Vision and Scope Document

for

Theia

Version 1.0

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Revision History

Name	Date	Reason For Changes	Version
Nick Sturgeon	11/11/25	Starting to add content	V1
Nick Sturgeon	12/2/25	Fixing Small Changes	V1

1. Business Requirements

1.1. Background

Visually impaired individuals have had to face unique challenges in navigating the world that was originally designed for those sighted individuals. This is especially true for indoor navigation, where aids like Braille signage are often sparse. While employees of a specific venue may be available to guide an individual, this assistance is not always reliable or available, particularly when a person is alone. But this is not always available to an individual especially if they are alone and already inside a building trying to get from one location to another. There have been strides in technology to help such as smart canes and apps like GoodMap and BlindSquare that can also assist users to get from point A to B. We aim to focus on trying to implement a novel idea that emphasizes on users with no vision and features to assist users that are in need of help, this will be explained later in the paper.

1.2. Business Opportunity

For the business side of the project, we are focusing on a couple of problems to try and solve with our application. First we want to try and create software that will give venues, establishments the ability to give freedom to more clients, guests, employees and anyone with a visual disability. The software will be able to recognize which building it will be in using bluetooth/wifi beacons and loading pre-built maps of the facility. The benefit of this is that a user isn't reliant on a working camera for the software to aid them. Second we will have features to alert the user of known static obstacles such as stairs, walls, etc. For a venue like a shopping mall, a more confident user is one who spends more time in the facility, visits more stores, and is more likely to return, directly increasing revenue. Third, we have a safety feature built in that if a user falls and loses their phone the system will alert them of the location of their phone and if the user doesn't pick up or respond to the beacon, emergency contacts will be alerted and given the location of the incident. This is directly beneficial for the venue, as the fall-detection feature mitigates safety liability. It provides an immediate, logged response to accidents, which lowers insurance risk and strengthens the venue's reputation for guest safety.

While other applications like Good Maps exist, they often rely on visual aid or require the user to hold their phone. Our solution is more attractive because it provides hands-free guidance, which is essential for a user who may be using a cane or guide dog. Our beacon-based system is low cost for venues to install and doesn't require users to have reliable cameras for their phones. By alerting users we lower the chances of accidents and lower a source of liability for a venue. The fall detection would also lower the risk of venues being sued or having insurance problems.

1.3. Business Objectives

The market for accessible indoor navigation is both significant and underserved. According to the CDC (May 2024), approximately 7 million people in the U.S. are visually impaired, and this number is expected to grow. This represents a substantial customer base with significant spending power; the National Library of Medicine notes the average person with visual challenges earns $35k-$50k annually. Our application provides the comfort and safety that encourages this demographic—along with their friends and family—to spend more time and money at partner venues.

Furthermore, the solution provides direct cost savings by mitigating "slip-and-fall" accidents, a primary driver of liability claims. The average general liability claim can cost a business over $20,000. By preventing just two such incidents per year, our system can pay for itself.

1.4. Success Metrics

Complete success for this prototype will be the following,

- User being able to navigate from point A to point B
    - 95% of users can successfully navigate from A to B on first attempt.
    - The app makes the user route 10% faster on average than an unassisted navigation.
- Being able to give commands via voice activation.
    - Voice command correctly interprets the user 98% of the time in a quiet environment.
- Having the phone activate the fall protocol upon the user dropping their phone.
    - Having the protocol activated 100% of the time in a drop test.
- The phone is able to recognize and alert users of static objects in their way.
    - The system is able to alert users an average of 5 feet before an obstacle.

These will be the factors we will directly be in control of for the prototype as for the documentation.

Internal Factors

- Quality of map: If map is wrong app fails.
- Fall Detection: Having algorithms be able to have zero false positive detection.
- UI: Interface needs to be intuitive and easy to pick up.

External Factors

- Beacon/Wifi Reliability: If the venue's hardware is low quality or faulty this can cause problems for software accuracy.
- User Trust: Will User be willing to trust the software to guide them.
- Professor: Specific rubric the professor will be going off of and how they may interpret our work this is one of external factors out of our control.

1.5. Vision Statement

Our vision is a world where digital accessibility is a standard, seamlessly connecting venues and guests to ensure everyone, regardless of ability, can explore public life with autonomy and the assurance of safety.

1.6. Business Risks

We do face multiple types of risks if we are to make this product available to the public. The major one is similar products that are already out in the market. Companies like GoodMaps and WayMap which have been around for much longer and because of this have had time to build their reputation and gain the people’s trust because of this. People are curious for something better or new to help, but we would struggle to make a name for ourselves being such a small team. The severity of this is medium to high due to niche market and market entry-barriers are a problem. Possible solutions are to start small and develop in locations where the software is not available yet, low income communities and the like.

Implementation could be a possible problem for us to make the application reliable or getting the accuracy of a user location while inside. If this is a problem and venues where to implement our software and users have a bad experience they could lose out on immediate customers and possibly receive bad reviews deterring new customers from going to their establishment. Severity High, it would be better to have no product at all then one that constantly causes problems. A solution is to start beta testing in our local universities. This will allow us to work out the bugs in our area and have live users giving us feedback on the product.

1.7. Business Assumptions and Dependencies

Assumptions

- Venue Technology: We assume that target venues such as malls, airports, and universities already have a modern infrastructure of Bluetooth/Wi-Fi beacons or are willing to install them as part of a modernization effort.
- Venue Partnership: We assume that venues will be willing to grant our application the necessary access to their beacon/Wi-Fi network. We also assume they will either provide existing digital maps or will pay a one time cost in time and/or money for our team to map their facility.
- User Technology: We assume that our target user base has a high use of modern smartphones capable of running our application and is comfortable using app-based assisted technology.
- Market Adoption: We assume that our key difference, specifically hands free operation and integrated fall detection are compelling enough to build user trust and attract users from established competitors.
- Technical Feasibility: We assume that the smartphone's native operating system will provide the necessary API access to accelerometers for reliable fall detection and voice recognition for high-accuracy commands.

Dependencies

- Critical Dependency: The entire business model is critically dependent on establishing B2B (Business-to-Business) partnerships with venues. Without access to their buildings and systems, the application cannot function.
- Technology Dependency: The application's core functionality navigation accuracy is directly dependent on the quality, density, and reliability of the venue's beacon and Wi-Fi hardware. This is a major external factor, as noted in our success metrics.
- Technology Dependency: Key features are dependent on third-party APIs, including:
    - Native OS Services: For accessing the phone's sensors like accelerometer or gyroscope for fall detection and the messaging services such as SMS, push notifications for emergency alerts.
    - Voice Recognition Engines: Reliance on the platform's native speech-to-text engines examples such as Apple's SiriKit, Google's Speech-to-Text to meet our 98% accuracy objective.

2. Scope and Limitations

<The project scope defines the concept and range of the proposed solution. It's also important to define what will not be included in the product. Clarifying the scope and limitations helps to establish realistic expectations of the many stakeholders. It also provides a reference frame against which proposed features and requirements changes can be evaluated. Proposed requirements that are out of scope for the envisioned product must be rejected, unless they are so beneficial that the scope should be enlarged to accommodate them (with accompanying changes in budget, schedule, and/or resources).>

2.1. Major Features

<Include a numbered list of the major features of the new product, emphasizing those features that distinguish it from previous or competing products. Specific user requirements and functional requirements may be traced back to these features.>

2.1.1 **Hands-Free, Voice-Activated Interface:** Unlike competitors that require touch input, the primary interface is designed to be 100% hands-free. Users can control navigation entirely through voice commands, allowing them to keep their hands available for a cane or guide dog.

2.1.2 **Hybrid Indoor Navigation:** Provides turn-by-turn guidance using a robust combination of pre-loaded building maps, the phone's internal sensors (IMU), and Bluetooth/Wi-Fi beacon triangulation to ensure accuracy where GPS fails.

2.1.3 **Proactive Obstacle Alerts:** The system identifies and audibly warns users of pre-mapped static hazards (such as stairs, pillars, or glass walls) *before* they encounter them.

2.1.4 **Automated Fall Detection & Safety Protocol:** A distinguishing safety feature that utilizes the phone's accelerometer to detect a fall/drop event. If the user does not respond to a prompt, the system automatically alerts emergency contacts with the user's precise indoor location.

2.1.5 **Emergency Quick-Action:** A secondary, user-triggered emergency feature allows the user to instantly broadcast their location to security or contacts via a voice command or gesture.

2.1.6 **Cross-Platform Accessibility:** Native support for both iOS and Android devices, fully integrating with existing accessibility frameworks (Apple VoiceOver and Google TalkBack).

2.2. Scope of Initial Release

2.2.1 **Hands-Free, Voice-Activated Interface:** Unlike competitors that require touch input, the primary interface is designed to be 100% hands-free. Users can control navigation entirely through voice commands, allowing them to keep their hands available for a cane or guide dog.

2.2.2 **Automated Fall Detection & Safety Protocol:** A distinguishing safety feature that utilizes the phone's accelerometer to detect a fall/drop event. If the user does not respond to a prompt, the system automatically alerts emergency contacts with the user's precise indoor location.

2.3. Scope of Subsequent Releases

2.3.1 **Proactive Obstacle Alerts:** The system identifies and audibly warns users of pre-mapped static hazards (such as stairs, pillars, or glass walls) *before* they encounter them.
2.3.2 **Emergency Quick-Action:** A secondary, user-triggered emergency feature allows the user to instantly broadcast their location to security or contacts via a voice command or gesture.
2.3.3 **Cross-Platform Accessibility:** Native support for both iOS and Android devices, fully integrating with existing accessibility frameworks (Apple VoiceOver and Google TalkBack).
2.3.4 **Hybrid Indoor Navigation:** Provides turn-by-turn guidance using a robust combination of pre-loaded building maps, the phone's internal sensors (IMU), and Bluetooth/Wi-Fi beacon triangulation to ensure accuracy where GPS fails.

2.4. Limitations and Exclusions

1. Outdoor navigation across streets, traffic, or open areas
2. Detection of dynamic obstacles (moving people, vehicles)
3. Within-room navigation (finding specific furniture or objects)
4. Support for users with multiple severe disabilities beyond visual impairment

3. Business Context

3.1. Stakeholder Profiles

<Stakeholders are individuals, groups, or organizations that are actively involved in a project, are affected by its outcome, or can influence its outcome. The stakeholder profiles identify the customers for this product and other stakeholders, and states their major interests in the product. Characterize business-level customers, target market segments, and different user classes, to reduce the likelihood of unexpected requirements surfacing later that cannot be accommodated because of schedule or scope constraints. For each stakeholder category, the profile includes the major value or benefits they will receive from the product, their likely attitudes toward the product, major features and characteristics of interest, and any known constraints that must be accommodated. Examples of stakeholder value include:

- *improved productivity*
- *reduced rework*
- *cost savings*
- *streamlined business processes*
- *automation of previously manual tasks*
- *ability to perform entirely new tasks or functions*
- *conformance to current standards or regulations*
- *improved usability or reduced frustration level compared to current applications*

Example:>

Stakeholder	Major Value	Attitudes	Major Interests	Constraints
Users	*Gain independence in large venues*	*Feeling more confidence.*	*To be able to explore venues without needing assistance from others.*	*Only works inside buildings*
Developers	*Produce a quality product to be proud of.*	*Ownership over work and sense of accomplishment.*	*Getting a passing grade.*	*Follow project schedule and constraints by professor.*
Venues	*Increased revenue*	*Eager to adopt new technology to gain a competitive edge.*	*Low maintenance and Reliable performance*	*Must have hardware to implement in buildings.*
Professor	*Evaluate our understanding of course material.*	*Curious about the practical application and learning outcome.*	*Clear evidence that the project was fulfilled and within scope of assignment.*	*Must adhere to the requirement of rubric.*

3.2. Project Priorities

<Describe the priorities among the project's requirements, schedule, and budget. The table below may be helpful in identifying the parameters around the project's key drivers (top priority objectives), constraints to work within, and dimensions that can be balanced against each other to achieve the drivers within the known constraints. For more information, see chapter 2 of Creating a Software Engineering Culture *by Karl E. Wiegers (Dorset House, 1996). Examples:>*

Dimension	Driver (state objective)	Constraint (state limits)	Degree of Freedom (state allowable range)
Schedule	*release Prototype by 12/2/25*		
Features			*50% of high priority features must be included in Prototype release*
Quality	*This is an application offering safety to visually impaired users.*		
Staff		*Team only*	
Cost			*No expenses accrued.*

3.3. Deployment Considerations

To ensure the effective deployment of the Theia indoor navigation system into its operating environment, several physical infrastructure and software activities must be coordinated between the development team and the partner venues.

Infrastructure and Operating Environment Effective deployment is heavily dependent on the physical readiness of the partner venue. Because Theia utilizes a hybrid navigation method, the operating environment must be prepared prior to software release.

- **Beacon Installation and Calibration:** Venues without existing infrastructure will need to install Bluetooth Low Energy (BLE) beacons or upgrade Wi-Fi access points to support positioning. These hardware components require on-site calibration to ensure the "dead reckoning" algorithms function correctly with location anchors.
- **Map Digitization:** Deployment requires the acquisition and processing of facility floor plans (CAD/DWG files). These maps must be converted into the Theia-compatible virtual indoor map format and uploaded to the local database before users can navigate.

User Access and Availability

- **User Distribution:** The end-users (visually impaired individuals) and caretakers are geographically distributed and will access the system at various partner locations such as universities, airports, and shopping malls.
- **Time of Access:** Users require access to the system 24/7, or effectively whenever the partner venue is open to the public. As the primary objective is independent navigation, the system must remain operational without reliance on venue staff availability.
- **Platform Requirements:** Users will access the solution via personal mobile devices. Deployment is targeted for **iOS (version 13+)** and **Android (version 9+)** to ensure compatibility with accessibility APIs like VoiceOver and TalkBack.

Infrastructure Changes and Data Needs

- **Data Storage:** To ensure reliability even in areas with poor cellular service, the system utilizes a **local database** on the user's device to store floor plans, destination history, and user favorites.
- **Network Capacity:** While navigation occurs locally, venues may need to ensure their public Wi-Fi or cellular networks have sufficient capacity to allow users to download initial map packs upon entering the facility.
- **Maintenance Access:** Building administrators require a mechanism to update building layouts (e.g., during renovations), necessitating a business process for submitting updated floor plans to maintain navigation accuracy.

Training and Documentation

- **End-User Training:** A User Manual has been developed to facilitate self-guided training for visually impaired users, covering voice command inputs and haptic feedback interpretation.
- **Caretaker Support:** Documentation must be provided for caretakers, who may assist with the initial configuration of the application settings (audio, haptics, and preferences) on the user's device.