

**Image Processing Tool for**

**Leidenfrost-Ratchets Systems**

**Requirements Specification for Version 2.0**

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**1. Introduction/Overview**

1.1 Purpose

The goal of this version of the Image Processing Tool is to make well-informed improvements to advance the processing capabilities of the software. The software's current capacity is to efficiently track a drop of liquid, through images gathered from a high speed camera, as it falls from an injection needle and travels along a surface.

1.2 Scope

. Systeml is pixels to real world distances tool tips/intuitive usesequencege in the sequencetion of the needle and surface lo1.2.1 Main Objective

The main objectives of this edition of the tool are to increase automation, improve the user interface, provide graphical data, and speed up processing.

1.2.2 Specific Goals

Specific modifications to be brought up in this version include:

* automatic determination of needle and ratchet location
  + if camera position is constant, determine location once using first image in sequence
  + if camera position is altered, determine location for each image in sequence
* removal of the base image calibration
* alter drop image manipulation (remove white glare)
* drop volume measurement for each image
* graphing of various plots using the extracted data
* improvements to the user interface, including tool tips/intuitive use
* increased processing efficiency
* conversion of pixels to real world distances

1.3 Overview of Document

This document outlines and specifies the details of the tool in terms of planning, development, and function.

**2. System**

2.1 Target Environment

The system shall be ran and developed on a PC with a CD-RW drive at the least. Minimum PC specifications will be adequate in order to run the software successfully.

2.2 Users

The primary users of the software are students or professional mechanical engineers studying material sciences, specifically Leidenfrost-Ratchets Systems.

2.3 Functional Requirements

A description of the operations of the tool and its possible challenges.

2.3.1 Issues

Some issues that may arise include minor inaccuracies due to poor image quality, and difficulty adjusting to inconsistent needle and surface locations from changes in camera position.

2.3.2 Major Functions

The main functions of the tool are to:

* Input and process images
* Determine the location of the injection needle and surface
* Calculate the centroid, acceleration, velocity, and volume of the droplet at every frame
* Output results to an Excel file and graphically display the data as a function of time

2.3.3 Major Classes

The major classes or divisions of functionality will include:

* the Image Processing Interface
* Algorithms/Calculations
* Data output and graphical presentation

2.3.4 Minor Functions

The minor functions will include:

* ability to fine tune the resultant locations of the needle and surface

2.4 User Interface Specifications

The user interface will incorporate image folder uploading, image file listing, image removal, processing progress bar, and run data action. In addition, the user will input the speed of the camera in terms of frames per minute in a numeric up down tool. Additional numeric up down tools will allow the user to set the bounding range of the droplet and the real world width (i.e. in cm) of the image.

2.5 Non-functional requirements

A description of aspects of development and software quality.

2.5.1 Management

The continued development of this tool will be ongoing for the Spring 2015 semester with the hopes of completing a polished, efficient, and accurate data software program. All members involved in on-going development are invested in learning and improving the needs of Leidenfrost-Ratchet Systems research.

2.5.2 Technical

The technical requirements necessary to achieve our purpose involve continued utility of the Visual Studio Professional Integrated Development Environment , and the C# language. For testing, NUnit software will be explored among others to be researched.

2.5.3 Performance

The first version of the tool report a 5x increase in performance over the Optimus software. The goal of this version is to improve upon that by usage of threading and optimized code.

2.5.4 Security (NOT SURE WHAT TO PUT HERE)

The tool is only to be accessed and utilized by members involved in the research group(s) on Leidenfrost-Ratchets Systems.

2.6 System Evolution and Maintenance

The group anticipates the tool to eventually evolve as the client desires additional functionality, however this edition will focus solely on the goals enumerated above. The organization of the software will be established well and will require little maintenance (until the next edition) once the final product has undergone thorough testing. However, some maintenance may be required in the interval to make manipulations to the graphical data, should data need different representation. In addition, we intend to structure the classes in a object oriented way to allow feasible enhancements with future objectives.

**3. Other Deliverables**

In developing and planning the software, a prototype of the design will be drawn up to improve the style and flow of the current software. The delivery of this artifact will serve as a guide and mechanism for feedback.

Additionally, a user manual detailing the final changes and additions will serve to update the previous manual and specify the new usage procedures.

**4. Risk**

As with any endeavor, there are risks associated that may impede or impact the quality of this product. Recognizing the following potential risks, the team intends to prepare and work as organized and proactive as possible.

We believe we may face these common obstacles:

* division of focus because of other responsibilities
* poor communication between team members
* poor time management of specific tasks
* scheduling conflicts between team members and possibly the client
* unforeseen emergencies involving health, family, etc.

**5. Team (or other things you can think of)...**

**6. Glossary**