Chemical Inventory Management System

Software Requirements Specifications

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Revision History:

Dates	Description	Comments

Document Approval:

The following Software Requirements Specification has been accepted and approved by the following:

Signature	Printed Name	Title	Date

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1.Introduction

Tracking in chemical inventory and management are important for safety as regulatory and challenging laboratory organizations, minimization of hazardous waste, responses and preparedness for emergencies, and all benefit by knowing where they exist and located, which has responsibility. So we are going to develop a web-based system for chemical inventory information and information management. This paper explains how the data in the database is going to ease work for chemical coordinators to manage chemicals , and it will be useful for chemical coordinators to maintain and manage chemical inventory and management.

A Chemical Inventory is an inventory system that keeps a record of chemicals and other hazardous materials present in the laboratory/workplace. Ideally, all corporations, whether big or small, are required to maintain an exclusive Chemical Inventory System. It is an important database that monitors all kinds of materials that are flammable, toxic, corrosive or reactive. It also helps in responding effectively to any chemical emergency. It is also known as CIS.

There are at least three reasons why a Chemical Inventory should be maintained. Reasons include: Safety of Workers, Regulatory Compliance, and Cost Reduction. Often the Safety of Workers and Regulatory Compliance are the driving forces, and for good reason; but at the same time maintaining an accurate Chemical Inventory can drive cost reduction. Chemicals used in laboratories have the potential to be Toxic, Water or Air Reactive, Flammable, Radioactive, Pyrophoric, Caustic and/or Acutely Hazardous. It is paramount that workers be protected from these hazards and often there are regulations that mandate that people and the environment are protected from these hazards. In order to keep workers safe and comply with these regulations, the members of the laboratory staff who physically populate and update their Chemical Inventory. The more accurate an inventory is, the better able you are to protect workers, minimize cost, minimize wastes and comply with the applicable regulations. The chemical inventory allows laboratory staff to identify chemicals and quantities in their lab. Not having an accurate inventory can result in, at best, ordering too much of a

particular chemical and not using the chemical before it expires or worse, change to an explosive or reactive chemical. This results in overspending in chemical procurement and increased waste disposal costs. At worst, an inaccurate inventory can result in workers being exposed to unknown hazardous chemicals.

Maintaining an accurate chemical inventory is a never-ending job, and one with little margin for error. Any disagreement or inconsistency could lead to major problems for health, safety, and sustainability.That's why a chemical inventory system is a must for any organization looking to take control of their chemical inventory. A good chemical inventory system offers a number of advantages that will help you simplify chemical ordering, storage, use, and reporting while reducing the potential for human error.

1.1 Purpose

The purpose of this document is to specify, in detail all the functionalities that this software will contain, as agreed upon by the client and the developers. This document will hence assist the developers in realizing this makeshift idea into a solid working application. Further, any individual who wishes to use or appropriate this piece of software can consult this document.

1.2 Document Conventions

MSDS	**Material Safety Data Sheet**
CAS	**Chemical Abstracts Service**
GHS	**Global Harmonization System**

1.Material Safety Data Sheet(MSDS):

A Material Safety Data Sheet (MSDS) is a document that contains information on the potential health effects of exposure to chemicals, or other potentially dangerous substances, and on safe working procedures when handling chemical products.

2.Chemical Abstracts Service(CAS):

CAS Registry Number, also referred to as CASRN or CAS Number, is a unique numerical identifier assigned by the Chemical Abstracts Service to every chemical substance described in the open scientific literature, including organic and inorganic compounds, minerals, isotopes, alloys and non-structural materials.

3.Global Harmonization System(GHS):

The Globally Harmonized System of Classification and Labelling of Chemicals is an internationally agreed-upon standard managed by the United Nations that was set up to replace the assortment of hazardous material classification and labelling schemes previously used around the world. Labelling schemes are shown in the further section of this srs.(source:wikipedia).

1.3 Intended audience and Reading suggestions

This SRS has been developed mainly with the objective of guiding the creation of a software that shall assist Dr.Apurba Das, his students and his staff in maintaining inventory of the Chemical Laboratory. So, it goes without saying that these individuals were kept in mind while writing this document.

Regardless, any individual who wishes to use and/or understand how our software works can refer to the later sections of this SRS.

1.4 Software Scope

The idea behind this software is to keep inventory of a laboratory the size of a typical institution. Its data manipulation functionalities and data storage capabilities can't match the needs of a full-fledged enterprise. Since, this software is meant to cater to the very specific needs of the client, it is very limited in its ability to adapt.

1.5 References

1. Dr. Apurba Das, Associate Professor in Chemistry, Indian Institute of Technology Indore
2. IEEE Recommended Practice for Software Requirements Specifications: http://www.cse.msu.edu/~cse870/IEEEXplore-SRS-template.pdf
3. www.github.com
4. www.geeksforgeeks.org
5. www.w3schools.com
6. www.stackoverflow.com

2. General Description

2.1 Product Perspective

Our project will store following information

1.Chemical Details :
The certain properties of the chemicals such as : chemical formula , molecular weight, physical state, purity etc .

2.Technical Details :
Expiration date , Lot no. , CAS no. , Bottle Reference

3.Location, Sub-location, Additional location information if required .

The inventory would be accessible by the staff members and admin only , through a secure login system.

2.2 Product Functions

The following are the aims the project serves to achieve in order to meet the client's requirements :-
Stock inventory management that updates the available quantities of chemicals and supplies when used in experiments. Other relevant product attributes could include locations and expiration information. Once a chemical is received, proper storage is a proactive means to mitigate the risk associated with the hazards of the chemical. An accurate inventory can provide the basis for ensuring that appropriate safety measures are in place. By tracking chemicals from date of purchase until disposal, we can easily determine how often or with what frequency chemicals are used and will need to be replaced. This saves precious purchasing dollars and reduces needless waste. Lastly, when a chemical nears the end of its lifecycle, proper disposal is crucial to maintain compliance with the relevant legislation.
Records for chemical inventories will include the following:

- Date of inventory
- Date chemical received
- Specific amount of each chemical
- Name, formula, and grade of each chemical printed on the container's label
- Chemical hazard of each item (Material Safety Data Sheet information)
- Safety Data Sheet(SDS)
- Chemical Abstract Service (CAS) registry number
- Source (supplier)
- Container type
- Hazard classification
- Required storage conditions
- Expiration date
- Storage location of each chemical
- Amount of chemical in the container

OVERVIEW OF OUR SOFTWARE :

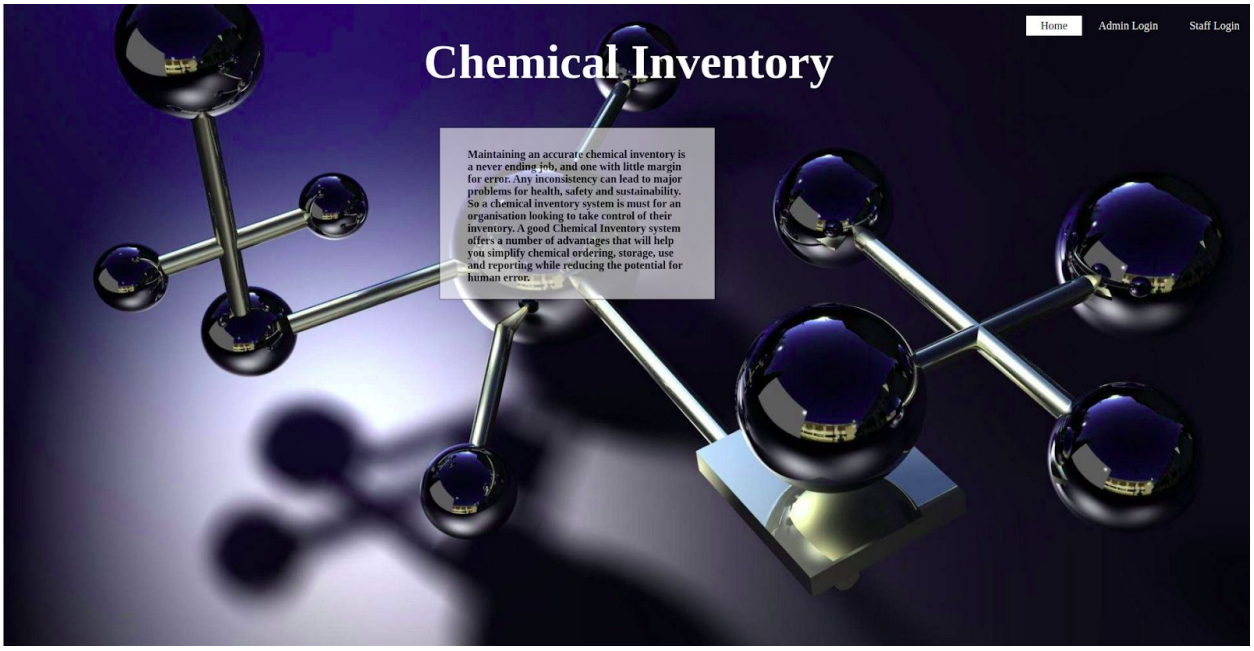
- The Chemical Inventory Overview helps labs identify what chemicals should be inventoried, the minimum information required to track, and how often it should be updated.
- This software main function is to keep record of all chemicals present in the inventory.It allows user i.e staff to search chemical of choice and to view its details such as storage location,Quantity,Molecular Formula,CAS number,Physical State and Purity etc and also to make request for new chemical if it is not there in the inventory.This request will be sent to Admin.
- Admin will have access to approve new requests,add new chemicals,to update any information of the chemical and to delete any chemical if required.
- Staff can go inside the software with different accounts.Simple Users like Lab Staff members cannot access some part of the program i.e to make any changes in the database unless staff holds the account of the administrator.

How to use the software ?

INSTALLATION INSTRUCTION (FRONT-END) :

- To avoid any changes in the already written codes , it is advised to download and keep all the files inside the same folder as the path is specified according to it .
- The files should not be renamed and instead ,used as such .

1) On opening the box.html file , the user will be automatically redirected to the homepage of the site.The homepage will contain some basic info along with links to redirect the user to the login page .



2) There are two login pages made separately for staff members and admin respectively .To further continue,the user must login successfully (i.e must enter the correct username followed by the password) . If the user is not registered in the database,they can sign-up using the sign-up page the link to which is present at the bottom of the respective login pages .

3) Click on staff login if you are a staff member and have already signed-up as a staff .

4) If not , proceed to sign-up (sign-up link is available on the bottom of the sign-in pages for staff and admin respectively)

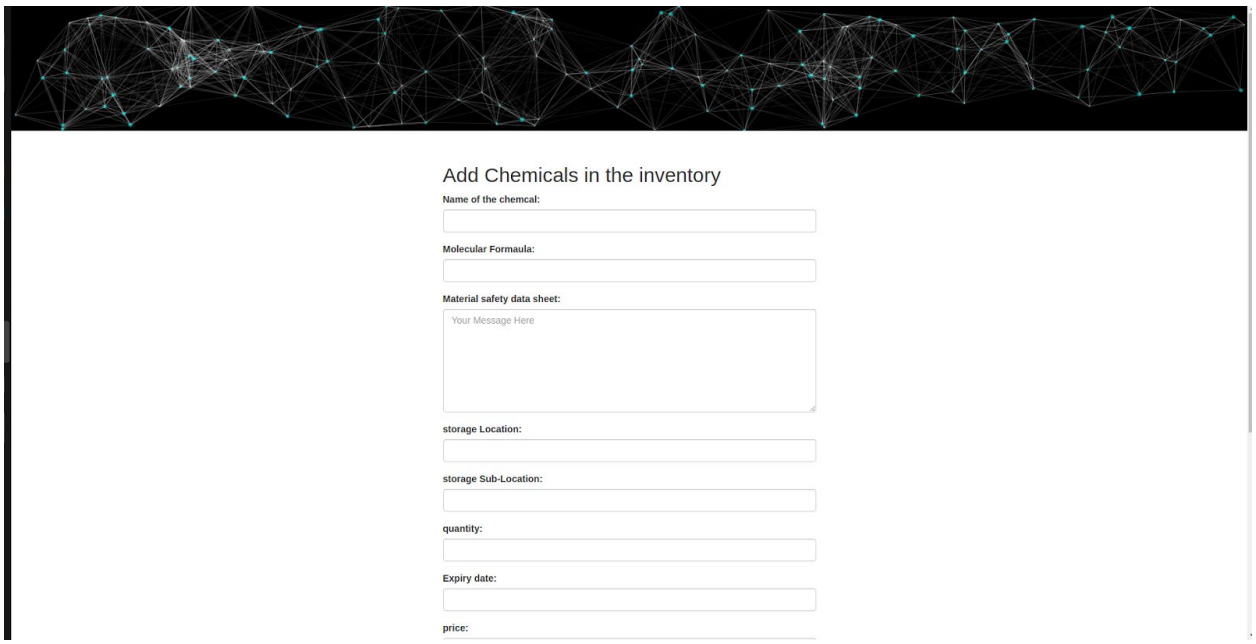
5) Once you've signed in to the inventory , you can access the inventory through the search query page that will be automatically directed to .

6) Output for the required search item will be shown like this

Result of your search query :

Serial Number	Item Name	Vendor	Catalog	Owner	Location	Sub Location	Location Details	Price	Amount in Stock	Unit Size	URL	Details	Expiry Date	Lot number	Cas number	Created By	Alternate name	Bottle Reference	Date opened	Formul
1	Sodium Chloride	St.pot	12	Adminname	Shelf4	S9	locationdet	1000	10	1	url	detailsurl	13/05/2021	34	2	lall	Caustic Soda	4	30/05/2020	NaCl

7) If you are an admin , you can also add/update in the inventory.



8) If you are a staff member , you can only view the inventory .
9) We've provided the user the option to search within the inventory . The results to the query will be displayed after the submit button is pressed.

2.3 User Classes and Characteristics

Users of the system should be able to access the database as per the following classification :

1.Admin:

a) Can view information about chemicals
b) Can insert information about new chemicals
c) Can delete information of chemicals
d) Can update all information of chemicals

2.Staff:

a) Would be able to view the database but not modify or manipulate it.
b) Would be able to see tracking details of all chemicals and other properties of each product which we are specifying in our database.

3.Architecture and Design

3.1.Introduction

This software is essentially a web application meaning that a user would access it using a web browser. There is a backend and there is a frontend. Since the frontend uses HTML 5/CSS 3, any browser that supports these should be able to access the software. As for the backend, it utilises NodeJS which is a Javascript runtime environment built on Chrome's V8 engine. Our backend is built using ExpressJS which is a robust NodeJS server framework.

Our database application serves to do 4 functions - View(including Search), Add, Update and Delete - like any basic CRUD application, but instead made specifically for an inventory of Chemicals.

Our server listens to HTTP Requests on specific URLs, one for each of the above four functions. Whenever an HTTP Request is received on any of these URIs, our server executes a callback function, to deal with the specific request and then delivers an HTTP Response.

What the callback function does is specific to the function. Like, if the user requires to update the database, our function will first take as input the 'Serial' of the particular entry that the user wishes to update. Following this, it will communicate with the database server to collect all the information about this specific entry, display this data on the browser, collects the changes to be made and then updates the database.

3.2.Design

Our file structure is as follows:-

```
-Project_Directory
        --package.json
        --server.js
        --node-modules
                --mysql
                --and other dependencies
        --callbacks
                --view.js
                --search.js
                --update.js
                --add.js
                --delete.js
        --views
                --view.ejs
                --update.ejs
```

--add.ejs

‘Server.js’ is our main server file. Initiating it will get our local server running and will enable it to listen to requests.

‘Node-modules’ stores all the modules and dependencies of our application including ‘express’ and ‘mysql’.

‘Package.json’ is just a config file pertaining to the NodeJs Project that is our directory.

‘Callbacks’ is a separate folder for all of the callback functions that our server calls. Rather than have this piece of code in our main server file, we keep it separate for better visibility and understanding.

‘Views’ contains all the front-end HTML,CSS files that will be displayed. Note that the ‘.ejs’ extension is due to the fact that we need to use a templating-engine which happens to be ‘ejs’. This enables us to pass data from our backend to the frontend and then render it in whichever way we like. ‘Server.js’ will automatically look into this folder to render views.

3.3.Components

Server.js

Our main server file responsible for starting up the server and define how it will function. Utilises several NodeJs modules for several purposes like Express for the server functionality arbitration, ‘cookie-parser’ to enable setting of browser cookies corresponding to user sessions, etc.

MySql

MySql server will listen to requests pertaining to it and run queries and respond with the query results. The MySql driver that is installed as a dependency, abstracts away the actual communication occurring between our Node server and the MySql server.

Callbacks

These are ‘.js’ functions called by ‘Server.js’. May or may not be considered as a separate component, but is still kept separate to avoid confusion. These will act as the middleman for the passing of data between the browser and the server.

EJS(View Engine)

Enables usage of data as Javascript objects in the HTML files.

4. System Features :

The chemical inventory management system keeps a record of the physical and chemical properties of the chemicals present in the lab along with their location, CAS number, purity, manufacturer and vendor.
Hazard Communication Standard, requires employers to make a chemical inventory list of the hazardous chemicals present in the workplace. The chemicals on these lists are identified with markers to easily find the corresponding safety data sheets(sds).
Quick and easy access to the chemical inventory list and safety data sheets allows employees to find important information about the chemicals in their workplace.

- Employees are able to find information on chemical hazards, properties, first aid, personal protective equipment (PPE), emergency procedures, and disposal methods.
- Emergency responders can quickly access chemical safety and hazard information.
- Regulatory chemical and waste reporting can be easily tracked and reported.

Our Chemical inventory lists will include notations of the following for each product :

- Identification marker
- Corresponding SDS on file
- Product name
- Manufacturer's name
- Manufacturer's address, city, and state
- Manufacturer's telephone number and emergency telephone number

Response Sequence :

- Search for a chemical by its name

- Displays a detailed list of all the above mentioned properties

5.User Interface requirements :

User interface (UI) is an important part of any software or hardware or hybrid

system. A software is widely used and accepted if it is :

=> Easy to operate

=> Quick in response

=> Effectively handling operational errors

=> Providing a simple yet consistent UI.

User acceptance majorly depends upon how the user can use the Software . UI is the only way for users to perceive the system.

5.1 User Interfaces :

=> Front-end software :HTML,JavaScript,Css

=> back-end software : Mysql,PHP,node-js

5.2 Hardware Interfaces :

=> Any OS which supports the languages used . For ease , we will be using Windows which is used by our client

Since we have used some advanced css features in the front-end development, it is advised to use IE8 version browsers for accessing the web pages .

5.3 Software Interfaces :

We will use following softwares in our project :

=> Operating system : We will use windows as an OS.

=Code Editor : We will implement our project using Visual Studio Code as the code editor.

Database : To store all the information about chemicals such as their chemical and physical properties we will use MySql.

5.4 Communication Interfaces :

Web portal for chemical inventory management system will have different login pages for staff and admin .We will be using signup and login forms to create profiles of admin and staff. Our project will contain the following pages :

=> login page

=> sign up page

=> chemicals information page

=> page for chemical details such as exp date,qty etc.(can be accessed by admin only.)

=> a page to place order of chemicals.

=> location page.

=> storage page in which we will update information of chemical as it get added or removed.

Our project will have a responsive UI with content presentation,it will also have feedback mechanism and easy navigation to navigate through different pages, strategic use of color and texture to make responsive UI.

6. Non- Functional Requirements

6.1 Performance Requirement

The various steps involved to implement Chemical Inventory Management System are listed down below :

A) E-R Diagram :

An ER diagram shows the relationship among entity sets. An entity set is a group of similar entities and these entities can have attributes. In terms of DBMS, an entity is a table or attribute of a table in a database, so by showing relationship among tables and their attributes, ER diagram shows the complete logical structure of a database.This analysis is then used to organize data as a relation, normalizing relation and finally obtaining a relational database.

B) Normalisation :

Normalization is a process of organizing the data in database to avoid data redundancy, insertion anomaly, update anomaly & deletion anomaly.
There are three types of anomalies that occur when the database is not normalized. These are – Insertion, update and deletion anomaly.
Here are the most commonly used normal forms:

- First normal form(1NF)
- Second normal form(2NF)
- Third normal form(3NF)
- Boyce & Codd normal form (BCNF)

Normalization is the process of breaking down a table into smaller tables. So that each table deals with a single theme. There are three different kinds of modifications of anomalies and formulated the first, second and third normal forms (3NF) is considered sufficient for most practical purposes. It should be considered only after a thorough analysis and complete understanding of its implications.

6.2 Safety requirements

Since the project will be stored **initially** on a **desktop database** i.e a database system that is made to run on a single computer or PC , safety will not be an issue as long as the access to the main PC is restricted (password protected) . However , If we are requested to make an online database by Mr Apurba Das , then we can Backup and restore the database . Database backup is a way to protect and restore a database. It is performed through database replication and can be done for a database or a database server. Database administrators can use the database backup copy to restore the database to its operational state along with its data and logs. The database backup can be stored locally or on a backup server.

6.3 Privacy and Security Requirements

Security is an important issue in database management because information stored in a database is very valuable and many times, a very sensitive commodity. So the data that will be stored in our database system will be protected from abuse and from unauthorized access and updates.

We firmly believe that privacy is just as important as security. That's why you retain full ownership of all data you upload to our servers. We'll never sell your information to third parties.

If we are requested to make an online database , we would segment our database for security . What it really means is that for instance, we might want to have users, super users, administrators, and super administrators. Users can access or input basic information, but not alter information beyond what they've put in, whereas superuser has computer permissions that allow wider access to data without being able to change everything. An administrator can work above all of these users, altering the structure of the database or having access to more sensitive information, while a super administrator can run the whole operation. This ensures that, should a password be exposed on the site, it's not devastating if it's only someone with access to basic information on the site.

6.4 Availability

This software is basically being designed to be used by Mr . Apurba Das for the purpose of maintaining inventory of his Chemical Laboratory and hence will be available to him and his concerned staff .

6.5 Maintainability

The administrators and staff in charge should maintain correct record of the chemicals in the inventory and should update the database as and when required.