

### **Jack of All Spades**

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# User Interface Design Document

Chemistry Instrumentation: Control, Data Acquisition and Offline Analysis

For Dr. Mitchell Bruce with the Chemistry Department at the University of Maine, Orono

12/03/2025

V1.0

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# 1 Introduction

This document presents the system requirements for Chemistry Instrumentation: Control, Data Acquisition and Offline Analysis. This project is being undertaken by a team of seniors at the University of Maine in order to fulfill the capstone requirements of a Computer Science degree. This is being undertaken in collaboration with the chemistry department at the University of Maine.

## 1.1 Purpose of This Document

Within this document, the user interface is described. We describe the design standards, walk through the architecture, and describe all data that can be put into the system. This document will serve to guide the creation of the UI of the program, ensuring that design standards are met.

This document was reviewed in collaboration with the client to create a common foundation for the project. It serves as a guide to the team for the user interface design. Additionally, it allows the client and the Computer Science Department to assess the progress of the team and provides guidelines for assessing project completion.

## 1.2 References

Bruce, M. (2025). *Chemistry Instrumentation: Control, Data Acquisition and Offline Analysis*. ms, University of Maine.

Fowler, M. (2018). *UML distilled*.

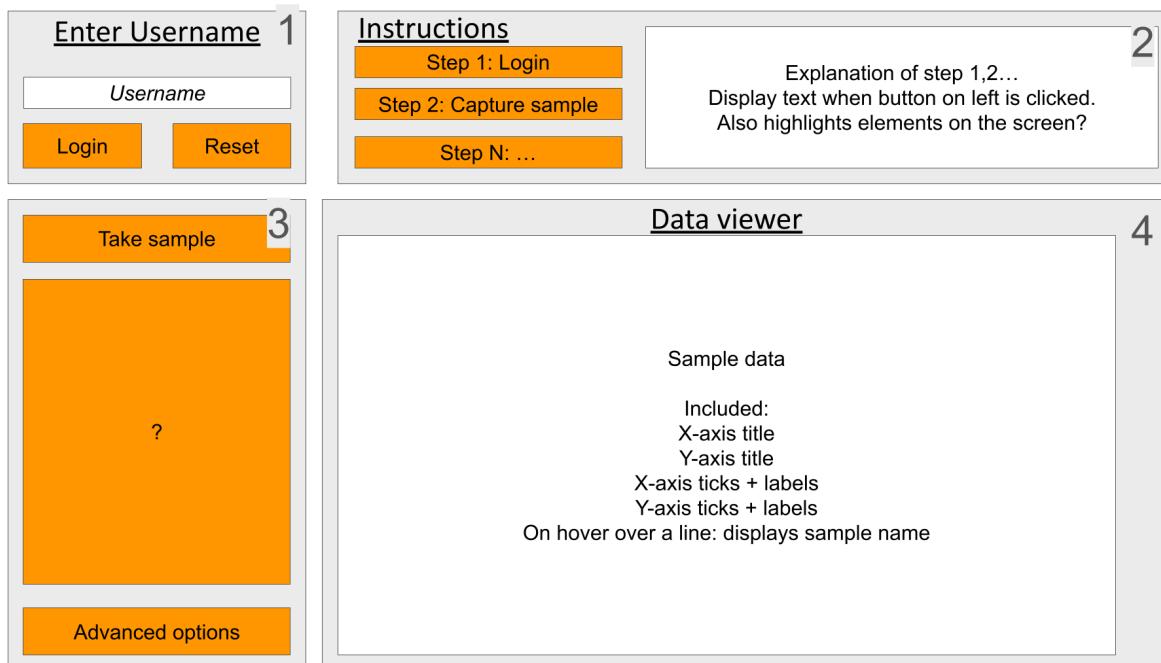
Jestel, E., Ayer, A., Roy, B., Letourneau, C., & Gouveia, C. (2025). *System Requirements Review*. ms. University of Maine.

Jestel, E., Ayer, A., Roy, B., Letourneau, C., & Gouveia, C. (2025). *System Design Document*. ms. University of Maine.

## 2 User Interface Standards

This section serves to describe the consistent design standards used throughout the project. The goal for this design is to have extremely clear visual language with as little complexity as possible.

Our program is primarily utilized by students. These students will be in an unfamiliar setting and therefore are not expected to have any experience or competency with the equipment. As such, we want to minimize the possibility for user error and reduce the need for TAs to help students through the process. To that end, we seek consistent visual language, well labeled buttons, and on-screen instructions. We also seek to have multiple cues, both visual and textual, when the users are acting in error or taking actions that are incongruous with the intended uses. In order to keep the usage simple, we present the students with a single page that all actions will occur on, called the *instrument page*.



**Figure 2.1 Instrument Page.** This figure is an illustration of the Instrument Page, which is the primary page by which the user will interact with the software. It includes a section for ICN student login, sample capture, data visualization, and instructions on what steps to take.

The Instrument Page (Fig. 2.1) is comprised of four primary sections:

1. ICN Student Login
2. User Instructions
3. Sample Capture
4. Data Visualization

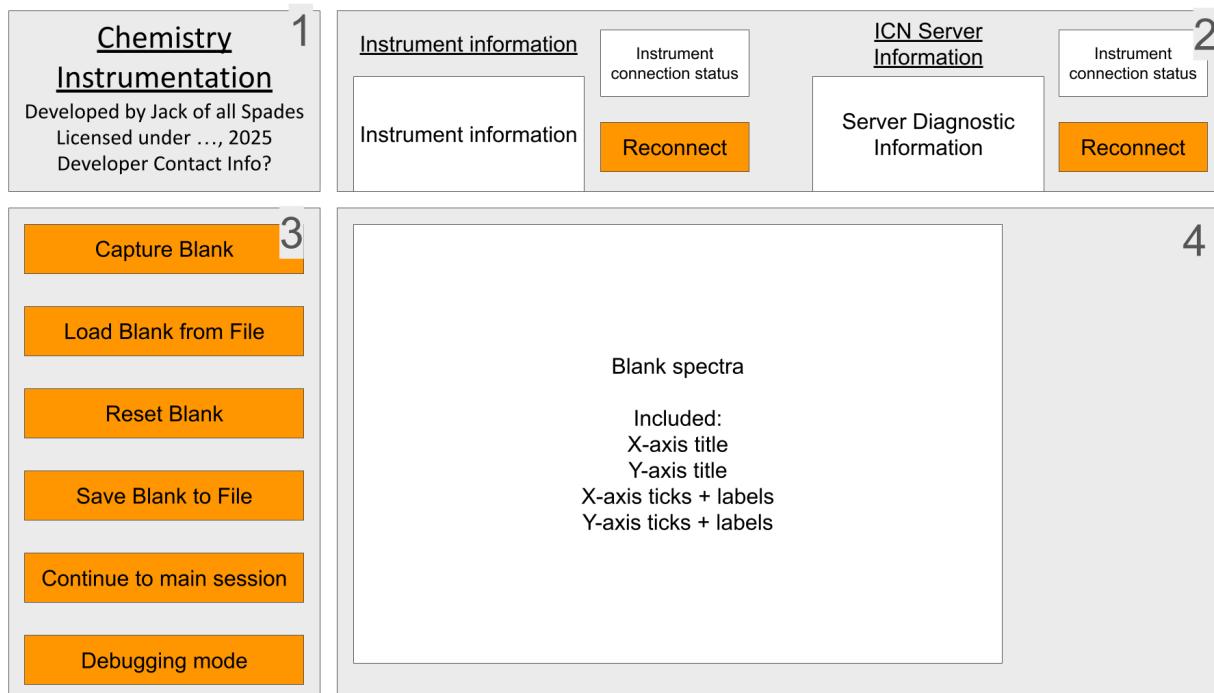
The first section, User Login, which is located in the top left corner of the screen, is where the student will enter their ICN username to login to their ICN student account. After typing their ICN username, the student will click/press the *Login* button. Once the student has finished their work on the system, they should click/press the *Reset* button, which will log them out as well as reset the entire page.

The next section, User Instructions, which is located in the top right corner of the screen, lets the student know what steps they should generally take to use the software and record samples from the instrument. Each step in the instructions is a button that can be clicked/pressed to show text on the right side with an explanation of the step.

Section 3 of the page, located in the bottom left corner, is the Sample Capture Section, which is where the student will capture a sample. To capture a sample, the student will click/press the *Take Sample* button. There is also an *Advanced Options* button, this brings the user to an advanced options popup, this will be discussed further later.

Finally, there is the data visualization section, which takes up most of the screen, and is in the bottom right. This section is where the student can see a graphical representation of the data sample, or samples, collected during their session. If there are multiple samples, the graphs will be overlaid on top of one another. To make this simpler for students, they will not be able to adjust the field of view of the graph, as this would distract them and increase confusion.

Before the students use the software, lab TAs will set up the software for the student. This is done in the *Setup page*. The setup page has more buttons and more complexity because it will only be used by TAs, who are well trained.



**Figure 2.2 Setup Page.** This figure is an illustration of the Setup page that the lab TAs will use to set up the software for the students.

In this page, the lab TA can capture or load the proper blank, verify instrument connection, ICN server connection, and any necessary debugging, before continuing to the Instrument page for the students. The page is broken down into four sections:

1. Software Information
2. Instrument and ICN Server information
3. Blank Setup, Continue to main session, and Debugging
4. Blank Data Visualisation

The first section, *Software Information*, simply has information regarding the name of the software, the developers involved in making it, and other basic information. This section will likely have nothing for the TA to interact with.

The next section, *Instrument and ICN Server information*, is where the TA can see information regarding information and connections status regarding the Instrument, as well as the ICN Server.

Section 3, allows the TA to set up the blank, enter Debugging mode, and continue to the instrument page for the students. The TA can capture a blank by clicking/pressing the *Capture Blank* button, and then save the blank to file by clicking/pressing the *Save Blank to File*. They can load a blank sample from the computer by clicking/pressing the *Load Blank from File* button, where a file explorer will pop up, allowing the TA to choose a blank sample file. The TA can enter debugging mode by clicking/pressing the *Debugging mode* button. There is also the *Continue to main session* button, which allows the TA to continue to the instrument page, which the students then use to make their measurements.

Finally, there is the data visualization section, which takes up most of the screen, and in the bottom right, similar to the *Data viewer* from the Instrument page. This section is where the TA can see a graphical representation of the blank sample.

### 3 User Interface Walkthrough

This section describes how users navigate through the system and interact with each screen.

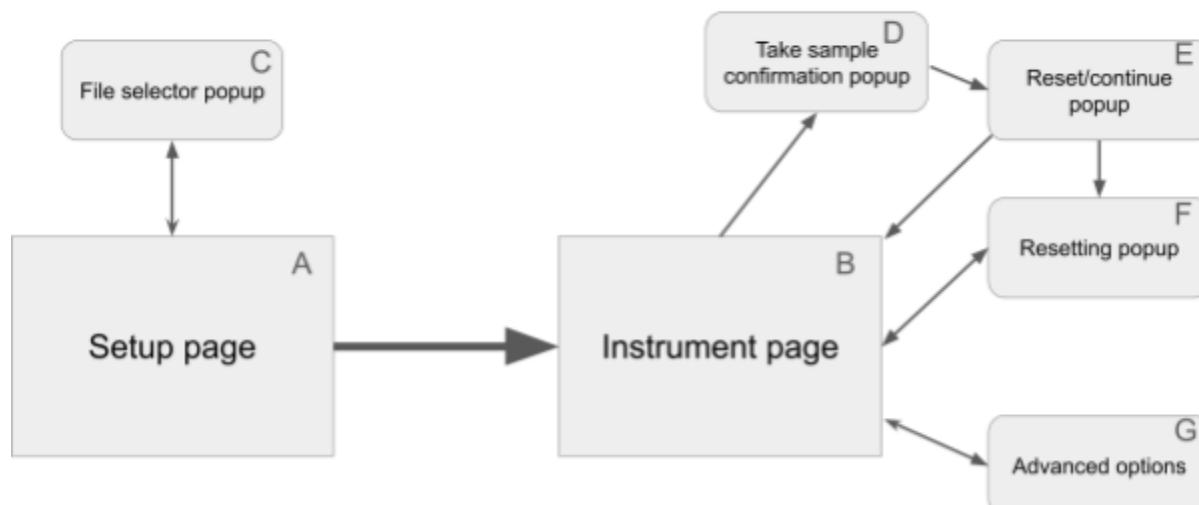
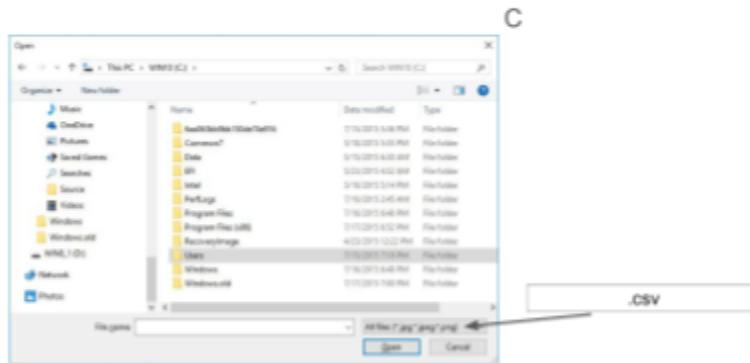


Figure 3.1: Navigation Diagram

The navigation flow illustrated in Figure 3.1. Users encounter the system in a linear, guided sequence designed to minimize error.

The system opens on the **Setup Page**, which is used exclusively by the lab TA to prepare the instrument before any student interaction. As described earlier in section 2, this page includes controls for blank management, connection verification, and basic system diagnostics. On this page, TA's can:

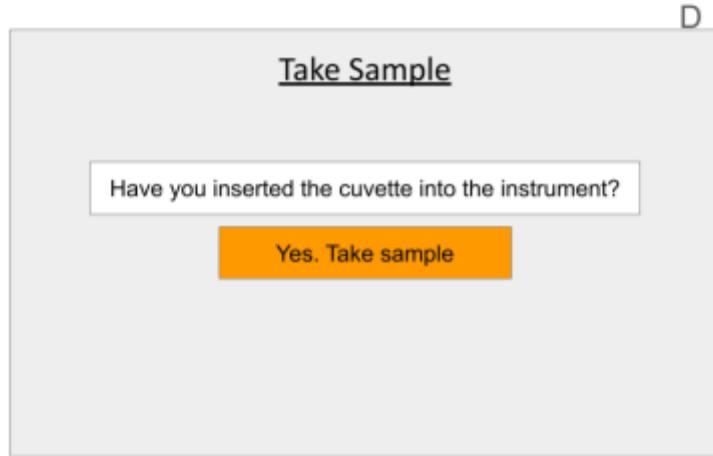
- Capture a new blank directly from the instrument.
- Load an existing blank file, which opens the **File Selector Pop-Up (C)** (Figure 3.2). The file browser allows the TA to navigate the local machine and choose a saved .csv blank.
- Verify Connection status for both the spectrometer and ICN server.
- Enter debugging mode if troubleshooting is required.



**Figure 3.2: File Selector Pop-up**

Once the TA selects or captures the appropriate blank and confirms both system connections are functional, pressing **Continue to Main Page** moves the session forward to the student-facing interface.

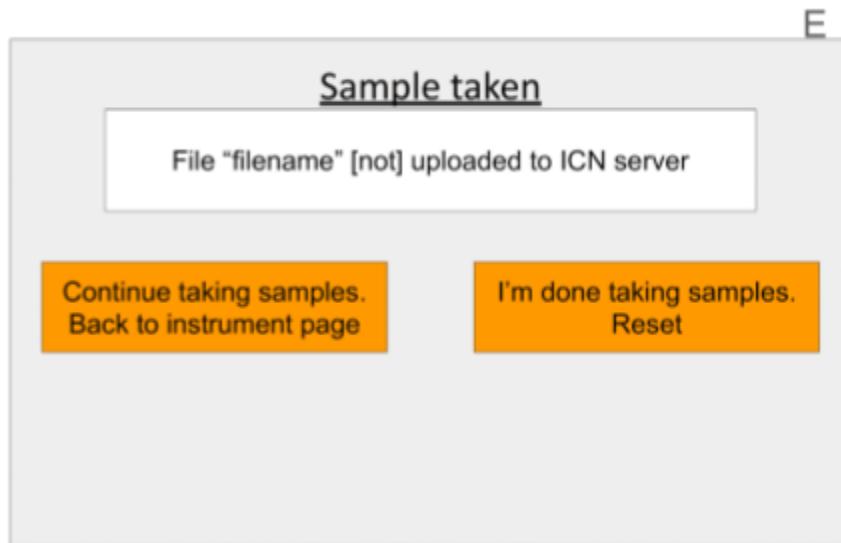
The **Instrumentation Page (B)** is the central workspace for students and is where all data collection occurs (Figure 2.1). It combines ICN login, procedural guidance, sampling controls, and real-time visualization into a single viewing window to reduce confusion and potential need for TA intervention. Key student actions include the ICN Login, Step by Step Instructions, and Take Sample. ICN Login has Students enter their ICN username to authenticate before taking samples. Step by Step Instructions displays the steps to use the machine and each step can be expanded to reveal more information and highlight what to do. Pressing the **Take Sample** button initiates the sampling workflow.



**Figure 3.3: Take Sample Confirmation Pop-up**

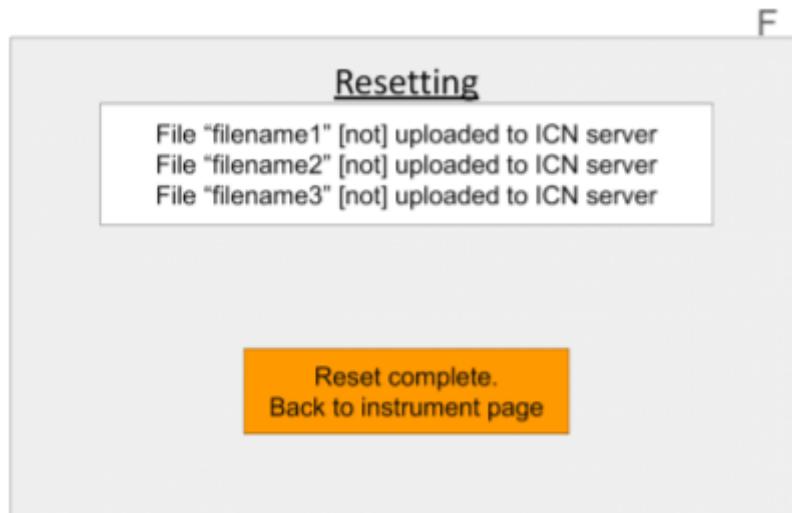
When a student starts the sampling process, the system immediately opens the **Take Sample Confirmation Pop-up (D)** (*Figure 3.3*). This pop-up will remind students to verify the cuvette is correctly inserted. To begin the sampling process, the student must click the **Yes, Take Sample** button, which will begin the process and close the pop-up, navigating the user back to the **Instrumentation Page** for data collection visualization.

Once data is captured, the interface automatically transitions to the **Continue/Reset Pop-up (E)**. This pop-up (*Figure 3.4*) provides immediate feedback on the sample status, including; whether the file was successfully uploaded to the ICN server, a **Continue Taking Samples** button, which returns the student to the **Instrumentation Page**, and a **Reset** button, signalling the end of that particular session.



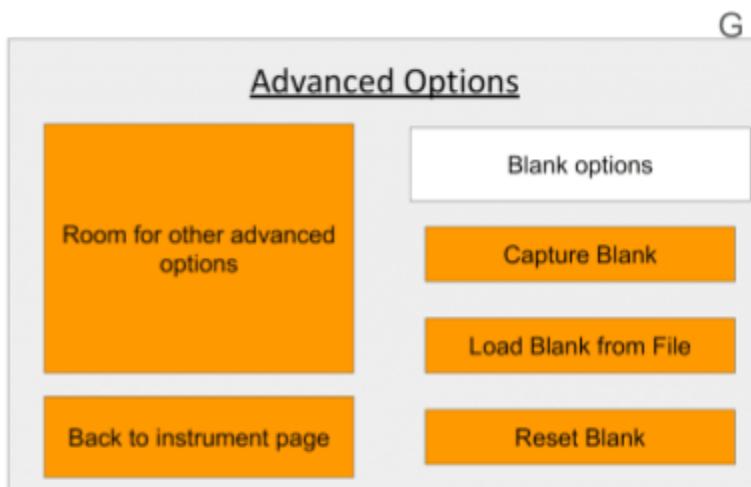
**Figure 3.4: Continue/Reset Pop-up**

If the student chooses to reset the session, the system proceeds to the **Resetting Pop-up** (**F**). This screen (*Figure 3.5*) lists each file sent (or not sent) to the ICN server during the session. This provides transparent feedback before the system clears the workspace. Once reset is complete, the system returns to the instrumentation page, waiting for a new user to enter their username to begin a new session.



**Figure 3.4: Resetting Page**

The **Advanced Options Page**, shown in *Figure 3.6*, can be accessed from the bottom left button on the **Instrumentation Page**. Although available from the student interface, this page is intended for TA use during active lab sessions. This Advanced Options menu allows the TA to Load a new blank and capture an updated blank without having to go back to the setup page.



**Figure 3.6: Advanced Options Page**

## 4 Data Validation

In order to keep the User Interface as simple as possible for the user we are limiting the number of places that a user can input data into the system. The following table indicates all of the places and the types of data that a user can input into that field, as well as any checks that we must perform on the data entered.

Element	Location	Data type	Limits
Username	Figure 2.1, Section 1	String	Must be a username validated by ICN Must be <20 characters
Load Blank from File	Figure 2.2, Section 3	String (File explorer)	Must be a .csv file in the “blanks” folder
Save Blank to File	Figure 2.2, Section 3	String (File explorer)	Must be a .csv file with a name that follows the Windows filename creation rules
Load Blank from File	Figure 3.6	String (File explorer)	Must be a .csv file in the “blanks” folder

## **Appendix A - Agreement Between Customer and Contractor**

This document outlines the user interface design that is agreed upon by the customer and the development team for the Chemistry Instrumentation project. By signing and dating in the specified fields, both parties agree on the information outlined within the contents of this document.

In the event that any information within this document changes, the software team is liable to meet with the client and review any alterations. If both parties agree to the new information, new signatures and dates will be recorded for the new version.

**Mitchell Bruce**



**12/11/2025**

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Customer Name

Customer Signature

Date

**Alexander Ayer**



**12/03/2025**

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Team Member

Team Member Signature

Date

**Conall Gouveia**



**12/03/2025**

---

Team Member

Team Member Signature

Date

/s/ Eric Jestel

**Eric Jestel**

**12/03/2025**

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Team Member

Team Member Signature

Date

/s/ Chris Letourneau

**Chris Letourneau**

**12/03/2025**

---

Team Member

Team Member Signature

Date



**12/03/2025**

**Bryce Roy**

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Team Member

Team Member Signature

Date

## Appendix B – Team Review Sign-off

Below are the signatures of all the team members working on the chemistry instrumentation project. By signing this document, all team members agree to its contents and format. Along with signatures, any member can provide comments in the provided space to list any concerns or disagreement that they may have with the information covered within this document.

Alexander Ayer		12/03/2025	N/A
Print Name	Signature	Date	Comments
Eric Jestel	/s/ Eric Jestel	12/03/2025	N/A
Print Name	Signature	Date	Comments
Chris Letourneau	/s/ Chris Letourneau	12/03/2025	N/A
Print Name	Signature	Date	Comments
Conall Gouveia		12/03/2025	N/A
Print Name	Signature	Date	Comments
Bryce Roy		12/03/2025	N/A
Print Name	Signature	Date	Comments
Additional Comments:			

## **Appendix C – Document Contributions**

Eric Jestel: Worked on 1 (not citations). Some writing for 2. Created all figures. Revisions on Sections 2, 3

Alex Ayer: Wrote the user interface walkthrough

Bryce Roy: Reviewed all sections for grammatical errors

Chris L: Worked on section 1 and section 4

Conall Gouveia: Wrote as well as revised Section 2