Scope and Charter

Identification

Project Name:
NRC Electron Microscope Tools
Sponsor Details:
Misa Hayashida
Research Officer
National Research Council at the University of Alberta

Software Description

Three Python tools that are used with the electron microscope laboratory. The qEELS software takes a spectrogram image and outputs calibrated energy loss. The Nanomi Optics software will optimize electron microscope optics settings based on user provided parameters. The Alignment software will take electron microscope nanoparticle images and align and optimize them for tracking them around each image.

Objectives

- Understand and document the legacy MATLAB implementations
- Translate MATLAB features to Python
- Maintain all functionality from the legacy project
- Design of a familiar user interface to the legacy implementation
- Create a straightforward manual/documentation that is understandable for non-programmers
- Exposing our client to formal software engineering practices

Stakeholder List

- Misa Hayashida
- National Research Council
- University of Alberta
- University of British Columbia Okanagan
- Project Team
- Potential future users

Scope

In scope

- Creating the tools
- Feeding input/data provided by the client into our tools

Out of Scope

- Using tools on actual electron microscopes

Milestones

1. Port qEELS
2. Port Nanomi optics
3. Port Alignment Software
4. Document usage of the softwares

Functional Requirements

- Legacy project and new software have functionally equivalent outputs given the same input
- qEELS
    - Software can accept spectrogram and feature locations
    - Software can detect fitted peaks of surface and bulk plasmon
    - Software can calculate calibrated energy loss axis and transfer axis
- Nanomi optics
    - Software can accept desired parameters from user
    - Software calculate optimized optics settings
- Alignment Software
    - Software can accept many frames/images
    - Software can automatically roughly the location of particles across frames
    - Software can accept manual adjustments to location of particles
    - Software can calculate and aligned sequence of images

Non-Functional Requirements

- Performance
    - Portable and ability to run on multiple operating systems
- Development
    - Delivered by early August
    - Cannot used paid resources
- Quality
    - Code must be linted and in a consistent format

Technical Requirements

- Legacy software must be run, documented and analyzed
- MATLAB dependencies must be replaced
- New software must be written in python
- New software must use well-supported Python packages
- New software must be thoroughly tested
- The GUI will be separated from backend

User Requirements

- User can learn can learn how to use software quickly from documentation
- User who used the legacy software can pick up new software easily
- qEELS
    - User can load spectrogram image into software
    - User can indicate the location of features on the spectrogram to the software
    - User can indicate that the software should detect fitted peaks of surface plasmon and bulk plasmon
    - User can request calibrated energy loss axis and transfer axis from software
- Nanomi optics
    - User inputs desired parameters for optics
    - User can request optimized lense settings from software
- Alignment Software
    - User can load images into software
    - User can indicate the location of particles in images
    - User can request aligned sequence images from software

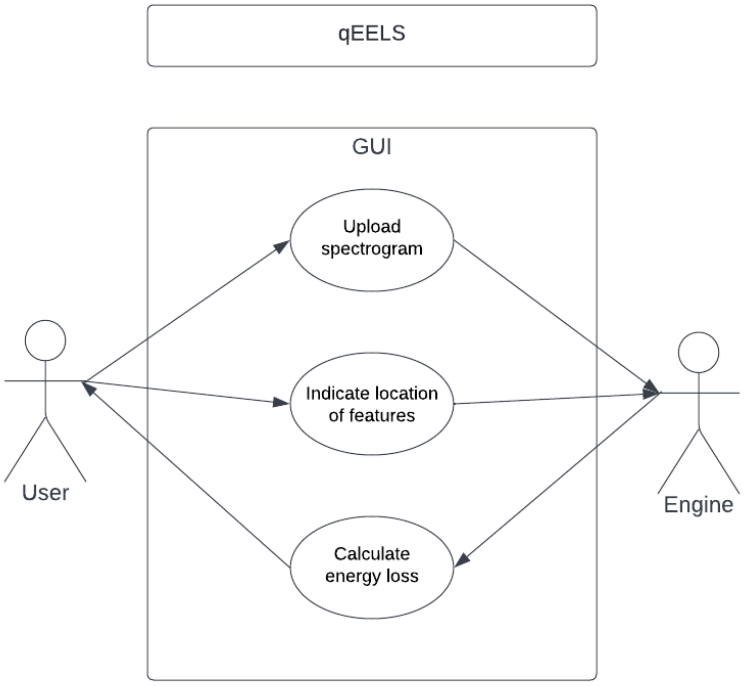
Assumptions

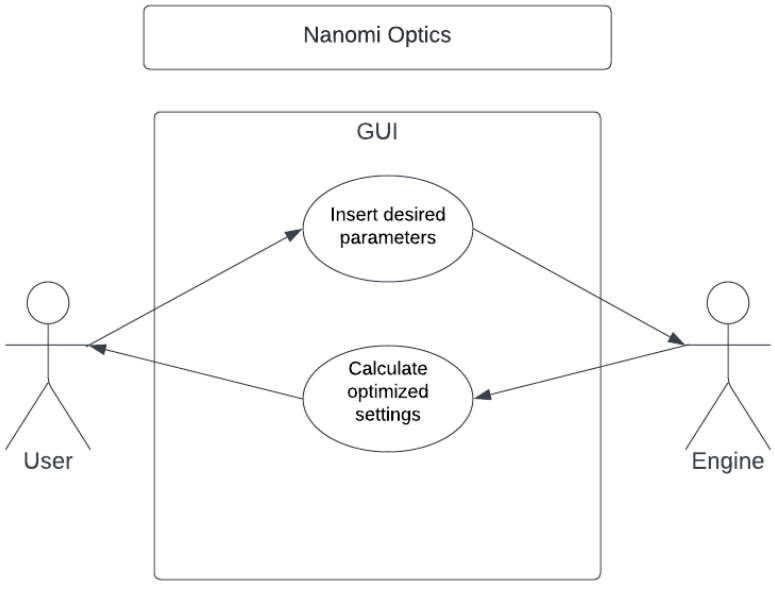
- Supplied with the legacy scripts
- Provided code works

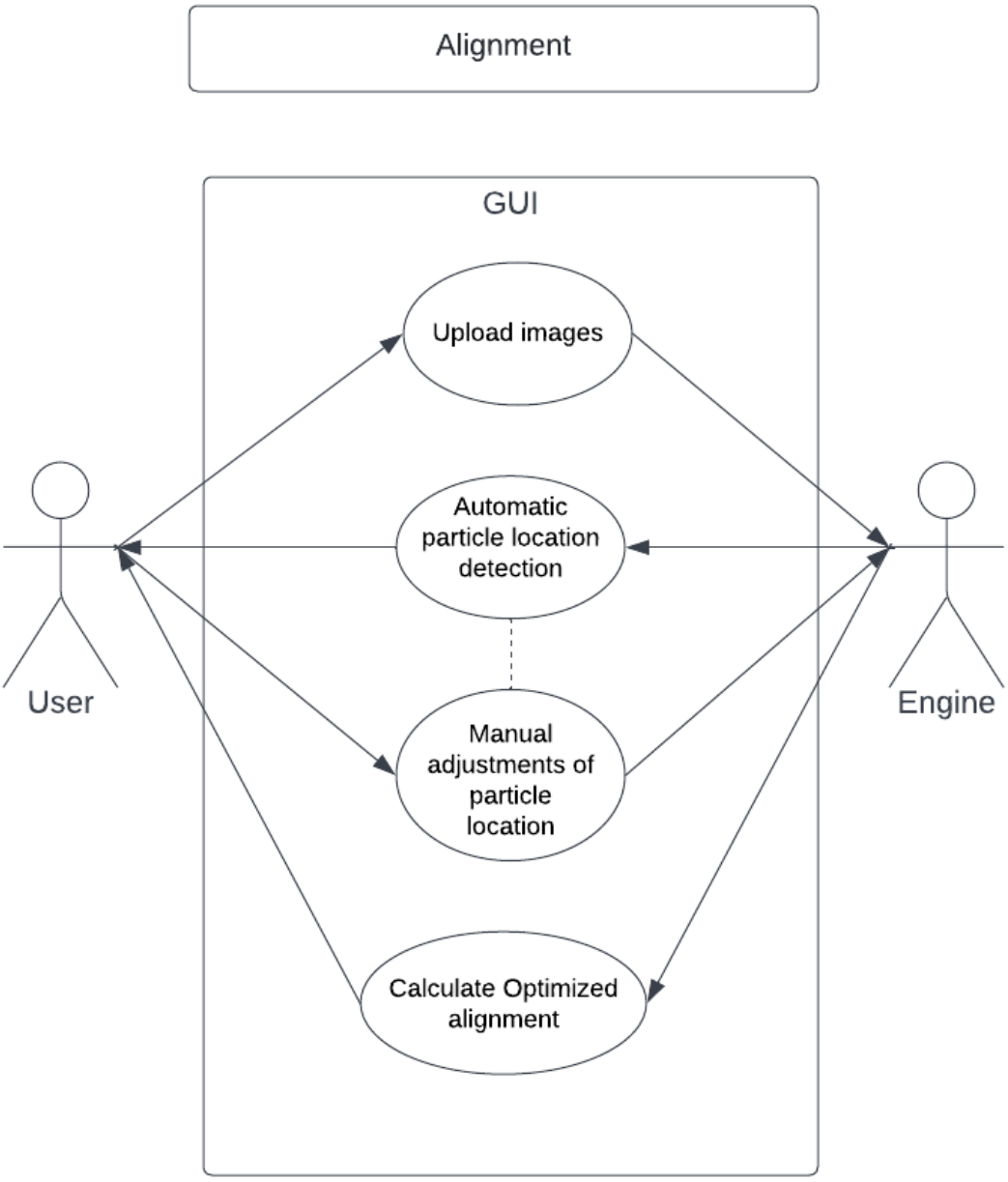
High-Level Risks

- Developers get sick/travel
- Client is unavailable
- Poor team synergy
- Bad estimation of task complexities
- Poor team/client communication
- Understanding MATLAB
- Not completing the project, leading to failure to create a product and failure of the course
- Time constraints

Use-Cases


qEELS
GUI
Upload spectrogram
Indicate location of features
Calculate energy loss
User
Engine


Nanomi Optics
GUI
Insert desired parameters
Calculate optimized settings
User
Engine


Alignment
GUI
Upload images
Automatic particle location detection
Manual adjustments of particle location
Calculate Optimized alignment
User
Engine

Summary Schedule

TASK	Lucas Estimate	Jasmine Estimate	Garrett Estimate	Jose Estimate
qEELS				
Run, document and analyze legacy qEELS		8		
Develop test scenarios	4			
Implement tests	4			
Determine MATLAB functionality can be replaced by python libraries		2		
Implement loading of spectrogram		2		
Implement GUI widget layout				6
Implement rendering of spectrogram			6	
Implement clicking to indicate features on spectrogram			8	
Implement peak detection and fitting backend				16
Integrate backend with GUI	6			
Validate new qEELS with Misa	1	1	1	1
qEELS TOTAL	15	13	15	23
Nanomi Optics				
Run, document and analyze legacy Nanomi Optics			12	
Develop test scenarios		6		
Implement tests		6		

Determine MATLAB functionality can be replaced by python libraries				2
Implement GUI widget layout		6		
Implement lens diagram rendering				12
Implement lens settings optimization backend	16			
Integrate backend with GUI			6	
Validate new Nanomi Optics with Misa	1	1	1	1
Nanomi Optics Total	17	19	19	15
Alignment Software				
Run, document, analyze legacy Alignment Software	16			
Develop test scenarios			12	
Implement tests			12	
Determine dependency footprint		2		
Determine MATLAB functionality can be replaced by python libraries		4		
Implement loading of many images		4		
Implement GUI widget layout	6			
Implement image rendering and frame switching				6
Implement image contrast adjustment	3			
Implement manual clicking and indication of particle location across frames			8	
Implement automatic detection of particle location across frames backend		24		
Implement optimization backend				24

Integrate backend with GUI	8			
Validate new Alignment Software with Misa	1	1	1	1
Alignment Software Total	34	35	33	31
Documentation				
Determine what format documentation should be in	1			
Document new qEELS usage				4
Document new Nanomi Optics usage		4		
Document new Alignment Software usage			4	
Document technical architecture and library usage	2			
Validate new Documentation with Misa	1	1	1	1
Documentation Total	4	5	5	5
Total	70	72	72	74
Weekly Average (9 weeks)	7.8	8	8	8.2

Approvals

Project Sponsor _____

Signature _____ Date _____

Project Manager _____

Signature _____ Date _____