UNIVERSIDAD DE GUADALAJARA

CENTRO UNIVERSITARIO DE LOS VALLES

Software Requirements Specification

System for the Analysis of Nanoparticles Micrographs

SRS-SAM-V0.1

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Change control

Revisión	Description	Actor	Date	Version
0.1	Preliminary version	Developer team	24/01/2023	SRS-SANM-V0.1

Table 1: Change control

1. Introduction

With the purpose of simplifying and streamlining the process of micrograph analysis, the development of a web-based system is proposed.

The use of artificial intelligence techniques to obtain relevant information from digital microscope images can reduce the time required to perform the activity manually.

1.1 Purpose

The purpose of this document is to define the specification of the functional and non-functional requirements for the implementation of a website that will allow the analysis of micrographs.

1.2 Scope

Develop a system to support the analysis of nanoparticles in micrographs. The development of this system is contemplated to be publicly available.

1.3 Definitions and abbreviations

Term	Definition
SAM	System for the Analysis of Nanoparticles Micrographs
SRS	Software requirements specification

1.4 References

[1] IEEE Std 830™-1998, IEEE Recommended Practice for Software Requirements Specifications.

1.5 Document overview

In order to orient the reader, this document is organized into the following sections:

The introduction provides background and important factors considered in the current process of monitoring and evaluating the academic performance of master's students.

The second section provides an overview of the system, describing the general factors included in the product and its requirements. The stakeholders addressed in this section of the document are the users involved and the system development team. The users will be able to identify the functionalities of the system, and the developers will be able to understand the software and communication constraints under which the development will proceed.

Finally, the third section describes the specific requirements of the system and the follow-up they will have during the development of the project. The elements are grouped into functional and non-functional requirements, in such a detail that facilitates the work of the development team using a natural and simple language, in order to integrate all project stakeholders into the process of building the software product.

2. General description

This section specifies the factors of interest and the functional requirements of the SAM system. To achieve this, it will be necessary to make a detailed description of the environment where the system will be implemented, the factors involved in the application space. In this way, this collected information will provide the guidelines for the development and implementation of this software.

2.1 Product perspective

The System for Analysis of Nanoparticles in Micrographs (SAM) web application is intended to be a tool to improve the current manual analysis process for the collection of micrograph data.

2.2 Product characteristics

The SAM system intends to make use of technological tools to achieve the objective set by the client. This requires: analysis, system design, as well as the database and user interface.

The product will allow the following functionalities:

1. Create user profiles
2. User login
3. Password recovery
4. Upload digital microscope images for analysis.
5. Generate reports of analyzed images
6. Consult previous reports

2.3 Roles characteristics

This section describes the types of users that will make up the system. Elements such as technical expertise and frequency of access to the system are considered for each user.

Role type	Description	Privileges	Technique experience
User	User with privileges to generate reports.	Access to all system functionalities	None

2.4 Restrictions

- The SAM system will be designed for web environments.
- The browser where the system will be tested will be Chromium v96, which includes support for many popular browsers.
- Users can access the application through an HTML5-compliant web browser on a desktop computer such as a Windows, Mac, Chromebook or Linux computer. HTML5 compliant web browsers that can be used include Google Chrome, Opera, Mozilla Firefox, Safari, Microsoft Edge, Microsoft Internet Explorer version 11 or later.
- The speed of response is determined by the internet connectivity of the user accessing and performing an action in the system.

2.5 Assumptions and dependencies

- System requirements will change during the development of the application.
- Availability of work of the development team.
- Availability of time of the project stakeholders.
- The coordinator will have the role of administrator, with the necessary permissions to create users within the system.

3. Specific requirements

Functional requirements:

- The system will be a landing page where you will find general information about the system by scrolling down.
- The system will have a section where you can log in with your username and password.
- The system will have a registration option for new users.
- The system will have a user manual section where information on how to use the system will be displayed.
- The system will have the option to enter the description of the images to be segmented.
- The system will allow you to select the type of micrographs to be analyzed from a list of options.
- The system has a scan command to run the scan script.
- The system returns the uploaded images together with the statistics resulting from the analysis.
- The system will return a histogram containing the nanoparticle count information by size.
- The system will return a downloadable report in PDF with the information of the analysis performed with the description information, date and time and user information such as name and email.
- The system will have a contact section where you will find the information of the developer, as well as the researchers involved in the project.

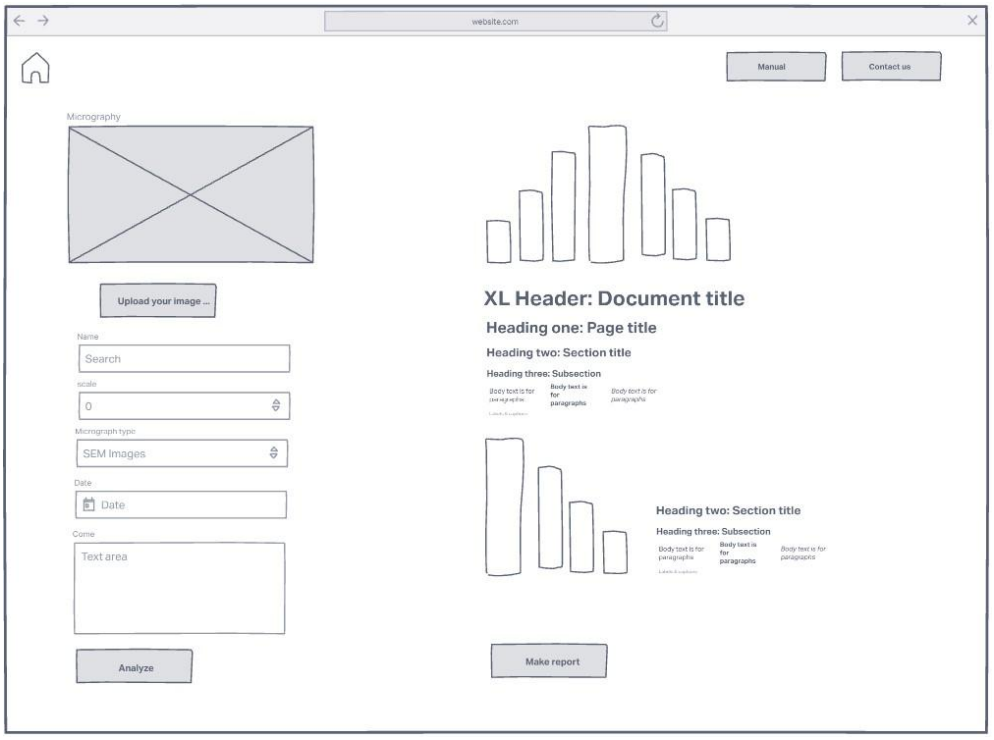
No-functional requirements:

- The system will be developed on the front-end using CSS for the design.
- The system will be developed with the use of HTML for the sections and information.
- The system will be developed on the back-end with python and the use of the Django framework for URL management.
- The system will have a Mongo type NoSQL database.
- The system will make use of Keras, Tensorflow for image processing and deep learning techniques.
- The system will be in English to be more globalized.

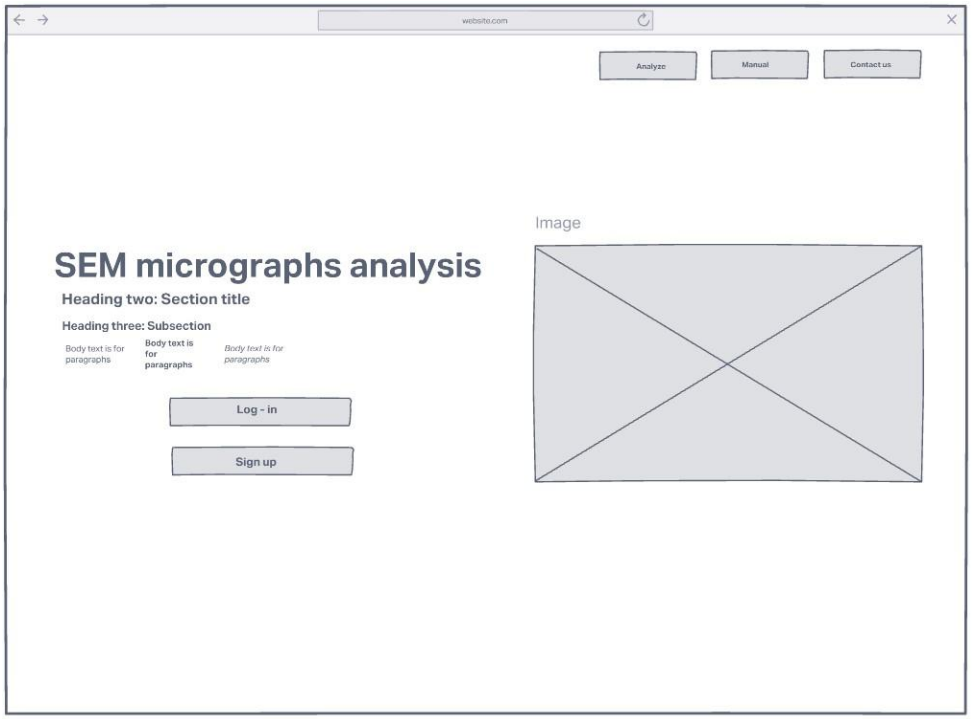
3.1 External interface

3.1.1 User interfaces

The user interface will have a set of windows with buttons, lists and text fields. The user interface will be displayed from the specified web browser. To access the interface you must have an internet connection.



Insert micrography and histogram viewer web page



web page home view

3.1.2 Software interfaces

Web browser: Google Chrome, Opera, Mozilla Firefox, Safari, Microsoft Edge.

3.2 Functions

This section will describe the system requirements in detail as shown in the following tables:

1. Sign up form
2. Sign up form: Email input
3. Sign up form: Name input
4. Sign up form: Occupation input
5. Sign up form: Password input
6. Log in form
7. Log in form: Email input
8. Log in form: Password input
9. Password recovery
10. Report form
11. Report form: Description
12. Report form: Upload image
13. Report form: Micrographs type
14. Report generation
15. History of reports

Code	Name		Priority level
FR-01	Sign up form		High
Description	A user can register by filling out and submitting the form.		
Inputs	Source	Output	Restriction
+Email +Password +Name +Occupation	User	> Confirmation message	> Only one user per email
Process	By filling in the requested fields: name, email, occupation and password and submitting the form, a user is registered on the platform. Confirmation is requested by email from the user. If the email is already registered in the database, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-02	Sign up form: Email input		High
Description	The user must fill the email field to register. The system must validate that the entry is a valid email address.		
Inputs	Source	Output	Restriction
+Email	User	> Error message	*Valid emails only *^[\w-\.]+@([\w-]+\.)+[\w-]{2,4}$ *Must be filled
Process	When filling the email field, the system must perform a validation with HTML and Javascript that the entry corresponds to a valid email address. If this is not the case, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-03	Sign up form: Name input		High
Description	The user must fill the name field to register. The system must validate that the entry is a valid name.		
Inputs	Source	Output	Restriction
+Name	User	> Error message	*Valid names only *[a-zA-ZÀ] *Must be filled
Process	When filling the name field, the system must perform a validation with HTML and Javascript that the entry corresponds to a valid name. If this is not the case, an error message will be displayed.		

Functional requirements specification

Code	Name		Priority level
FR-04	Sign up form: Occupation input		High
Description	The user must select from the drop-down list the occupation that best describes him/herself.		
Inputs	Source	Output	Restriction
+Occupation	User	> Error message	*Must be filled
Process	The user selects an option from the drop-down list. If this is not the case, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-05	Sign up form: Name input		High
Description	The user must fill in the name field to register. The system must validate that the entry is a valid name.		
Inputs	Source	Output	Restriction
+Name	User	> Error message	*Valid names only *[a-zA-ZÀ] *Must be filled
Process	When filling the name field, the system must perform a validation with HTML and Javascript that the entry corresponds to a valid name. If this is not the case, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-06	Sign up form: Password input		High
Description	The user must fill in the password field to register. The system must validate that the entry is a valid password.		
Inputs	Source	Output	Restriction
+Password	User	> Error message	*Must be filled
Process	When filling the name field, the system must perform a validation with HTML and Javascript that the entry corresponds to a valid name. If this is not the case, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-07	Log in form		High
Description	A user can log in by filling out the form with their username and password.		
Inputs	Source	Output	Restriction
+Email +Password	User	> Confirmation message	
Process	By filling in the requested fields: e-mail and password, the user logs in, successful login enables the module to analyze micrographs. In case the email address is not registered, or the password is wrong, a warning message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-08	Log in form: Email input		High
Description	The user must fill the email field to log in. The system must validate that the entry is a valid email address.		
Inputs	Source	Output	Restriction
+Email	User	> Error message	*Valid emails only *^[\w-\.]+@([\w-]+\.)+[\w-]{2,4}$ *Must be filled
Process	When filling in the email field, the system must perform a validation with HTML and Javascript that the entry corresponds to a valid email address, and it must be registered in the database. If not, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-09	Log in form: Password input		High
Description	The user must fill in the password field to log in.		
Inputs	Source	Output	Restriction
+Password	User	> Error message	*Must be filled
Process	The system must validate that the password matches the user's password.		

Functional requirements specification			
Code	Name		Priority level
FR-10	Password recovery		High
Description	A user can recover his password if he forgets it.		
Inputs	Source	Output	Restriction
+Email	User	> Confirmation message	
Process	The user fills out a form where the e-mail address is entered. The system validates that the email address is registered in the database. If it exists, a link for password recovery is sent, otherwise the email will not be sent.		

Functional requirements specification

Code	Name		Priority level
FR-11	Report form		High
Description	A user can generate reports by filling in the entries for: description, image and type of analysis.		
Inputs	Source	Output	Restriction
+Description +Image +Type of analysis	User	> Alert message	
Process	In case of filling in all requested fields and submitting the form, an alert message is displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-12	Report form: description input		Mid
Description	The user must fill the description field. The system must validate that entry is filled.		
Inputs	Source	Output	Restriction
+Description	User	> Error message	*Must be filled
Process	In the description field, the system must perform a validation with HTML and Javascript that the entry is filled.		

Functional requirements specification			
Code	Name		Priority level
FR-13	Report form: image input		High
Description	The user must upload an image. The system must validate that entry is a valid image.		
Inputs	Source	Output	Restriction
+Image file	User	> Error message	*An image must be uploaded * Valid extensions (jpg, png and tif)
Process	The user selects a file with valid image extensions: jpg, png and tif. If the file is not of a valid extension a warning message will appear.		

Functional requirements specification

Code	Name		Priority level
FR-14	Report form: micrographs type input		High
Description	The user must select from the drop-down list the micrographs type.		
Inputs	Source	Output	Restriction
+Micrographs type	User	> Error message	*Must be filled
Process	The user selects an option from the drop-down list. If this is not the case, an error message will be displayed.		

Functional requirements specification			
Code	Name		Priority level
FR-15	Report generation		High
Description	A user can generate reports.		
Inputs	Source	Output	Restriction
	User	> Report	
Process	After the system analyzes the requested image, a report with the following information is displayed: Description, the original image, the segmented image, a graph of the frequency of nanoparticles versus their size.		

Functional requirements specification			
Code	Name		Priority level
FR-16	History of reports		High
Description	A user can view all the reports he has generated, sorted by date.		
Inputs	Source	Output	Restriction
	User		* Only reports that you have made can be displayed.
Process	In the report history module you can view all your reports by date.		

3.3 Performance requirements

- The system must have the capacity to support a minimum of 30 concurrent users.
- the system must have a database manager.
- the system must have a fast response time that is not noticeable to the user and must be able to alert the user and the administrator if the response time is not met.

3.4 Safety requirements

- The system must keep user data private and encrypted in the database.
- The system has to be able to be flexible and adapt to different state-of-the-art browsers.

3.5 Reliability Requirements

- The system must be reliable by keeping all passwords and personal keys out of the browser programming and only storing them in environment variables.
- The system must validate the type of data entered in the fields is correct.

3.6 Availability Requirements

- The system must be available 90% of the time as there are no platforms such as Azure, Google cloud or AWS to guarantee online availability and relies on the school network.
- The database manager must be available 80% of the time.
- The database manager must be used locally (only by the system).

3.7 Maintainability Requirements

- The system shall have parameterisable features to allow for future maintenance (source code).
- The system shall be created in such a way that modules can be added in the future

3.8 Portability Requirements

- The system must be able to run on any operating system that supports the chromium web browser version 96.
- The system will be developed in different frameworks in the back-end and front-end.

3.9 Design constraints

- The system should be intuitive using UX/UI conventions.
- The system must have a logo that identifies it and gives it an identity that refers to its user.

3.10 System attributes

- The system shall be able to send emails.
- The system shall be able to generate a PDF report.
- The system shall be able to read images in jpeg , jpg , png

3.11 Other requirements

- The system does not interact with another external system.
- The system shall have internal documentation to explain the operation to users.

3.12 Error control

- The system must have in its external programming system to avoid crashes due to different factors.
- The system shall have error messages to alert the user of a malfunction such as image loading or format error.

4. Human resources

Engineers	
Iker Ismak Toscano Santos	Frontend and program manager
Diego Alejandro Morales Bravo	Backend and DevOps engineer
Jimena Rodriguez Viallreal	Developer
Rocio Perez Sandoval	Human Resources
Ivan Medrano RIos	Contability

5. Budget

Budget by month	Engineers	Usd $
	Iker Ismak Toscano Santos	Frontend and program manager
1		700 $
2		700 $
3		700 $
4		700 $
	Diego Alejandro Morales Bravo	Backend and DevOps engineer
1		700 $
2		700 $
3		700 $
4		700 $