying glass or using a voice command, the user is able to enter another destination if it is not displayed on their frequent places list.



Caretaker Mode:

When clicking on the user button or using a voice command, the user is able to access caretaker mode. This mode fulfills **FR2**: allowing the caretaker's input to determine the route, where they are able to configure specific directions according to user preferences and needs.

Route Options:

This feature fulfills **FR3**: providing alternate routes to give options to the user, based on distance and other preferences. This feature additionally fulfills **NFR2**: leading the user through the fastest route, if chosen.

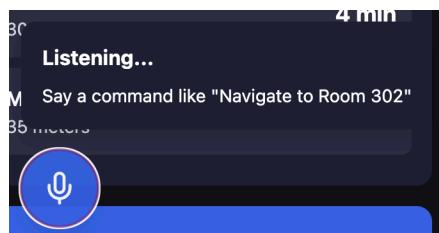


Navigation Screen 2:

The second navigation screen fulfills **FR4**: giving clear instructions to the user on time based on caretaker's input (entered through caretaker mode), and **FR9**: giving verbal instructions to the user. Here, the screen displays the map to the user's destination, the distance from the destination, audio guidance (with the blue bar demonstrating the timing of each instruction), emergency status (**NFR1**), and an option to stop navigation.

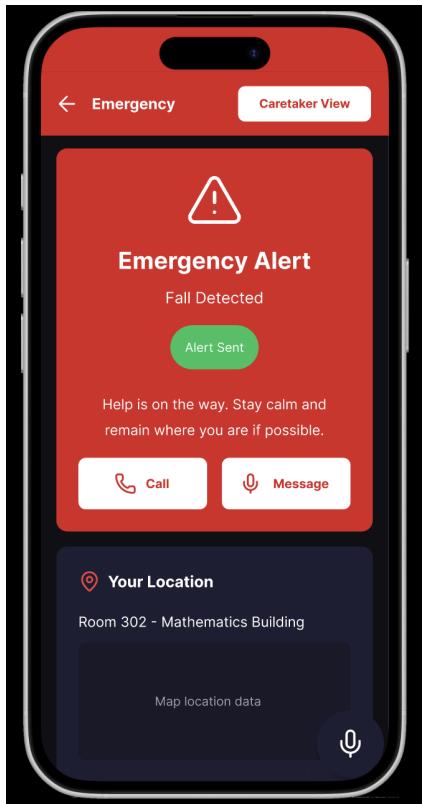
Obstacle Detection:

According to **FR6**, THEIA will detect obstacles and alert the user before a potential collision occurs. The app will do this visually as well as with an audio alert to the user.



Voice Commands:

In addition to the continuous listening mode (similar to “Hey Siri” implementation), verbal commands can be made throughout the entire app, through the microphone button.

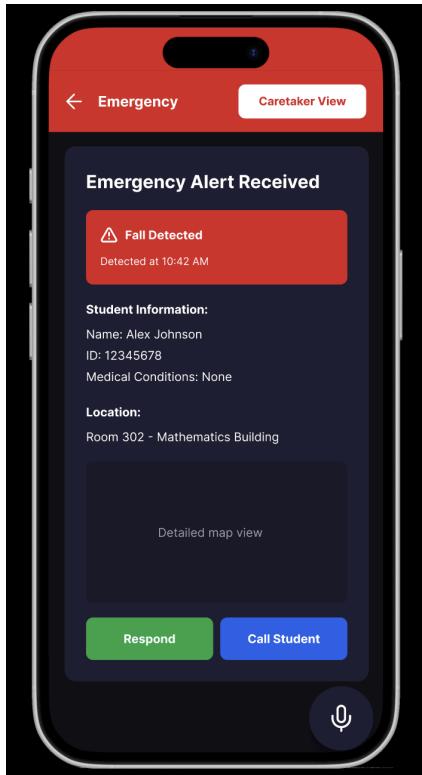
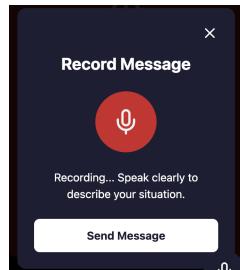


Emergency Alert Screen (User Side):

According to **FR7**, THEIA shall place emergency alerts to the user's caregivers and first responders. The emergency alert screen allows the user to send out any alerts. Additionally, the screen automatically activates when an emergency is detected (such as the user falling) and no user confirmation is given. Important user information is stored, and the system will update the user via audio.

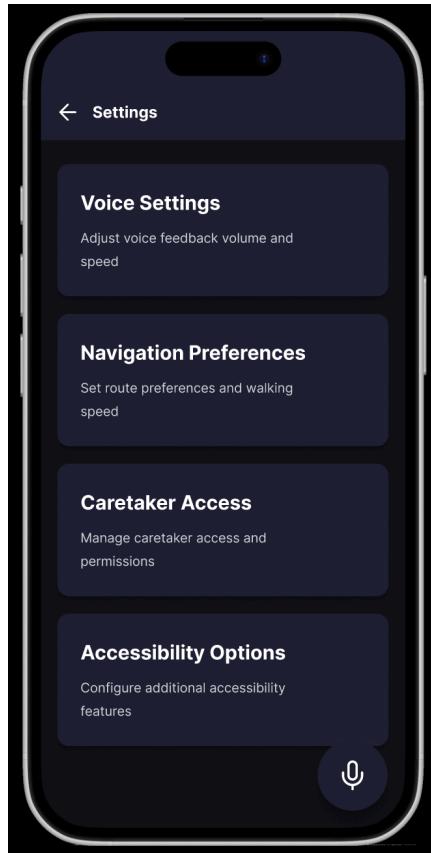
Additional Features:

The emergency alert screen contains options for contacting emergency contacts, with a call and message button.



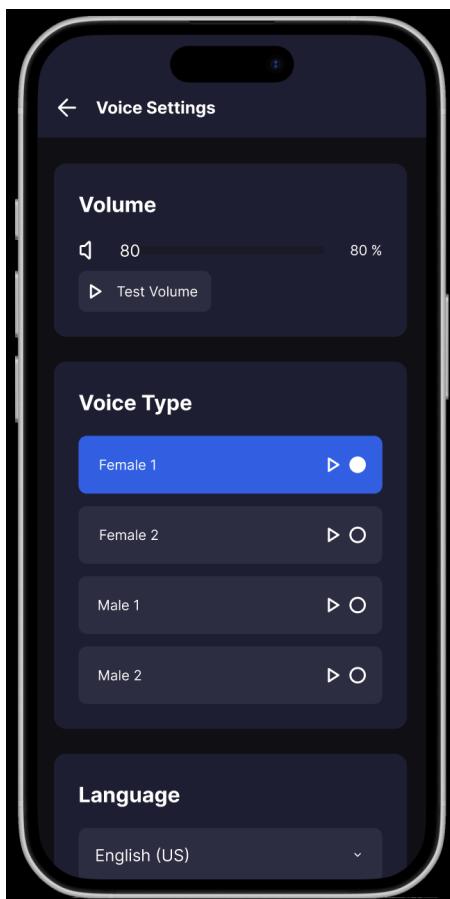
Emergency Alert Screen (Recipient Side):

This screen displays the caretaker and first responder view of an emergency alert. Relevant user information will be displayed and given to the recipient, keeping them updated about the situation in real time.



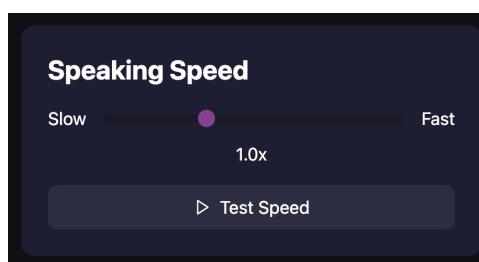
Settings (Main Screen):

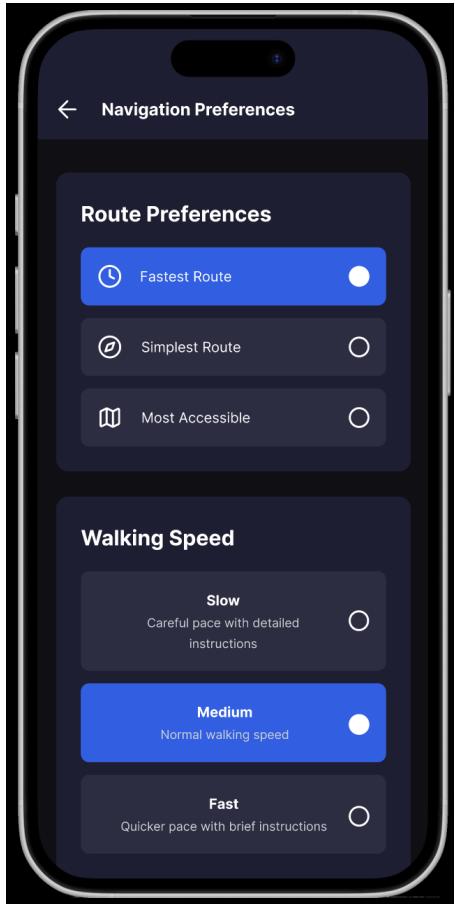
Overall, the settings page fulfills **NFR5**: providing customizable options to every user according to their current needs, environment, etc. Settings can be updated by both the user and by caretakers assisting with the initialization and usage of the app.



Voice Settings:

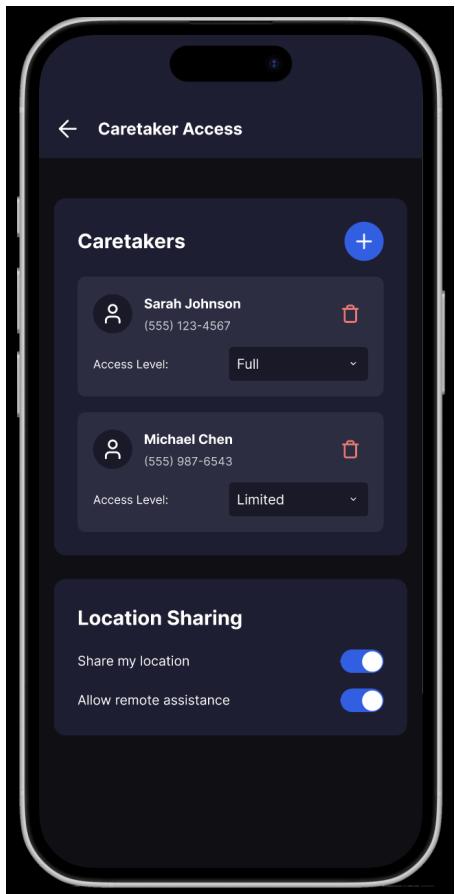
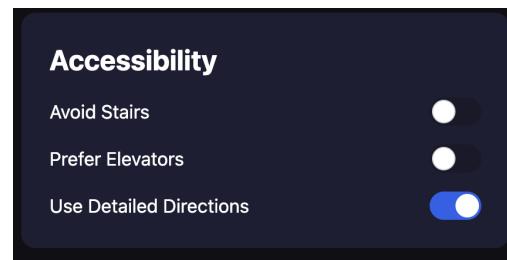
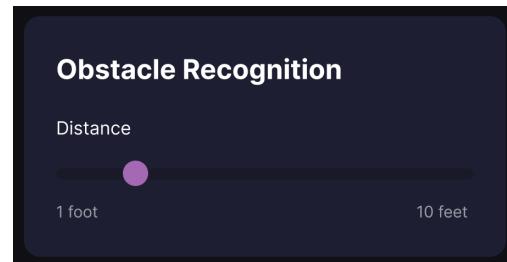
A wide range of voice settings are offered to the user, including voice type, language, and speaking speed.





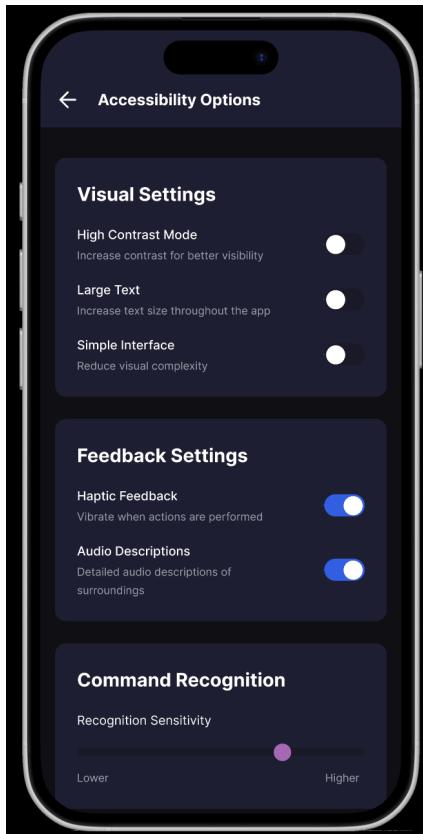
Navigation Settings:

The navigation settings lists options in addition to ones listed in the actual navigation page. This includes route preferences, walking speed of the user (using the user's location and instruction preference), obstacle recognition (**FR6**), and accessibility options.



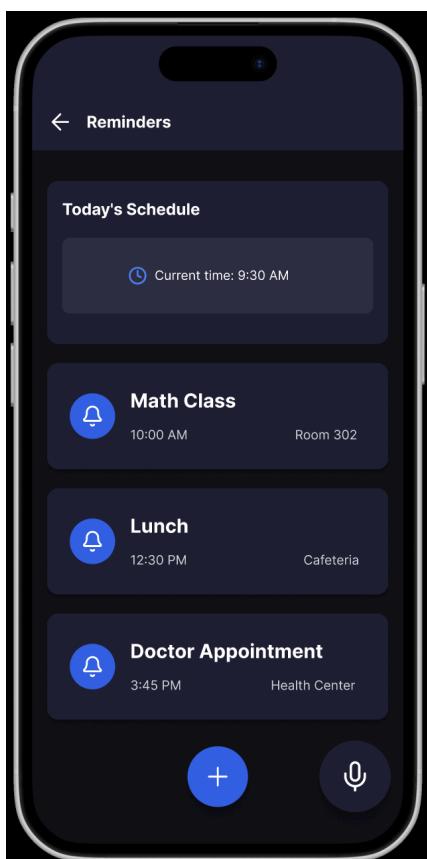
Caretaker Access Settings:

The caretaker access settings is where the user can manage caretaker access, add a new caretaker, and adjust location sharing settings. Note that caretakers are listed as emergency contacts to the user.



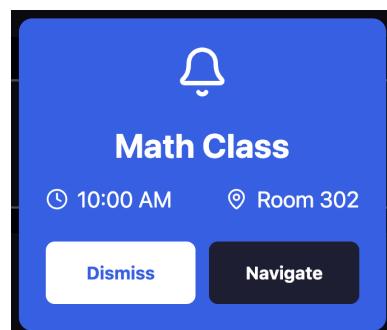
Accessibility Settings:

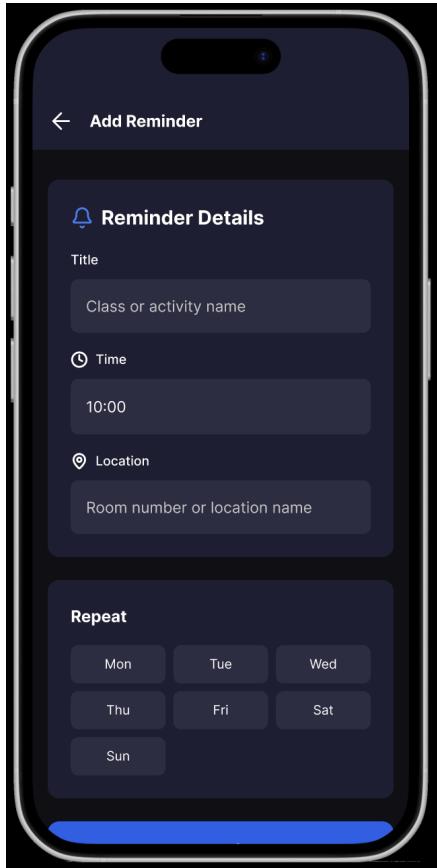
The accessibility settings offer options such as visual settings, feedback settings (haptics and audio descriptions according to **NFR5**), and command recognition / sensitivity options.



Reminders Settings:

According to **FR8**, THEIA will save the user's schedule and give reminders to users. Here, the reminders screen will show the user what is on their schedule and will send out alerts depending on the ETA to their destination.





Adding Reminders:

The user will have options to add a new reminder to their schedule.

[6] User Manual

As a blind or visually impaired user:

The main use of this application will be to navigate from one indoor location to another based on your schedule.

At the Homepage you can:

- Start navigation: Clicking on the ‘Navigate’ button will take you to the navigation screen to select the route.
- Send an emergency alert: In case of an emergency, use the emergency alert button to get assistance from your emergency contacts.
- View your schedule: See reminder alerts and view your schedule.
- Modify settings: Customize the settings for voice, navigation, caretaker access, and accessibility.

At the Navigation page you can:

- Start navigation to your desired location: Use the voice commands to enter a destination or select one of the frequently used routes.

- Select optimal route: Select between alternative routes provided, depending on your needs.

During an active navigation you are able to:

- Receive clear directions to your destination: Timely verbal instructions will be given as you progress through your route.
- Receive obstacle alerts: When an obstacle is detected, a verbal alert will be given to prevent collision.
- Feel assured in case of emergency: When a fall is detected, an emergency alert will be issued. If there is no response, an alert will be sent to emergency contacts.

As the caregiver of a blind or visually impaired user:

The main use of this application will be setting up the app for your blind/visually-impaired care-receiver.

At the Homepage you can:

- Go to settings: This is where you can assist your care-receiver with customizing settings for voice, navigation, caretaker access, and accessibility.
- Go to the navigation page: This is where you can input routes for your care-receiver to use.
- Setup up care-receiver schedule: Enter the care-receiver's schedule and reminder options.

At the Navigation page you are able to:

- Set up routes: In caretaker mode, you can input step-by-step directions for routes your care-receiver needs. You can also set navigation preferences.

In an emergency situation you will:

- Receive an alert notification: An notification will be sent to your mobile phone, alerting you that the care-receiver has encountered an emergency situation. You will be able to view their current location and contact them if required.
- Be able to call the authorities: If the care-receiver is injured, you are able to escalate the issue to first responders for assistance.

[7] References

Cpt_S 484 Team Project Specification Phase I,

https://wsu.instructure.com/courses/1844402/pages/team-project-phase-i-documents?module_item_id=24039396

World Assumptions Masterlist,

https://wsu.instructure.com/courses/1844402/pages/team-project-phase-i-documents?module_item_id=24039396

Wikipedia: Visual Impairment, https://en.wikipedia.org/wiki/Visual_impairment

WRS Sample Document,

https://wsu.instructure.com/courses/1844402/pages/team-project-phase-i-documents?module_item_id=24039396

Lesson 4 Slides, <https://wsu.instructure.com/courses/1844402/pages/lesson-4-your-to-do-list>

Lesson 6 Slides, <https://wsu.instructure.com/courses/1844402/pages/lesson-6-your-to-do-list>

[8] Team Resources

GitHub Project Repository, <https://github.com/hkgarcia/484-project-theia.git>

Figma Prototype Link,

https://www.figma.com/design/lvVYe50IbT4hFGYFv4fnVF/CPTS484---THEIA-Prototype?node_id=548-2207&t=bRPPfbe0JmHlcRqF-1

Appendix I: Process Details

Phase 1 Roles

Project Manager: Trisha Teredesai

Requirements Analyst: Hannah Garcia

Software Architect: Akalya Sridharan

Product Manager: Giri Vignesh

Software Engineer: Ishaan Joshi

Meetings

Meeting Number	Date	Notes
1	9/04/25	Introductions & beginning Phase 1 planning and scheduling
2	9/12/25	Preliminary plan finalization
3	10/02/25	Phase 1 presentation planning (discuss scenarios & requirements)
4	10/08/25	Presentation walk-through
5	10/09/25	Demo with professor
6	10/10/25	Working on WRS

7

10/12/25

Prototype finalization & Phase 1 final submission