

Deliverable #1 Template : Software Requirement Specification (SRS)

SE 3A04: Software Design II – Large System Design

February 7, 2025

Tutorial Number: T01

Group Number: G3 Gx

Group Members:

- Group Member Name (as listed in Avenue)
- You do not need to use student #s or macid (keep those private).

IMPORTANT NOTES

- Be sure to include all sections of the template in your document regardless whether you have something to write for each or not
 - If you do not have anything to write in a section, indicate this by the *N/A*, *void*, *none*, etc.
- Uniquely number each of your requirements for easy identification and cross-referencing
- Highlight terms that are defined in Section 1.3 (**Definitions, Acronyms, and Abbreviations**) with **bold**, *italic* or underline
- For Deliverable 1, please highlight, in some fashion, all (you may have more than one) creative and innovative features. Your creative and innovative features will generally be described in Section 2.2 (**Product Functions**), but it will depend on the type of creative or innovative features you are including.

1 Introduction

This SRS will describe the software requirements for GeoLens, a community-driven application for identifying locations based on images, descriptions and discussions. This document outlines the system's overall purpose, the context for building the application, functional and non-functional requirements and user interaction.

1.1 Purpose

This document serves as a guideline for developers, designers, QA engineers, project managers and other stakeholders, ensuring a clear understanding of the system, including its objectives, users, expected behavior, and technical constraints. As the project progresses and changes, the document will provide a baseline from which these changes can be compared. This SRS may also aid in risk identification early in the project lifecycle by outlining dependencies and constraints, allowing managers to prevent risks.

1.2 Scope

GeoLens is a community and AI driven application designed to identify locations from images. It consists of several individual software products described below.

The **Forum** UI is the primary interface where users interact with GeoLens. It allows users to upload images of locations for identification, view responses, and engage with the community. If the forum UI can provide ease of use and an interactive experience it will encourage community engagement and bring traffic to the application. The interface facilitates discussions, displays aggregated predictions, and contains gamification elements such as leaderboards. The forum UI should be accessible to all users, intuitive to use and respond to user requests within 100 ms. It does not perform image analysis or identification itself but serves as the user's gateway to the platform.

The **Orchestrator** is responsible for handling submitted images, delegating tasks to experts, and returning the final result to users. The Orchestrator should coordinate system components concurrently, managing task distribution, monitoring progress, and aggregating responses to ensure quick and accurate results. It handles task prioritization, load balancing, and error recovery while maintaining seamless interactions between users and experts. The back end does not analyze images directly but functions as the between layer that processes requests and returns items to the forum.

The **Host DBMS** stores user account information, historical user interactions, reputation scores, previously identified locations and leaderboards. It ensures that the system retains valuable data, in a structured way that is efficiently accessible by other system components. The database should be highly secure, as it contains sensitive user information. The database does not process images or make identifications but acts as the central location for all platform data.

The three **Experts** are as follows:

1. GeoKnowr AI

- Pre-trained image processing model
- Predicts coordinates where an image was taken

2. Landmark Recognition

- Google images API
- Search by image to locate a popular landmark

3. Region Specific AI

- Uses a specialized AI model trained for a specific region

- Enhances accuracy for areas with distinct visual features

The primary goal of these experts is to work cohesively to provide an accurate prediction with little delay. GeoKnowr AI aims to deliver an initial estimate of where an image was taken by assigning coordinates. Then the region specific AI can further refine this prediction by applying localized knowledge. If a landmark is present in the image, the Landmark Recognition software should pin point it's location.

1.3 Definitions, Acronyms, and Abbreviations

- **GeoLens:** the system being specified
- **AI:** Artificial Intelligence

1.4 References

- Provide a complete list of all documents referenced elsewhere in the SRS.
- Identify each document by title, report number (if applicable), date, and publishing organization.
- Specify the sources from which the references can be obtained.
- Order this list in some sensible manner (alphabetical by author, or something else that makes more sense).

References

- [1] Non-functional requirements - the University of Texas at ..., <https://personal.utdallas.edu/~chung/SYSM6309/NFR-18-4-on-1.pdf> (accessed Feb. 7, 2025).
- [2] AltexSoft,"Nonfunctional requirements:Examples, types and approaches," AltexSoft,<https://www.altexsoft.com/blog/non-functional-requirements/> (accessed Feb. 7, 2025).
- [3] "Android mobile App Developer tools," Android Developers, <https://developer.android.com/> (accessed Feb. 7, 2025).
- [4] insert ref here
- [5] insert ref here

1.5 Overview

Section 2 aims to put the value of GeoLens into perspective, relating and contrasting it to other similar products that currently exist. It should also provide a summary of the primary functions of the application and a description of the expected users. This should provide readers with a general understanding of the system, and how users are expected to interact with it. Finally, constraints and assumptions are listed to clarify the scope of the application and the context in which it operated.

Section 3 presents a use case diagram outlining the main functionality and interactions with stakeholders.

Section 4 is a detailed overview of the functional requirements, discussing what the system will do. These requirements will be organized in terms of business events, viewpoints and scenarios. This provides a structured understanding of the system in various contexts.

Finally, section 5 describes the Non-Functional Requirements, focusing on how the system aims to be a valuable service. This section provides a rationale for each requirement, explaining their necessity and benefits.

2 Overall Product Description

2.1 Product Perspective

- If the product is independent and totally self-contained, it should be stated here
- If the SRS defines a product that is a component of a larger system, then this subsection should relate the requirements of that larger system to the functionality of the software being developed. Identify interfaces between that larger system and the software to be developed.
- A block diagram showing the major components of the larger system, interconnections, and external interfaces can be helpful

2.2 Product Functions

- Provide a *summary* of the major functions that the software will perform.
 - **Example:** An SRS for an accounting program may use this part to address customer account maintenance, customer statement, and invoice preparation without mentioning the vast amount of detail that each of those functions requires.
- Functions should be organized in a way that makes the list of functions understandable to the customer or to anyone else reading the document for the first time
- Present the functions in a list format - each item should be one function, with a brief description of it
- Textual or graphical methods can be used to show the different functions and their relationships
 - Such a diagram is not intended to show a design of a product, but simply shows the logical relationships among variables

2.3 User Characteristics

The app is meant to be a user-friendly app and as a result has the following expected qualifications of its users:

1. Education Level: Basic Literacy and Geographical knowledge

- A person with basic literacy skills of reading and writing should be able to utilize this app without any difficulties.
- A person with basic geographical knowledge of the division of the world into continents, countries, and regions should be able to utilize this app without any difficulties.

2. Experience: Any

- Since the app is meant to be user-friendly, someone who is using the app for the very first time should be able to do so without any major problems.

3. Technical Expertise: Basic knowledge of smartphone usage

- A person having basic experience with the usage of a smartphone should be able to easily use the app.

2.4 Constraints

1. **Budget:** The budget allocated to the project will have a great affect on which technologies may be used in the development of the app, as well as limiting the external integrations that can be used. The indicated budget for the project is \$0.

2. **Time:** The time allotted for the project will have a significant affect on the feasible scope of the project. Consequently, this limits the number and quality of features that can be integrated into the app.

2.5 Assumptions and Dependencies

1. Assume that pictures of locations will be able to be located to at minimum country level accuracy.
2. Assume that users encounter pictures of unknown origin (no information about where it was taken).
3. Assume that users wish to know where pictures of unknown origin were taken.
4. Assume that the processing of unauthorized photos of public spaces are legal in all regions in which the app operates.

Other assumptions that, if it fails to hold, could require a change to the requirements:

1. A recent (released within 3 years) version of the Android operating system will be available on the device.
2. The device will have internet access if the user wishes to use the app.
3. The app will have access to an on-device photo library if the user wishes to upload a photo.
4. Assume all API dependencies are fully functional during the operation of the product.

2.6 Apportioning of Requirements

1. Further language capabilities
 - The software will be developed only in English for the first version of the system.
2. User rating/rank based on guess accuracy
 - Users will be able to guess on other user's posts as to where they think it is (This does **not** affect the expert determination and is simply to add game-like mechanics). In a future version of the software, each user will have a rating/rank based on how close their guesses are to the expert determination.
3. No question limit for paid tier
 - In a future version of the software, users would be able to purchase a paid premium tier to be able to ask as many questions per day as they'd like.

3 Use Case Diagram

- Provide the use case diagram for the system being developed.
- You do not need to provide the textual description of any of the use cases here (these will be specified under "Highlights of Functional Requirements").

4 Highlights of Functional Requirements

- Specify all use cases (or other scenarios triggered by other events), organized by Business Event.
- For each Business Event, show the scenario from every Viewpoint. You should have the same set of Viewpoints across all Business Events. If a Viewpoint doesn't participate, write N/A so we know you considered it still. You can choose how to present this - keep in mind it should be easy to follow.
- At the end, combine them all into a Global Scenario.
- Your focus should be on what the system needs to do, not how to do it. Specify it in enough detail that it clearly specifies what needs to be accomplished, but not so detailed that you start programming or making design decisions.
- Keep the length of each use case (Global Scenario) manageable. If it's getting too long, split into sub-cases.
- You are *not* specifying a complete and consistent set of functional requirements here. (i.e. you are providing them in the form of use cases/global scenarios, not a refined list). For the purpose of this project, you do not need to reduce them to a list; the global scenarios format is all you need.

- Red text below is just to highlight where you need to insert a scenario - don't actually write it all in red.

Main Business Events: List out all the main business events you are presenting. If you sub-divided into smaller ones, you don't need to include the smaller ones in this list.

Viewpoints: List out all the viewpoints you will be considering.

Interpretation: Specify any liberties you took in interpreting business events, if necessary.

BE1. Business Event Name #1

VP1. Viewpoint Name #1

Insert Scenario Here

VP2. Viewpoint Name #2

Insert Scenario Here

Global Scenario:

Insert Scenario Here

BE2. Business Event Name #2

VP1. Viewpoint Name #1

Insert Scenario Here

VP2. Viewpoint Name #2

Insert Scenario Here

Global Scenario:

Insert Scenario Here

5 Non-Functional Requirements

- For each non-functional requirement, provide a justification/rationale for it.
Example:
SC1. *The device should not explode in a customer's pocket.*
Rationale: Other companies have had issues with the batteries they used in their phones randomly exploding [insert citation]. This causes a safety issue, as the phone is often carried in a person's hand or pocket.
- If you need to make a guess because you couldn't really talk to stakeholders, you can say "We imagined stakeholders would want...because..."
- Each requirement should have a unique label/number for it.
- In the list below, if a particular section doesn't apply, just write N/A so we know you considered it.

5.1 Look and Feel Requirements

5.1.1 Appearance Requirements

LF-A1. The system shall have a minimalistic and clean UI.

Rationale: A minimalistic and clean UI reduces visual clutter and will allow users to quickly interact with the app while avoiding unnecessary distractions.

- LF-A2. All images in the system must be high-quality with the resolution well-adjusted.
- Rationale:** High-quality images ensure a visually appealing and professional user experience. Low-resolution or poorly adjusted images may lead to confusion of the exact location users are looking for, and may reduce the app’s credibility and engagement.
- LF-A3. The system shall use a consistent and legible font.
- Rationale:** Using a clear and legible font improves readability for users and ensures they can properly navigate the app while reducing extra cognitive strain when reading.

5.1.2 Style Requirements

- LF-S1. The system shall have both a light and dark mode option.
- Rationale:** Multiple theme modes provide flexibility and comfort for users, depending on which mode they prefer. Many users prefer dark mode for visual comfort, while others use light mode as either the default theme or in bright environments.
- LF-S2. The system must follow a gamified design and have visually appealing elements (ex. Leaderboard, user profile).
- Rationale:** The app has an additional game feature. Users are given an image of a location and are tasked with guessing the location. The gamified design is consistent with this feature and enhances user engagement by making the experience interactive and fun.
- LF-S3. The system must scale to the size of the screen.
- Rationale:** Users may have various types and sizes of devices when accessing the app, as such it is important the system scales to fit the screen size to optimize the layout and consistency of the app.
- LF-S4. The system must use consistent spacing and padding between elements.
- Rationale:** Proper spacing between elements improves readability and makes it harder for users to be distracted by visual inconsistencies.

5.2 Usability and Humanity Requirements

5.2.1 Ease of Use Requirements

- UH-EOU1. The system’s buttons shall be big and bright in colour.
- Rationale:** The app’s buttons would be easy to tap, and larger and brighter buttons would ensure that users can comfortably interact with them, especially on smaller screens.
- UH-EOU2. The system shall allow users to complete the identification of a location within four steps.
- Rationale:** By reducing the number of steps required to complete the system’s primary task (the main motivation for downloading the app), users will experience less frustration and an efficient and simple app design.
- UH-EOU3. The system shall allow users to report incorrect results through a feedback tool in the application.
- Rationale:** Allowing users a method to report incorrect results encourages them to increase engagement with the app. This also helps maintain accuracy when providing location solutions to users, enhancing the app’s reliability and user trust.

5.2.2 Personalization and Internationalization Requirements

UH-PI1. The system must be able to support multiple languages.

Rationale: This feature enhances user experience by providing localized content, allowing users to interact with the app in their preferred language.

UH-PI2. The system shall allow the user to select between the metric or imperial system to display information.

Rationale: Different regions use different measurement systems, improving usability on a wider scale.

5.2.3 Learning Requirements

UH-L1. The system shall have a basic tutorial for navigating through the features, which automatically executes the first time a user opens the app and is available at all times within the app.

Rationale: A built-in tutorial ensures that new users can quickly understand how to navigate the app's features without overwhelming them. Having the option to review the tutorial enhances usability and accessibility for users who may have forgotten certain functions.

UH-L2. The system shall provide short descriptions when the user presses and holds key features, that automatically fade after a short period.

Rationale: Users should be able to learn how basic functionalities work without exiting the app and using external guides.

5.2.4 Understandability and Politeness Requirements

UH-UP1. The system shall hide information and aspects of the app construction that are necessary for the user to interact with [1].

Rationale: Hiding unnecessary technical details and background processes simplifies the user experience, making the app more intuitive and user-friendly [1].

UH-UP2. The system shall provide positive engagement with the user when they successfully identify a location.

Rationale: Positive reinforcement encourages users to continue to engage with the app and makes the experience more enjoyable and rewarding.

5.2.5 Accessibility Requirements

UH-A1. The system must be compatible with screen readers.

Rationale: Compatibility with screen readers supports visually impaired users and improves inclusivity and accessibility for a wider range of users.

UH-A2. The system shall allow built-in zoom-in and zoom-out features.

Rationale: Zoom features improve accessibility by allowing users to adjust content visibility according to their needs.

UH-A3. The system shall provide high-contrast options that are colorblind-friendly.

Rationale: High-contrast options ensure that users with colour vision deficiencies can comfortably use the app.

5.3 Performance Requirements

5.3.1 Speed and Latency Requirements

PR-SL1. The system shall have a basic app response time of no longer than 3 seconds [2].

Rationale: According to Google recommendations for performance requirements, apps with a response time longer than 3 seconds lose over half of user engagement [2]. As such, the app must process and return information fast.

PR-SL2. The system shall return location identification results within 5 seconds.

Rationale: The system must complete its basic functions quickly, as users expect fast responses. Delays of more than a few seconds may lead to frustration and lower user engagement.

5.3.2 Safety-Critical Requirements

PR-SC1. The system must securely encrypt all user data.

Rationale: Data encryption prevents unauthorized access to sensitive information.

PR-SC2. The system must not return locations that reveal people’s addresses or sensitive information.

Rationale: Protecting user privacy is essential to prevent possible safety risks like unauthorized tracking or doxxing. This aligns with ethical data handling practices and ensures the app complies with privacy regulations.

5.3.3 Precision or Accuracy Requirements

PR-PA1. The system must successfully return the general location of the image processed to within 25 km of the actual area.

Rationale: Returning the location result within a range balances both accuracy and feasibility. To ensure the app provides accurate and useful data for users, potential limits in AI-based location identification APIs must be accounted for.

PR-PA2. The system shall have a priority setting to assess the accuracy of each of the API’s results.

Rationale: If the APIs return contrasting location results, a priority system must be implemented to assess the accuracy of each expert’s results and select the most reliable response.

5.3.4 Reliability and Availability Requirements

PR-RA1. The system must maintain an uptime of 99%, except during routine maintenance, patch updates, and unexpected situations (ex. power outage).

Rationale: Ensuring a 99% uptime guarantees that users can access the system reliably and do not face issues or disruption while interacting with the app.

PR-RA2. The system shall save and backup the user’s progress continuously.

Rationale: Consistent saving and backup of user progress ensures that no data is lost due to unexpected events, such as update crashes or power outages.

5.3.5 Robustness or Fault-Tolerance Requirements

PR-RFT1. The system shall be able to handle incorrect inputs or inputs of wrong formats.

Rationale: If users submit a format that cannot be accepted (ex. A PDF instead of an image), the system must not crash or cause any errors and gracefully handle the issue.

PR-RFT2. The system must retry a failed image input up to three times before alerting the user of an error.

Rationale: Having the system retry processing image inputs can reduce user frustration in light of potential network instability and increase the success rate of submissions.

5.3.6 Capacity Requirements

PR-C1. The system must be able to support at least 10000 concurrent users during peak usage hours.

Rationale: This requirement is crucial, as it will prevent potential crashes and lag as the app attracts more users. The system should be able to maintain performance under load and reduce service failures or delays.

5.3.7 Scalability or Extensibility Requirements

PR-SE1. The architecture of the system must be modular and allow APIs to be integrated without major refactoring.

Rationale: If the system's architecture is modular, scalability and app expansions can be made without interference with the integrated APIs.

5.3.8 Longevity Requirements

PR-L1. The system shall have quarterly updates for new and changed locations.

Rationale: Quarterly updates ensure the system reflects recent and accurate location data, maintaining reliable solutions for users over time.

5.4 Operational and Environmental Requirements

5.4.1 Expected Physical Environment

OE-EPE1. The system should be able to process images in various outdoor conditions.

Rationale: Many images are taken in various real-world conditions, so the system must be flexible in accurately processing images under different lighting, scenarios, and situations.

5.4.2 Requirements for Interfacing with Adjacent Systems

OE-IA1. The system must be able to send and receive geolocation data with all the connected APIs.

Rationale: For the app to complete its most basic function, it must be able to seamlessly integrate with all APIs to collect, assess, and return precise location results.

5.4.3 Productization Requirements

OE-P1. N/A

5.4.4 Release Requirements

OE-R1. The system must be compatible with Android 14 (API level 34) [3].

Rationale: The app's compatibility with at least Android 14 guarantees that it is accessible to a wide user base [3], as it supports the latest Android features in terms of performance, security, and access to new platform abilities.

5.5 Maintainability and Support Requirements

5.5.1 Maintenance Requirements

MS-M1.

5.5.2 Supportability Requirements

MS-S1.

5.5.3 Adaptability Requirements

MS-A1.

5.6 Security Requirements

5.6.1 Access Requirements

SR-AC1.

5.6.2 Integrity Requirements

SR-INT1.

5.6.3 Privacy Requirements

SR-P1.

5.6.4 Audit Requirements

SR-AU1.

5.6.5 Immunity Requirements

SR-IM1.

5.7 Cultural and Political Requirements

5.7.1 Cultural Requirements

CP-C1.

5.7.2 Political Requirements

CP-P1.

5.8 Legal Requirements

5.8.1 Compliance Requirements

LR-COMP1.

5.8.2 Standards Requirements

LR-STD1.

A Division of Labour

Include a Division of Labour sheet which indicates the contributions of each team member. This sheet must be signed by all team members.