

Software Requirements Specification for Software Engineering: subtitle describing software

Team #11, OKKM Insights

Mathew Petronilho

Oleg Glotov

Kyle McMaster

Kartik Chaudhari

October 7, 2024

Contents

1	Purpose of the Project	vi
1.1	Goals of the Project	vi
1.1.1	High Data Accuracy	vi
1.1.2	Ease of use	vi
1.1.3	Minimizing Cost to Analyze Images	vi
1.1.4	Results Returned Within Appropriate Timeframe	vii
1.1.5	High System Reliability and Accessibility	vii
2	Stakeholders	vii
2.1	Client	vii
2.2	Customer	vii
2.3	Other Stakeholders	vii
2.4	Hands-On Users of the Project	vii
2.5	Personas	viii
2.6	Priorities Assigned to Users	viii
2.7	User Participation	viii
2.8	Maintenance Users and Service Technicians	viii
3	Mandated Constraints	viii
3.1	Implementation Environment of the Current System	viii
3.2	Partner or Collaborative Applications	viii
3.3	Off-the-Shelf Software	ix
3.4	Anticipated Workplace Environment	ix
3.5	Schedule Constraints	ix
3.6	Budget Constraints	ix
4	Naming Conventions and Terminology	x
4.1	Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project	x
5	Relevant Facts And Assumptions	x
5.1	Relevant Facts	x
5.2	Business Rules	x
5.3	Assumptions	x

6	The Scope of the Work	x
6.1	The Current Situation	x
6.2	The Context of the Work	x
6.3	Work Partitioning	x
6.4	Specifying a Business Use Case (BUC)	x
7	Business Data Model and Data Dictionary	xi
7.1	Business Data Model	xi
7.2	Data Dictionary	xi
8	The Scope of the Product	xi
8.1	Product Boundary	xi
8.2	Product Use Case Table	xi
8.3	Individual Product Use Cases (PUC's)	xi
9	Functional Requirements	xi
9.1	Functional Requirements	xi
10	Look and Feel Requirements	xi
10.1	Appearance Requirements	xi
10.2	Style Requirements	xii
11	Usability and Humanity Requirements	xii
11.1	Ease of Use Requirements	xii
11.2	Personalization and Internationalization Requirements	xiii
11.3	Learning Requirements	xiii
11.4	Understandability and Politeness Requirements	xiii
11.5	Accessibility Requirements	xiii
12	Performance Requirements	xiii
12.1	Speed and Latency Requirements	xiii
12.2	Safety-Critical Requirements	xiii
12.3	Precision or Accuracy Requirements	xiii
12.4	Robustness or Fault-Tolerance Requirements	xiii
12.5	Capacity Requirements	xiii
12.6	Scalability or Extensibility Requirements	xiv
12.7	Longevity Requirements	xiv

13 Operational and Environmental Requirements	xiv
13.1 Expected Physical Environment	xiv
13.2 Wider Environment Requirements	xiv
13.3 Requirements for Interfacing with Adjacent Systems	xiv
13.4 Productization Requirements	xiv
13.5 Release Requirements	xiv
14 Maintainability and Support Requirements	xv
14.1 Maintenance Requirements	xv
14.2 Supportability Requirements	xv
14.3 Adaptability Requirements	xv
15 Security Requirements	xv
15.1 Access Requirements	xv
15.2 Integrity Requirements	xvii
15.3 Privacy Requirements	xvii
15.4 Audit Requirements	xviii
15.5 Immunity Requirements	xviii
16 Cultural Requirements	xviii
16.1 Cultural Requirements	xviii
17 Compliance Requirements	xix
17.1 Legal Requirements	xix
17.2 Standards Compliance Requirements	xix
18 Open Issues	xix
19 Off-the-Shelf Solutions	xix
19.1 Ready-Made Products	xix
19.2 Reusable Components	xx
19.3 Products That Can Be Copied	xx
20 New Problems	xx
20.1 Effects on the Current Environment	xx
20.2 Effects on the Installed Systems	xx
20.3 Potential User Problems	xx
20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product	xx

20.5 Follow-Up Problems	xx
21 Tasks	xxi
21.1 Project Planning	xxi
21.2 Planning of the Development Phases	xxi
22 Costs	xxi
23 User Documentation and Training	xxi
23.1 User Documentation Requirements	xxi
23.2 Training Requirements	xxi
24 Waiting Room	xxi
25 Ideas for Solution	xxi

Revision History

Date	Version	Notes
10/1/2024	Mathew Petronilho	Added Purpose Of Project
Date 2	1.1	Notes

1 Purpose of the Project

There is currently a lack of high-quality, labeled satellite imagery datasets tailored for specific use cases. Many industries require specialized data for tasks like disaster response, environmental monitoring, urban planning, or defense, but building these datasets manually is time-consuming, costly, inefficient and may require expert data analysis. This hinders the development and deployment of accurate computer vision models for critical use cases across these various industries.

The purpose of this project is to create an online platform that accelerates this process and brings simplicity to satellite imagery data analysis.

1.1 Goals of the Project

1.1.1 High Data Accuracy

The system should have high classification accuracy for objects reported in the images. The core problem this system must solve is extracting useful information from the provided images. One key metric to determine the utility of the information found, is the classification accuracy of objects identified in the images. If the system is not able to determine what is contained in an image, it will not be useful to stakeholders.

1.1.2 Ease of use

The system should be very easy for stakeholders to use. There should be very low friction for users to classify images and objects found within images, with minimal training. It should also be simple for users to upload images to be analyzed. To maximize the information gained from users who are contributing to classification efforts, the system must ensure it is simple for users to get started with, and continue using the system. This is necessary to build a large enough user base, which will make it more likely to get insights in an acceptable amount of time.

1.1.3 Minimizing Cost to Analyze Images

The system should minimize the cost for users request insights from images. This could be implemented through intelligent algorithms for task delegation. Users of the system who upload images are interested in getting an

appropriate return for their investment. If the cost to analyze is too high, the platform will not retain a sufficiently large user base of purchasers.

1.1.4 Results Returned Within Appropriate Timeframe

The system should ensure the time it takes to obtain information from images is within a specified limit, as determined by users who upload images. Purchasers will have some time limit they require the system to process images within. To ensure timing needs are met, the system should provide realistic timelines and stick to them.

1.1.5 High System Reliability and Accessibility

The system should be useable remotely for purchasers and labellers, and have minimal downtime. The system should allow purchasers to upload images without being physically located where the system is hosted to ensure flexibility of use. The same should also be true for labellers, as they should be able to perform their tasks remotely. In both cases, the system should have low down time as to not introduce additional friction into the completion of tasks.

2 Stakeholders

2.1 Client

Insert your content here.

2.2 Customer

Insert your content here.

2.3 Other Stakeholders

Insert your content here.

2.4 Hands-On Users of the Project

Insert your content here.

2.5 Personas

Insert your content here.

2.6 Priorities Assigned to Users

Insert your content here.

2.7 User Participation

Insert your content here.

2.8 Maintenance Users and Service Technicians

Insert your content here.

3 Mandated Constraints

- The solution must be fully compatible with the latest stable releases of Google Chrome, Firefox, Microsoft Edge, and Safari browsers.

Rationale: Users will interact with the web application through various modern web browsers, so ensuring cross-browser compatibility is essential for providing a consistent user experience.

Fit Criteria: The web application must display consistently, maintain full functionality, and support core features across all specified browsers without major visual or functional discrepancies. Testing should be conducted on each browser to validate compatibility.

3.1 Implementation Environment of the Current System

There is no current environment in which our application must be implemented.

3.2 Partner or Collaborative Applications

There are no constraints regarding external applications that must be used alongside our product.

3.3 Off-the-Shelf Software

There is no required off-the-shelf software that must be used for our application.

3.4 Anticipated Workplace Environment

There is no particular location where users are required to work and use the product. As a web application, it can be accessed from most computers with an internet connection. We do not anticipate that the users' environment will physically constrain their ability to use the app in any way.

3.5 Schedule Constraints

- The proof of concept for this project must be ready to demonstrate by **November 11, 2024**. Not meeting this deadline will result in uncertainty about overcoming major risks associated with the project.
- The first project demonstration must be ready by **February 3, 2025**. Missing this deadline will reduce the time available to make refinements based on feedback and findings.
- The final demonstration must be ready by **March 24, 2025**. Missing this milestone would prevent the project from being presented and result in a significant loss of marks.

To see other documentation deadlines related to this project, refer to our [Development Plan](#).

3.6 Budget Constraints

- The project budget must not exceed \$750. All funds will be sourced from the team itself.

4 Naming Conventions and Terminology

4.1 Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project

Insert your content here.

5 Relevant Facts And Assumptions

5.1 Relevant Facts

Insert your content here.

5.2 Business Rules

Insert your content here.

5.3 Assumptions

Insert your content here.

6 The Scope of the Work

6.1 The Current Situation

Insert your content here.

6.2 The Context of the Work

Insert your content here.

6.3 Work Partitioning

Insert your content here.

6.4 Specifying a Business Use Case (BUC)

Insert your content here.

7 Business Data Model and Data Dictionary

7.1 Business Data Model

Insert your content here.

7.2 Data Dictionary

Insert your content here.

8 The Scope of the Product

8.1 Product Boundary

Insert your content here.

8.2 Product Use Case Table

Insert your content here.

8.3 Individual Product Use Cases (PUC's)

Insert your content here.

9 Functional Requirements

9.1 Functional Requirements

Insert your content here.

10 Look and Feel Requirements

10.1 Appearance Requirements

Requirement LF1:

- **Description:** The application shall adapt to various screen sizes, ensuring legibility and an uncluttered layout.

- **Rationale:** Users will have computers with varying screen sizes, so a consistent experience across all these sizes is ideal.
- **Fit Criterion:** Visual elements must not exceed the boundaries of a screen with a size between the range 1024×768 pixels to 1920×1080 pixels.

Requirement LF2:

- **Description:** Interactive elements such as buttons shall provide visual feedback to the user.
- **Rationale:** This will allow users a better understanding of when their actions have been processed by the application.
- **Fit Criterion:** Every interactive element changes colour or displays additional visual cues, such as animations or shadows, to indicate interaction.

10.2 Style Requirements

Requirement LF3:

- **Description:** The application should maintain a unified visual design across all components.
- **Rationale:** A consistent appearance enhances the application's cohesiveness and conveys a professional aesthetic.
- **Fit Criterion:** Font type, sizing, and colour, along with background tones are all consistent throughout the application.

11 Usability and Humanity Requirements

11.1 Ease of Use Requirements

Insert your content here.

11.2 Personalization and Internationalization Requirements

Insert your content here.

11.3 Learning Requirements

Insert your content here.

11.4 Understandability and Politeness Requirements

Insert your content here.

11.5 Accessibility Requirements

Insert your content here.

12 Performance Requirements

12.1 Speed and Latency Requirements

Insert your content here.

12.2 Safety-Critical Requirements

Insert your content here.

12.3 Precision or Accuracy Requirements

Insert your content here.

12.4 Robustness or Fault-Tolerance Requirements

Insert your content here.

12.5 Capacity Requirements

Insert your content here.

12.6 Scalability or Extensibility Requirements

Insert your content here.

12.7 Longevity Requirements

Insert your content here.

13 Operational and Environmental Requirements

13.1 Expected Physical Environment

Insert your content here.

13.2 Wider Environment Requirements

Insert your content here.

13.3 Requirements for Interfacing with Adjacent Systems

Insert your content here.

13.4 Productization Requirements

Insert your content here.

13.5 Release Requirements

Insert your content here.

14 Maintainability and Support Requirements

14.1 Maintenance Requirements

NFR-MR1

- **Description:** All maintainance required for the system shall be possible to complete by a competent software developer after reading all of the documentation provided in the source repository.
- **Rationale:** The system should be well documented, and therefore maintainable after reading said documents.
- **Fit Criterion:** A competent software developer, as determined by the original developers or their agents, can solve problems related to the core of the system, as determined by the features outlined in this document.

14.2 Supportability Requirements

N/A

14.3 Adaptability Requirements

N/A

15 Security Requirements

15.1 Access Requirements

Requirement SR1:

- **Description:** The application shall only allow users with labeling access, including labellers, customers, and admins, to view active projects and label images.
- **Rationale:** We do not want random users with no stake in the process to effect the results.

- **Fit Criterion:** Users who have not logged in to the application have no way of viewing projects or labeling images. Users logged in as labellers, customers, or admins have access to these features.

Requirement SR2:

- **Description:** The application shall only allow users with customer access and above to create new image analysis projects.
- **Rationale:** Unidentified users creating projects would be impossible to facilitate. Also, labellers have no need to access project creation.
- **Fit Criterion:** Users who have not logged in to the application have no way of creating an image analysis project. Users logged in as customers or admins have access to these features.

Requirement SR3:

- **Description:** The application shall validate the email format the user provides when creating an account.
- **Rationale:** We do not want users using invalid emails to sign up.
- **Fit Criterion:** Let E represent the set of all email addresses, and let V represent the set of all valid email addresses. A valid email address conforms to the general pattern:

$$V = (\forall \text{ email} \in E \mid \text{email matches the pattern } [a-zA-Z0-9+_{-}]+@[a-zA-Z0-9_{-}]+[a-zA-Z])$$

Requirement SR4:

- **Description:** The application shall validate the password format the user provides when creating an account.
- **Rationale:** We do not want users using weak passwords to sign up.
- **Fit Criterion:** Let P represent the set of all passwords, and let V represent the set of all valid passwords. A valid password has a at least one lowercase, uppercase, number and special character and is a

minimum of 8 characters in length:

$$V = (\forall \textit{password} \in P \mid \textit{password matches the pattern } (?=.*[a-z])(?=.*[A-Z])(?=.*[0-9])(?=.*[!@#$\%&])[a-zA-Z0-9!@#$\%&]\{8,\})$$

15.2 Integrity Requirements

Requirement SR5:

- **Description:** The application shall prevent incorrect data from being introduced.
- **Rationale:** The database of information should always reflect correct and up to date information.
- **Fit Criterion:** The system must validate user inputs for data accuracy and format before they are saved. Any invalid data must trigger error messages, preventing it from being entered into the database. Users must be required to correct errors before proceeding.

15.3 Privacy Requirements

Requirement SR6:

- **Description:** User data will be securely encrypted to protect user's privacy.
- **Rationale:** This will help to avoid user's being compromised if a data leak occurs.
- **Fit Criterion:** An encryption algorithm is used on sensitive user data such as passwords.

Requirement SR7:

- **Description:** The application shall ensure that all payment transactions are processed securely using encryption and comply with relevant security standards, such as PCI-DSS, which helps to protect payment account data (PCI Security Standards Council, 2024).

- **Rationale:** Protecting users' financial information is critical to maintaining trust. Failing to secure payments can lead to data breaches, financial loss, and legal liabilities.
- **Fit Criterion:** All payment transactions must use industry-standard encryption to protect sensitive data. Payment information, such as credit card details, must not be stored locally on the application and must be processed via a secure, PCI-DSS-compliant third-party payment gateway.

15.4 Audit Requirements

These requirements are not applicable as we are not an organization that is currently subject to audits.

15.5 Immunity Requirements

Requirement SR8:

- **Description:** The application shall use parameterized queries or prepared statements for all database interactions.
- **Rationale:** We want to prevent SQL injection attacks which can lead to unauthorized data access or manipulation.
- **Fit Criterion:** All database queries must be implemented using parameterized queries or prepared statements. Dynamic SQL strings that concatenate user input must not be used in the codebase.

16 Cultural Requirements

16.1 Cultural Requirements

NFR-CUR1

- **Description:** The system shall present users with the option to select the most popular language in each country it is deployed in.
- **Rationale:** It is important that the users of the program can understand what is said in each step.

- **Fit Criterion:** A drop down will allow users to select from the list of languages. At a minimum, the most popular language by number of speakers will be available for each country.

17 Compliance Requirements

17.1 Legal Requirements

Insert your content here.

17.2 Standards Compliance Requirements

Insert your content here.

18 Open Issues

Task Assignment Algorithm: To ensure labelers are engaged as they complete tasks and to obtain the highest quality of information possible, the system must implement an intelligent task allocation system. This system has not yet been determined.

Label Consensus Algorithm: Similarly, the algorithm for combining multiple user labels into one accurate label has not yet been determined.

Labeling Services Offered: The system has determined several potential labeling services to be offered by the system, but has not confirmed with certainty what will be included. This will be determined after more research has been completed on the task assignment algorithm.

19 Off-the-Shelf Solutions

19.1 Ready-Made Products

Amazon Mechanical Turk: A web-based crowdsourcing platform. Instead of building a novel front end, the system could obtain labels through this platform instead.

19.2 Reusable Components

Label Studio: A React library which contains components for building a web-based data annotation platform.

19.3 Products That Can Be Copied

Tolka AI: A general purpose image label crowdsourcing site. Supports image segmentation, bounding box drawing, and more computer vision labeling tasks.

20 New Problems

20.1 Effects on the Current Environment

Insert your content here.

20.2 Effects on the Installed Systems

Insert your content here.

20.3 Potential User Problems

Insert your content here.

20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Insert your content here.

20.5 Follow-Up Problems

Insert your content here.

21 Tasks

21.1 Project Planning

Insert your content here.

21.2 Planning of the Development Phases

Insert your content here.

22 Costs

Insert your content here.

23 User Documentation and Training

23.1 User Documentation Requirements

Insert your content here.

23.2 Training Requirements

Insert your content here.

24 Waiting Room

Insert your content here.

25 Ideas for Solution

Insert your content here.

References

1. PCI Security Standards Council. (2024, May 13). *PCI Security Standards Council – Protect Payment Data with Industry-driven Security Standards, Training, and Programs*. <https://www.pcisecuritystandards.org/standards/pci-dss/>

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.
2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?