Scope and Charter

Project 2: MATLAB to Python Application Translation

Team members:

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Document Overview:

1. Identification:

Project Name:

NRC Electron Microscope Tools

Sponsor Details:

Misa Hayashida
Research Officer
National Research Council at the University of Alberta's Nanotechnology Research Centre

2. Software Description

There are currently three MATLAB tools created by the NRC laboratory that are used to analyze and calibrate electron microscope data. The new software will have the same functionality as the MATLAB tools, but translated into Python. The client wants to switch their software to Python because it's more portable, user friendly, and readable, among various other advantages.

The three tools being translated are named qEELS, Nanomi Optics, and Alignment Software. The qEELS software takes a spectrogram image and outputs calibrated energy loss. The Nanomi Optics software optimizes electron microscope optics settings based on user provided parameters. The Alignment Software takes electron microscope nanoparticle images and aligns and optimizes them for tracking them around each image.

3. 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
- Test and verify
- Software will run as fast or faster than the legacy implementation

4. Stakeholder List

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

5. Scope

In scope

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

- Testing
- Documentation

Out of Scope

- Using tools on actual electron microscopes

6. Milestones

1. Charter, Scope, and Requirements document - 5 June
2. Minimum Viable Product Presentation - 6 July
3. Final Prototype and Presentation - 17 August
4. Port qEELS
    a. GUI, backend, tests
5. Port Nanomi optics
    a. GUI, backend, tests
6. Port Alignment Software
    a. GUI, backend, tests
7. Document usage of the softwares

7. Requirements

7.1. Functional Requirements

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

7.2. Non-Functional Requirements

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

7.3. 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
- Avoid GPL and maintain correct licensing

7.4. User Requirements

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

8. Assumptions

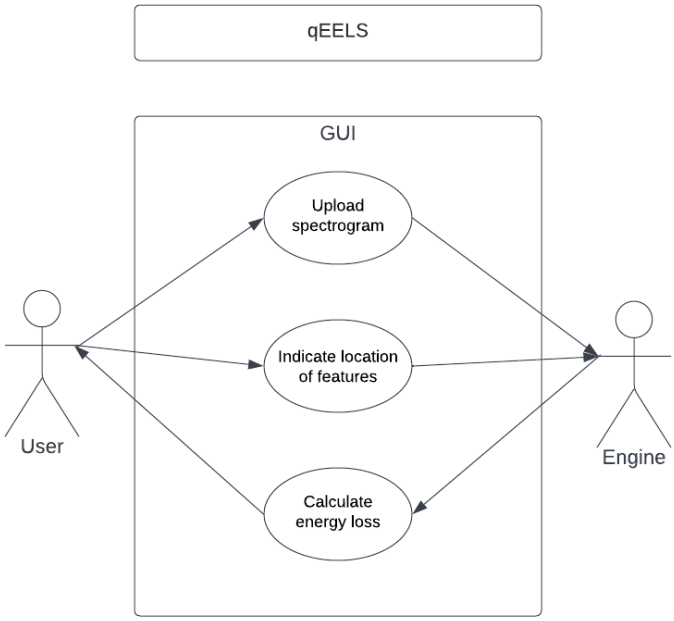
- Supplied with the legacy scripts
- The supplied legacy script works as intended to begin with

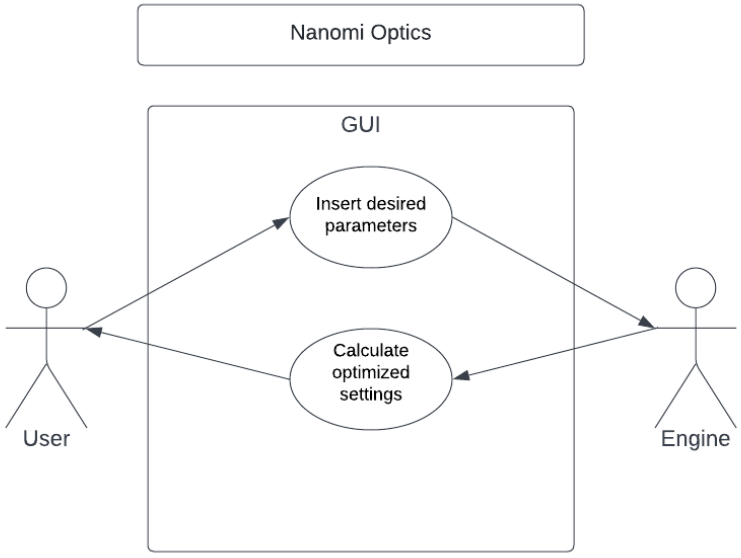
9. High-Level Risks

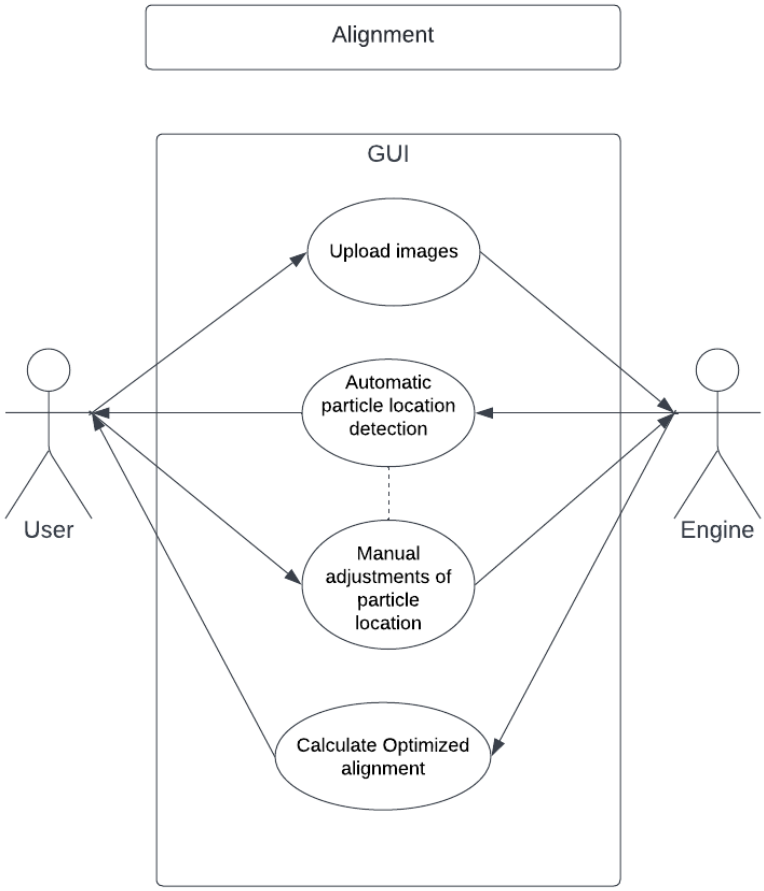
- Developers get sick/travel
- Client is unavailable
- Poor team synergy
- Bad estimation of task complexities
- Poor team/client communication
- Understanding MATLAB
- Not completing the project, leading to failure to create a product and failure of the course
- Time constraints
- Issues with current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

10. Use-Cases

In all three pieces of software, the user will interact via GUI. The calculations and/or optimization will occur in the engine and report results back to the user in the GUI, by graph, image, or numerical values.




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

11. WBS: Summary Schedule

TASK	Lucas Estimate	Jasmine Estimate	Garrett Estimate	Jose Estimate
qEELS				
Run, document and analyze legacy qEELS		8		
Develop test scenarios	6			
Implement tests	10			
Determine MATLAB functionality can be replaced by python libraries		8		
Implement loading of spectrogram		24		
Implement GUI widget layout				14
Implement rendering of spectrogram			14	
Implement clicking to indicate features on spectrogram			26	
Implement peak detection and fitting backend				26
Integrate backend with GUI	20			
Validate new qEELS with Misa	1	1	1	1
qEELS TOTAL	41	41	41	41
Nanomi Optics				
Run, document and analyze legacy Nanomi Optics			12	

Develop test scenarios		8		
Implement tests		12		
Determine MATLAB functionality can be replaced by python libraries				10
Implement GUI widget layout		26		
Implement lens diagram rendering				36
Implement lens settings optimization backend	48			
Integrate backend with GUI			34	
Validate new Nanomi Optics with Misa	1	1	1	1
Nanomi Optics Total	49	47	47	47
Alignment Software				
Run, document, analyze legacy Alignment Software	16			
Develop test scenarios			12	
Implement tests			14	
Determine dependency footprint		4		
Determine MATLAB functionality can be replaced by python libraries		6		
Implement loading of many images		8		
Implement GUI widget layout	10			
Implement image rendering and frame switching				12
Implement image contrast adjustment	5			

Implement manual clicking and indication of particle location across frames			16	
Implement automatic detection of particle location across frames backend		24		
Implement optimization backend				30
Integrate backend with GUI	10			
Validate new Alignment Software with Misa	1	1	1	1
Alignment Software Total	42	43	43	43
Documentation				
Determine what format documentation should be in	1			
Document new qEELS usage				12
Document new Nanomi Optics usage		12		
Document new Alignment Software usage			12	
Document technical architecture and library usage	10			
Validate new Documentation with Misa	1	1	1	1
Documentation Total	12	13	13	13
Total	144	144	144	144
Weekly Average (9 weeks)	16	16	16	16

12. Approvals

Project Sponsor _____

Signature _____ Date _____

Project Manager _____

Signature _____ Date _____