SE 4351: Requirements Engineering

WRS Evolution: NaviSense

Requirements Elicitation

Project Members: Shay Abaid, Tabarak Abaid, Ubadah Saleh, Omar Hussain

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Revision History

Date	Version	Changes	Editor

Team Meetings

Meeting #	Date	Focus	Participants	Key Takeaways
1	2/19	Project Kickoff	Omar, Ubadah, Tabarak, and Shay	- discussed the given project description and identified several issues in the informal project description, including incompleteness and ambiguity - resolved these issues by conducting further analysis to clarify both the domain description and the system description - defined the project scope more clearly, by focusing on creating a smartphone app that utilizes sensors and audio cues to guide visually impaired individuals through indoor spaces
2	2/28	Requirements Elicitation	Omar, Ubadah, Tabarak, and Shay	- delved into gathering functional and non-functional requirements in addition to the ones listed - encountered issues such as inconsistency and redundancy in the requirements identified

				- Planned a follow-up meeting to resolve the specified issues and finalize the requirements for our app
3	3/5	Requirements Consolidation and Prioritization	Omar, Ubadah, Tabarak, and Shay	- discussed how to resolve inconsistencies and redundancies in the requirements to ensure a streamlined and effective development process - focused on consolidating and prioritizing the elicited requirements for the smartphone app - established traceability between the requirements and the project goals to ensure alignment throughout the development process
4	3/11	System Design	Omar, Ubadah, Tabarak, and Shay	- discussed the mockup prototype for the smartphone app by reviewing the design elements, including the user interface, navigation features, and accessibility options

				- ensured that the prototype was user-friendly and intuitive for blind users, incorporating feedback from usability testing sessions - focused on user-centered design principles to create a seamless and effective solution for indoor navigation
5	3/14	WRS Documentation and User Manual	Omar, Ubadah, Tabarak, and Shay	- addressed the need for a preliminary user manual for the app by discussing the importance of providing clear instructions and guidelines for users with visual impairments - emphasized the use of simple language, tactile cues, and audio instructions in the manual to enhance accessibility - outlined the documentation requirements for the WRS to ensure an accurate representation and analysis of our app
6	3/18	Questionnaire Development	Omar, Ubadah, Tabarak, and Shay	- discussed the creation of a questionnaire to

				gather feedback and insights from potential users of the smart home app - identified the need to understand the specific challenges faced by visually impaired individuals when navigating indoors and how technology could assist them effectively - outlined key points for the questionnaire which include demographic information, navigation challenges, technology preferences, and user experience

Participant Signatures:

Omar Hussain

Ubadah Saleh

Tabarak Abaid

Shay Abaid

[1]   Introduction

1.1. Purpose

The purpose of this is to outline the development of a smartphone app tailored specifically for blind individuals, aiming to address the considerable challenges they encounter while navigating indoor environments. By leveraging sensor data and audio cues, the app intends to provide real-time guidance and assistance, empowering users to move through indoor spaces confidently and securely. The primary objective is to create a user-friendly and intuitive solution that enhances independence and safety for blind individuals, while also striving to seamlessly integrate with existing smart home technologies to augment the overall user experience.

1.2. Scope

The scope for the development of a smartphone app aimed at facilitating safe indoor navigation for blind individuals is to design, implement, and deploy a comprehensive digital solution that addresses the unique challenges faced by visually impaired users in navigating indoor environments. This involves conducting thorough research to understand user needs and preferences, designing an intuitive user interface with accessibility features, integrating sensor data and audio cues to provide real-time guidance and assistance, and ensuring seamless compatibility with existing smart home technologies. Additionally, the scope encompasses thorough testing, including usability testing with blind individuals, to refine the app and ensure optimal functionality, security, and privacy. Overall, the goal is to develop a user-friendly and inclusive solution that enhances the independence, confidence, and safety of blind individuals when navigating indoor spaces.

1.3. Objectives and Success Criteria

Objectives:

- Develop a smartphone app tailored for blind individuals to facilitate safe indoor navigation, addressing challenges such as obstacles, changing layouts, and lack of visual cues.
- Design an intuitive user interface with accessibility features to accommodate varying degrees of visual impairment and user preferences.
- Conduct thorough testing, including usability testing with blind individuals, to identify and address any usability issues, bugs, or shortcomings in the app.
- Ensure robust security measures are in place to protect user data, secure transactions, and safeguard against potential threats.

Success Criteria:

- Receive positive feedback from blind individuals regarding the effectiveness and intuitiveness of audio cues for navigation.

- Continuously update the app based on user feedback and technological advancements to enhance functionality and user experience over time.
- Receive no reported incidents of security breaches or data privacy concerns related to the app.

1.4. Definitions, Acronyms, and Abbreviations

Definitions:

- NaviSense: Refers to the smartphone application designed specifically for blind individuals to facilitate safe navigation within indoor environments.
- Sensor Data: Information gathered from various sensors embedded in smartphones or connected devices, including GPS, Wi-Fi positioning, Bluetooth beacons, and inertial sensors, used to detect the user's surroundings and provide real-time guidance.
- Audio Cues: Sound-based signals generated by the app to provide navigation instructions, alerts, and feedback to users, aiding in orientation and obstacle avoidance.
- Smart Home Technologies: Refers to interconnected devices and systems within a home environment that can be controlled remotely or automated, including voice-controlled assistants, home automation systems, and Internet of Things (IoT) devices.
- Accessibility Features: Design elements and functionalities incorporated into the app to ensure usability for individuals with disabilities, such as screen readers, high-contrast interfaces, and alternative input methods.

Acronyms and Abbreviations:

- IoT: Internet of Things

1.5. Overview

Overview:

NaviSense is a cutting-edge smartphone application tailored to empower blind individuals with safe indoor navigation capabilities. Leveraging advanced sensor data and audio cues, NaviSense provides real-time guidance and assistance, enabling users to confidently maneuver through indoor spaces with ease and security. Designed with accessibility features at its core, NaviSense ensures inclusivity for individuals with disabilities, while seamless integration with smart home technologies enhances the overall user experience. Through rigorous usability testing and iterative improvements driven by user feedback, NaviSense is committed to delivering an intuitive and user-friendly solution that fosters independence and safety for blind individuals.

[2]   Preliminary Definition

2.1. Preliminary Domain

PD_ID	Preliminary Domain Description
PD1	NaviSense is a smartphone app designed to assist blind individuals in navigating indoor spaces safely. Using sensor technology and audio cues, it offers real-time guidance through obstacles and changing layouts. With accessibility features and integration with smart home tech, NaviSense aims to enhance independence and confidence for users.

2.2.Preliminary Functional Requirements

P FR_ ID	Preliminary FR Description
PFR1	NaviSense must offer real-time guidance, providing step-by-step instructions for navigating indoor environments effectively.
	Allow users to customize navigation preferences, including voice type, volume, and frequency of alerts, to suit individual needs
	Offer support for multiple languages to accommodate users from diverse linguistic backgrounds.

2.3.Preliminary Non-Functional Requirements

PNFR_ ID	Preliminary NFR Description
PNFR1	Respect user privacy by implementing transparent data handling practices and allowing users to control their personal information.
	Provide localization support to adapt the app interface and content to different languages and cultural preferences.
	Ensure compatibility with a wide range of smartphone devices and operating systems to maximize accessibility for users.

Domain Issue ID	Domain Issue Description	
	NaviSense should provide fast and responsive navigation guidance, with minimal latency in processing sensor data and delivering audio cues.	

[3]   Issues with the Preliminary Definition Given

3.1.Domain Issues

Domain Issue ID	Domain Issue Description	
DI1	PD_ID	NaviSense is a smartphone app designed to assist blind individuals in navigating indoor spaces safely. Using sensor technology and audio cues, it offers real-time guidance through obstacles and changing layouts. With accessibility features and integration with smart home tech, NaviSense aims to enhance independence and confidence for users.
	1. Lack of Specificity: lacks specifics about NaviSense's features, functionality, and target users, making it hard to grasp its unique value. 2. Absence of Key Components: overlooks critical components like sensor tech, audio cues, accessibility features, and smart home integration, vital for understanding NaviSense's support for blind individuals.	
	Option 1	Consider which categories of disability we can easily support with the minimum number of functional requirements and prioritize functional requirements to target those first.
	Option 2	Consider which categories of disability have the most sufferers and prioritize the requirements that target those first.
	Option 3	For each category of disability, research characteristics that define levels of minimal, moderate, and severe disability. Identify requirements that will aid each category and level, and determine if there are levels of disability that the team cannot realistically support.
	Choice	Option 3
	Rationale	Option three provides the most complete domain knowledge of the listed options. It also provides greater

		granularity when conducting traceability of requirements to problems within the domain.
Revised wording		4.1.3.1

3.2. Functional Requirements Issues

FR Issue ID	Description	
FRI1	PFR_ID	PFR1. Generating desired sentences and representing them pictorially as well as associating with a sound/voice.
	1. How to decide between picture and sound for that particular sentence?	
	Option 1	Use common sentences and associate them with sound (for the blind) or pictures (for the deaf).
	Option 2	Allow the user to select whether to associate words with pictures or with sounds at runtime.
	Option 3	Allow the user to configure the system to play sounds and/or associate pictures with sentences.
	Choice	Option 3
	Rationale	If the user wants to see the sentence in the form of a picture (or) in the form of sound he/she will have an option at run-time to choose from. This should be able to be adjusted in options as needed (if a user enters a noisy room, they may want to switch from sounds to pictures, for instance).
Satisfied by	FR1	

3.3. Non-Functional Requirements(NFR) Issues

NFR Issues ID	Description	
NFRI1	PNFR_ID	PNFR1. The system shall be secure.
	What is the definition of security?	

	Option1	Confidentiality
	Option2	Integrity
	Option3	Authentication
	Choice	1
	Rationale	For the particular smartphone app. being considered, confidentiality seems the most relevant (in relation to HIPAA).
Satisfied by		

NFR Issues ID	Description	
NFRI2	PNFR_ID	PNFR1. The system shall be usable.
	What mechanism does the system support for Confidentiality?	
	Option1	Password
	Option2	Access Card
	Option3	Retinal Scan
	Choice	1 + 2
	Rationale	Easy to implement and cheap, and yet provides a satisfactory level of assurance.
Satisfied by		

[4]   WRS

4.1. W

4.1.1. Problem

Problem ID	Problem Description	Corresponding Goals
P1	Inability to navigate public areas because of a visual impairment	G1
P2	Limited alternatives for the visually handicapped in current navigation tools.	G5
P3	Heavy reliance on auditory cues, which can be crippling in noisy environments	G2
P4	A more user-friendly and adaptable user interface is required to accommodate different levels of visual impairment.	G3, G4

4.1.2. Goals

Goal ID	Goal Description	Backward Traceability	Forward Traceability
G1	To improve visually impaired people's capacity for autonomous public space navigation	P1	FO1
G2	To create an adaptive navigation tool that reduces the need for audio signals in challenging situations.	P3	

G3	To design a user experience that is clear and simple for novice users to understand	P4	
G4	To include interface options that can be customized to accommodate different levels of visual impairment	P4	
G5	To incorporate accessibility elements that the current navigation tools do not have	P2	

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	NaviSense will include capabilities that make it easier for visually impaired people to travel to specific areas.

4.1.3.2. Stakeholders

- Users with visual impairments
- Marketing Managers
- Family members
- Experts in accessibility/disability
- Blindess Research Centers
- App Devs

4.1.3.3. Improved Functional Objectives

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

Improved FR Objective ID	Objective Description	Alleviates Problems	Achieves Goals
IFRO1	NaviSense will offer a user-friendly navigation system that provides direction via both visual and audible cues.	P1, P3	G1, G2, G3, G4
IFRO2	An extensive, current mapping system will be included into NaviSense for both indoor and outdoor navigation.	P2	G5
IFRO3	The application will make use of sensors or interface with other gadgets to deliver obstacle notifications in real time.	P1, P3	G1, G2

4.1.3.4. Improved Non-Functional Objectives

Improved NFR Objective ID	Objective Description	Alleviates Problem	Achieves Goal
INFRO1	NaviSense will guarantee the security and privacy of user data.	P1	G2
INFRO2	The application must function well in a range of networks and environmental circumstances.	P3,P4	G2,G3,G4

4.2. RS

4.2.1. Functional Requirements

FR ID	Description
FR1	NaviSense is designed to offer users both visual and audible input in real-time, contingent on their location.
Satisfies Functional Requirement Issue	FRI1
Satisfies Objectives	FO1, FO2, FO3
Satisfied by prototype feature	Yes

FR ID	Description
FR2	NaviSense will provide user-customizable feedback options based on ambient and user preferences.
Satisfies Functional Requirement Issue	FRI2
Satisfies Objectives	FO1, FO2, FO3, FO4
Satisfied by prototype feature	Yes

FR ID	Description
FR3	Voice commands will be supported by the system, enabling hands-free control and navigational modifications.
Satisfies Functional Requirement Issue	FRI3
Satisfies Objectives	G2,G3
Satisfied by prototype feature	Yes

FR ID	Description
FR4	Contextual location-based information, such as descriptions of nearby places and points of interest, will be provided via the app.
Satisfies Functional Requirement Issue	FRI5
Satisfies Objectives	IFRO4
Satisfied by prototype feature	Yes

FR ID	Description
FR5	An extensive mapping system, including indoor navigation for public buildings and transportation hubs, will be included into the app.
Satisfies Functional Requirement Issue	FRI5
Satisfies Objectives	IFRO2
Satisfied by prototype feature	Yes

FR ID	Description
FR6	In order to serve a multilingual user base and improve accessibility for non-English users, NaviSense will support multiple languages.
Satisfies Functional Requirement Issue	FRI6
Satisfies Objectives	G1,G5
Satisfied by prototype feature	Yes

- This has to be further refined in terms of specification(s).

4.2.2. Non-Functional Requirements

NFR ID	Nonfunctional Requirement 1	
NFR1	To safeguard user privacy, NaviSense will provide data encryption and user anonymity.	
Operationalized Functional Requirements	OFR1	The system shall provide login function with password .
	OFR2	Support the privacy of users when processing and storing data.
Satisfies Nonfunctional Requirement Issue	NFRI1	
Satisfies Non-functional Objective	NFO2	
Constrains	FO1, FO2, FO3, FO4	
Satisfied by prototype feature	Yes	

NFR ID	Nonfunctional Requirement 1	
NFR2	NaviSense will guarantee peak performance and dependability, providing prompt replies and less downtime.	
Operationalized Functional Requirements	OFR1	Respond to input from the user in two seconds.
	OFR2	Achieve high uptime
Satisfies Nonfunctional Requirement Issue	NFRI2	
Satisfies Non-functional Objective	NFO1	

Constrains	FO1, FO3, FO5
Satisfied by prototype feature	Yes

NFR ID	Nonfunctional Requirement 1	
NFR3	NaviSense should be designed to be easily scalable to support expanding user bases and future features without sacrificing usability or speed.	
Operationalized Functional Requirements	OFR1	The system architecture shall support updates.
	OFR2	The app's ability to accommodate growing numbers of users will be tested.
Satisfies Nonfunctional Requirement Issue	NFRI3	
Satisfies Non-functional Objective	NFO3	
Constrains	FO1, FO2, FO3, FO4	
Satisfied by prototype feature	Yes	

NFR ID	Nonfunctional Requirement 1	
NFR4	By guaranteeing user-friendly navigation, quick load times, and seamless interaction across the app, NaviSense will provide an outstanding user experience, accommodating users with varying levels of technical proficiency.	
Operationalized Functional Requirements	OFR1	Use UI design principles to make sure the app's functions are easily accessible and the navigation is user-friendly.
	OFR2	For a flawless user experience, optimize the app's speed to guarantee fast load times and fluid interaction.
Satisfies Nonfunctional Requirement Issue	NFRI4	

Satisfies Non-functional Objective	NFO4
Constrains	FO1, FO2, FO3, FO4
Satisfied by prototype feature	Yes

NFR ID	Nonfunctional Requirement 1	
NFR5	To protect user privacy, NaviSense will offer data encryption and user anonymity.	
Operationalized Functional Requirements	OFR1	Encrypt all user data before it is sent or kept within the NaviSense ecosystem.
	OFR2	Provide user anonymity tools to make sure that when using the app or analyzing data, personal identifiers are kept private.
Satisfies Nonfunctional Requirement Issue	NFRI3	
Satisfies Non-functional Objective	NFO1	
Constrains	FO1, FO2, FO3	
Satisfied by prototype feature	Yes	

NFR ID	Nonfunctional Requirement 1	
NFR6	In order to guarantee that the app is fully useable by people with a wide range of disabilities, NaviSense will uphold the highest standards of accessibility and inclusivity.	
Operationalized Functional Requirements	OFR1	Incorporate accessibility features, including as voice commands, haptic feedback, and screen reader compatibility
	OFR2	To find and fix any accessibility issues with the software, test its usability with people who have a range of disabilities.

Satisfies Nonfunctional Requirement Issue	NFR6
Satisfies Non-functional Objective	NFO2
Constrains	FO1, FO2
Satisfied by prototype feature	Yes

4.2.3. Specifications

Functional Specification ID	Functional Requirement
FS1	For navigational assistance, the device will translate GPS data into audible and sensory feedback.
Satisfies Functional Requirement	FR1
Satisfies Objectives	FO1, FO2, FO3
Satisfied by prototype feature	Yes
Functional Specification ID	Functional Requirement
FS2	Voice-controlled operation will be made accessible by NaviSense, enabling users to provide commands, request directions, or specify locations with voice commands.
Satisfies Functional Requirement	FR2
Satisfies Objectives	G2
Satisfied by prototype feature	Yes

Functional Specification ID	Functional Requirement
FS3	The user can activate NaviSense's emergency assistance feature, which will notify established contacts or services of the user's location.
Satisfies Functional Requirement	

Satisfies Objectives	G1, G3
Satisfied by prototype feature	Yes

| Functional Specification ID	Functional Requirement
FS4	Advanced auditory guiding systems will be implemented by NaviSense, which will use 3D spatial audio cues to assist users in understanding and navigating their surroundings. Directions, distances, and environmental descriptions will all be sent using this method.
Satisfies Functional Requirement	
Satisfies Objectives	G1
Satisfied by prototype feature	Yes

NAVISENSE

USER
MANUAL

What is NaviSense?

NaviSense offers voice-activated, intuitive guidance through spatial audio cues and real-time feedback, revolutionizing navigation for the blind and visually impaired. Experience newfound independence and confidence as you explore the world around you with ease.
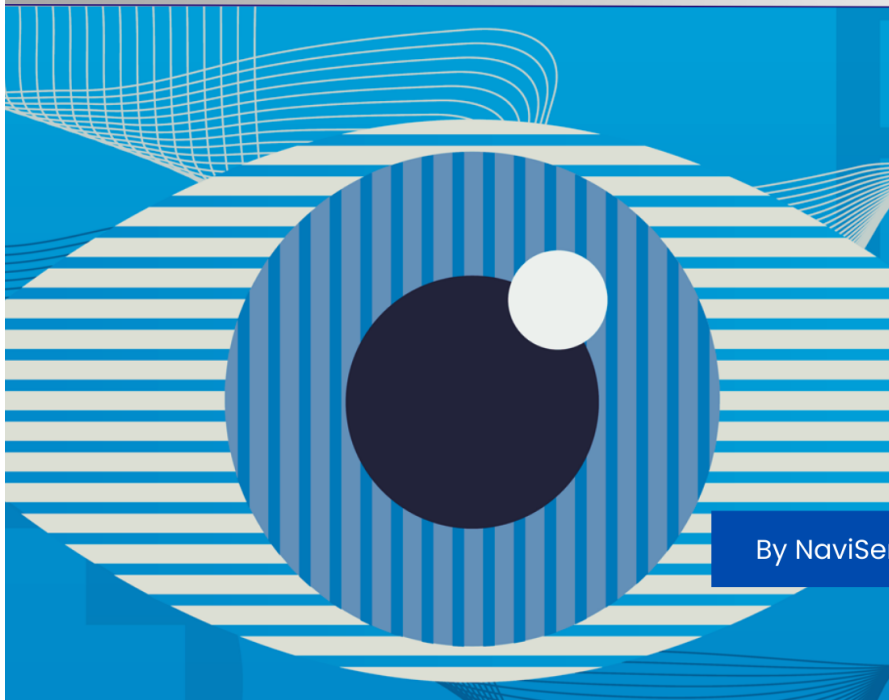
HOW TO USE?

By NaviSense Team

Getting Started

1. Download: NaviSense may be downloaded and installed by searching for it in the app store on your smartphone. The iOS and Android operating systems support the application.
2. Create an Account: To create a new account, launch the app and follow to the instructions. You'll have to set up a password along with providing an email address. You will be guided through each step by voice prompts.
3. Set up Profile: Using voice commands or the accessible touch interface, change the navigation settings and emergency contact details on your profile.

NaviSense's Features

- With its voice-activated, spatial audio cues and real-time feedback, NaviSense transforms navigation for the blind and visually impaired.
- Voice-Controlled Navigation: Just say "destination" to begin your journey. NaviSense will use 3D spatial audio to deliver audible guidance in real-time.
- Dynamic Route Adjustment: The software updates your route to take into account user input and real-time obstacle detection to make sure you're traveling the safest possible route.
- With the use of an advanced emergency feature, users may instantly notify certain contacts or emergency services of their location, guaranteeing that help is always available.

How to Navigate?

1. Instructions for Navigation: First, speak your destination into the app to activate it. Along with directions on how to continue, you'll hear an audio confirmation.
2. Keeping Up the Route: Get 3D spatial audio cues by using headphones. You'll receive alerts from the app about turns, obstructions, and elevation changes.
3. Making Preference Adjustments: At any point, you can use voice commands to reach the settings menu and change where you are headed to.

FAQs

Q1: Is internet access required for using NaviSense?
A1: In order to use real-time capabilities like obstacle detection and public transportation updates, NaviSense needs an internet connection. However, GPS access alone is sufficient for basic navigation to operate.

Q2:Does NaviSense come in languages other than English?
A2: To accommodate people globally, NaviSense does support multiple languages. During setup or at any time, you can adjust the language to your preference from the options.

Q3: How do I use NaviSense?
A3: Launch NaviSense from the app store, select your preferred navigation settings, then establish an account by following the voice-guided setup instructions.

Q4: What should I do if I discover a navigational or mapping error?
A4: The app's feedback feature allows you to easily report any errors. Based on customer feedback, we update and enhance NaviSense frequently.

Q5: What should I do if NaviSense stops giving me audio feedback?
A5: Initially, make sure that the volume on your smartphone is turned up and that your earbuds or headphones are firmly attached. Restart the program and make sure you have a reliable internet connection if the problem continues. Please email support@navisense.com or use the app to reach out to our support staff for additional help.

Any questions?

We are available to assist you with any general inquiries or troubleshooting issues. Do not hesitate to contact our customer service center by phone or via email at support@navisense.com. Our committed staff is on hand to offer you the assistance you need to guarantee an effortless and enjoyable NaviSense experience.

www.navisense.com

support@navisense.com

214-000-0000

123 Main St., Dallas, TX 12345

[6]   Traceability

Item Type	Item ID	Description	Traces To	Satisfied By Prototype Feature
Improved Functional Objectives (IFRO)	IFRO1	NaviSense will offer a user-friendly navigation system providing direction via both visual and audible cues.	P1, P3	Yes
	IFRO2	An extensive, current mapping system will be included for both indoor and outdoor navigation.	P2	Yes
	IFRO3	The application will use sensors or interface with gadgets for real-time obstacle notifications.	P1, P3	Yes
Improved Non-Functional Objectives (INFRO)	INFRO1	NaviSense will guarantee the security and privacy of user data.	P1	Yes
	INFRO2	The application must function well in various networks and environments.	P3, P4	Yes
Functional Requirements (FR)	FR1	NaviSense offers visual and audible input in real-time, based on user location.	FRI1	Yes
	FR2	NaviSense provides user-customizable feedback options.	FRI2	Yes
	FR3	System supports voice commands for hands-free control and navigation adjustments.	FRI3	Yes
	FR4	Contextual location-based information will be provided.	FRI5	IFRO4, Yes
	FR5	An extensive mapping system, including indoor navigation, will be integrated.	FRI5	Yes
	FR6	Support for multiple languages to serve a multilingual user base.	FRI6	Yes

Item Type	Item ID	Description	Traces To	Satisfied By Prototype Feature
Non-Functional Requirements (NFR)	NFR1	Data encryption and user anonymity to safeguard privacy.	NFRI1	Yes
	NFR2	Guarantee peak performance and reliability.	NFRI2	Yes
	NFR3	Designed for easy scalability and future feature support.	NFRI3	Yes
Functional Specifications (FS)	FS1	Device translates GPS data into audible and sensory feedback for navigation.	FR1	Yes
	FS2	Voice-controlled operation enabling command and direction requests via voice.	FR3	Yes
	FS3	Emergency assistance feature to notify contacts or services of user's location.		Yes
	FS4	Advanced auditory guiding systems using 3D spatial audio cues for navigation.		Yes

[7]   References

[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: http://www.utdallas.edu/~chung/RE/Project1.pdf

[8] Why Choose Our App

Our smartphone app for blind people is designed to be the most efficient and effective navigation tool available. We believe that our app is at least as good as, if not better than, any other team's app based on our observation of the other teams' presentations. Here are some of the key features that detail why our app should be used:

User-Centric Design: Our app has been meticulously designed with a focus on user experience and accessibility. Every feature and function has been carefully crafted to ensure ease of use and navigation for individuals with visual impairments.

Innovative Navigation Technology: Unlike other apps that rely solely on GPS technology, our app incorporates indoor navigation technology using a combination of inertial sensors and computer vision. This ensures more accurate and reliable navigation guidance within indoor spaces where GPS signals may be weak or unavailable.

Real-Time Obstacle Detection: One of the key features that sets our app apart is its real-time obstacle detection capabilities. Our app can detect obstacles in the user's path and provide timely alerts to help prevent collisions and ensure safe navigation.

Customizable Alerts and Preferences: Our app allows users to customize alerts and preferences based on their individual needs and preferences. Whether it's adjusting the volume of navigation prompts, choosing specific types of alerts, or customizing the interface layout, our app empowers users to tailor the experience to suit their unique requirements.

Integration with Smart Home Devices: Our app goes beyond basic navigation assistance by integrating seamlessly with smart home devices. Users can easily control lights, appliances, and other IoT devices within their home or office environment directly from the app, enhancing convenience and independence.

Continuous Improvement and Support: We are committed to continuously improving our app based on user feedback and emerging technologies. Our team is always available to address any issues or concerns, ensuring a seamless and reliable user experience.

Our app provides a seamless and intuitive user experience. With simple and easy-to-use features, the user can input their desired destination and receive turn-by-turn directions with audio feedback. Our app also includes haptic feedback, which ensures that the user is aware of their surroundings and obstacles. Advanced mapping and localization technologies are used to provide the most accurate and up-to-date information. The app can easily detect the user's location down to a few centimeters, making it easy to navigate complex indoor environments. We have designed our app with safety in mind. Specifically, we have implemented features that alert the user when they are approaching potential hazards such as stairs, escalators, or obstacles in their path. We also provided emergency assistance

features, such as a panic button that immediately alerts emergency services and provides the user's location. In conclusion, we believe that our app is the optimal choice available for blind people to safely navigate indoors. Our combination of user experience and safety features make it a comprehensive and reliable solution. By prioritizing user experience and providing personalized assistance, our app ultimately will ensure a transformative indoor navigation experience for blind individuals.