INVENTORY MANAGEMENT SYSTEM FOR RETAILERS
USING CLOUD APPLICATION DEVELOPMENT

A Project report submitted in partial fulfilment of 7th semester in degreeof

BACHELOR OF ENGINEERING
IN

COMPUTER SCIENCE AND ENGINEERING
Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report "**INVENTORY MANAGEMENT SYSTEM FOR RETAILERS"** is the bonafide record work done by **Ms NIKKITHA SM** (612719104046), **Ms KAVIYA K** (612719104032), **Ms DIVYA A**(612719104021), **Ms KOWSALYA S** (6127104036) for **IBM-NALAIYATHIRAN** in **VII** semester of **B.E.,** degree course **in Computer Science and Engineering** branch during the academic year of 2022 - 2023.

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ABSTRACT

Retail inventory management is the process of ensuring you carry merchandise that shoppers want, with neither too little nor too much on hand. By managing inventory, retailers meet customer demand without running out of stock or carrying excess supply.

In practice, effective retail inventory management results in lower costs and a better understanding of sales patterns. Retail inventory management tools and methods give retailers more information on which to run their businesses. Applications have been developed to help retailers track and manage stocks related to their own products. The System will ask retailers to create their accounts by providing essential details. Retailers can access their accounts by logging into the application.

Once retailers successfully log in to the application they can update their inventory details, also users will be able to add new stock by submitting essential details related to the stock. They can view details of the current inventory. The System will automatically send an email alert to the retailers if there is no stock found in their accounts. So that they can order new stock.

Project Report Format

1.INTRODUCTION

Inventory management helps companies identify which and how much stock to order at what time. It tracks inventory from purchase to the sale of goods. The practice identifies and responds to trends to ensure there's always enough stock to fulfill customer orders and proper warning of a shortage.

Once sold, inventory becomes revenue. Before it sells, inventory (although reported as an asset on the balance sheet) ties up cash. Therefore, too much stock costs money and reduces cash flow.

One measurement of good inventory management is inventory turnover. An accounting measurement, inventory turnover reflects how often stock is sold in a period. A business does not want more stock than sales. Poor inventory turnover can lead to deadstock, or unsold stock.

1.1 Project overview

The Inventory Management System is developed and designed for recording and managing the inventory of an organization. It can also be used for different institution with fewer modification as per requirement. the system can be easily updated as the other institutional requirement may not be integrated on our project .

After the continuous effort , testing and debugging the current system is ready to be implemented in an organization. The System development Project has developed the ability on us to implement the theoretical Knowledge we have gained during BIM study in the real life scenario. Some of the lesson that we had learned from the project are:- Sharpen the knowledge of working cooperating in working organizational environment and work place. Know the value of time and disciple. Work in group and make group decision. Learnt communication skill, leadership , quality and to make good public relation.

1.2Purpose

The primary purpose of inventory management is to ensure there is enough goods or materials to meet demand without creating overstock, or excess inventory. The main purpose of inventory management is to help businesses easily and efficiently manage the ordering, stocking, storing, and using of inventory. By effectively managing your inventory, you'll always know what items are in stock, how many of them there are, and where they are located.

Plus, practicing strong inventory management allows you to understand how you use your inventory–and how demand changes for it–over time. You can zero in on exactly what you need, what's not so important, and what's just a waste of money. That's using inventory management to practice inventory control. By the way, inventory control is the balancing act of always having enough stock to meet demand, while spending as little as possible on ordering and carrying inventory.

2. LITERATURE SURVEY

2.1 Existing Problem

The inventory process involves multiple intricate aspects that drive accurate product delivery. Even a single error in the process can have expensive and long-term consequences. This will eventually affect the company's growth and reputation.

Thus, retail companies need to understand and analyze the risks involved in inventory management. Only then can companies find proactive solutions to the problems.

To-Increase's Anywhere for Retail employs automation to resolve critical issues of manual inventory management. Our software has helped many retail companies address their stock management challenges.

2.2 Reference

https://www.mural.co/templates/empathy-map-canvas

https://www.mural.co/templates/empathy-map-canvas

https://miro.com/templates/customer-problem-statement/

https://www.ideahackers.network/problem-solution-fit-canvas/

https://medium.com/@epicantus/problem-solution-fit-canvas-aa3dd59cb4fe

2.3 Problem Statement & Definition

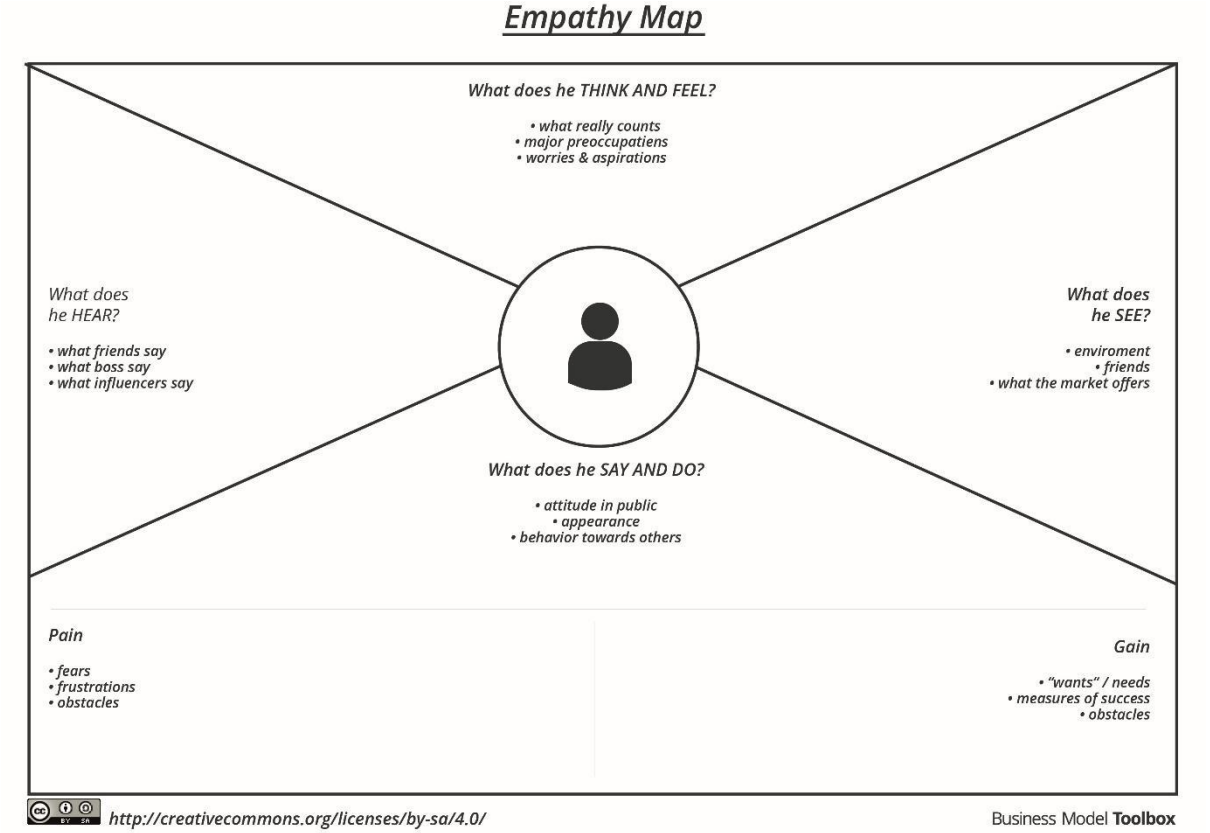
Inventory control is an essential need for every business organizations. The future of business organizations depends upon inventory considered and on the achievements of company's objectives. To know the significant factors that push for a purchasing behavior and meeting customers' needs remain a critical matter for the growth and survival in the nowadays competitive market.

In today's world where rapid developments are taking place in science and technology, mathematical modelling has become a powerful tool to solve complex, interconnected, and interacting phenomena arising from this rapid change. The first step is to define the problem and all of its constraints theoretically. Next, the objective function of this mathematical problem is formed. In most of all industries different departments have a need to optimize their objective function with decision variables, subjected to a set of constraint

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

- An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behavior and attitudes.
- It is a useful tool to helps teams better understand their users.
- Creating an effective solution requires understanding the true problem and the person who is experiencing it.
- The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

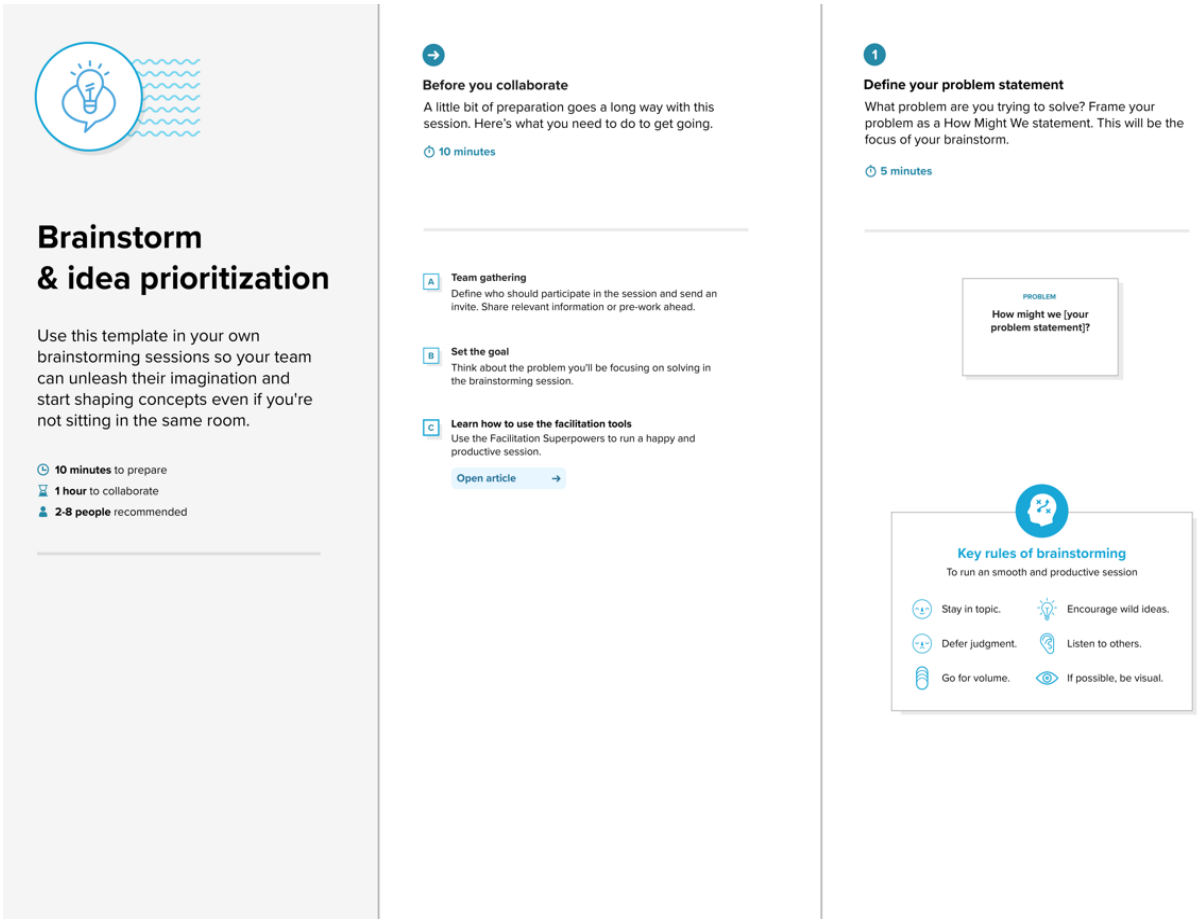


3.2 Ideation and Brainstroming

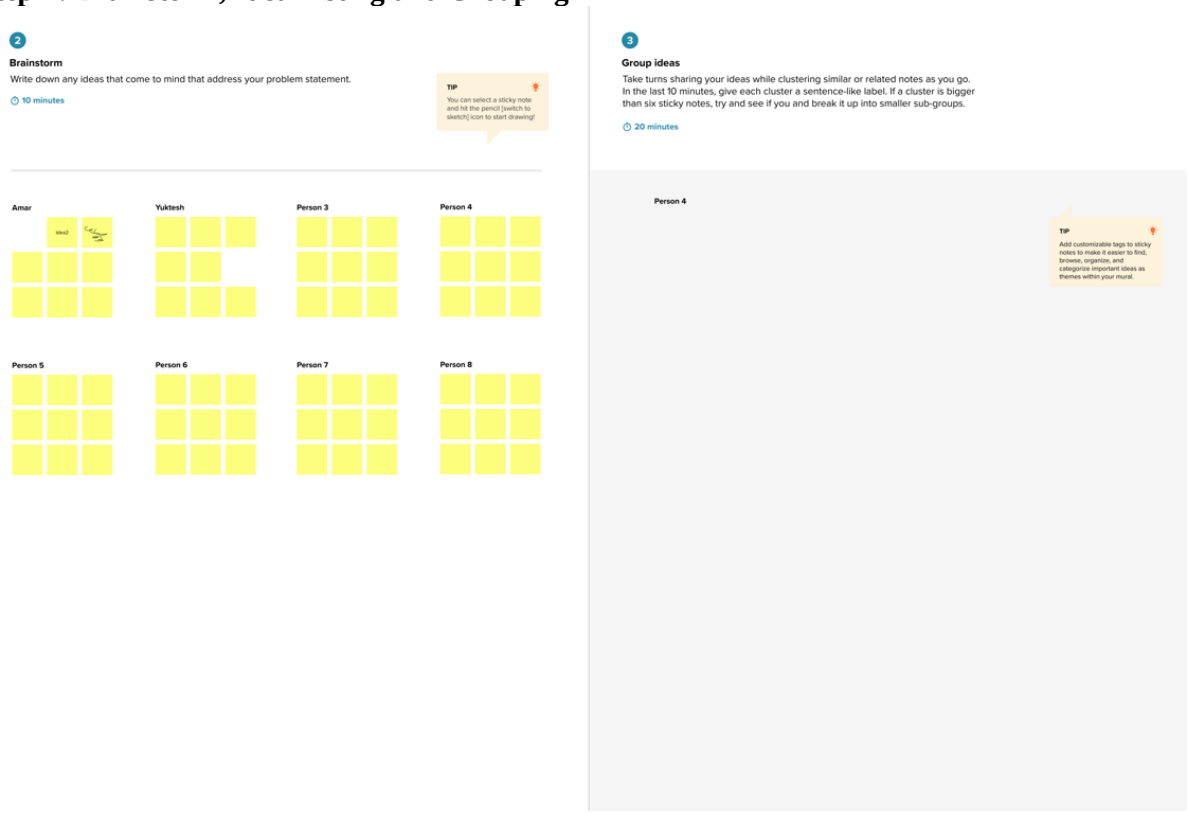
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

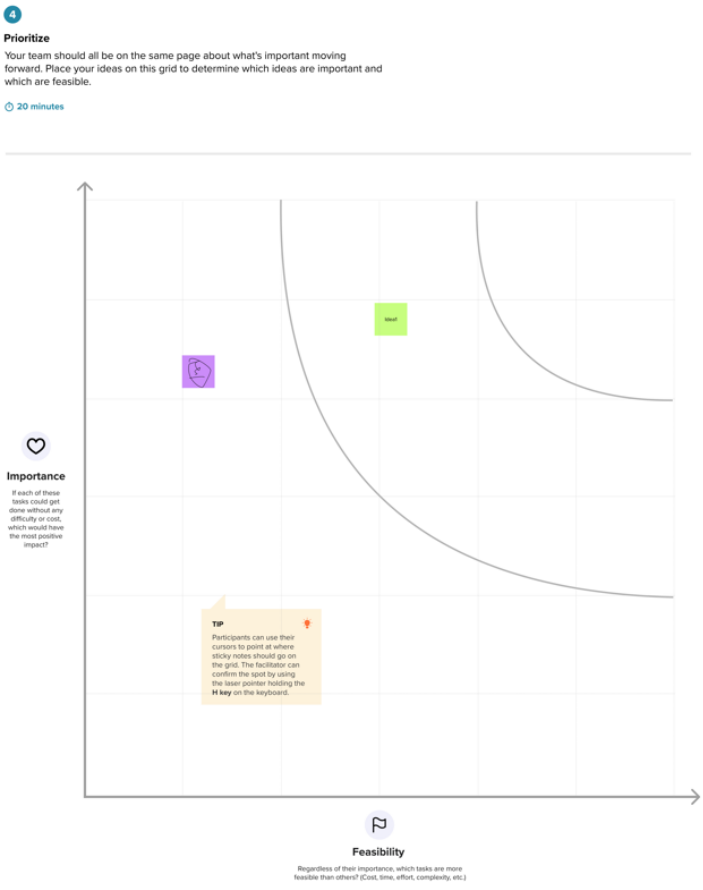
Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization



3.3 Propose Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The two basic inventory decisions that managers face are: How much additional inventory to order or produce When to order or produce it Although it is possible to consider these two decisions separately, they are so closely related that a simultaneous solution is usually necessary. Typically, the objective is to minimize total inventory costs. Total inventory costs typically include holding, ordering, shortage, and purchasing costs. In a continuous review system, managers continuously monitor the inventory position. Whenever the inventory position falls at or below a level R, called the reorder point, the manager orders Q units, called the order quantity. (Notice that the reorder decision is based on the inventory position including orders and not the inventory level. If managers used the inventory level, they would place orders continuously as the inventory level fell below R until they received the order.)
2.	Idea / Solution description	Retail inventory management works by creating systems to log products, receive them into inventory, track changes when sales occur, manage the flow of goods from purchasing to final sale and check stock counts. The information from these systems helps you achieve the benefits of retail inventory management, such as lower costs and higher profit margins.
3.	Novelty / Uniquenes s	Consumer behavior changes, it's a fact. So for better accuracy select a more recently added product when possible. You can use multiple reference products to get the best average and the novelty sales estimates will be based on features fromall of them using the average.
4.	Business Model (Revenue Model)	An inventory management system (or inventory system) is the process by which you track your goods throughout your entire supply chain, from purchasing to production to end sales. It governs how you approach inventory management for your business.
5.	Social Impact / Customer Satisfactio n	Customer satisfaction occurs when the value and customer service provided through a retailing experience meet or exceed consumer expectations. If the expectations of value and customer service are not met, the consumer will be dissatisfied. Only very satisfied customers are likely to remain loyal in the long run.
6.	Scalability of the Solution	Here we are using time series analysis so, When historical data for a product or product line is available and patterns are obvious, organizations typically employ the time series analysis technique to demand forecasting. A time series analysis can help you detect seasonal variations in demand, cyclical patterns, and major sales trends. The time series analysis approach works best for well- established organizations with several years of data to work with and verysteady trend patterns.

3.4 Problem Solution Fit

Identify strong TR & EM	1. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. 2. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.	3.. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.	4.CHANNELS of BEHAVIOUR CH 1. ONLINE What kind of actions do customers take online? Extract online channels from #7 2. OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

Retail Management System has a modular nature, so it is logical to address requirements to different modules (some of the modules can be integrated into RMS as stand-alone solutions):

Point of sale - manages sales in a retail store

- Scan item barcode and load the item info from the system
- Allow manual input and search of sale item
- Record sale, return, and exchange to the database

Save and store customer information (name, date of birth, contact info, client id, password)

- Apply client's discount levels
- Automate marketing and customer satisfaction analytics
- E-commerce - manages an online store

Add item to the catalog (manually or from file)

- Update item in the catalog
- Show sale items info
- Record online orders
- Allow online payment
- Connect customer with the sales manager for consultation
- Inventory management - track goods throughout the supply chain

Remove or add items from the store

- Remove or add items to the warehouse
- Ship items between stores
- Ship items to customers
- Order supplies

- Employee management - automate HR tasks

Store information about employees

- Track employees' attendance
- Manage absence and leave requests
- Collect productivity data
- Manage payments
- Manage employee accounts permissions
- Accounting - transfer data to the accounting department/software and import approved reports

5.2 Non-Functional Requirements

Non-functional requirements define requirements to the system as a whole and should be considered with attention before approaching the architecture phase, as introducing changes in later stages will be difficult.

Usability

The Retail Management system is required to have a simple and user-friendly interface, and allow to customize the interface and dashboard for individual users. The system must fully support languages that business operates on and allow to import and export of data in .csv and spreadsheet file formats.

Interoperability

The System must allow integration and partial replacement of sub-modules.

Data integrity

All data about sales, orders, client information, and other must be accurate and consistent over the entire life cycle.

Environmental

The system must require minimum resource usage for its maintenance to comply with the principles of sustainability.

Security

The system restricts access to client data, analytics, and reports to only authorized users. The rights to add or correct data must be restricted for individual employees. Financial data must be secured with two-factor authentication. Data relative to the latest operational year must be duplicated on a reserve server.

Maitainability

System maintenance must run without shutting down or in automated mode during non-working hours.

Capacity

The system must be capable of handling 100 employee accounts and 10000 orders per day without affecting its performance.

Availability

The availability of the system must be not less than 99.999% during the retail working hours, and not less than 95% round-the-clock for the e-commerce module.

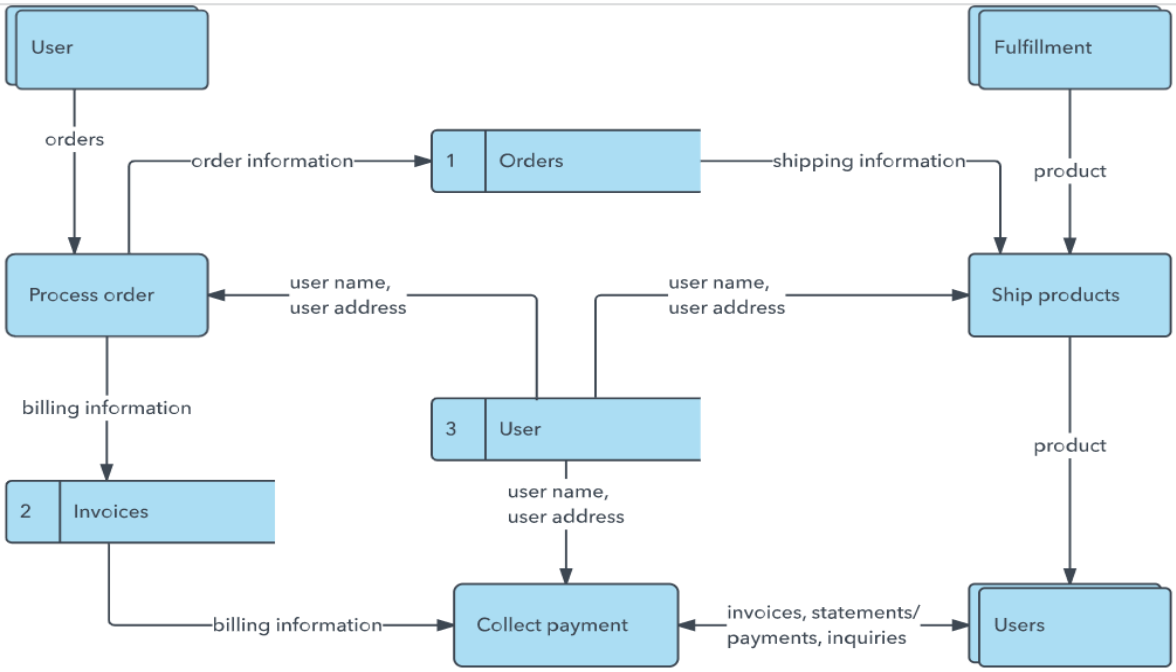
Scalability

The system must support implementing new features and modules without disrupting existing processes. The system must support horizontal scaling for launching new retail stores with multiple POS.

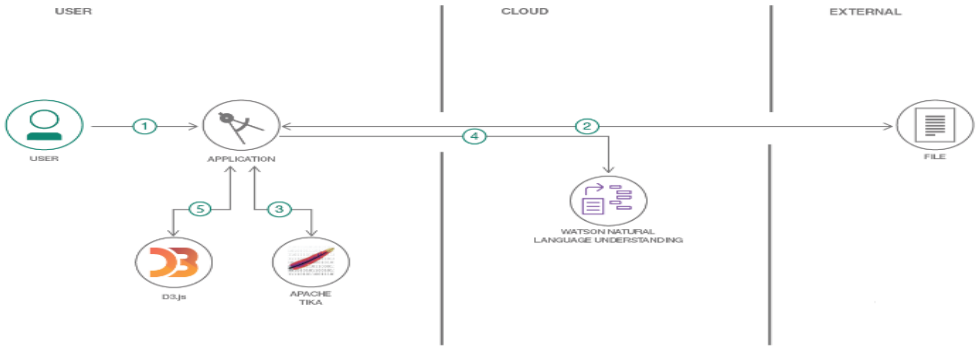
5. PROJECT DESIGN

5.1 Data Flow Diagram

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Flow



1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

5.2 Solution and Technical Architecture

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Order processing during pandemics for offline mode

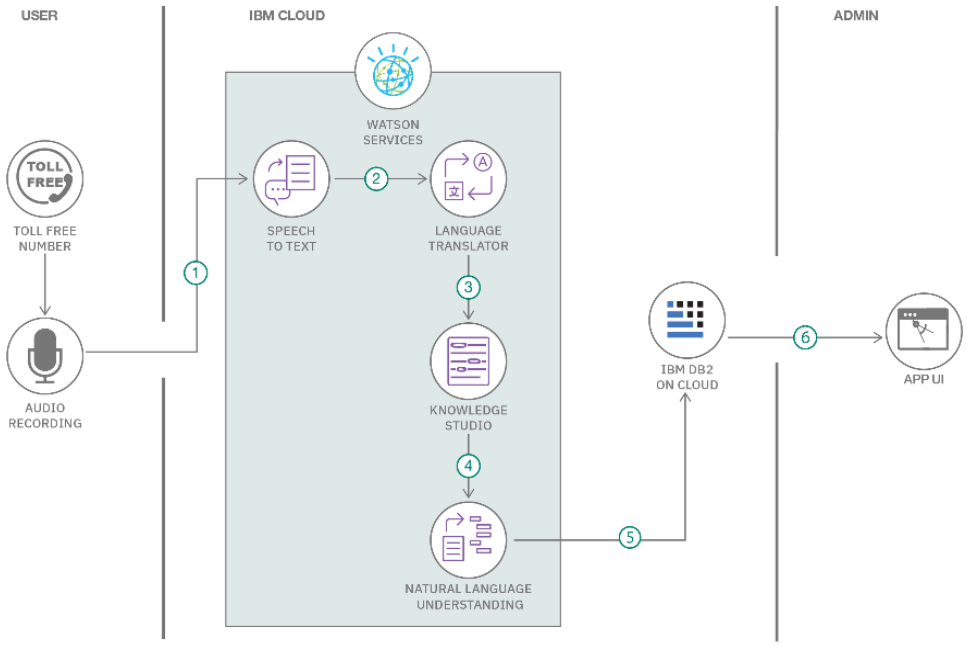


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

5.3 User Stories

Use the below template to list all the user stories for the product.

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
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
		USN-4	As a user, I can register for the application through Gmail	I can register & apply through gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1

6.PROJECT PLANNING AND SCHUDLING

Project planning is important since it serves as a guide for all facets of the business process. It includes, among other things, the following:

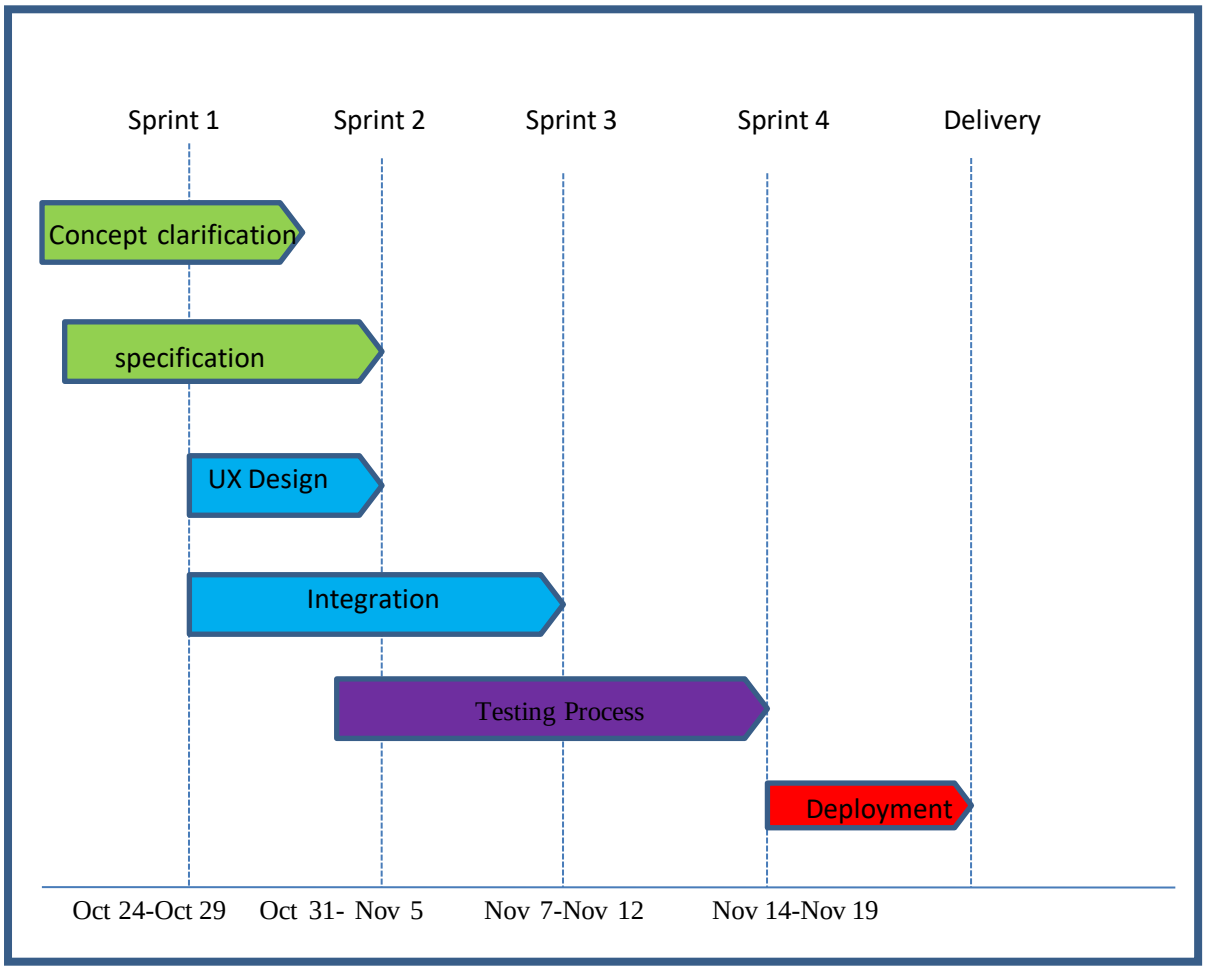
1. clarifies the methods that should be used
2. Describes a few modes of communication.
3. Recognizes who is in charge of each action.
4. Describes a risk response mechanism for every imaginable event and risk.
5. It has a system for tracking and monitoring progress.
6. The pledge of partners is kept.

6.2 Sprint Planning & Estimation

Milestone Name	Milestone Number	Description		Optional
Pre-Requisites	M-001	We will be downloading the following anaconda software to complete this project and also will be learningsome concepts.	Yes	
Prior Knowledge	M-002	We will be learning the supervised learning, unsupervised learning, flask, matrices	Yes	
Project objectives	M-003	We will get the knowledge about the machine learning algorithms, python with machine learning, clean the data, real time analysis of project, building user Interface	Yes	

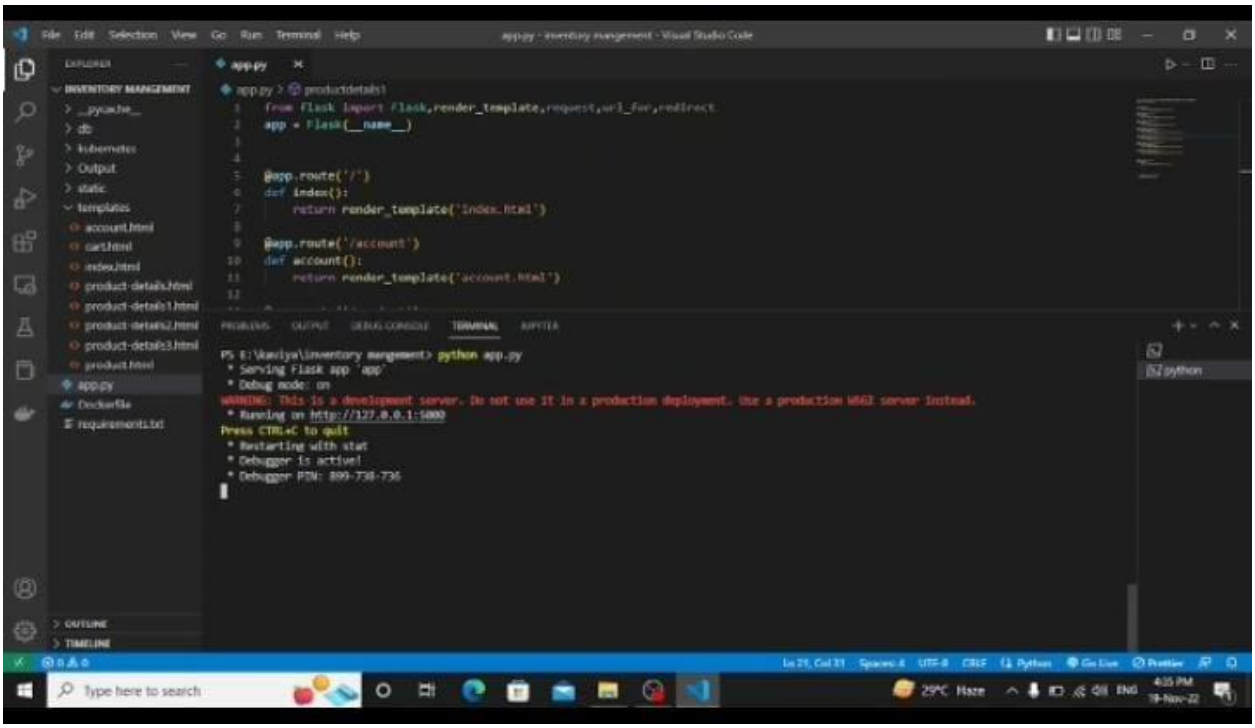
Project flow	M-004	In this installing required libraries, data collection, data preprocessing, model building, application building, final UI	Yes	
Project structure	M-005	We will be building a flask application that needs HTML pages and this model is built in notebook floods	Yes	
Data collection	M-006	Downloading the dataset for the project from the open sources like keggel.com, data.gov	Yes	
Visualizing and analyzing the data	M-007	Importing the important libraries for the project, reading the dataset, univariate, bivariate, multivariate, descriptive analyzing of project done in this phase	Yes	
Data preprocessing	M-008	Finding the shape of the dataset and converting the categorical data to integer encoding or binary encoding and balancing dataset, scaling dataset.	Yes	
Model building	M-009	Model building with the use of fouralgorithms best algorithm used in the future Decision tree, random forest, KNN, xgboost model areused.	Yes	
Application building	M-010	Building the html pages, python code with all tests done running the application	Yes	
Train the model on IBM	M-011	We will learning to built deep learning anddeploying it on the cloud	Yes	
Ideation phase	M-012	Literature survey on the project and preparing the empathy map	Yes	
Project design phase	M-013	Prepare proposed solution, problem solution fit and solution architecture	Yes	
Project design phase 2 Project planning	M-014M-015	Prepare the customer journey map, functional requirement document, data flow diagrams, technology architecture for the project	Yes Yes	
Project development phase	M-016	Project development delivery of sprint 1, sprint 2, sprint 3, sprint 4	Yes	

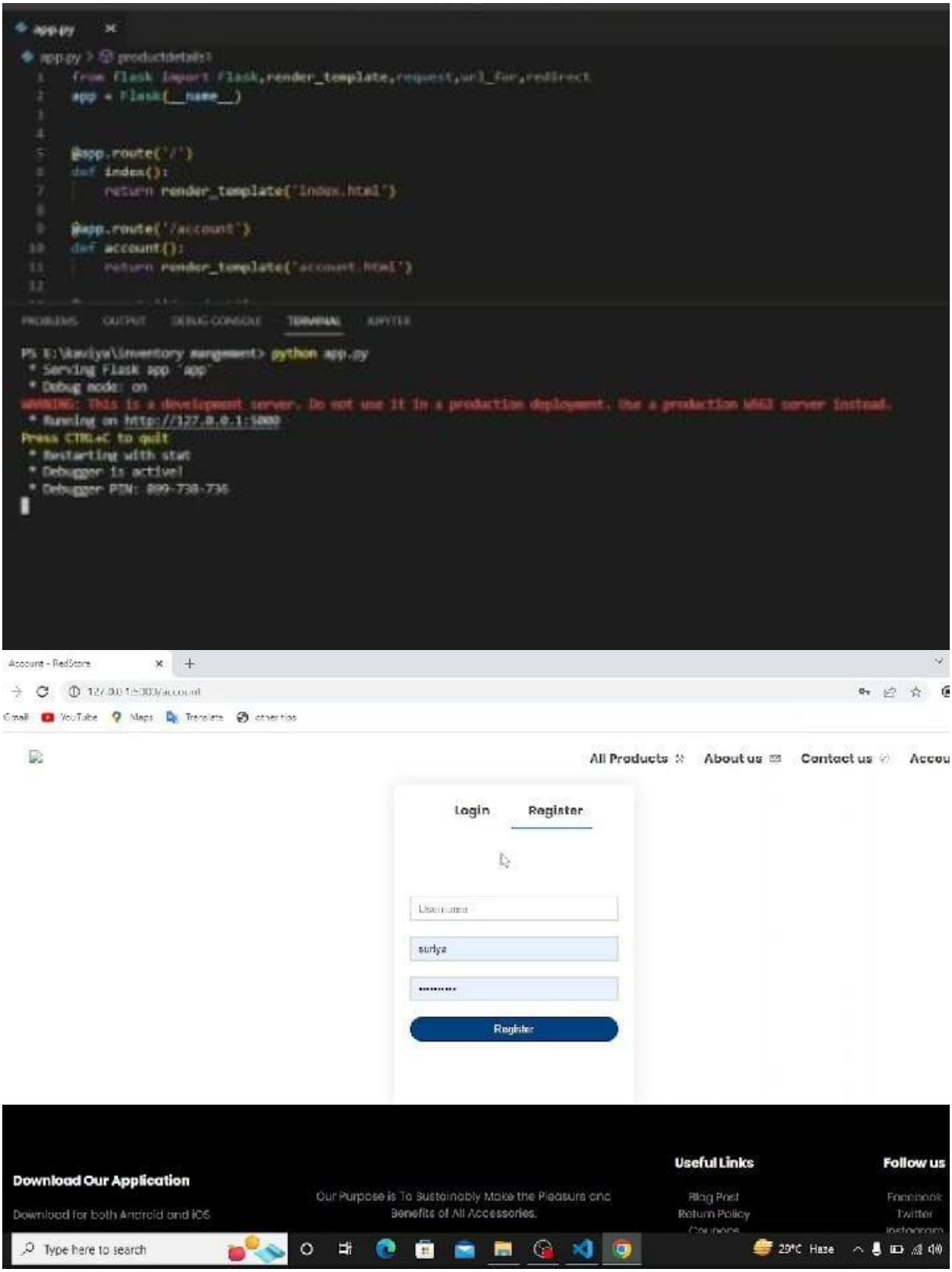
6.2Sprint Delivery Scheduling



6.3 Report From JIRA

7.COADING AND SOLUTION





8.TESTING

8.1 Test Cases

Functional test cases

Functional test cases are designed to validate that the application performs a specified business function. The majority of these test cases take the form of user or business scenarios that resemble common transactions.

Testers and business users should work together to compile a list of scenarios. Following the business process testing practice, functional test cases should be derived directly from the business process, where each step of the business process is clearly represented in the test case.

Structural test cases

Structural test cases are designed to verify that the application structure is correct. They differ from functional cases in that structural test cases are based on the structure of the application, not on a scenario. Typically, each component has an associated structural test case that verifies that the component has the correct layout and definition (for example, verify that a view contains all the specified applets and controls).

Performance test cases

Performance test cases are designed to verify the performance of the system or a transaction. There are three categories of performance test cases commonly used:

- Response time or throughput
- Scalability
- Reliability

8.2 User Acceptance Testing

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://shopenzer.com/	Login/Signup popup should display
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	https://shopenzer.com/	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link

LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123	User should navigate to user account homepage
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail password: Testing123	Application should show 'Incorrect email or password ' validation message.
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123678678678687676	Application should show 'Incorrect email or password ' validation message.
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam password: Testing123678678678687676	Application should show 'Incorrect email or password ' validation message.

9.RESULTS

Inventory management system for Retailers using cloud application developed and executed at the level o fcompleted progress .

10.ADVANTAGES AND DISADVANTAGES

Advantages

- It helps to maintain the right amount of stocks:
- It saves time and money
- It leads to a more organized warehouse
- Improves efficiency and productivity
- A well-structured inventory management system leads to improved customer retention
- Schedule maintenance
- Avoid lawsuits and regulatory fines
- Increased information transparency

Disadvantages

- Bureaucracy
- Impersonal touch
- Increased space is need to hold the inventor
- Complexity
- High implementation costs

11.CONCLUSION

As you can see the importance of inventory management is very serious, it is one of the most important aspects of any business. The aspect of this part of the business is whether or not you can satisfy the demand of your customers if you aren't sure if you have all the materials availableto make the final product . Without Wheeled Coach©having the proper inventory management they would not be able to supply their customers with their ordered ambulance. And this product is what their entire business is based on, so it is of great importanceWhen they are choosing from the different types of programs or automated systems to help with keeping records accurate, Wheeled Coach©needs to keep in mind that the customer is not concerned with which materials are needed to complete the finished product, but the product is operating as promised based on the contract.

12.FUTURE SCOPE

- The scope of an inventory system can cover many needs, including valuing the inventory, measuring the change in inventory and planning for future inventory levels.
- The value of the inventory at the end of each period provides a basis for financial reporting on the balance sheet.
- Measuring the change in inventory allows the company to determine the cost of inventory sold during the period.
- This allows the company to plan for future inventory needs.

13.APPENDEX

13.1 Github &Demo link

Github link
https://github.com/IBM-EPBL/IBM-Project-40575-1660631571

Demo link
https://drive.google.com/file/d/1f9_nLdhrO0317QswJlByxhkXaf2g0CUO/view?usp=drivesdk