# Software Requirements Specification for Software Engineering: Alkalytics

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# Contents

# Revision History

| Date | Version | Notes |
|------|---------|-------|
| Date 1 | 1.0 | Notes |
| Date 2 | 1.1 | Notes |

# 1 Purpose of the Project

## 1.1 User Business

*Insert your content here.*

## 1.2 Goals of the Project

*Insert your content here.*

# 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

## 3.1 Solution Constraints

**Description**: The product must accept Comma-Separated Value (CSV) files as input.
**Rationale**: The lab apparatus generates and stores results as CSV files.
**Fit Criterion**: The product's input process (the processing and acceptance of input data) into the database shall be approved by testers and developers.

## 3.2 Implementation Environment of the Current System

**Description**: The product must be able to run on a Windows machine.
**Rationale**: Currently, the lab has a Windows machine that is used to operate the machine and analyse the produced results.
**Fit Criterion**: The product shall be approved as Windows compliant by testers and developers.

## 3.3 Off-the-Shelf Software

**Description**: MongoDB - a document-oriented, NoSQL database product shall be used to store the datapoints.
**Rationale**: Using an existing, verstaile and scalable solution like MongoDB that does not use SQL and is thus, non-relational, will allow greater flexibility in storing datapoints.

## 3.4 Anticipated Workplace Environment

**Description**: The product shall be used in the Chemical Engineering Lab run by Dr. Charles de Lannoy and Bassel Abdelkader.

## 3.5 Partner or Collaborative Applications

**Description**: The product shall be used in collaboration with the *name of lab software*.
**Rationale**: The *name of lab software* is used to retrieve data from the lab apparatus. The retrieved data shall be used as input for the product.

## 3.6 Schedule Constraints

**Description**: The project must be finished within the course of the current academic year.
**Rationale**: The finished product, as outlined in the project requirements, must be submitted by the end of the academic year.

A few relevant deadlines include:

- Proof of Concept Demonstration: November 11 to 22, 2024

- Revision 0 Demonstration: February 3 to 14, 2025

- Final Demonstration (Revision 1): March 24 to 30, 2025

## 3.7 Budget Constraints

**Description**: The total cost of the project must not exceed $750.
**Rationale**: The product must be economically feasible and all teams must have an equal budget to ensure conformity and equality in terms of access of resources.

## 3.8 Enterprise Constraints

*N/A*

# 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

Currently, two sources of data input are used -

- The CSV files that contain datapoints generated by the apparatus.

- The initial parameter values for each experiment such as power voltage, age of membrane, density module and more. These values are manually inputted by the user and remain constant throughout each experiment.

## 5.2 Business Rules

*N/A*

## 5.3 Assumptions

*N/A*

# 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 Data Input Requirements

**FR-1.** The system shall allow the user to input new experiment data or parameters.

- *Rationale:* The system needs to be kept up-to-date with ongoing experiments, which may include new parameters that did not exist previously.
- *Fit Criterion:* The user should be able to input new data and parameters with 0 errors.

**FR-2.** The system shall store experiment data in the database with all associated parameters and values correctly labelled.

- *Rationale:* Ensures that data retrieval and analysis will be correct and accurate.
- *Fit Criterion:* The system database parameters and values shall match the original experiment data parameters and values.

## 9.2 Data Migration and Organization Requirements

**FR-3.** The system shall read existing experiment data stored in .CSV files.

- *Rationale:* Existing experiment data is stored in Excel spreadsheets and must be integrated into the new system for continuity and analysis.
- *Fit Criterion:* The system shall read and import the data files with 0 errors.

**FR-4.** The system shall organize experiment data by timestamps and experiment ID for unique identification.

- *Rationale:* Each experiment needs to be separately identified for quick retrieval of data and efficiency in search or query actions.
- *Fit Criterion:* Each ID and timestamp shall be traceable to one experiment.

## 9.3 Data Search and Query Requirements

**FR-5.** The system shall allow the user to search for specific datasets based on different parameters.

- *Rationale:* Allows for quick look-ups of certain experiments and their results.

- *Fit Criterion:* The system shall retrieve the correct experiments based on the matching parameters.

**FR-6.** The system shall allow the user to query two or more parameters or datasets for comparison and analysis.

- *Rationale:* Allows for direct comparisons between different experiment parameters and/or results, which is necessary for analysis.
- *Fit Criterion:* The system shall retrieve the correct parameters and/or experiments based on the query inputs.

**FR-7.** The system shall display the results of a user's selected search or query in a format that is readable to the user.

- *Rationale:* The user needs to see the results in a format that they can interpret.
- *Fit Criterion:* The results shall be displayed in a table with all labels correct and legible.

## 9.4   Data Visualization Requirements

**FR-8.** The system shall generate visual graphs based on selected parameters and datasets.

- *Rationale:* Visual representation of the data allows for easy interpretation and graphical analysis.
- *Fit Criterion:* The result should display a graphical plot with a title, axes, labels, and a legend.

**FR-9.** The system shall allow the user to customize the data visualization by adjusting axes, data ranges, labels, etc.

- *Rationale:* Allows the user to adjust the graphical representation to their needs for their analysis.
- *Fit Criterion:* Modifications to axes, data ranges, labels should be reflected in the generated graph in real-time.

## 9.5　Data Analysis Requirements

**FR-10.** The system shall analyze patterns and trends in the experiment data based on the user's selected parameters.

- *Rationale:* Trend analysis is critical for the user to discover important findings pertaining to the experiment.
- *Fit Criterion:* The system shall generate a result of the analysis to display to the user.

**FR-11.** The system shall use machine learning algorithms to predict and interpolate the data.

- *Rationale:* Allows for future predictions of data and efficiency in running future experiments.
- *Fit Criterion:* The system shall generate a report of value predictions or interpolate a graph and provide the interpolated data points.

## 9.6　Error Tracking Requirements

This section outlines functional requirements for one of the project's stretch goals.

**FR-12.** The system shall track and log errors in the experiment data.

- *Rationale:* Helps users identify irrelevant or missing parameters.
- *Fit Criterion:* Missing values from input data should be flagged.

**FR-13.** The system shall remove data logged as errors.

- *Rationale:* Ensures data is organized and produce accurate results in analysis.
- *Fit Criterion:* Flagged data should be removed from the database after user confirmation.

## 9.7 User Access Management Requirements

This section outlines functional requirements for one of the project's stretch goals.

**FR-14.** The system shall allow the user to sign in with valid credentials.

- *Rationale:* Ensures the data can only be accessed and modified by authorized users.
- *Fit Criterion:* The user shall be able to log in with a username and password.

## 9.8 Data Export Requirements

This section outlines functional requirements for one of the project's stretch goals.

**FR-15.** The system shall generate a report of queries in a session for the user to save or download.

- *Rationale:* Allows user to keep a record of their findings for future use or reference.
- *Fit Criterion:* The report should be exported in CSV or PDF format.

# 10 Look and Feel Requirements

## 10.1 Appearance Requirements

*Insert your content here.*

## 10.2 Style Requirements

*Insert your content here.*

# 11  Usability and Humanity Requirements

## 11.1  Ease of Use Requirements

**Description**: The product must be easy to navigate and use for individuals with basic computer literacy.

**Rationale**: The product must be user-friendly. In the context of this project, basic computer literacy is defined to encompass five computer skills - using a keyboard to type, using a mouse to navigate, understanding basic software applications such as word processing and spreadsheets, browsing the internet, and managaing files and folders.

**Fit Criterion**: An individual with basic computer literacy must be able to launch the application and upload an input file without any assistance from the administrator.

## 11.2  Personalization and Internationalization Requirements

**Description**: The current version of the product will only be available in English (EN-US) and more languages can be added in the later versions.

**Rationale**: Currently, the product is only expected to be used by McMaster faculty and staff who are fluent in English.

**Description**: The product must recognize commonly used scientific and mathematical symbols.

**Rationale**: The product shall be used to store scientific parameters as datapoints so the product must be able to recognize commonly used symbols used to specify scientific properties.

**Fit Criterion**: The product must be able to recognize the uppercase and lowercase Greek Alphabet.

## 11.3  Learning Requirements

**Description**: Users must be able to use the product without any formal training and with minimal guidance.

**Rationale**: The product shall be intuitive to use. Users must be able to freely naviagte and experiment with the product after a simple product walkthrough.

**Fit Criterion**: A new user with basic computer literacy skills should be able to upload an input file, enter initial experiment parameters, select fields to be compared and view their graph after a simple product walkthrough by the administrator.

## 11.4 Understandability and Politeness Requirements

*N/A*

## 11.5 Accessibility Requirements

*N/A*

# 12 Performance Requirements

## 12.1 Speed and Latency Requirements

1. The system shall store new data or parameters within 60 seconds of input.

2. The system shall retrieve data from the database within 50ms for typical search and queries.

3. The interaction between the interface and the user shall have a maximum response time of 2 seconds.

4. The system shall have a maximum latency of 2 seconds for typical search and queries.

5. The system shall generate a visualization of the data within 5 seconds.

- *Rationale:* Quick response times ensure efficiency and smooth user experience without disrupting the flow of the user's thought processes.

- *Fit Criterion:* The system shall satisfy the requirements above.

## 12.2 Safety-Critical Requirements

The product does not have safety-critical requirements to consider.

## 12.3 Precision or Accuracy Requirements

1. All parameter values shall be accurate to four decimal places.

2. All timestamps of experiment data shall be accurate to milliseconds.

3. Values on visual data plots shall be accurate to four decimal places.

- *Rationale:* Accuracy of the data is critical for data analysis, prediction, and interpolation.

- *Fit Criterion:* The system shall satisfy the requirements above.

## 12.4 Robustness or Fault-Tolerance Requirements

1. The application shall not terminate but display an error message if it loses connection to the backend server.

2. The application shall provide basic functionality if it loses connection to the internet.

- *Rationale:* The system should not fail or crash when experiencing unexpected circumstances.

## 12.5 Capacity Requirements

1. The application shall allow for up to three simultaneous users.

2. The system shall store up to x amount of data.

- *Rationale:* The system must be capable of storing and processing large amounts of data.

- *Fit Criterion:* The system shall satisfy the requirements above.

## 12.6 Scalability or Extensibility Requirements

1. The system shall be able to process and store the existing data. The amount of data going into the system is expected to grow until the experiment study comes to an end.

2. The system shall be able to add additional parameters that did not previously exist in the database at the discretion of the user.

- *Rationale:* The system must be able to expand to keep up with future experiments.

## 12.7 Longevity Requirements

1. The system shall operate for the duration of the experiment study.

# 13 Operational and Environmental Requirements

## 13.1 Expected Physical Environment

1. The application shall operate in a typical office environment with reliable internet connectivity.

2. The application shall be compatible with a desktop or laptop environment.

- *Rationale:* Ensures functionality in environments where end-users are most likely to use the application, accomodating several screen sizes and operating systems.

- *Fit Criterion:* Testing will be conducted on the two most common operating systems, Windows and macOS.

## 13.2 Wider Environment Requirements

*Insert your content here.*

## 13.3 Requirements for Interfacing with Adjacent Systems

1. The application shall operate on the most recent versions of Google Chrome and Apple Safari.

- *Rationale:* The application must be able to operate on these two most common web browsers, as these will be the primary platforms where it is hosted and accessed by users.

- *Fit Criterion:* Performance testing shall be done to ensure the application functions correctly.

## 13.4   Productization Requirements

1. The system shall be distributed as a web application.

2. The system shall have an easy onboarding process with user documentation.

    - *Rationale:* Ensures that users can use the application without needing frequent support.
    - *Fit Criterion:* Usability testing shall be done to ensure users are able to onboard easily.

## 13.5   Release Requirements

1. The first version of the system shall be released after project completion.

# 14   Maintainability and Support Requirements

## 14.1   Maintenance Requirements

*Insert your content here.*

## 14.2   Supportability Requirements

*Insert your content here.*

## 14.3   Adaptability Requirements

*Insert your content here.*

# 15    Security Requirements

## 15.1    Access Requirements

*Insert your content here.*

## 15.2    Integrity Requirements

*Insert your content here.*

## 15.3    Privacy Requirements

*Insert your content here.*

## 15.4    Audit Requirements

*Insert your content here.*

## 15.5    Immunity Requirements

*Insert your content here.*

# 16    Cultural Requirements

## 16.1    Cultural Requirements

*Insert your content here.*

# 17    Compliance Requirements

## 17.1    Legal Requirements

*Insert your content here.*

## 17.2    Standards Compliance Requirements

*Insert your content here.*

# 18   Open Issues

*Insert your content here.*

# 19   Off-the-Shelf Solutions

## 19.1   Ready-Made Products

*Insert your content here.*

## 19.2   Reusable Components

*Insert your content here.*

## 19.3   Products That Can Be Copied

*Insert your content here.*

# 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   Migration to the New Product

## 22.1   Requirements for Migration to the New Product

*Insert your content here.*

## 22.2   Data That Has to be Modified or Translated for the New System

*Insert your content here.*

# 23   Costs

*Insert your content here.*

# 24   User Documentation and Training

## 24.1   User Documentation Requirements

*Insert your content here.*

## 24.2   Training Requirements

*Insert your content here.*

# 25   Waiting Room

*Insert your content here.*

# 26   Ideas for Solution

*Insert your content here.*

# 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?