NaviSense

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Problem Description

- Blind individuals face significant challenges when navigating indoor environments due to obstacles, changing layouts, and lack of visual cues. The critical need for a smartphone app can offer reliable and intuitive navigation support to help increase mobility. We are to design a smartphone app that facilitates safe indoor navigation for blind individuals. The app will utilize sensor data and audio cues to provide real-time guidance and assistance, enabling users to navigate indoor environments with confidence and security. The primary goal is to develop a user-friendly and intuitive solution that addresses the unique challenges faced by blind individuals when moving through indoor spaces, ultimately enhancing their independence and safety. Additionally, the app aims to integrate seamlessly with existing smart home technologies to further enhance the overall user experience.

AS-IS Scenario

Currently, blind individuals face significant obstacles when navigating indoor spaces, which hinders their independence and mobility. Key challenges include:

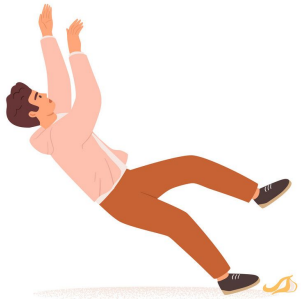
- **Orientation and Starting Location:** Determining the starting point within a building can be difficult without visual cues. Blind individuals often rely on memory or assistance from others to identify their location.
- **Pathfinding:** Finding the correct path involves navigating complex hallways and turns, which can be challenging without sight. Traditional aids like canes provide limited information, primarily detecting immediate ground-level obstacles.
- **Safety Concerns:** Safety is important. Without the ability to visually detect obstacles, there is a risk of collisions, trips, and falls. Braille indicators, while useful, are static and cannot signal temporary hazards.
- **Time Efficiency:** Reaching a destination in a timely manner can be stressful, especially in unfamiliar environments or when under time constraints.
- **Route Familiarity:** Repeatedly traversing the same route helps build familiarity, but changes in the environment or navigating new routes require constant adaptation.

TO-BE Scenario

- **Intuitive Start Location Identification:** Upon opening NaviSense, users will be greeted with an audio message that confirms their current location using GPS and indoor positioning technologies. This removes the guesswork from identifying their starting point.
- **Intelligent Pathfinding:** NaviSense will guide users through complex indoor spaces with audio directions. By processing real-time data from the phone's sensors and indoor maps, NaviSense can direct users along the safest and most efficient paths.
- **Enhanced Safety Measures:** The app will include features such as obstacle detection using the phone's camera and sensors, providing audio and haptic feedback to alert users of potential hazards and safely navigate around them.
- **Learning and Adaptation:** NaviSense will remember frequently travelled routes and will learn to suggest these to the user over time. It will also adapt to changes in the environment, such as temporary obstructions, updating its guidance accordingly.
- **Reduced Dependence on External Aids:** By leveraging NaviSense, users can gain more autonomy and reduce their reliance on guide dogs, human assistance, and braille indicators, which may not be uniformly available in all indoor environments.
- **Emergency Support**: In case of an emergency, users can shake their phone to immediately call a predefined emergency contact and share their location.

AS-IS

- Billy is walking to his Requirements Engineering at UTD
- He does not see the banana peel on the floor
- He slips and falls to the floor and hits his head
- Billy does not make it to class



TO-BE

- Billy is walking to his Requirements Engineering class at UTD
- He is using NaviSense to navigate to class
- NaviSense picks up the location of the banana peel and directs Billy to walk away from it
- Billy makes it to class safely

Questionnaire

- How do you currently navigate indoor environments?
- What challenges do you face most frequently when navigating indoors?
- How comfortable are you with using smartphone apps for assistance in navigation?
- Which of the following features have you used or would feel comfortable using in an app?
- What is the most important feature you would like in an indoor navigation app?
- How would you like the app to alert you to obstacles or turns?
- In what way should the app provide navigation instructions?
- How important is it for the app to adapt routes based on your familiarity with the building?
- Would you prefer the app to offer routes that prioritize safety over speed, or vice versa?
- How important are customization options to you (e.g., voice speed, volume)?
- What kind of support or tutorials would you find helpful when first using the app?
- What additional features would you find useful in an indoor navigation app? (Open-ended)
- How willing would you be to provide feedback on early versions of the app to help improve it?

Stakeholder Types

- **Caregivers/Family Members**
  - Can act as guides for blind people. The app can provide accurate directions and assist in navigating indoor spaces, ensuring the safety and well-being of blind individuals.
- **Researchers**
  - Researchers in the field of assistive technology, human-computer interaction, and accessibility can use the app as a tool for conducting studies and gathering data on indoor navigation challenges faced by blind individuals. This analysis can contribute to the advancement of knowledge and the development of future research initiatives.
- **Accessibility Department Staff**
  - Can use the app to conduct testing and evaluation of its accessibility features. They can assess the effectiveness of the app in facilitating indoor navigation for blind individuals and provide valuable feedback for further improvement.
- **Police**
  - The app can facilitate coordination and communication among police officers during emergency incidents. Officers can share their locations, movements, and relevant information through the app, enabling effective teamwork, avoiding duplication of efforts, and ensuring a synchronized response.

Stakeholder Types Cont.

- **Fire/Ambulance Services**
  - By using the app's navigation capabilities, first responders can optimize their routes within indoor spaces, minimizing response times and maximizing the allocation of resources. This efficiency can be particularly crucial in large and complex buildings, where finding the shortest and safest path can be challenging.
  - Can integrate with building information systems, enabling first responders to access crucial information such as floor plans, emergency exits, utility shut-off locations, and hazardous material storage areas. This information can help them navigate complex buildings and respond appropriately to the specific emergency at hand.
  - The app can provide first responders with audio cues and alerts about potential hazards or obstacles within indoor environments. This increased situational awareness can help them make informed decisions and respond effectively to emergency situations, ensuring their safety and the safety of those they are assisting.

Issues with domain requirement

- Lack of Specificity: lacks specifics about NaviSense's features, functionality, and target users, making it hard to grasp its unique value.

- 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.

Functional Requirements

FR1- NaviSense is designed to offer users both visual and audible input in real-time, contingent on their location.

FR2- NaviSense will provide user-customizable feedback options based on ambient and user preferences.

FR3- Voice commands will be supported by the system, enabling hands-free control and navigational modifications.

FR4- Contextual location-based information, such as descriptions of nearby places and points of interest, will be provided via the app.

FR5- An extensive mapping system, including indoor navigation for public buildings and transportation hubs, will be included into the app.

FR6- In order to serve a multilingual user base and improve accessibility for non-English users, NaviSense will support multiple languages.

Non-Functional Requirements

NFR1- To safeguard user privacy, NaviSense will provide data encryption and user anonymity.

NFR2- NaviSense will guarantee peak performance and dependability, providing prompt replies and less downtime.

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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.

NFR5- To protect user privacy, NaviSense will offer data encryption and user anonymity.

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.

Specification Model

World(W): NaviSense focuses on indoor environments where visually impaired individuals must navigate through specific navigational problems.

Requirement(R): The goal of NaviSense is to offer visually impaired people a simple navigational experience while guaranteeing their safety

Specification(S): GPS guidance in real time, sensor-based obstacle detection, a user interface that can be adjusted to various settings, robust data security protocols, speech audio cues for hands-free operation, and auditory feedback.

Program(P):Camera-based visual identification for enhanced interior obstacle detection, uses algorithms to secure user data, and combines advanced voice recognition for input and audio feedback for navigation.

Machine(M): User's Smartphone

Issues with NFRs

- **Performance:**
  - Issue: Lack of specific performance targets (e.g., maximum acceptable latency).
- **Accessibility:**
  - Issue: The requirement mentions compliance with accessibility standards but does not specify which standards or guidelines will be followed.
- **Reliability:**
  - Issue: The requirement lacks clarity on how reliability will be measured or ensured.
- **Security:**
  - Issue: The requirement mentions encryption and secure storage but does not specify the encryption algorithms or security protocols that will be used.

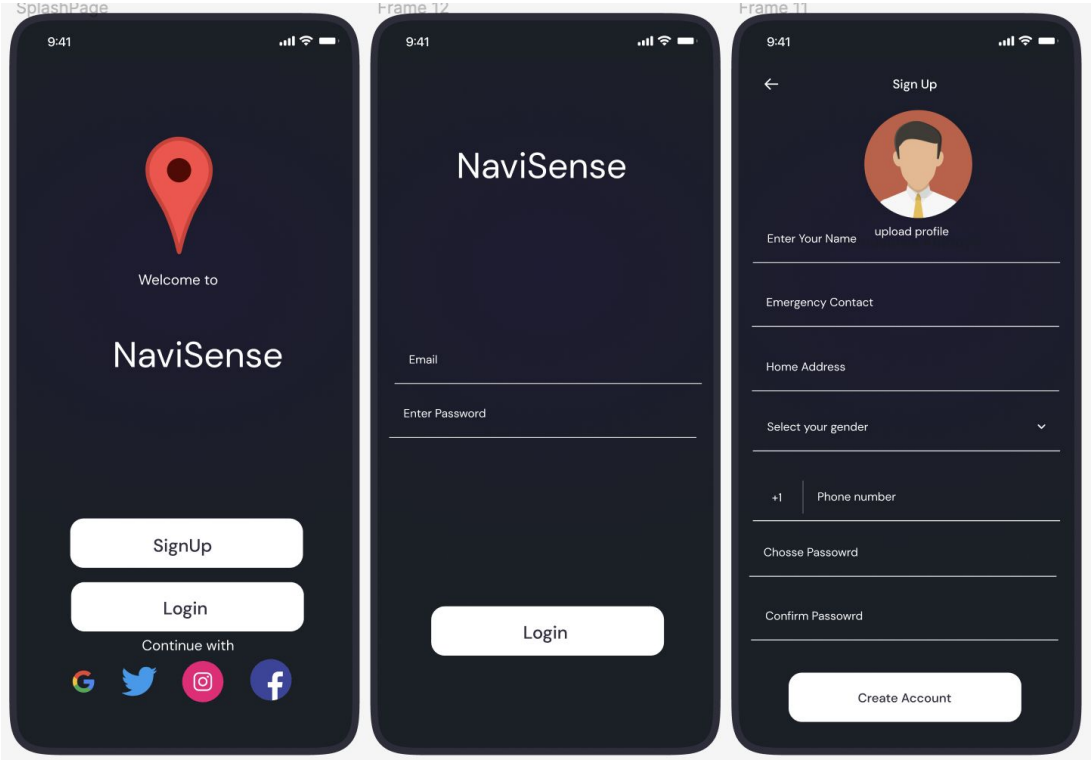
Issues with FRs

- **Navigation:**
  - Issue: The requirement lacks specificity on the types of indoor navigation instructions provided (e.g., turn-by-turn directions, landmark descriptions).

- **User Feedback:**
  - Issue: The requirement mentions user feedback but does not specify how it will be collected or utilized.

- **Emergency Assistance:**
  - Issue: Emergency assistance features are mentioned but not specified in terms of how users can request assistance or what actions the app will take in emergencies.

App Demo (1)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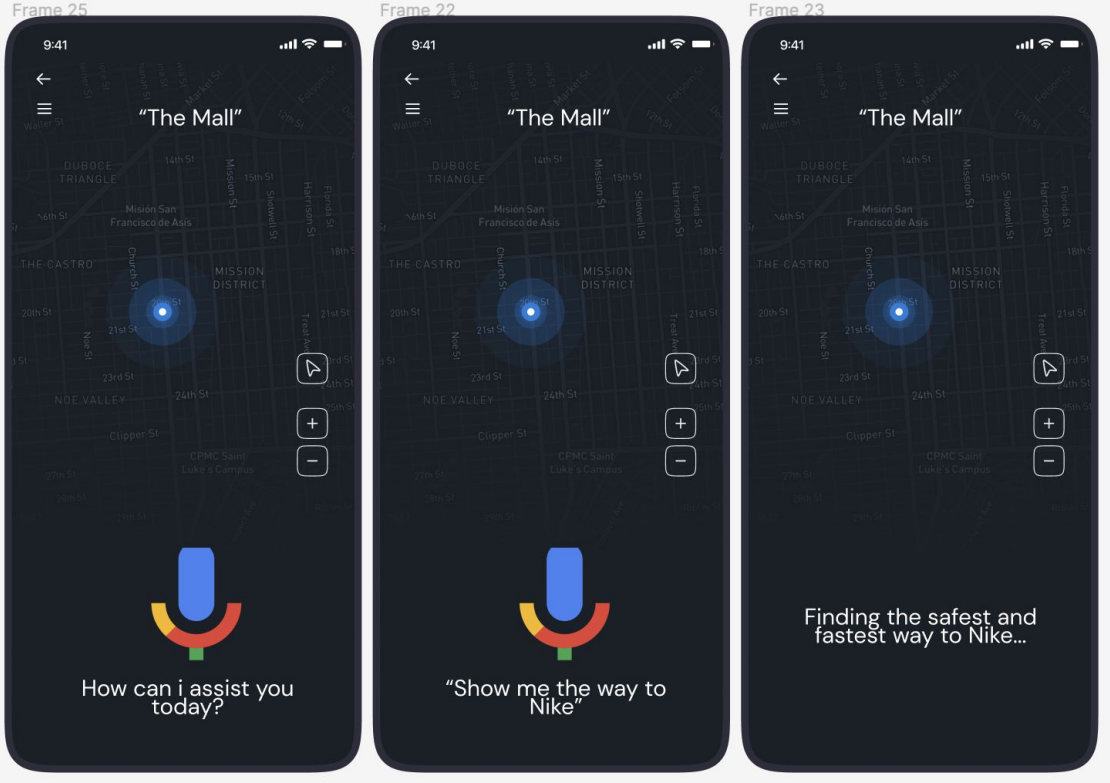
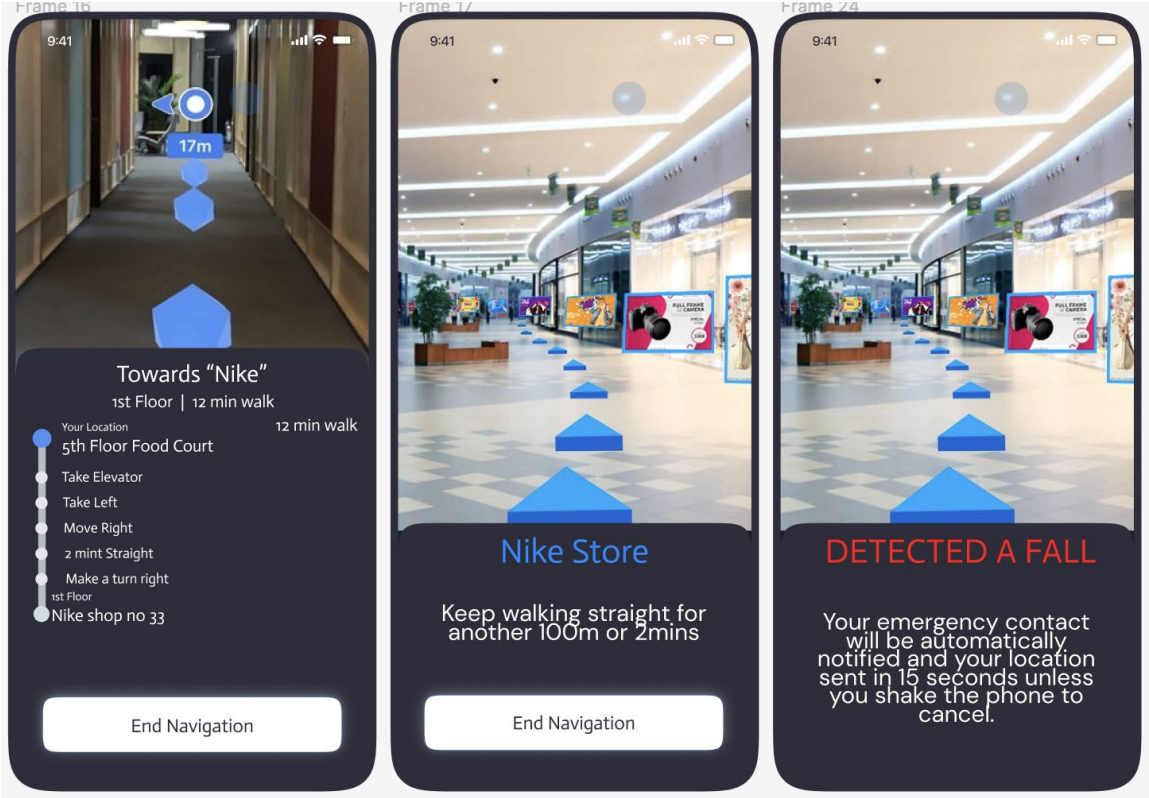
9:41
Welcome to
NaviSense
SignUp
Login
Continue with
Frame 12
9:41
NaviSense
Email
Enter Password
Login
Frame 11
9:41
Sign Up
upload profile
Enter Your Name
Emergency Contact
Home Address
Select your gender
+1
Phone number
Chosse Passowrd
Confirm Passowrd
Create Account

App Demo (2)


Frame 25
9:41
"The Mall"
How can i assist you today?
Frame 22
9:41
"The Mall"
"Show me the way to Nike"
Frame 23
9:41
"The Mall"
Finding the safest and fastest way to Nike...

App Demo (3)


Frame 16
9:41
17m
Towards "Nike"
1st Floor | 12 min walk
Your Location
12 min walk
5th Floor Food Court
Take Elevator
Take Left
Move Right
2 mint Straight
Make a turn right
1st Floor
Nike shop no 33
End Navigation
Frame 17
9:41
Nike Store
Keep walking straight for another 100m or 2mins
End Navigation
Frame 24
9:41
DETECTED A FALL
Your emergency contact will be automatically notified and your location sent in 15 seconds unless you shake the phone to cancel.

Requirements Creep

- **Wearable Device Compatibility:** Initially, the app might be designed solely for smartphones. Requirement creep could lead to requests for compatibility with various wearable devices, such as smartwatches or fitness bands, necessitating additional development and compatibility testing.

- **Advanced Obstacle Detection Features:** The initial requirement might focus on basic obstacle detection and avoidance. Creep could introduce advanced features, such as identifying specific types of obstacles (e.g., liquids on the floor, overhanging objects) using AI and machine learning, which require more sophisticated technology and data.

- **Integration with External Services:** Initially, the app might be designed to work independently for indoor navigation. However, requirement creep could introduce demands for integration with external services like public transportation schedules, ride-sharing apps, or even social media to share locations or meet with friends, significantly expanding the scope.

Why Choose Our App

- Our app aims to provide a seamless and intuitive user experience
- Audio feedback allows the user to input their desired destination and receive turn-by-turn directions
- Haptic feedback ensures that the user is aware of their surroundings and obstacles
- Advanced mapping and localization technologies provide the most accurate and up-to-date information
- Our app can easily detect the user's location down to a few centimeters, making it easy to navigate complex indoor environments
- Our app is designed with safety in mind alert the user when they are approaching potential hazards such as stairs and escalators
- Emergency assistance features such as a panic button immediately alert emergency services and provide the user's location
- A combination of user experience and safety features make it a comprehensive and reliable solution

Thank you for listening!