

**The A Team**

**Image Processing Tool for**

**Leidenfrost-Ratchet Systems**

**Design Document for Version 2.0 (First Draft)**

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**1. Introduction/Overview**

The design document details the project design for the design phase of the development process.

1.1 Purpose of Design Document

The design document will brain storm the user interface, UML diagrams, and Topology.

1.2 Project Scope and Objectives

The scope comprises what we intend to implement and nothing more. The software's current capacity is to efficiently track a drop of liquid and record measurements through images gathered from a high speed camera as it falls from an injection needle and travels along a ratchet surface. We intend to add to this according to the following new design plan.

1.3 Document Organization

This document is organized into the following sections:

|  |  |
| --- | --- |
| Introduction | Provides information related to this document |
| Design Overview | Describe the approach, optimization goals, and design patterns |
| System Architecture | Describe the various components and the integration between them. |
| UML Diagram | Describe the overall design of sequence, class, and use case diagram |
| Glossary | Explain the definition and terminology |
| Reference | List all of the material used in producing this document |

1.4 Audience

The intended audience of this document is the development team, and testers.

**2. Design Overview**

The design overview describes the process of the design phase.

2.1 Approach

This document is created after the initial design of the User Interface. The document diagram is used in multiple documents.

2.2 Optimization Goals

The requirement of this Leiden-frost software tool is to be user friendly. The A-Team conceived a creative but friendly user interface. The tool is supposed to be so fast we will be implementing multi-threading to optimize the speed of the tool. Also, the user interface will have a tool tip to guide the user to using the tool.

2.3 Design Patterns

The design will accommodate three major classes: Image Processing Form, which consists of the user interface and its controls, Droplet Image, which holds the object of the image and includes the algorithms and fine-tuning capability, and Output, which will export the data into Excel files

**3. User Interface Diagram**

The user interface was designed to be user-friendly and simple and includes tool tips to guide the user. The purpose of the user interface is to aid the user as much as possible for easy application use. See Appendix A.

**4. System Architecture Diagram**

The purpose of this figure is to show the integration required between various components to use this Image Processing tool. In summary, a high-speed camera captures images in sequence of a droplet released by an injection needle as it travels along a ratchet surface. The images are processed by the tool to calculate and then export data to a spreadsheet application.

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Figure 1. System architecture for the Image Processing tool.

**5. UML Diagram**

The overall of UML diagram is to help the development team organize what processes need to be implemented and how.

5.1 Sequence Diagram

The purpose of this diagram is to describe the sequence of actions the user may take in using the Image Processing tool. The sequence diagram specifically outlines the interaction between the user and the user interface in detail, accounting for individual class actions. See Appendix B.

5.2 Class Diagram

The class diagram lists the properties and methods for each of the major classes as we have decided so far. See Appendix C.

5.3 Use Case Diagram

The use case diagram is to tell a story between the user and the software interface. The user will load the data, input the frame rate, input the width of the Image, Run the data, and fine-tune the location of the needle if needed. Then the output will show the real time measurements in an excel sheet.

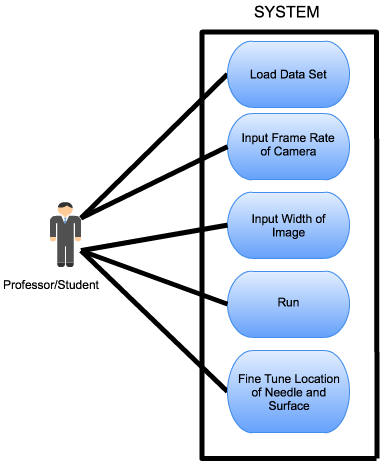


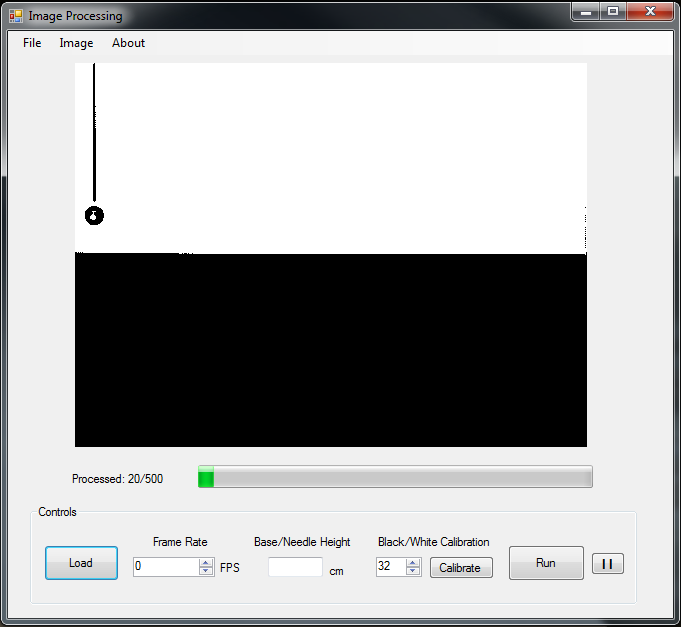
Figure 2. Use Case Diagram of the Image Processing Project

**6. Glossary**

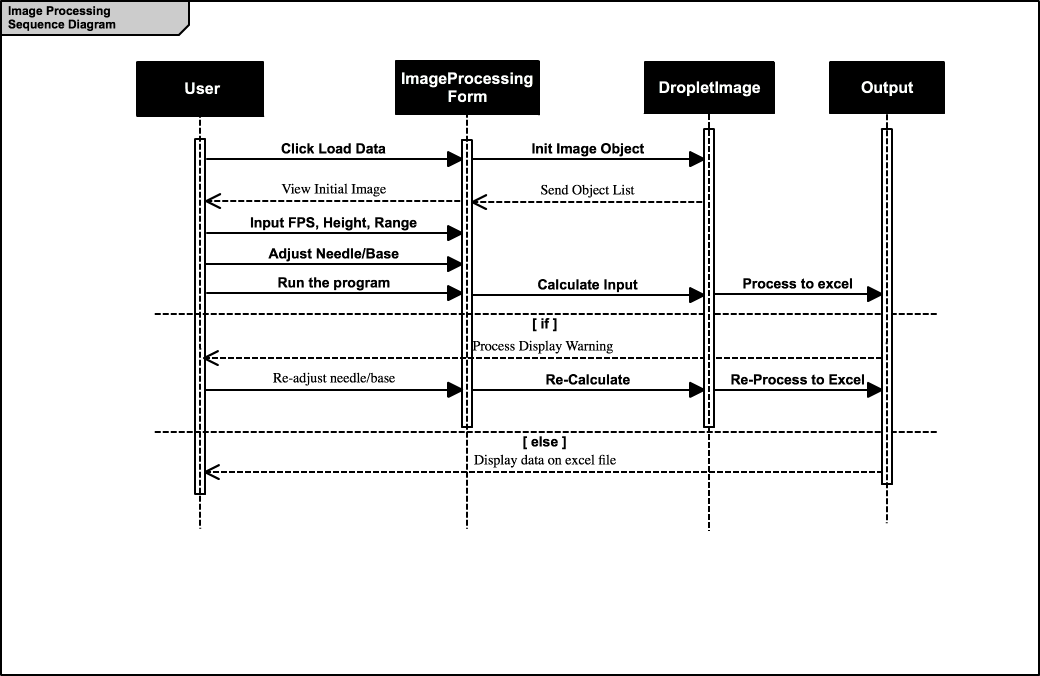
|  |  |
| --- | --- |
| **Term** | **Definition** |
| **Leidenfrost-Ratchet System** | A system involving a ratchet surface heated to a fluid's Leidenfrost point will allow a droplet of that fluid to spontaneous accelerate along that surface, even if it means traveling up slope. |
| **UML** | Unified Model Language |
| **Droplet** | A very small drop of a liquid. |

**7. References**

This document was completed with the guidance from the Online Screening Tool Tech Design Document, Design Powerpoints written by Catherine Stringfellow, a professor at Midwestern State University, and the presentation of Julia John and James Miller of UML Diagrams for the Software Engineering class at Midwestern State University.

Appendix A

Appendix B



Appendix C

