

Theia Process Specification

prepared by

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1. Introduction

This document summarizes the requirements engineering process that Team 7 utilized through the requirements gathering and development process for the Theia application. The purpose of the document is to showcase the evolution of Team 7's process of gathering and refining requirements, serving as a reflection of how the team initially approached the project, what the team learned from feedback given on the initial requirements, and the process of refining requirements by the end of Phase II.

Section 2 summarizes and provides a simple model of the RE process utilized through Phase I. Section 3 explains the feedback given and the expectations provided for Phase II, with a discussion of how the changing project specification evolved the state of the project's requirements. Section 4 combines the processes from sections 2 & 3, providing a final IDEF0 diagram of how Phase I's process influenced the process in Phase II.

2. Phase I Requirements Engineering Process

2.1 Initial Approach & Methodology

Team 7's initial approach to Requirements Engineering (RE) for the Theia application was primarily deductive and scenario-driven, based on a foundational problem statement: enhancing indoor navigation and safety for visually impaired individuals. Without direct access to end-users at this stage, the team relied on shared domain knowledge, academic research into assistive technologies, and competitive analysis of existing solutions (e.g., white canes, guide dogs, basic GPS apps) to infer user needs.

The core methodology involved creating narrative "AS-IS" and "TO-BE" scenarios to humanize the problem and visualize the solution. We focused on a primary persona, "Stevie," to represent our target user. The three initial scenarios addressed common, high-impact pain points:

- Imprecise Navigation: Difficulty knowing exactly when to turn indoors.
- Unseen Obstacles: Collision with objects missed by a traditional cane.
- Emergency Stress: Difficulty accessing help when disoriented.

From these scenarios, we derived an initial set of functional requirements: turn-by-turn audio-haptic guidance, real-time obstacle detection using the phone's camera, and a one-tap emergency call feature. The process was linear, moving from problem identification directly to solution ideation with the goal of demonstrating clear technological value and innovation.

2.2 Process Model (IDEF0 Diagram A0)

The Phase I process can be modeled by the following IDEF0 diagram:

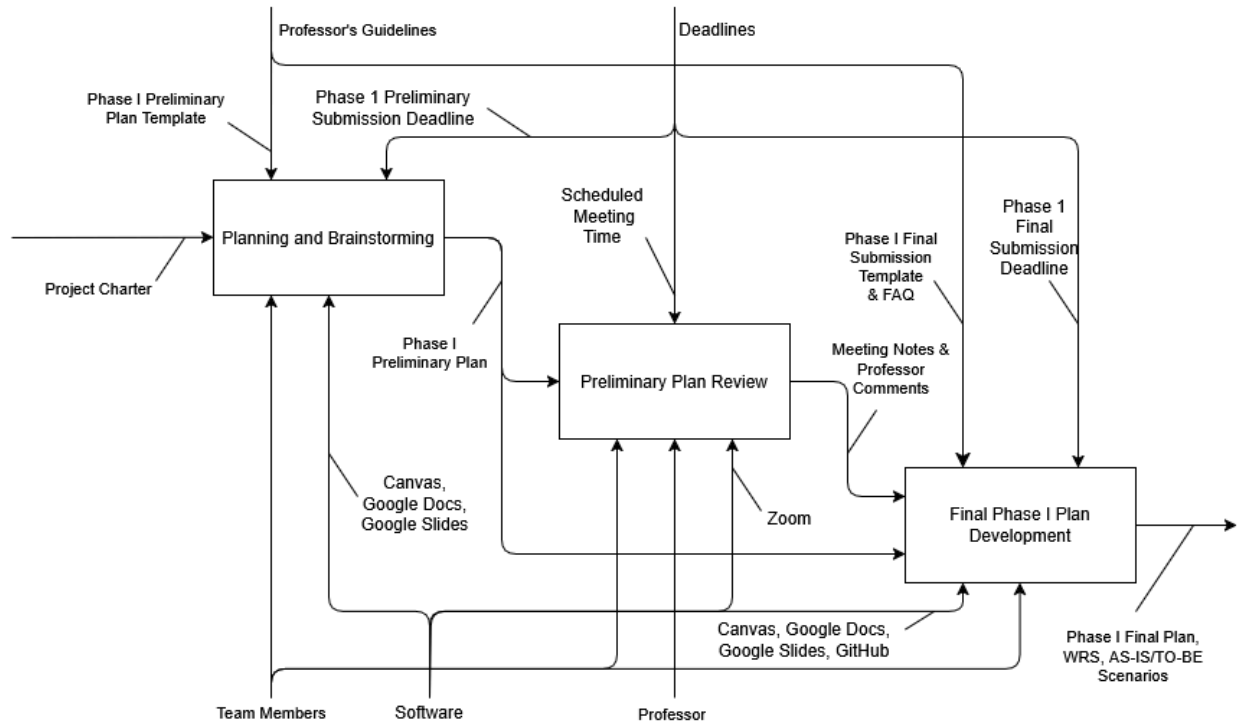


Figure 1 - Phase I Requirements Engineering Process in an IDEF0 Diagram

2.3 Strengths and Gaps Identified

The Phase I process was effective in rapidly generating a coherent, user-centered vision and aligning the team on a shared goal. The scenario format successfully communicated the application's intended value in an accessible, story-driven manner.

However, significant gaps were later identified through feedback:

- **Narrow User Perspective:** The process centered solely on the end-user, overlooking other stakeholders like caregivers or building administrators who interact with the system.
- **Incomplete Scenario Analysis:** Scenarios ended at success cases. We failed to ask "what-if" questions to explore edge cases and failure modes (e.g., dropped phone, poor connectivity, false positives in detection).
- **Lack of Prioritization & Feasibility Analysis:** Features were presented as a list without a clear rationale for priority or consideration of technical and implementation constraints.
- **Abstracted System Context:** The comparison of Theia to canes and dogs was conceptual but not systematically analyzed to justify why a phone-based app was the optimal solution for the outlined problems.

3. Phase II Requirements Engineering Process

3.1 Incorporation of Feedback

The feedback on our Phase I deliverables served as the primary catalyst for evolving our RE process. Key critiques included:

- **Expand Stakeholder Consideration:** Specifically, incorporate a caretaker role who could configure settings for the user.
- **Deepen Scenario Robustness:** Scenarios needed to account for things going wrong. For the emergency feature, a pointed question was asked: "What happens if the user drops their phone?"
- **Explicitly Prioritize:** We were asked to justify which scenario/feature was the top priority and why.
- **Strengthen Solution Justification:** The analysis comparing Theia to existing tools needed to be more concrete and attribute-based.

This feedback fundamentally shifted our controls from general guidelines to specific, critical questions our design had to answer.

3.2 Evolution of Requirements

Guided by the feedback, our requirements expanded and became more precise:

- **New Actor & Requirement:** We introduced a "Caretaker" actor, leading to new functional requirements for a secondary interface or profile management system allowing personalized adjustment of user settings (e.g., haptic intensity, navigation preferences).
- **Enhanced Emergency Protocol:** The emergency call requirement evolved into a more fault-tolerant system. We added requirements for accelerometer-based fall detection, a countdown timer with cancel function to prevent false triggers, and a fallback SMS protocol for low-connectivity situations.

Clear Prioritization: Through team discussion, Emergency Assist (Scenario #3) was formally prioritized as the "Top Priority TO-BE Scenario." The rationale was its direct alignment with the core project values of safety and independence in critical, high-stress situations.

Structured Analysis: We replaced conceptual comparisons with a structured attribute matrix, directly comparing Cane, Dog, and Theia across senses (See, Hear, Feel) and capabilities (Think, Talk, Smell) to visually argue for Theia's complementary advantages.

3.3 Refined Process and Activities

Phase II involved a more analytical and iterative RE loop. Key activities included:

- **Scenario Expansion & "5W1H" Analysis:** For the top-priority scenario, we dissected it using Who, What, When, Where, Why, and How questions to uncover hidden requirements and constraints.
- **"What-If" Failure Mode Analysis:** We systematically asked "what if" for each feature (e.g., "What if the camera is obscured?", "What if the user is in a loud area?"), leading to robustness requirements.

- **Structured Decision-Making:** Using the attribute comparison matrix, we made explicit, justified trade-offs, acknowledging Theia's disadvantages (e.g., tech-dependence, no companionship) while arguing for its unique strengths (e.g., precision, proactive safety, cost).

3.4 Process Model (IDEF0 Diagram A0)

The Phase II process was a direct evolution of Phase I, and as such, the output of the Phase I process branches directly into the Phase II process. Phase II's RE process is modeled as follows:

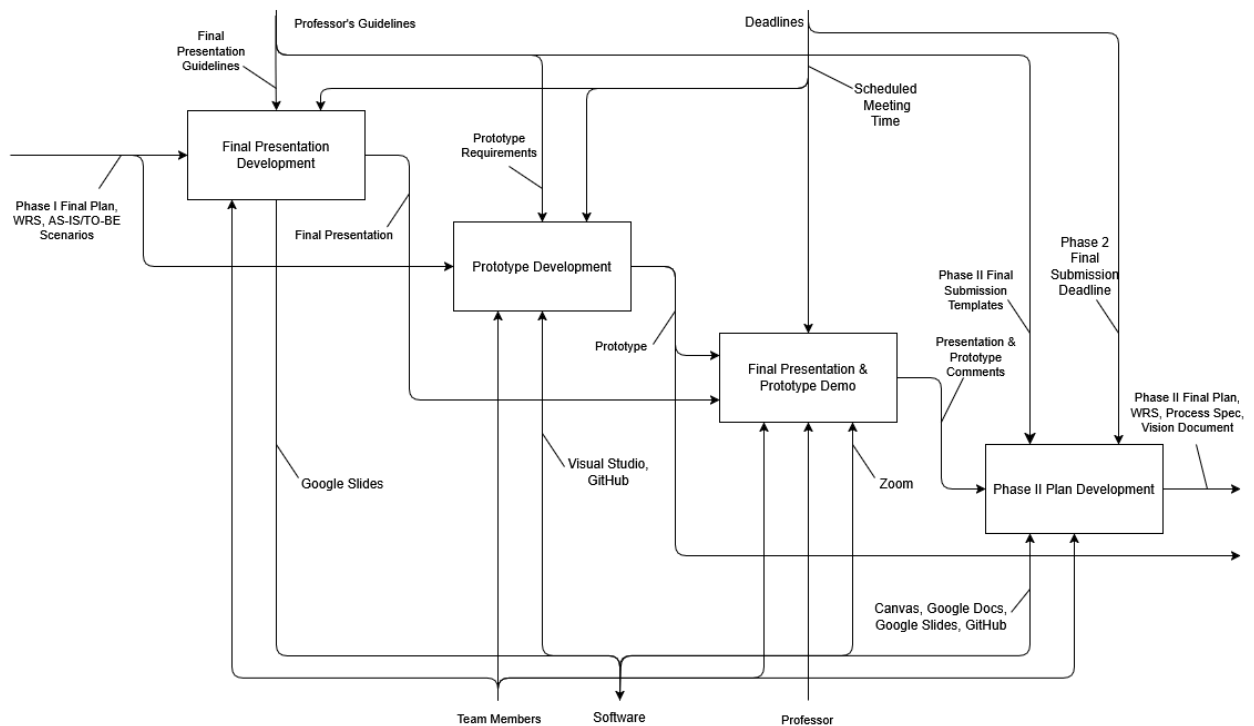


Figure 2 - Phase II Requirements Engineering Process in an IDEF0 Diagram