

THEIA

Indoor Navigation System

Final Presentation and Prototype Demonstration

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GitHub:

<https://github.com/hyeonjijulialee/CPTS-484-THEIA>

Prototype:

<https://theia-1051950042990.us-west1.run.app/>



Meet the Team



Julia Lee

1. Phase Plan 2.0
2. Process Specification (RE) 1.0
3. Vision & Scope Section 2
4. WRS 2.0 Section 1-4
5. Develop prototype
6. Meeting Notes
7. GitHub with documentation
8. Slides for presentation



Shaya Arya

1. Vision & Scope Section 3
2. WRS 2.0 Section 5-9
3. Finalize WRS
4. Review Phase Plan



Andrew Neal

1. Phase Plan 2.1
2. Finalize Phase Plan
3. Vision & Scope Section 1
4. Review WRS



Overview and Requirements

Scenario 1: Navigation from Entrance to Classroom

Core Elements

Actors: Primary user

Preconditions: User on Home screen

Trigger: User taps Navigation button

Initial State: Destination selection screen

Key Technologies

- Real-time camera integration with 2.5-second frame analysis
- Dynamic TTS with queued, non-interrupting step instructions
- Progress tracking with distance updates every second
- Obstacle detection with visual overlay and haptic feedback



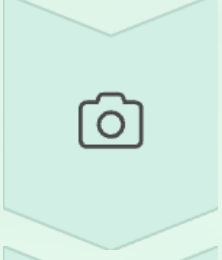
Home Screen

User launches navigation feature



Destination Selection

TTS: "Select your destination"



Navigation Active

Camera activates, real-time guidance begins



Obstacle Detection

Visual overlay, vibration, and audio alert



Arrival

Destination reached, state changes to ARRIVED



Navigation



Live Camera



Emergency



Search...

**Dana 213 – Society of Women Engineers**

Club • 3rd Floor

**Professor Zeng Office**

Office • 3rd Floor

**EME 120**

Classroom • 1st Floor

**Main Elevator in EECS**

Elevator • All Floor

**CUB**

Common Area • 1st Floor

**Holland and Terral Library**

Common Area • 1st Floor

**OBSTACLE DETECTED**

Pause

Scenario 1: Alternate Paths and Demo Validation

Alternate Scenarios

Camera Permission Denied

System Response: TTS announces "Camera unavailable. Using audio guidance"

Behavior: Navigation continues in audio-only mode with enhanced verbal directions and distance cues

Recovery: User can grant permissions mid-session to enable visual features

Pause and Resume Support

Function: User can pause navigation at any point during guidance

State Preservation: Progress, destination, and route data remain intact

Resume Behavior: TTS confirms "Resuming navigation" with current position update

01. Home to Destination Transition

Verify TTS fires correctly on screen load

02. Destination Selection

Confirm selection triggers navigation initialization

03. Navigation Entry with Camera

Validate camera activation and corresponding TTS announcement

04. Obstacle Alert System

Test visual overlay appearance, vibration intensity, and TTS warning

05. Arrival Notification

Verify arrival TTS announcement and vibration pattern

06. Session Termination

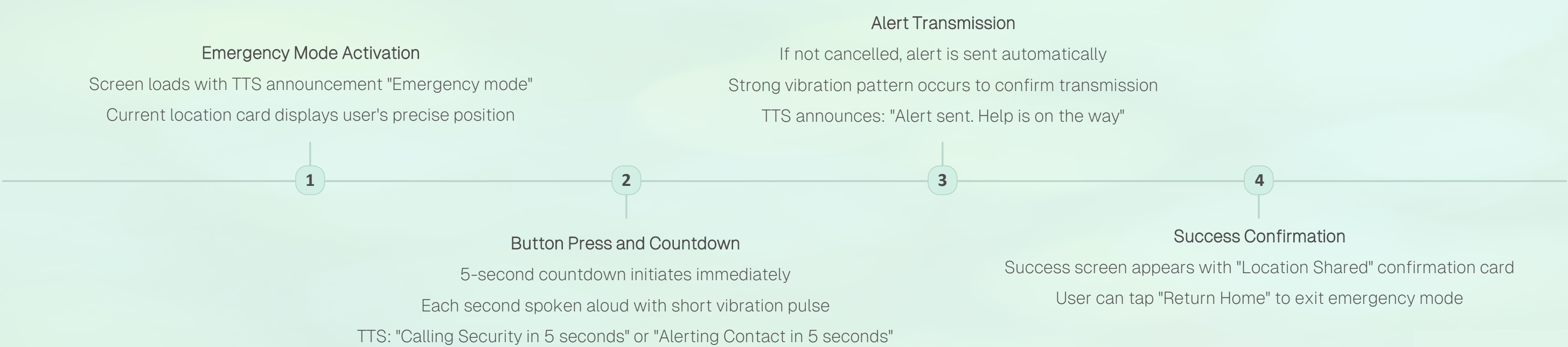
Confirm End button returns user to Home screen cleanly

Scenario 2: Emergency Assistance Request

Scenario Parameters

- Actors: Primary user
- Preconditions: Emergency accessible from Home
- Trigger: User taps "Call Security" or "Alert Contact"
- Initial State: 5-second countdown with cancellation option

Main Success Path: Step-by-Step Flow





Emergency



CURRENT LOCATION

WSU Hall

Floor 4, near Room 427



Call Security



Alert Contact



SENDING ALERT...



CANCEL

Scenario 2: Alternate Flows and Demo Validation

Alternate Scenario: Cancellation

User Cancels During Countdown

- Action:** User presses CANCEL button at any point during 5-second countdown
- System Response:** Countdown stops immediately without delay
- Audio Feedback:** TTS announces "Emergency alert cancelled" for confirmation
- State Reset:** System returns to initial Emergency screen state, ready for new interaction
- No Alert Sent:** Emergency services and contacts are not notified

Exit Criteria

- Emergency flow concludes through one of two paths:
- Successful Alert:** Alert transmission completes and user voluntarily exits via "Return Home"
 - Cancellation:** User cancels countdown, returning to initial Emergency state without alert transmission

- 1 Emergency Mode Entry**
Verify TTS "Emergency mode" announcement fires correctly on screen load
- 2 Button Interaction**
Test both "Call Security" and "Alert Contact" button responses
- 3 Countdown Sequence**
Confirm all five countdown numbers are spoken clearly and sequentially
- 4 Vibration Feedback**
Validate vibration pulses occur each second during countdown and on alert transmission
- 5 Cancellation Handling**
Test CANCEL button functionality at various countdown stages
- 6 Success Screen Display**
Verify success screen appears correctly after alert transmission with location confirmation

Scenario 3: Accessibility Settings and Emergency Contact

Scenario Overview

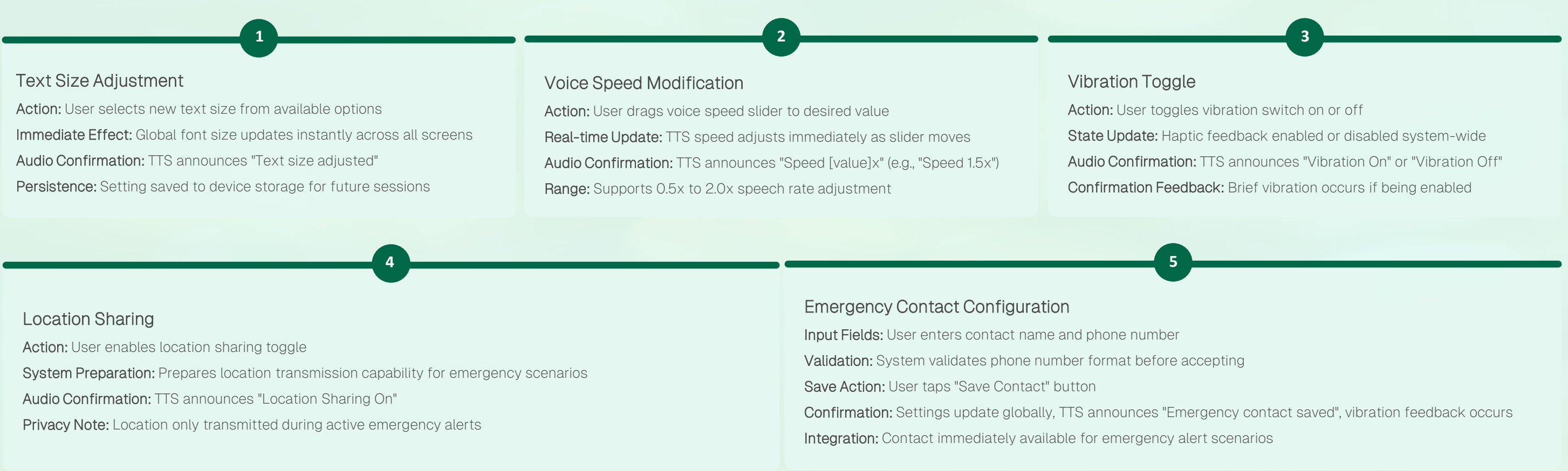
Actors: Primary user

Preconditions: User can access Settings from navigation bar

Trigger: User adjusts any setting in Settings screen

Initial State: All settings apply globally and immediately across the application

Main Success Path: Setting Adjustments





Settings

T TEXT SIZE

A

A

A

A

🔊 VOICE SPEED

Slow

Fast

1x



Vibration

Haptic feedback



Location Sharing

Send location in emergency



EMERGENCY CONTACT

NAME

Dad

PHONE NUMBER



Settings

Slow

Fast

1x



Vibration

Haptic feedback



Location Sharing

Send location in emergency



EMERGENCY CONTACT

NAME

Dad

PHONE NUMBER

102-540-2931



Save Contact

Reference Notes and System Architecture

Universal Interaction Standards

Button Accessibility

All buttons read their label text on focus for screen reader compatibility and vibrate on click for haptic confirmation

Live View Functionality

Allows users to capture current scene using "Scan Scene" feature; TTS reads generated scene description aloud for environmental awareness

Navigation Bar Controls

Manages top-level titles and handles smooth transitions between Home and Settings screens throughout the application

Phase Comparison: WRS Evolution

Feature Area	Phase Plan 1.0	WRS 2.0 and Phase Plan 2.1
Interaction Mode	Voice only	Multimodal with touch buttons, vibration patterns, visual banners
Navigation System	Indoor guidance concept	FR1 and FR5 with real-time progress updates and ETA calculations
Obstacle Warning	Mentioned need only	FR2 and FS2 with static and dynamic obstacle type detection
Emergency Help	Mention only	FR3 detailed with 5-second countdown and location sharing capability
Environmental Description	Not present	FR4 and FS4 Live View added with scene scanning and TTS narration
Route Optimization	Intended goal	Not implemented in current demo (deferred to future phase)
Privacy and Consent	Simple description	Layered consent system, location sharing controls, local storage priority
Connectivity	Offline implied	Intermittent connectivity allowed with graceful degradation
Fall Detection	Implicit expectation	Deferred as future enhancement candidate
User Manual	Not present	Comprehensive manual covering all major functions and accessibilit

Scope Creep Calculation

Initial 7 baseline features

1. Indoor navigation
2. Obstacle warning
3. Voice only interaction
4. Emergency help
5. Optimal route selection
6. Accessibility settings
7. Extensibility support

Additions

- A. Live View environmental description (FR4 and FS4)
- B. Layered privacy and location sharing (NFR1, OFR1, OFR2)
- C. Multimodal interaction including buttons, vibration, visual feedback

Reductions

- D. Fall detection deferred
- E. Optimal route selection not implemented

Formula

Scope creep percent = $(\text{Added } 3 - \text{Reduced } 2) / 7 * 100$

Result: 14.3 %

- Net system scope increased by 14.3 percent
- Three new features added, two deferred
- WRS 2.0 adopts multimodal interaction and layered privacy which expands system scope
- If voice only is treated as a principle instead of a feature, the increase could be interpreted as zero percent
- However, functional expansion interpretation is more consistent