INVENTORY MANAGEMENT SYSTEM FOR RETAILERS

TEAM ID-PNT2022TMID12683

1. INTRODUCTION

1.1 Project Overview

When a company does not have any systematic system to record and keep their inventory data, it is difficult for the admin to record the inventory data and keep it in the logbook and not properly organized. For this Retail inventory management is built which is useful for retailers to meet the customers demand without running out of stock or carrying excess supply. In order to manage stocks, retailers can register their accounts by providing their necessary details. Once they have an account they can access the system by logging in. The application allows the retailers to add new stocks, update stocks and view the existing stocks. If the stock falls below a certain threshold value, the system sends an email to the retailer using SendGrid.

1.2 Purpose

The goal of retail inventory management is to maintain the right amount of desired product in stock—neither too little nor too much. Retailers may meet client demand without running out of product by properly managing their inventory. Effective retail inventory management reduces costs and improves knowledge of sales patterns in practice. Tools and techniques for retail inventory management provide merchants with more data on which to run their businesses. Applications have been created to assist shops in keeping track of and managing the supply of their own products. Retailers will be prompted by the system to register their accounts by providing necessary information. Retailers can log into the programme to access their accounts. Once retailers have successfully logged in to the programme, they can update the information on their inventory. Users can also add new goods by providing the necessary information regarding the item. They have access to the current inventory's specifics. If there is no stock detected in the accounts of the retailers, the system will immediately send an email alert to them, in order for them to order new supplies.

2. LITERATURE SURVEY

2.1 Existing problem

Lack of inventory can be negative in a number of businesses, including manufacturing, retail, and food services. In addition to being a liability, inventory also carries a risk. It might be susceptible to theft, harm, and deterioration. Sales might be impacted by having a huge inventory as well. No matter the size of your organization, having an effective inventory management system is crucial. It can assist you in keeping track of all your goods and figuring out the precise costs. Additionally, it can assist you in managing rapid variations in demand without compromising customer satisfaction or product quality. This is especially crucial for businesses that want to focus more on their customers. For businesses with intricate supply chains, balancing the risks of shortages and overstocks is a particularly difficult procedure. Inventory is frequently a present asset that a business expects to sell within a year. To be regarded as a current asset, it must be measured and tallied frequently. For businesses with intricate supply chains, balancing the risks of shortages and overstocks is a particularly difficult procedure. Inventory is frequently a present asset that a business expects to sell within a year. To be regarded as a current asset, it must be measured and tallied frequently.

2.2 References

[1] Punam Khobragade , Roshni Selokar, Rina Maraskolhe, Prof. Manjusha Talmale 2018 “Research paper on Inventory management system” Volume: 05 Issue: 04

[2] Cinthya Vanessa Muñoz Macas, Jorge Andrés Espinoza Aguirre, Rodrigo Arcentales-Carrión, Mario Peña 2021 “Inventory management for retail companies: A literature review and current trends” DOI: 10.1109/ICI2ST51859.2021.00018

[3] Varalakshmi G , Asst Prof. Shivaleela 2021 “A Review of Inventory Management System” Vol. 10, Issue 6, June 2021 DOI: 10.17148/IJARCCE.2021.10689

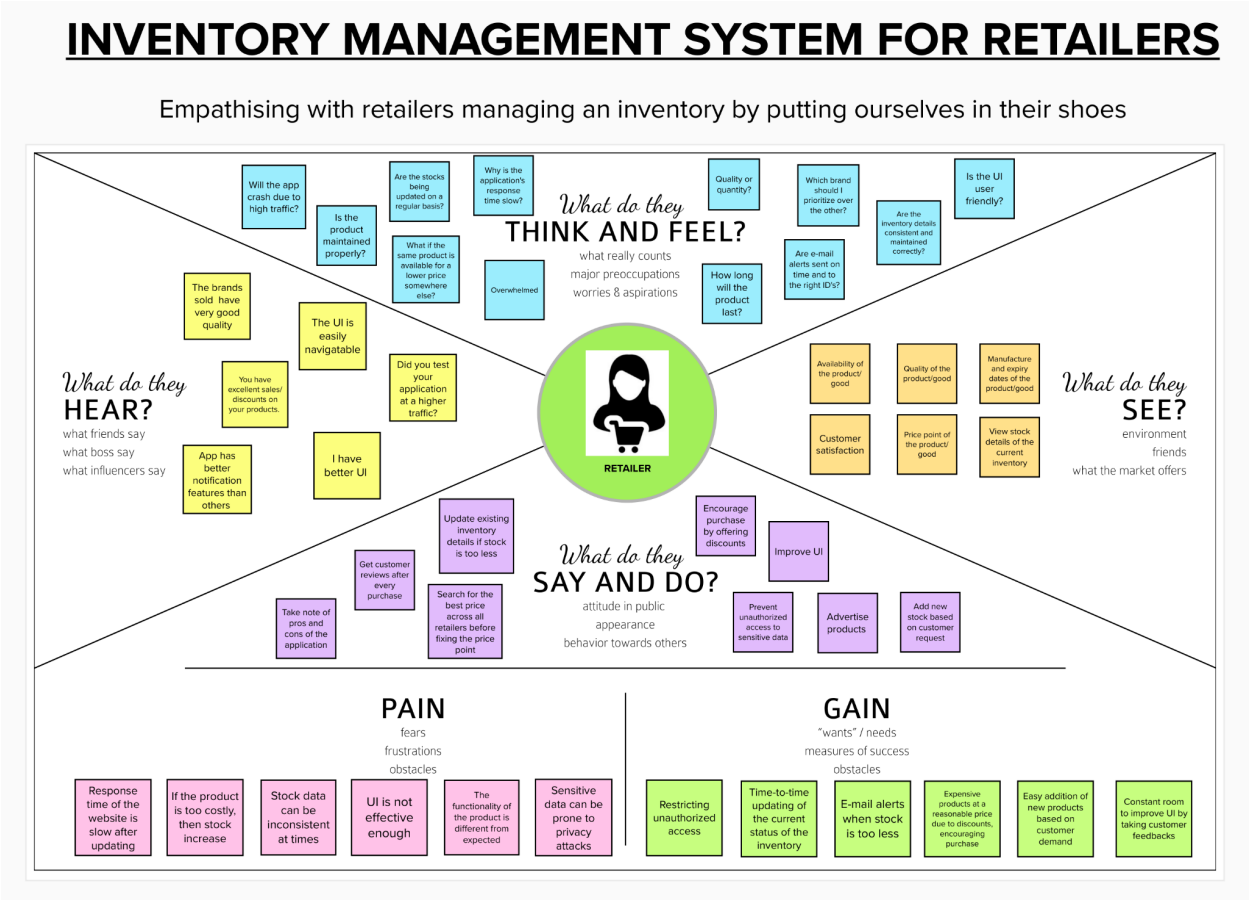
[4] Puppala Sridhar, C.R.Vishnu, R Sridharan 2021 “ Simulation of inventory management systems in retail stores: A case study” Volume 47, Part 15 DO!: 10.1016/j.matpr.2021.05.314

2.3 Problem Statement Definition

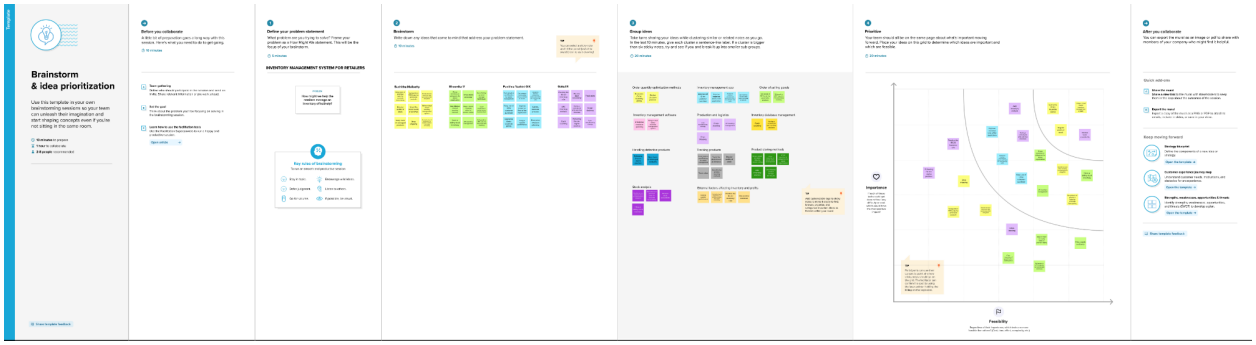
To develop an application for an inventory management system for retailers to meet the customers demand without running out of stock or carrying excess supply. In order to manage stocks, retailers can register their accounts by providing their necessary details. Once they have an account they can access the system by logging in. The application allows the retailers to add new stocks, update stocks and view the existing stocks. If the stock falls below a certain threshold value, the system sends an email to the retailer using SendGrid.

3. IDEATION & PROPOSED SOLUTION

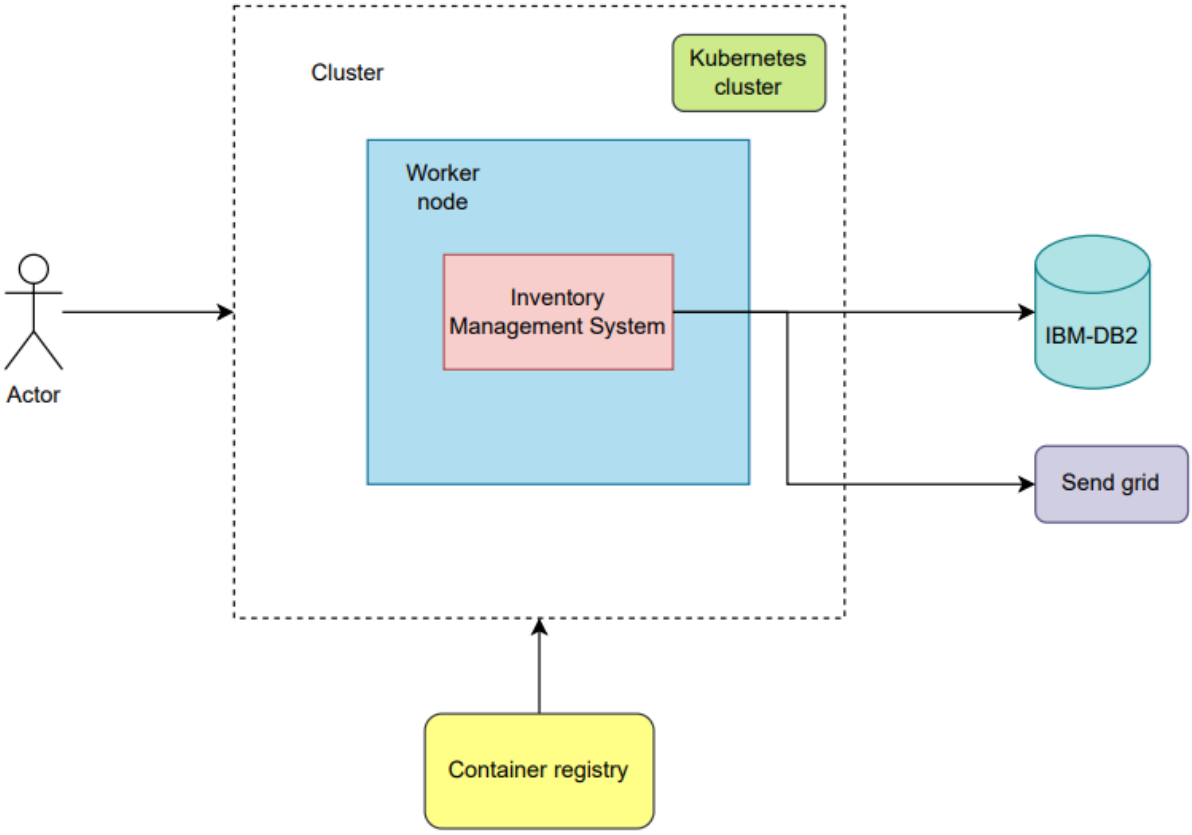
3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3 Proposed Solution



3.4 Problem Solution fit

Problem Solution Fit

INVENTORY MANAGEMENT SYSTEM FOR RETAILERS - TEAM ID - PNT2022TMID12683

Define CS, fit into

1. CUSTOMER SEGMENT(S) CS

Retailers

6. CUSTOMER LIMITATIONS CC

Available devices

Network Connection

5. AVAILABLE SOLUTIONS AS

Manually counting and tallying items

Maintaining Account registers and Excel workbooks

Explore AS,

Focus on J&P, tap into BE, understand

2. JOBS-TO-BE-DONE / PROBLEMS PR

To add, delete and update the inventory.

To notify the retailers about the items which are out of stock.

9. PROBLEM ROOT / CAUSE RC

Manual work consumes time and it is error prone.

Not much organized

7. BEHAVIOUR BE

Enquire the retailers in the neighborhood

Get reference from customers who visit their shop

Focus on J&P, tap into BE, understand

Identify strong TR & EM

3. TRIGGERS TO ACT TR

Monotonous and error prone

4. EMOTIONS: BEFORE / AFTER EM

Before: Frustated, Breaking Head

After: Stress free,in control

10. YOUR SOLUTION SL

A web application to manage stocks using database. It allows the retailers to add new stocks, update stocks and view the existing stocks.

If the stock falls below a certain threshold value, the system sends an email to the retailer using SendGrid

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

Immediate accessibiltiy irrespective of place and time.

8.2 OFFLINE

Access of previously downloaded information.

Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

- An easy-to-use interface that doesn't require advanced training, support or documentation.
- Automation for eliminating manual processes of business functions related to inventory management.
- A reliable, secure database that provides accurate, real-time data.
- Performance that enables fast, actionable inventory monitoring and control.
- The ability for administrators to easily add software modules with minimal configuration so that the system is scalable.
- Software integrations and automated features that minimize manual inventory updates or inputs.

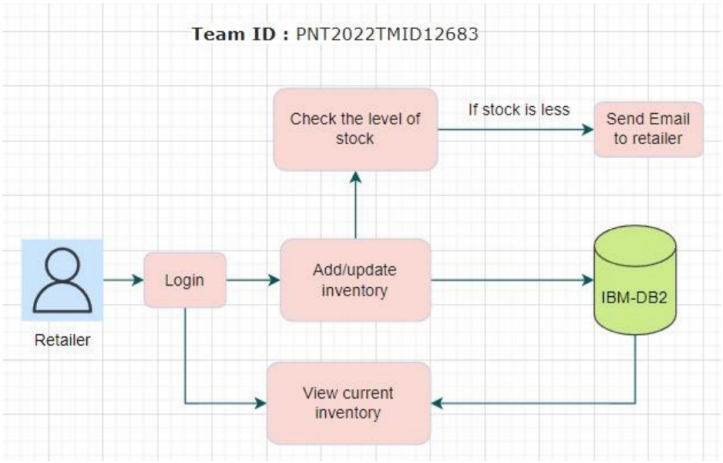
4.2 Non-functional requirements

- Data integrity - Data correctness, completeness, consistency, and overall accuracy are handled according to the concept of data integrity.
- Extensibility - It is the capacity to extend a system and the amount of work required to do so. Utilize Nvntri to become more efficient and save time.
- Availability - This feature specifies how long the system operates, how long it takes to fix a problem, and how long it takes between lapses.
- Reliability - The chance and percentage of the software working without failure for a given number of uses or period of time is referred to as reliability. Manage things stress-free, to become more efficient and save time with Nvntri.
- Maintainability - This feature indicates the average time and ease and rapidity with which the system can be stored after a failure. For example, if the automated email services become unavailable, they can be under maintenance for approximately three hours.

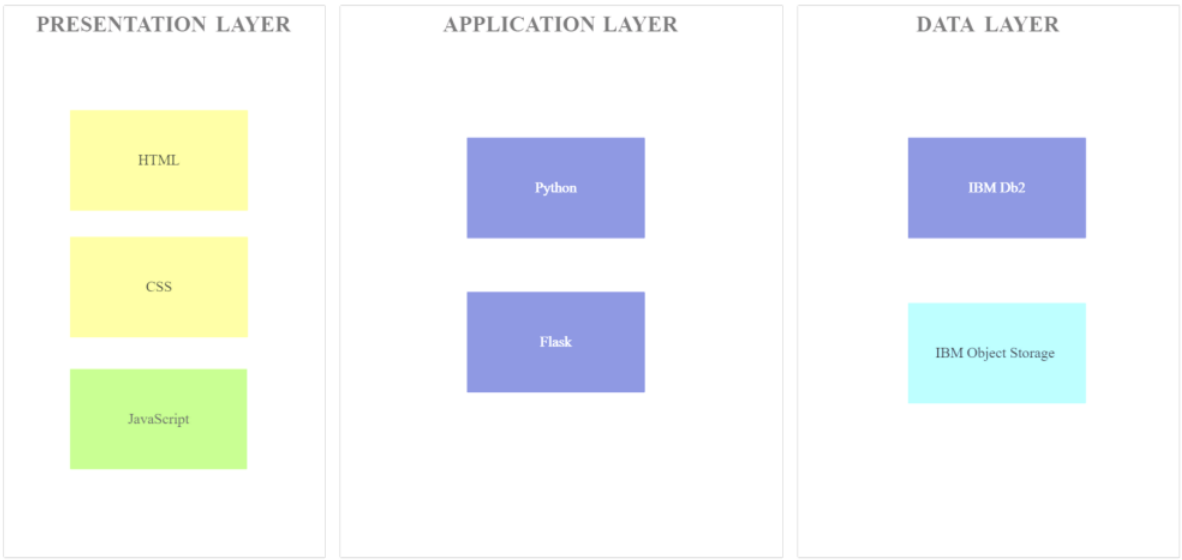
5. Project Design

5.1 Data Flow Diagrams

Data Flow Diagrams:



5.2 Solution and Technical Architecture



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Login	USN-2	As a user, I can log into the application by entering username & password	I can access my account/dashboard	High	Sprint-1
	Add and delete inventory	USN-3	As a user, I can enter the details of the stocks	The details are stored in the database	High	Sprint-2
	Update inventory	USN-4	As a user,I can update the sock details	The database is updated	High	Sprint-2
	Alert email	USN-5	As a user,I'll receive email notification when the stock is low	I can refills the stock	Medium	Sprint-3
	Logout	USN-6	User will be logout from the system	I will be redirected to the login page	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint 1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	High	Suchitha Malisetty Bhoovika V Pavithra Yazhini G K Gokul R
Sprint 1		USN-2	As a user, I will receive confirmation email once I have registered for the application	Medium	Suchitha Malisetty Bhoovika V Pavithra Yazhini G K Gokul R
Sprint 1	Login	USN-3	As a user, I can log into the application by entering email & password	High	Suchitha Malisetty Bhoovika V
Sprint 2	Items	USN-5	As a user, I can add the items.	High	Pavithra Yazhini G K Gokul R
Sprint 2		USN-6	As a user, I can see the items	Low	Pavithra Yazhini G K
Sprint 2	Inventory	USN-7	As a user, I can add the items to inventory.	High	Gokul R Bhoovika V
Sprint 2		USN-8	As a user, I can see the items in the inventory.	Low	Suchitha Malisetty

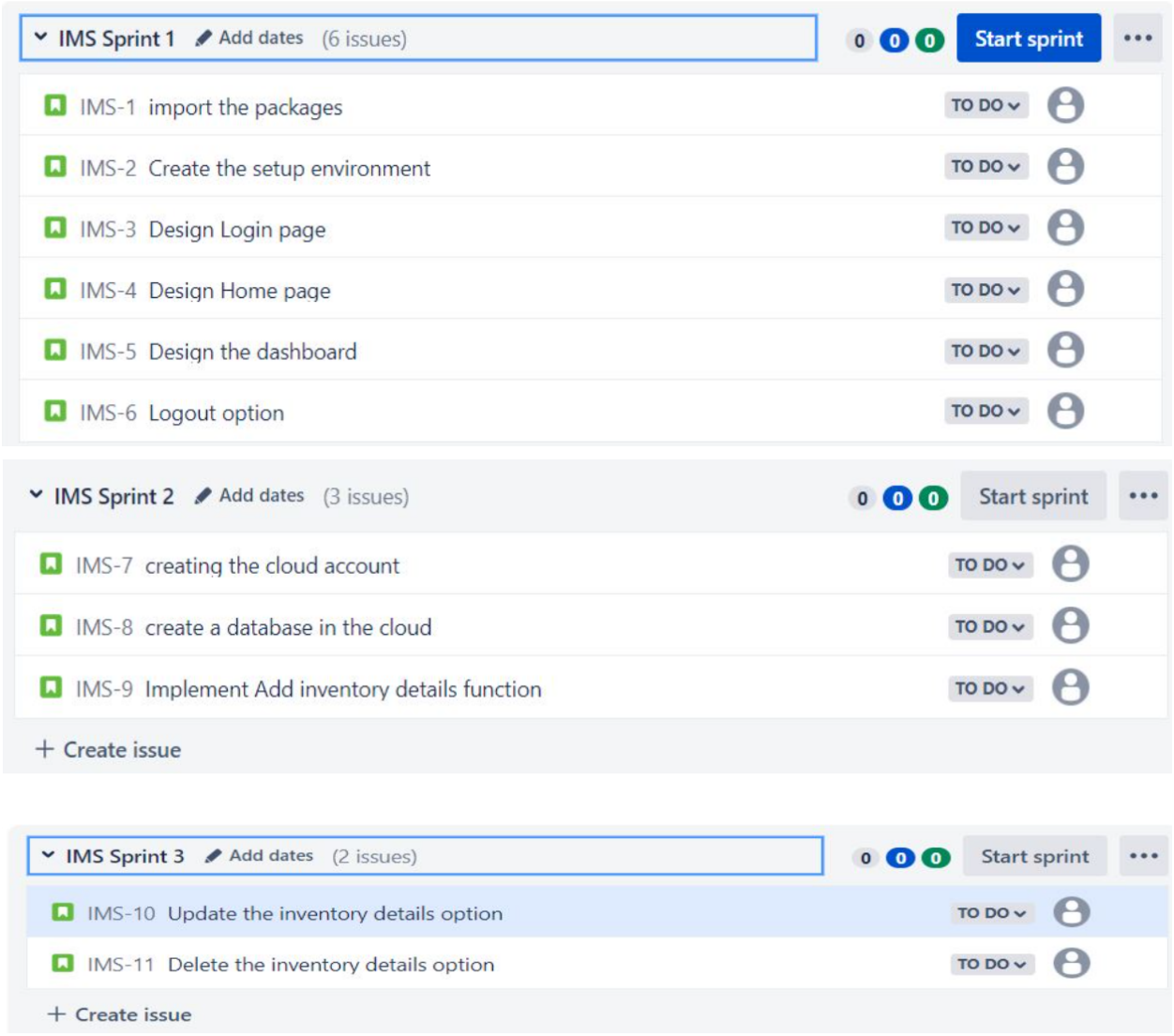
Sprint 3	Indication	USN-9	As a user, I can be able to receive indication	High	Suchitha Malisetty Bhoovika V
Sprint 3	Location	USN-10	As a user, I can be able to see items from a particular store location	Medium	Pavithra Yazhini G K Gokul R
Sprint 3		USN-11	As a user, I can add a new location of my store	Medium	Suchitha Malisetty

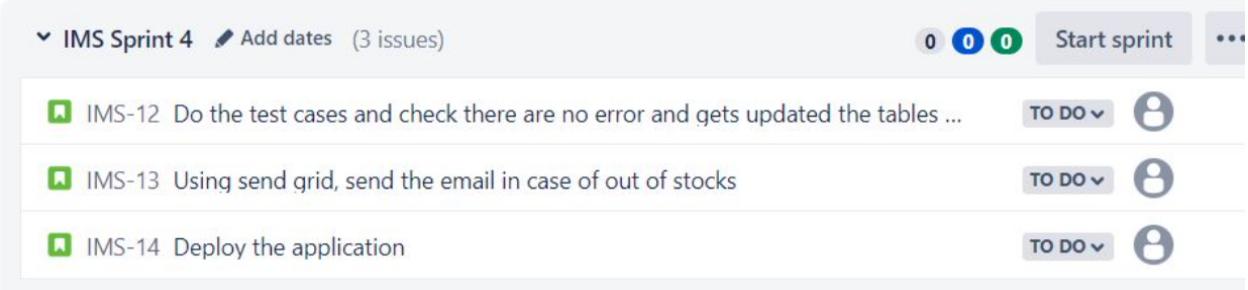
Sprint 4	Purchase	USN -12	As a customer, I can be able to purchase good from the particular location of the store	High	Bhoovika V Pavithra Yazhini G K
Sprint 4	Deployment	USN-13	As a user, I can access the software in the web	High	Suchitha Malisetty Gokul R

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	7 Days	24 Oct 2022	30 Oct 2022	20	30 Oct 2022
Sprint-2	20	7 Days	31 Oct 2022	06 Nov 2022	20	07 Nov 2022
Sprint-3	20	7 Days	07 Nov 2022	14 Nov 2022	20	14 Nov 2022
Sprint-4	20	7 Days	14 Nov 2022	21 Nov 2022	20	21 Nov 2022

6.3 Reports from JIRA





7. CODING & SOLUTIONING

7.1. Sign up/Registration

The registration feature of the inventory management system allows external users to register a new user account. Registration is of high priority because only when a user is registered, He/She may be able to login and use the functionalities.

7.2. Login

The login feature of the inventory management system allows external users to log in to his/her account. This has equal priority to registration because only if the user is registered and logged in, he will be able to access the website and place the order.

```
<body>
<form method="POST" action = "http://localhost:5000/login">
<br>
<center>
<br>

<table class="form1" bordercolor="#7FFFD4" cellspacing="2" cellpadding="2" width="50%" height="400px">
<br>
 <tr>
    <th style="width:180px"></th>
    <th style="width:80px"></th>
  </tr>
<tr>
<center><td colspan="2"><h1><center>Login</center></h1></td></center>
</tr>
<tr>
  <td colspan="2">
    <div>{{ msg }}</div>
  </td>
</tr>
<tr>
<td style="font-size: 18pt;">  &nbspUser Name :</td>
<td><input type="text" style="height: 40px; width:280px; " placeholder="User name" name="username" pattern="[A-Za-z0-9]*" required>
</td>
</tr>
<tr>
<td style="font-size: 18pt;">  &nbspPassword :</td>
<td><input type="password" style="height: 40px; width:280px; " placeholder="Password" name="password" pattern="[A-Za-z0-9]{5}[A-Za-z0-9]
</td>
</tr>
<tr><td colspan="2"><center></center><button class="button">Login</button></center></td></tr>
<tr><td colspan="2"><center><a href="/register">Create a new account</a></center></tr></td>
</table>
<br><br>
</center>
</form>
</body>
```

7.3. View Inventory

The system shall have a feature for the admin to view items and their details.

```
<div class="container">
  <form method="post">

    <div class="row">
      <div class="col-25">
        <label for="id">Product ID</label>
      </div>
      <div class="col-75">
        <select id="id" name="id" required>
            <option value="None">None</option>
            {% for i in product_ID  %}
            <option value="{{i}}">{{i}}</option>

            {% endfor %}
            </select>
      </div>
    </div>
    <div class="row">
        <div class="col-25">
          <label for="name">Product Name</label>
        </div>
        <div class="col-75">
            <select id="name" name="name" required>
                <option value="None">None</option>
                {% for i in product_name  %}
                <option value="{{i}}">{{i}}</option>

                {% endfor %}
                </select>
        </div>
      </div>
```

7.4. Add inventory

The system shall have a feature for the admin to add items and their details.

```
<h2>ADD ITEMS</h2>
<div class="container">
  <form method="post">

    <div class="row">
      <div class="col-25">
        <label for="name">Product name</label>
      </div>
      <div class="col-75">
        <input type="text" id="name" name="name" pattern="[a-zA-Z0-9 ]+" oninvalid="alert('Enter a valid product name');" required>
      </div>
    </div>
    <div class="row">
      <div class="col-25">
        <label for="supplier">Supplier</label>
      </div>
      <div class="col-75">
        <input type="text" id="supplier" name="supplier" required></div> </div>
    <div class="row">
      <div class="col-25">
        <label for="quantity">Threshold Quantity</label>
      </div>
      <div class="col-75">
        <input type="number" id="t_quantity" name="t_quantity" required>
      </div>
    </div>
    <div>{{ msg }}</div>
    <div class="row">
      <div class="space">
      <input type="submit" value="Submit" name="submit">
      </div>
    </div>
  </form>
</div>
</body>
```

7.5. Update inventory

The system shall have a feature for the admin to update items, etc.

```
<body>
<h2>UPDATE STOCKS</h2>

<div class="container">

  <table class="table table-hover">
    <thead>
    <tr>
    <th>Product ID</th>
    <th>Product name</th>
    <th>Quantity</th>
    <th>Supplier</th>
    <th>Edit</th>

  </tr>
  </thead>
  {% for data in product_details  %}
  <tbody>
  <tr>

  <td>{{data['Product_ID']}} </td>
  <td>{{data['Product_name']}} </td>
  <td>{{data['quantity']}}</td>
  <td>{{data['supplier']}} </td>
  <td><a href="{{ url_for( 'update_selected_stocks', product_id=data['Product_ID'] ) }}"><i class='far fa-edit'></i></a></td>

 <tr>
 </tbody>
 </div>
 {% endfor %}
 </table>
 </body>
 </html>
```

7.6. Delete inventory

The system shall have a feature for the admin to remove items once they move out of stock.

```
<div class="container">

 <table class="table table-hover">
   <thead>
   <tr>
   <th>Product ID</th>
   <th>Product name</th>
   <th>Quantity</th>
   <th>Supplier</th>
   <th>Delete</th>

 </tr>
  </thead>
  {% for data in product_details  %}
 <tbody>
 <tr>

  <td>{{data['Product_ID']}} </td>
  <td>{{data['Product_name']}} </td>
  <td>{{data['quantity']}}</td>
  <td>{{data['supplier']}} </td>
  <td><a href="{{ url_for( 'delete_selected_stocks', product_id=data['Product_ID'] ) }}"><i class='far fa-trash-alt'></i></a></td>

<tr>
</tbody>
</div>
```

7.7. Logout

This feature of the online inventory management system allows customers to log out of his/her account.

7.8. Database Schema

Name
PRODUCT_ADD_DETAILS
PRODUCT_DETAILS
USER

PRODUCT_ADD_DETAILS

Name	Data Type	Nullable	Length	Scale
ADD_ID	INTEGER	N		0
PRODUCT_ID	INTEGER	N		0
PRODUCT_NAME	VARCHAR	N	32	0
QUANTITY	INTEGER	N		0
LOCATION	VARCHAR	N	32	0
DATE_OF_PURCHASE	DATE	N	4	0

PRODUCT_DETAILS

Name	Data Type	Nullable	Length	Scale
PRODUCT_ID	INTEGER	N		0
PRODUCT_NAME	VARCHAR	N	32	0
QUANTITY	INTEGER	N		0
SUPPLIER	VARCHAR	Y	30	0
THRESHOLD_QTY	INTEGER	Y		0

USER

Name	Data Type	Nullable	Length	Scale
USER_ID	INTEGER	N		0
USER_NAME	VARCHAR	N	32	0
PASSWORD	VARCHAR	N	32	0
EMAIL	VARCHAR	Y	20	0

8. TESTING

8.1. Test Cases

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Expected Result	Status
LoginPage_TC_OO1	Functional	Login Page	Verify user is able to see the Login/Registration popup when user enters the site.	1.Enter URL and click go 2.Verify login/Singup popup displayed or not	Login/Signup popup should display	Pass
LoginPage_TC_OO2	UI	Login Page	Verify the UI elements in Login/Signup popup	1.Enter URL and click go 2.Verify login/Singup popup with below UI elements: a.name text box b.email text box c.password text box d.Login button e.New customer? Registration link	Application should show below UI elements: a.email text box b.password text box c.Login button with pastel green colour d.New customer? Create account link e.Last password? Recovery password link	Pass

LoginPage_TC_OO3	Functional	Login page	Verify user is able to log into application with Valid credentials	1.Enter URL and click go 2.Enter Valid username/email in Email text box 3.Enter valid password in password text box 4.Click on login button	User should be able to navigate to user account homepage.	Pass
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with Invalid credentials	1.Enter URL and click go 2.Enter InValid username/email in Email text box 3.Enter valid password in password text box 4.Click on login button	Application should show 'Incorrect email or password ' validation message.	Pass
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with Invalid credentials	1.Enter URL and click go 2.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Application should show 'Incorrect email or password ' validation message.	Pass
HomePage_TC_OO1	UI	Home page	Verify user is able to navigate to the Prediction page	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Click on the Prediction button to navigate to Prediction page.	Home Page with Dashboard should be displayed	Pass
HomePage_TC_OO2	UI	Home page	Verify user is able to navigate to the Logout Page	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Click on the Logout button	Logout Page should be displayed	Pass
PredictionPage_TC_OO1	UI	Predicito n Page	Verify user is able to navigate to the Logout Page	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Enter on the Prediction Page 4.Click on the Logout button	Logout Page should be displayed	Pass

PredictionPage_TC_OO2	UI	Predicito n Page	Verify user is able to navigate to the Home Page	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Enter on the Dashboard Page 4.Click on the Home button	Logout Page should be displayed	Pass
PredictionPage_TC_003	Funciton	Predicito n Page	Verify user is able to upload an image	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Enter on the Home Page 4.Upload an image in the given input box 5.Click Submit	Image is uploaded	Pass
PredictionPage_TC_004	Funciton	Predicito n Page	Verify user is not able to upload any other image formats	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Enter on the Dashboard Page 4.Upload an image in the given input box 5.Click Submit	Image is uploaded	Fail
LogoutPage_TC_001	UI	Logout Page	Verify User is able to navigate to Login Page	1.Enter URL and click go 2.Enter Home Page using valid credentials 3.Enter on the Logout Page 4.Click on the Login button	Login Page should be displayed	Pass

8.2. User Acceptance Testing

Defect Analysis

Resolution	Severity1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	2	18
Fixed	6	2	2	2	12

Skipped	0	0	0	1	1
Won't Fix	0	0	0	1	1
Totals	16	6	4	6	32

Test Case Analysis

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	8	0	0	8
Client Application	17	0	0	17
Security	2	0	0	2
Exception Reporting	2	0	0	2
Final Report Output	5	0	0	5
Version Control	1	0	0	1

9. ADVANTAGES AND DISADVANTAGES

Advantages -

1. It helps to maintain the right amount of stocks: contrary to the belief that is held by some people, inventory management does not seek to reduce the amount of inventory that you have in stock, however, it seeks to maintain an equilibrium point where your inventory is working at a maximum efficiency and you do not have to have many stocks or too few stocks at hand at any particular point in time. The goal is to find that zone where you are never losing money in your inventory in either direction. With the aid of an efficient inventory management strategy, it is easy to improve the accuracy of inventory order.
2. It leads to a more organized warehouse: with the aid of a good inventory management system, you can easily organize your warehouse. If your warehouse is not organized, you will find it very difficult to manage your inventory. A lot of businesses choose to optimize their warehouse by putting the items that have the highest sales together in a place that is easy to access in the warehouse. This ultimately helps to speed up order fulfilment and keeps clients happy.

3. A well-structured inventory management system leads to improved customer retention: for customers to keep patronizing you, you will need to always have the goods they want, at the amount they want, and at the time they want it. Inventory management helps you to meet up this demand by allowing you to have the right products all the times so that you and your customers are never stranded.

Disadvantages -

1.Production problem: even though inventory management can reveal to you the amount of stock you have at hand and the amount that you have sold off, it can also hide production problems that could lead to customer service disasters. Since the management places almost all of its focus on inventory management to the detriment of quality control, broken or incorrect items that would normally be discarded are shipped along with wholesome items.

2. Increased space is need to hold the inventory: in order to hold inventory, you will need to have space so unless the goods you deal in are really small in size, then you will need a warehouse to store it. In addition, you will also need to buy shelves and racks to store your goods, forklifts to move around the stock and of course staff. The optimum level of inventory for a business could still be a lot of goods and they will need space to be stored in and in some cases additional operational costs to manage the inventory. This will in turn increase cost and impact negatively on the amount of profit the business makes.

3.Complexity: some methods and strategies of inventory management can be relatively complex and difficult to understand on the part of the staff. This may result in the need for employees to undergo training in order to grasp how the system works.

10. CONCLUSION

An inventory management system for retailers was successfully implemented.

11. FUTURE SCOPE

1. An inbuilt Open-to-Buy (OTB) system - OTB is an inventory planning and budgeting system that allows companies to quickly determine the level of funds available for purchasing or manufacturing inventory. The goal is to make sure the company has enough inventory for the next month based on the stock and number of sales from the current month.
2. Daily analysis for inventory shrinkage - Inventory shrinkage is caused by mismanagement of inventory, theft, and incorrect data entry, severely cuts into a company’s bottom line. We can implement specific processes for minimizing inventory shrinkage. Some ways to manage shrinkage are by keeping a regular manual inventory cycle count schedule and checking through return and exchange transactions at the end of each day to make sure they were done correctly.

3. Providing enhanced retailer support - An additional authorization system ensuring the authenticity of the goods brought and the vendor selling them can be implemented to establish quality assurance of the products brought.
4. Implementing a direct chat system with vendors - Maintaining healthy relationships with your vendor partners is one of the best ways to manage an inventory. Strong partnerships will create an environment where a scalable inventory management system is possible.

12.APPENDIX

Source Code

Source code is uploaded in the github:

https://github.com/IBM-EPBL/IBM-Project-14253-1659547334

GitHub & Project Demo Link

Github: https://github.com/IBM-EPBL/IBM-Project-14253-1659547334

Demo Link :https://youtu.be/Q1iHTieRM_Q