Biotech Research hazardous system for NW-BYOTEK Inc.

System Design Specification Document

May 1, 2023

Prepared by Triton Consulting Group

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Section 1: Management Summary

The following System Design Specification was compiled by Triton Consulting Group for NW-BYOTEK Inc. as per the request submitted to us on April 3rd, 2023. This report outlines our preliminary findings regarding the chemical inventory management, security, and alert system. This document was designed with the document managers and users in mind to help demonstrate how the new system is going to operate.

Our task was to create a design for a web-based application to serve as the central interface for managing incoming and outgoing chemical inventories for the storage facility and labs at NW-BYOTEK. Each of the twelve laboratories are independent and are led by scientists who conduct their own research. As a requirement from the City of Seattle, the quantity of each chemical must be tracked throughout the building, from the moment it is delivered by the vendor, requested by one of the laboratories, and then expended during a lab procedure or experiment.

This system also intends to host a live feed of the security cameras placed throughout the facility, which can be accessed by the security staff and chief security officer. Additionally, the system must be able to generate and/or relay access request codes from the chief security officer to the lab technicians, and properly interface with the building's security systems.

Lastly, the system should generate several types of alerts via the alerts screen and/or email and SMS. These alerts will notify various individuals of certain events, such as low inventory reports for lab technicians, access requests for security and CSO, spill alerts for CSO and potentially Seattle Fire. Additional types of alerts may need to be added as this program develops and matures.

1.1 Effort To-Date

4/3	Project scenario, functional and nonfunctional requirement review
4/14	Prototype planning
4/16	UI mockups
4/18	Storyboarding
4/18	Prototype sent to client
4/20	Database design
4/21	Dictionary and specifications
4/27	Process and network models
4/29 (current)	Feedback and review with client

1.2 Current Status Report

As of today, May 1st, our team is comfortable with our understanding of the system requirements and potential challenges. So far, we have delivered a list of functional and

nonfunctional requirements, a prototype plan, a UI mockup, and storyboard. We also completed our initial database design and data dictionary, where we defined many of the necessary data types and relationships between entities. Before the implementation phase begins, we would like to receive final approval from the NW-BYOTEK management team and stakeholders.

1.3 Project Costs

The total cost of the NW-BYOTEK Inc system is estimated to be around $43,000.00 and that includes all the tangible and intangible costs like the contracts, training, installation cost, materials, labor, maintenance cost, warranty, support, and so on.

1.4 Benefits of the new system

Central database: The quantity and location of each chemical, in both the storage facility and labs, will be stored in a central database. As chemicals are scanned into the system by the vendors, the storage facility's inventory will be updated in real time. Similarly, as chemical delivery requests are processed by lab technicians and delivered to the laboratories, these quantities will be deducted from the storage facility's digital inventory and transferred to those specific lab's digital inventories.

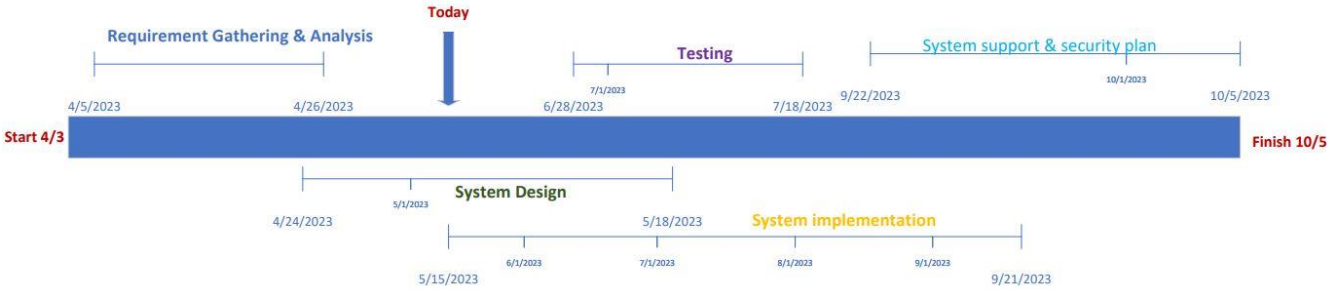
Security: The system will provide an elevated level of security for the storage as requested by the Chief Security Officer.

The cameras equipped with motion detectors will detect any movement around the storage and send an alert to the Chief Security Officer and act.

Safety: The system equipped with sensors will detect any spillage and send an alert to the Chief Security Officer and the fire department. This will prevent disasters.

Save Time: The new system will save the researchers considerable time by providing reports of the chemicals that need to be fulfilled instead of doing it manually. The report will contain the location of the chemicals as well and that will allow the vendors to go straight to the locations instead of searching the 2500 square feet location and that can be time-consuming.

1.5 Present system implementation schedule



1.6 Issues

Maintenance and enhancements

The system is complex since it includes a database, web servers, and security cameras. To maintain the system, the employees must have experience and expertise in areas of database management systems, web service administration, and security camera systems. The employees must be able to work collaboratively to ensure the system runs smoothly while troubleshooting issues and implementing necessary upgrades and improvements. NW-BYOTEK management must be receptive toward employee requests for enhancements and fixes and provide adequate funding for the development team.

Training

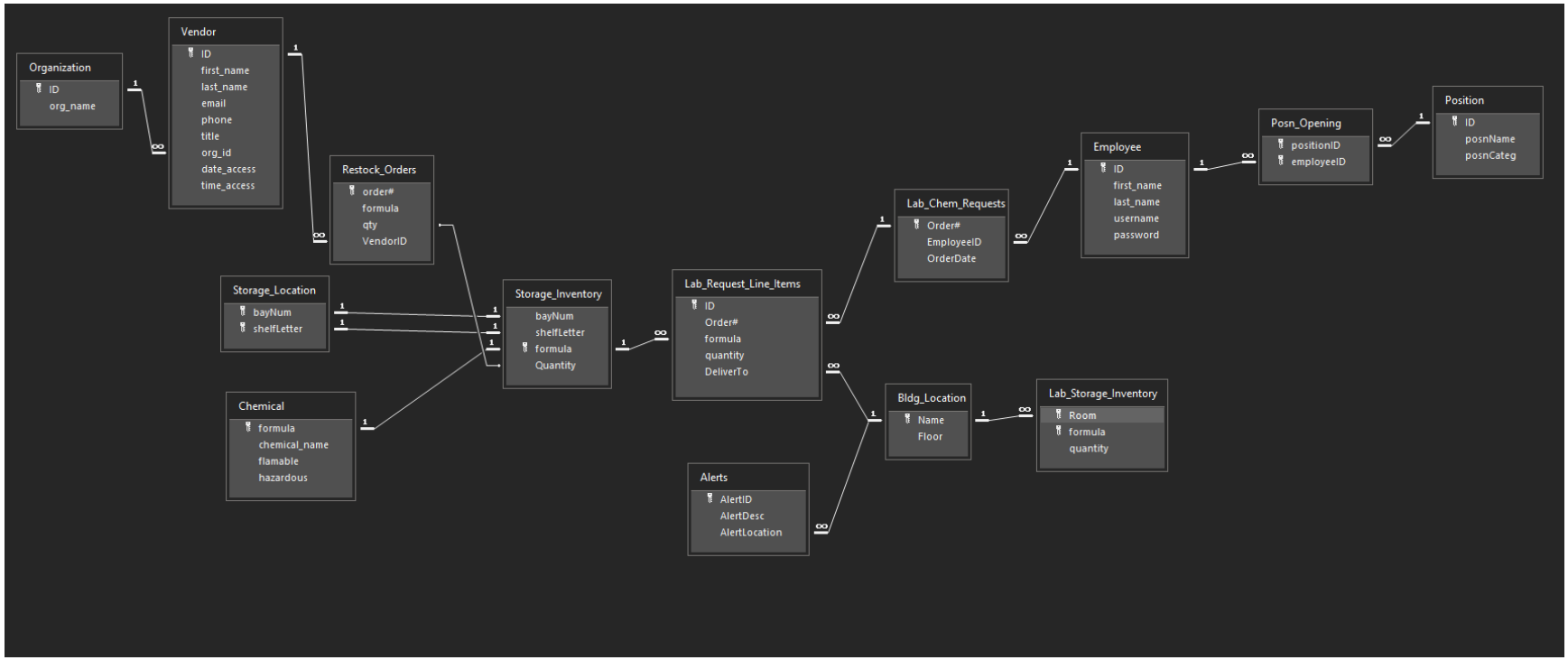
The system relies heavily on the employee's ability to accurately enter data and follow safety protocols. Proper training must be provided to all employees to reduce the risk of accidents and data errors.

Security risks

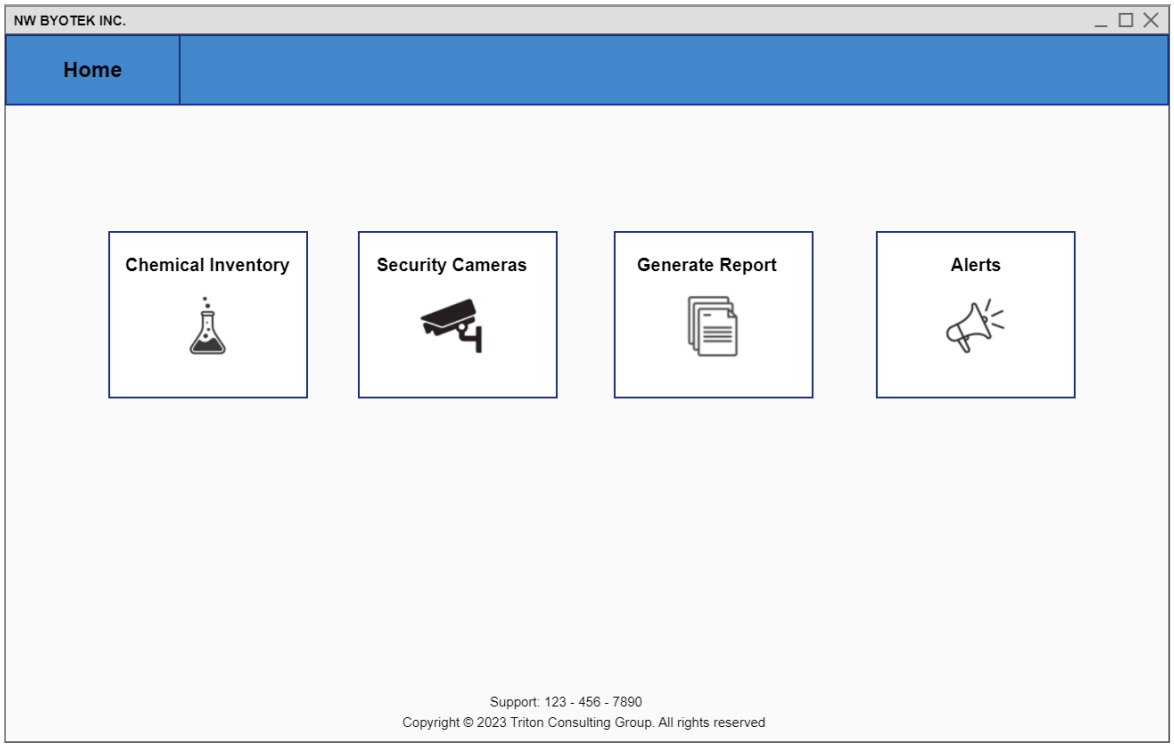
The system will handle sensitive information and material which makes it prone to data breach and unauthorized access. The data is backed up at the end of every day which can leave room for a small loss of data if a failure or disaster occurs.

Section 2: System Components

2.1 Database Design

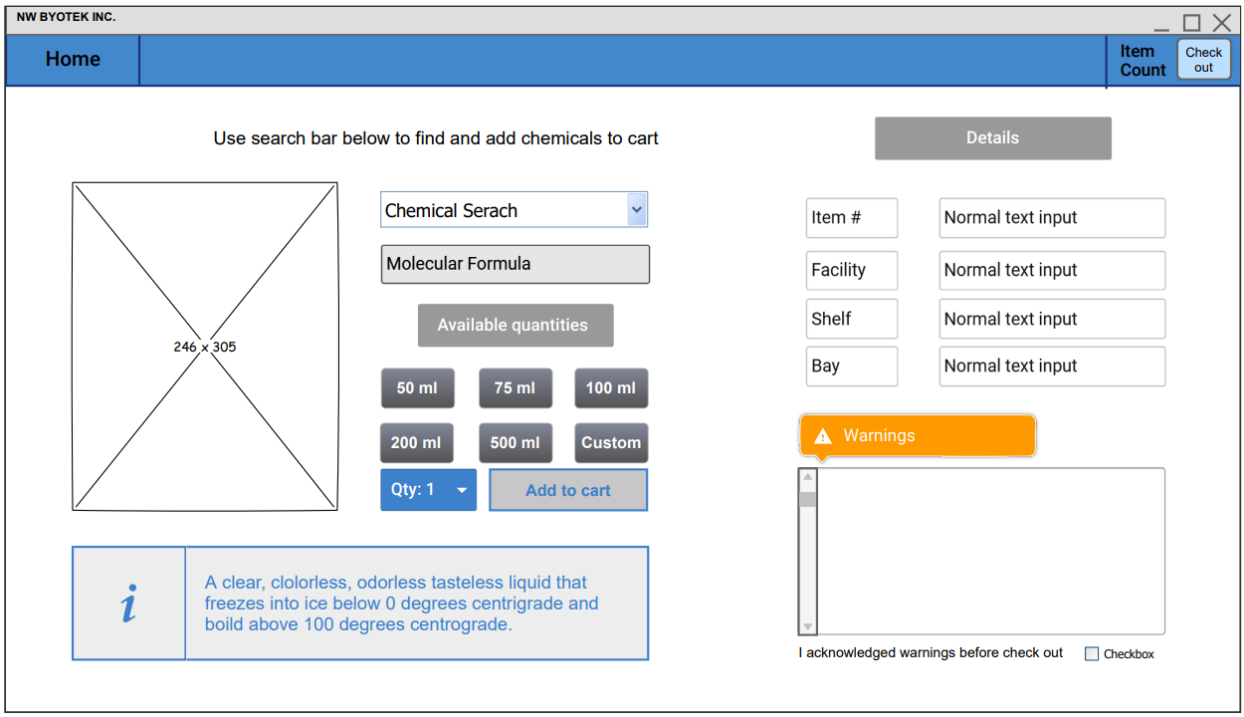


2.2 Home Page



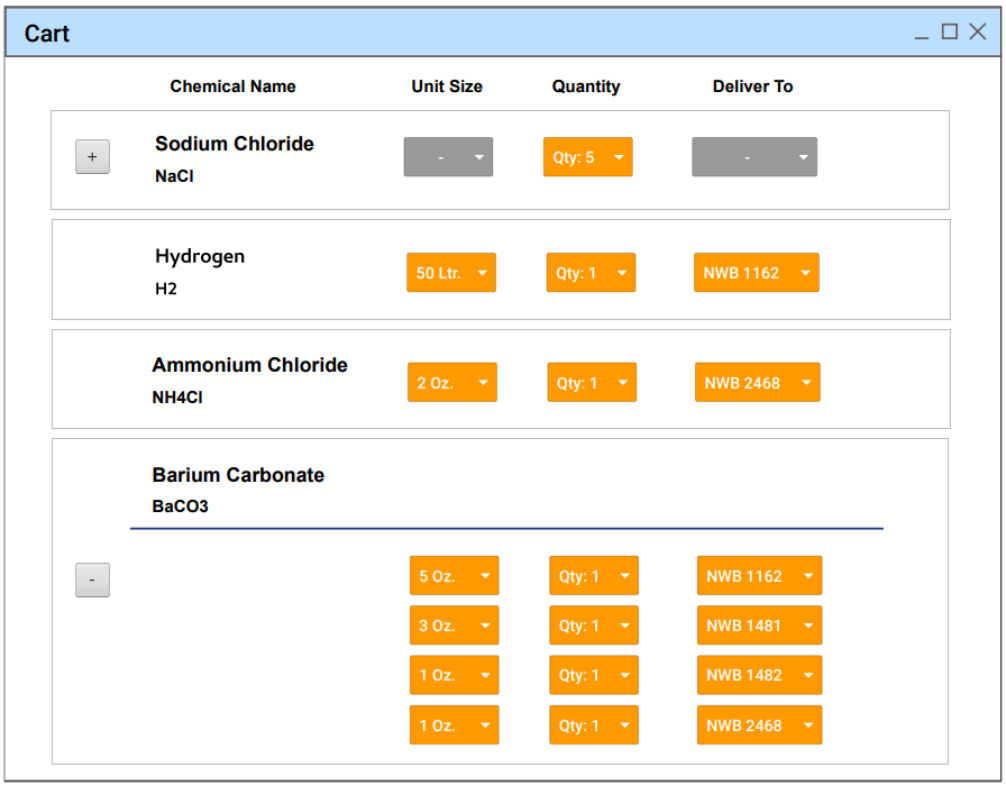
The Home page serves as the gateway to all other UI screens. Most individuals using this system will only need access to one or two of these pages, depending on the responsibilities of their role. Therefore, the system will implement user access controls over these items accordingly.

2.3 Chemical Selection Page



The Chemical Selection page will allow principal investigators and lead scientists to browse the range of available items in the NW-BYOTEK storage facility and view available quantity amounts. These quantity amounts may then be requested in multiples (for example, a request for two 5 oz. containers of Barium Carbonate, as well as a single 1 oz. container, all belonging to the same order). The page will also display molecular formulas, storage location data, and handling/usage warnings.

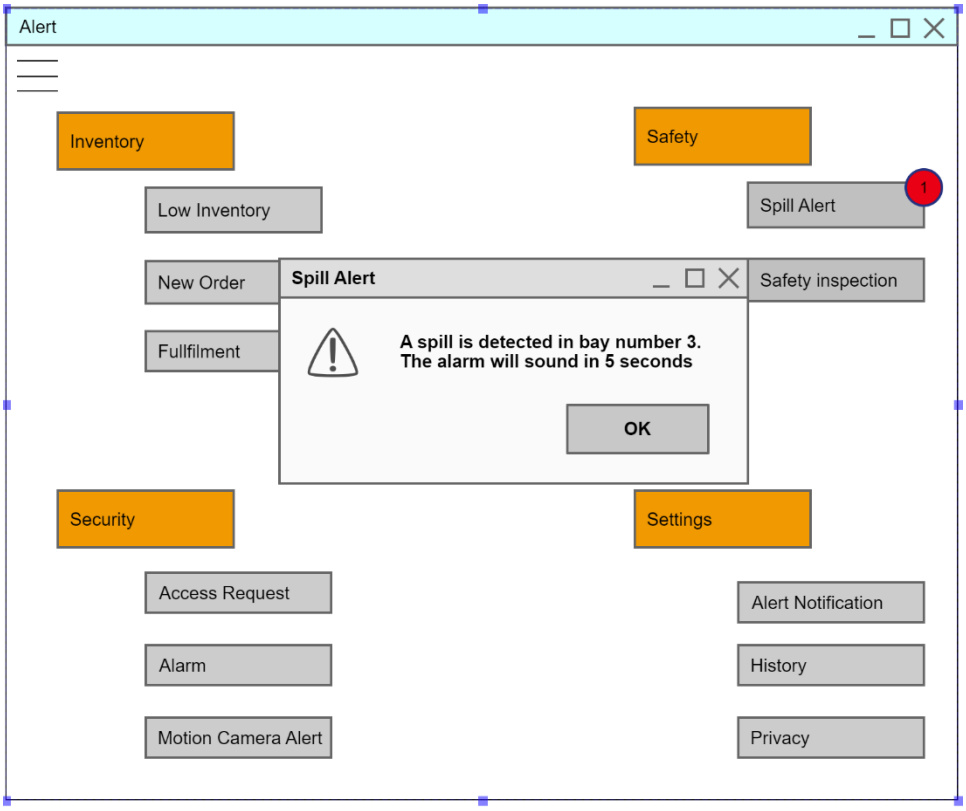
2.4 Cart Page



Once the lead scientist or principal investigator selects at least one item to be added to their cart, they may then proceed to the cart page, where they may review and/or modify the unit size and quantity amount of chemicals that they are requesting. This page also requires the user to select which lab they would like their materials delivered to.

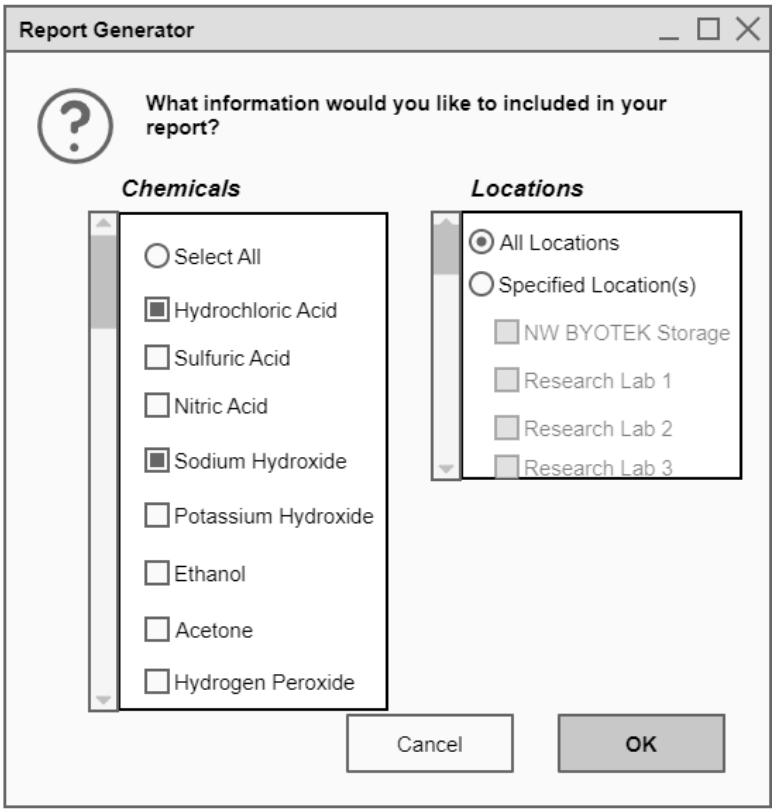
Note that via a single chemical request order, items can be requested from multiple different labs. This was intentional in our design but can be changed if necessary. Our assumption is that this will allow greater flexibility and usability if the same people end up working in multiple different labs.

2.5 Alert Page



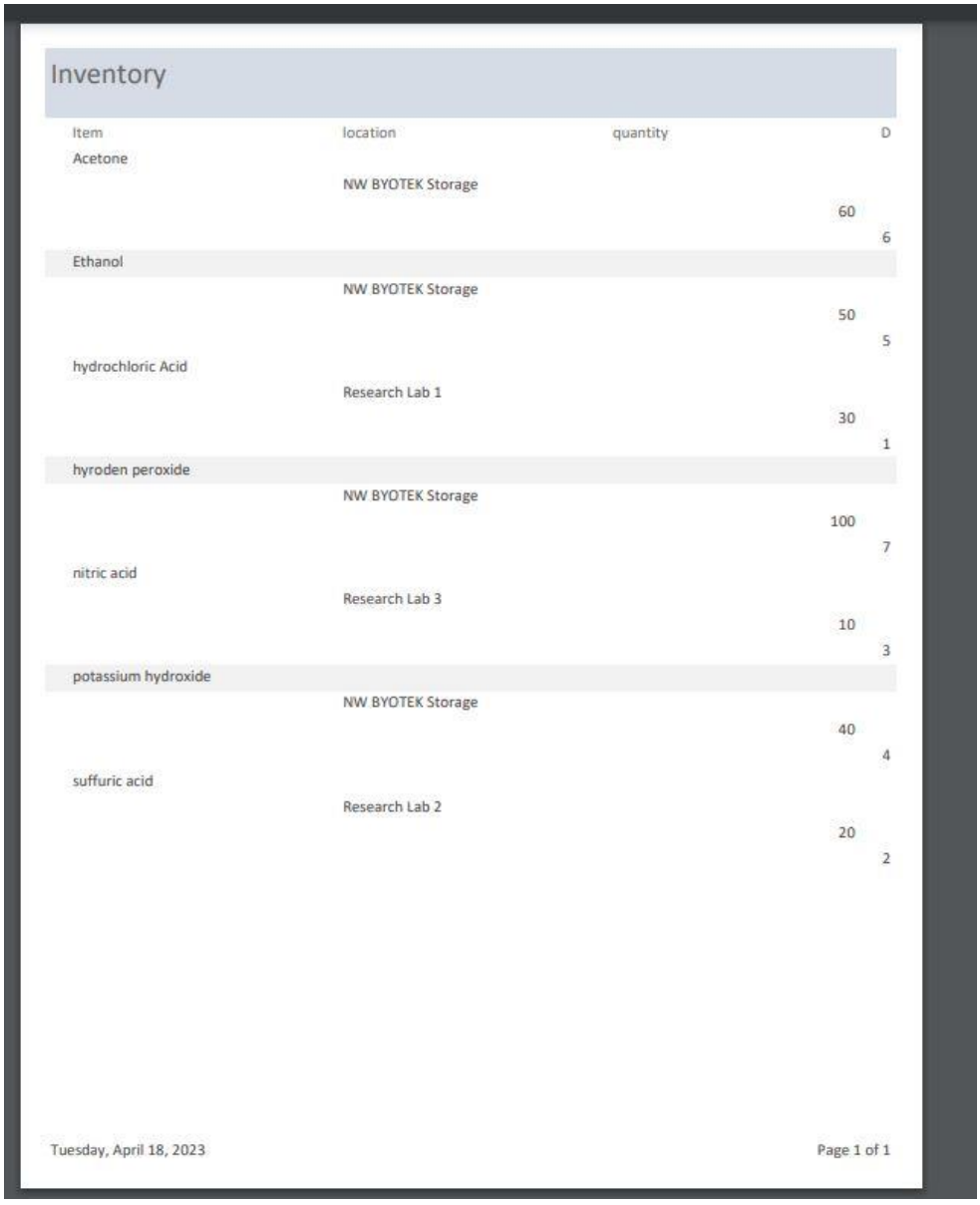
The alert page displays the important messages or alerts that need immediate attention related to safety, security, and inventory. Inventory alerts will include low Inventory, new orders, and fulfillments. The security alerts will include a motion camera alert and an alarm. Safety alerts will include spill alerts which may provide information about the type of chemical detected to have been spilled, as well as alerts to notify about upcoming safety inspections or monitoring requests from the Seattle Fire Department.

Generate Report



The report generator allows the user to query a list of results which currently include two types of criteria/filters. First, users may specify which chemicals they want included in the report, or alternatively, opt to have all chemicals in the report. The second criterion will be its location in the NW-BYOTEK facility. Either all locations may be selected, or a specific location may be selected.

Storage Inventory Report



Inventory

Item	location	quantity	D
Acetone			
	NW BYOTEK Storage		
		60	
			6
Ethanol			
	NW BYOTEK Storage		
		50	
			5
hydrochloric Acid			
	Research Lab 1		
		30	
			1
hyroden peroxide			
	NW BYOTEK Storage		
		100	
			7
nitric acid			
	Research Lab 3		
		10	
			3
potassium hydroxide			
	NW BYOTEK Storage		
		40	
			4
suffuric acid			
	Research Lab 2		
		20	
			2

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The Storage Inventory Report displays a list containing the name and quantity of each chemical which is in either the storage facility or one of the labs. We expect that additional types of reports may need to be generated in the future should business needs change.

Section 3: Prototype Approach

3.1 Purpose

Prototyping provides the opportunity to test different system concepts before they are finalized. The purpose of the prototype is to create an example of the new system that will be tested and evaluated in the preliminary stages of the design. This will make it possible to identify errors and any missing functionality before the system is implemented.

The prototype also makes it possible for the stakeholders to follow the design process and leave feedback which is necessary to ensure that the new system meets the needs and expectations of its users. The prototype is crucial since it allows us to identify and adjust issues early in the process which speeds up the development process.

3.2 Approach

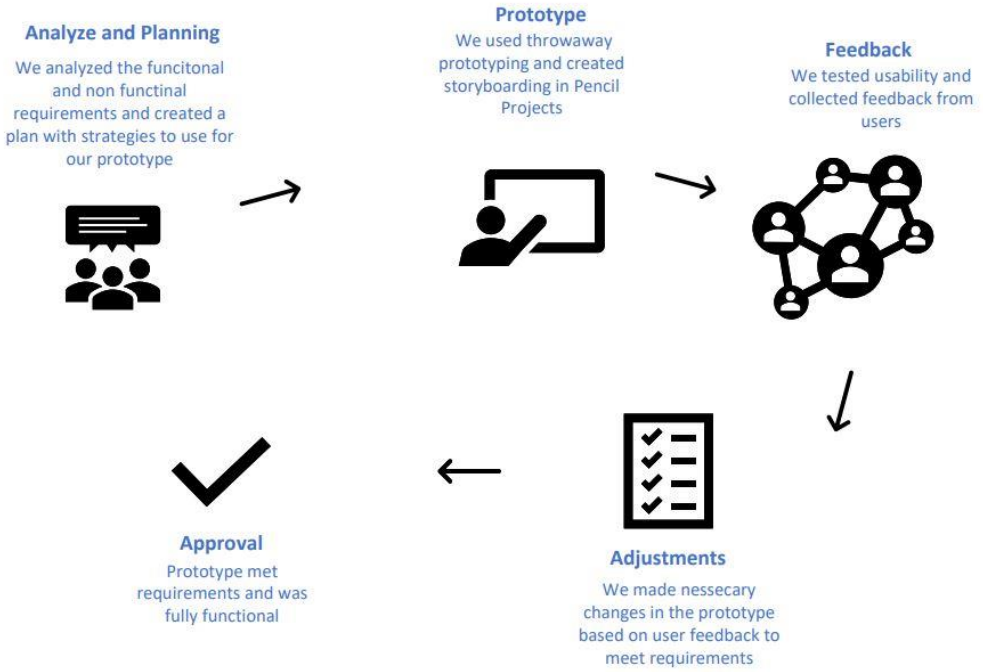
We used the throw away approach in our prototyping as it allowed us to quickly create a design for the stakeholders to review. The stakeholders had clearly communicated the system's needs and requirements and therefore we were able to create storyboarding to visually create a representation of the new system's function and features. This quick approach ensured that we got the needed feedback from the users in an early stage and could adjust issues right away. By receiving feedback this early on we were able to avoid investing time and money in a system that would not meet the expectations of the users.

3.3 Plan

To plan the prototype, we started by analyzing the stakeholder's functional and nonfunctional requirements and we also looked over their needs. Following that, we created a plan where we decided what prototype approach would benefit us the most and we created a timeline that included the steps to finalize the prototype.

We began developing the prototype using storyboarding and displaying all screens the users would interact with the new system. After that, we conducted user testing and survey feedback. From the feedback we gained, we were able to adjust the prototype. When the adjustments were made, we were able to do the final testing to ensure the systems met all the requirements and needs.

3.4 Prototype plan



Section 4: System Environment

The system environment of NW-BYOTEK is based around what type of facility it is, a biotech research facility with twelve laboratories, security monitoring rooms, and rooms for work PCs. Because of this, there are some constraints and obstacles we have had to deal with to make the system run as optimally as possible. To make it so that all the NW-BYOTEK employees can use the computers when needed, the database stores employee information and log ins that differ depending on the employee type. Scientists have clearance for computer stations outside of the laboratories to do paperwork and further research, while guards can access security footage and vendors keep track of laboratory storage.

The workstation computers at NW-BYOTEK are capable machines, so it will have no issue running custom software designed with said computers in mind. Said software has been designed with Windows 10 and 11 in mind since NW-BIOTEK is planning to upgrade from 10 to 11 very soon. Every computer at NW-BYOTEK has an SSD that is around 500 gigabytes. The web application was designed to be quick, easy to understand immediately, and have no response time errors or other bugs due to the real time nature of the inventory tracking and security camera footage. Every few months the scientists must turn in progress reports about how their current work is going and what needs to be further researched. To help offset some of the

workload, the software comes with a section for generating reports that each scientist can plug information into, though it is expected that each scientist will use the generated reports as a basis rather than the entire report.

The NW-BYOTEK security system has security cameras running in all twelve laboratories as well as outside of the facility, all of which are connected to the central security system, the database, and the cloud. Speaking of the database and cloud, precautions have been taken so that important data is not lost if there is a catastrophic system failure. Both the system database and the cloud are backed up at the end of every day so that if the system fails, there will not be much if any data lost to said failure. The facility also has a backup power generator, since electricity is required to run everything in the building which includes the system and database, if the power cuts out from a storm or for some other reason the backup generator will kick in to keep everything running.

Finally, everything with the BIOTEK facility as well as the system we are designing for it is compliant with the Health Insurance Portability and Accountability Act. This is because even if the scientists do not directly work with any patients, the materials that are used to make the cures/medicine need to be handled with proper safety and caution so that when in the future these materials can be used by doctors for patients it is safe and does not cause common major side effects.

Section 5: Implementation Requirements

5.1 Start-Up Processing

The system will initialize all its components, specifically the database server on site, the web server, and any other required services. The system should be integrated with all safety systems including the on-site security cameras, the biometric scanner, gas detection systems or fume hoods, and fire alarms for the system to process alerts properly. Backup and recovery fail safes need to be properly set up in the event of system failure or data loss. When setting up the initial inventory software, the system should prompt the user to provide all current chemical details and locations where they are stored.

5.2 Initial Data Entry

Initially, all chemicals located in the NW-BYOTEK storage facility and subsequent research laboratories need to be entered into the inventory database via the In-house software. Every location that houses chemicals will need to submit a full list of what chemicals are being stored at that location, the amount of each chemical in milliliters or liters, and whether the chemicals are hazardous or flammable. After initial entry, whenever a chemical is used or moved to another location, the chemical entry for each location involved must update the chemical information immediately.

5.3 User Training Requirements

All system users will need to be trained in how to use the inventory software's basic functions such as logging on, finding chemicals and their locations, submitting requests for chemicals, and editing/adding new chemicals to the database. Users should be professionally trained to enter data accurately and promptly, including entering the correct chemical names, chemical formulas, amounts of each chemical in milliliters or liters, and locations. All users that have direct access to chemicals will need to learn what is proper protocol when the system gives out a safety alert regarding hazardous chemical spills, fire alarms, and gas detection. Users that have access to chemicals will finally need to be trained in how to properly handle, label, and store various chemicals on site.

5.4 Software Test Plans

The objectives of testing the inventory tracking software are to verify that the software tracks and manages chemical data accurately, to certify that the software meets all functional requirements, to confirm that the software has reliable performance, and to verify that the software is user-friendly. The tracking software will be tested in an environment that closely resembles the production environment. It is important to utilize both manual and automated testing, automatic testing will be used for any repetitive functions such as report generation and data entry, while manual testing will used to ensure that the software meets user accessibility requirements and functions properly in various simulations of real-world scenarios.

Section 6: Time and Cost Estimates

6.1 Detailed schedule

The Triton Consulting Group finished the design phase of the System Development Life Cycle. After approval from the management, the team will start the two last phases of the SDLC which are the System Implementation and System Support and Security. A Gant chart figure X was created to map the schedule of the accomplished phases and the next phases.

Task Mode	Task Name	Duration	Start	Finish	% Complete	Actual Cost	Cost1
✓	**Requirement Gathering and Analysis**	**16 days**	**Wed 4/5/23**	**Wed 4/26/23**	**100%**	**$1,400.00**	**$1,500.00**
✓	Case Study	4 days	Wed 4/5/23	Mon 4/10/23	100%	$300.00	$200.00
✓	Highliting the functional and non-functional requirement	6 days	Tue 4/11/23	Tue 4/18/23	100%	$300.00	$250.00
✓	User Interface Requirement(Team Review)	4 days	Wed 4/19/23	Mon 4/24/23	100%	$300.00	$400.00
✓	Prototyping Requirement(Team Review)	2 days	Tue 4/25/23	Wed 4/26/23	100%	$300.00	$400.00
✓	**System Design**	**19 days**	**Mon 4/24/23**	**Thu 5/18/23**	**100%**	**$6,300.00**	**$7,300.00**
✓	User Interface design	4 days	Mon 4/24/23	Thu 4/27/23	100%	$1,500.00	$1,800.00
✓	Report Design Mockups	5 days	Fri 4/28/23	Thu 5/4/23	100%	$1,500.00	$1,600.00
✓	Database Design	7 days	Thu 5/4/23	Fri 5/12/23	100%	$2,300.00	$2,600.00
✓	System Architecture	7 days	Wed 5/10/23	Thu 5/18/23	100%	$1,000.00	$1,300.00
✓	Process Flow	4 days	Wed 5/10/23	Mon 5/15/23	100%	$0.00	$0.00
✓	Network Models	3 days	Wed 5/10/23	Fri 5/12/23	100%	$0.00	$0.00
	System Implementation	**94 days**	**Mon 5/15/23**	**Thu 9/21/23**	**0%**	**$0.00**	**$10,000.00**
	Coding	25 days	Mon 5/15/23	Fri 6/16/23	0%	$0.00	$0.00
	Testing Plan(Team Review)	7 days	Mon 6/19/23	Tue 6/27/23	0%	$0.00	$0.00
	Testing	15 days	Wed 6/28/23	Tue 7/18/23	0%	$0.00	$0.00
	Documentation Plan	20 days	Wed 7/19/23	Tue 8/15/23	0%	$0.00	$0.00
	Installation/ Go Live	10 days	Wed 8/16/23	Tue 8/29/23	0%	$0.00	$0.00
	Training	7 days	Wed 8/30/23	Thu 9/7/23	0%	$0.00	$0.00
	Operation and Maintenance plan	10 days	Fri 9/8/23	Thu 9/21/23	0%	$0.00	$15,000.00
	System Support and Security Plan	10 days	Fri 9/22/23	Thu 10/5/23	0%	$0.00	$10,000.00

In the next section, a detailed timeline of the phases is presented.

Requirement Gathering and Analysis: Before starting any design, our team spent two weeks studying the case, understanding the functional and non-functional requirements, and studying the user interface and prototype requirements.

Design: The team was able to design the user interface in four days, a report design mockup in five days, a database design in seven days, and a system architecture (Process flow and Network Models) in seven days. The team spent a total of twenty-three days in the design phase.

System Implementation: The programming team will finish the implementation in approximately ninety-four days. Here are the steps in more detail:

Programming: Working from the logical design already created, the programming team will transform it into a code statement. It will be the longest step, and the team is predicted to finish it in about twenty-five days.

Testing Plan: Before starting any testing, the programming team will spend about seven days producing a testing plan.

Testing: The programs will be tested and make sure they are running properly. This step will take at most fifteen days.

Documentation Plan: In this step, the information system will be described. The team will work on the program documentation, system documentation, operation documentation, and user documentation that includes the user manual. This step will take about twenty days to accomplish.

Installation/Go Live: After the information system gets approved, passes all the testing, and all the documentation is updated, the installation will be performed. This step will take around ten days.

Training the vendors, lab technicians, and storage employees: At this point training and video tutorials will be available for the concerned employees who will be interacting with the system. The training should not take longer than seven days.

Operation and maintenance plan: At this point, our team and the programming team will work together to produce a plan for the test environment. It will take about ten days to accomplish.

System Support and Security Plan: Security plan is the last step in the SDLC. Before completely delivering the new system, the team implements a security plan to protect the system from any outside threats. This will be developed in about ten days.

6.2 Cost Estimate

The total cost of the NW-BYOTEK Inc system is estimated to be around $43,000.00 total.

$1,500.00 is the cost estimation for the work performed by our team for the requirement gathering and analysis.

$7,300.00 is the amount predicted to be spent in the system design phase.

$10,000.00 will cover the programming team contract, the training, installation cost, materials purchased, labor, and warranty.

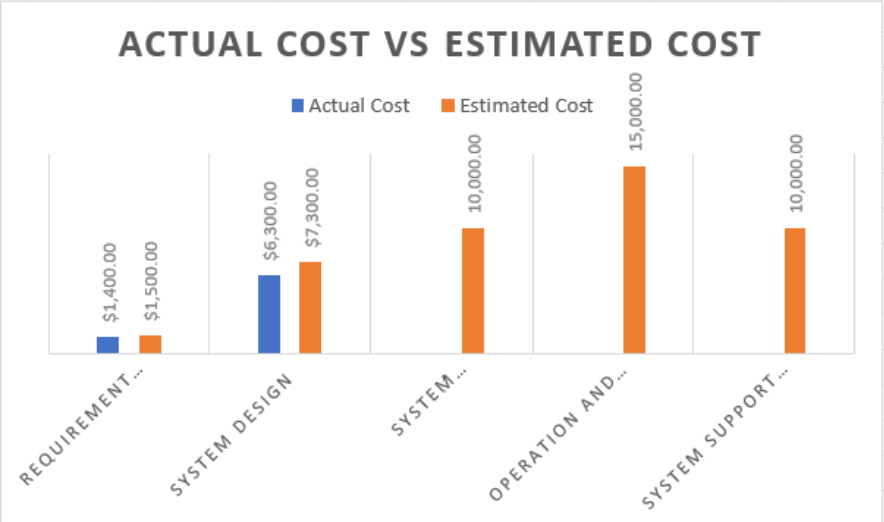
$15,000.00 will cover the operation and maintenance expenses.

$10,000.00 will be spent on system security and system support.

Total Costs-to-date for the Project

The project has stayed within budget so far. In the Requirement Gathering and Analysis, $1,400.00 out of 1,500.00 was spent. The design cost was $6,300.00 and the estimated budget for the phase was $7,300.00.

The chart below shows a comparison between the cost-to-date and the estimated cost for the accomplished phases and the coming phases.



Staffing requirements for the systems development

The Triton Consulting Group is working on hiring a programming team to work on the system development phase. The programming team will have the duty of coding, testing, and describing the testing for managers, taking care of all the documentation, and installing the new system which includes training the users. Our team is looking for programmers that will stay within budget, follow the schedule, and deliver a quality project.

Section 7: Next Step

After getting the management approval, the Triton Consulting Group will start working on finalizing the user interface, the database, and the system architecture.

The programming team will revise all the testing and documentation plans and finalize them. They will also review the training, the maintenance, and the security plan and bring any necessary modifications before moving into action and starting the actual work.