Optimized Warehouse Management of Perishable Goods for Food Delivery Company

Report Submitted For

Call For Code - Global Challenge 2020

Submitted By:

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(Period: - June 15, 2020 to July 15, 2020)

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1) INTRODUCTION

OVERVIEW

Food Demand Forecasting is a key component to every growing online business. Without proper demand forecasting processes in place, it can be nearly impossible to have the right amount of stock on hand at any given time. A food delivery service has to deal with a lot of perishable raw materials which makes it all the more important for such a company to accurately forecast daily and weekly demand. The problem of over-stock and under-stock arises. Too much inventory in the warehouse means more risk of wastage, and not enough could lead to out-of-stocks - and push customers to seek solutions from your competitors.

An algorithm can be design for extracting frequent raw materials required for making the various food item. Sets of all the common or dependent materials can be identified. A material set is considered as frequent; if it meets a food/user -specified support threshold. For instance, if the support threshold is set to 0.5 (50%), a frequent material set is defined as a set of materials that occur together in at least 50% of all food items in the database. For example the raw materials like onion, tomato, water are required for almost every food item. Predicting such sets of frequently used raw materials will surely indicate its increasing demand.

- Project Requirements: Node-RED,IBM Cloud, IBM Watson, Cloudant
- Functional Requirements: IBM Cloud
- IBM Services: Watson Studio, Watson Assistant, Watson IOT, Machine Learning, Cloudant
- Project Features:
    1. Predictive Analysis
    2. Monitoring Warehouse Temperature
    3. Insights
    4. Location
    5. Chatbot
    6. Stock Management

PURPOSE

Freshness of products and timeliness of delivery are two critical factors which have impact on customer satisfaction in terminal delivery of perishable products. This project investigates how to make a cost-saving budget for perishable products by maximizing customer satisfaction. Customer satisfaction is defined from the two aspects of freshness and time window. Then we develop a priority function based on customer satisfaction and use the hierarchical clustering method to identify customer service priority. Based on the priority, a multiobjective vehicle scheduling optimization model for perishable products had been formulated to maximize customer satisfaction and minimize total delivery costs. It defers the service and customer satisfaction levels required in the food supply chain. From automated system to augmented

reality and the use of big data, machine learning and artificial intelligence (AI), technological tools have the potential to make the supply chain cheaper, safer, and simpler.

2) LITERATURE SURVEY

Existing problem

Considering customer satisfaction in perishable products delivery has been continuously a concern in both academic research and industry application. We have to focus on the objective related to delivery problems for perishable products. We look into what had been done in perishable products distribution i.e. how warehouse manages raw product with time windows and the definition of customer satisfaction. Moreover, perishable products have the characteristic of perishability and the spoilt products can decrease customer satisfaction tremendously. In this sense, the above studies only simply considered the economic perspective and ignored customer satisfaction for distributing perishable products. According to the above analysis, we try to define customer satisfaction from the aspects of freshness and time window. Moreover, we combine customer satisfaction with terminal delivery, which can make a reasonable vehicle scheduling for perishable products.

Proposed solution

- Predictive Analysis
- Monitoring Warehouse Temperature
- Insights
- Location tracking
- Chatbot
- Stock Management

Of great significance in the food, supply chain is the use of predictive analytics, with AI as its foundation. It uses current and historical data, ML algorithm, real time status or performance information, customer or vendor behavior data, market intelligence, the contemporary and social background to make predictions. Predictive analytics is a broad field and an innovative tool with phenomenal scope in every industry. Predictive analytics can be incredibly beneficial for identifying and targeting prospective and highly profitable business opportunities in production optimization and improving operation coherence.

With the help of AI and Machine Learning the food supply chain can optimize and shrink the demand and supply gap of food produce and food products by assessing market conditions, channeling warehousing requisites, identifying target consumers, forecasting demand, and

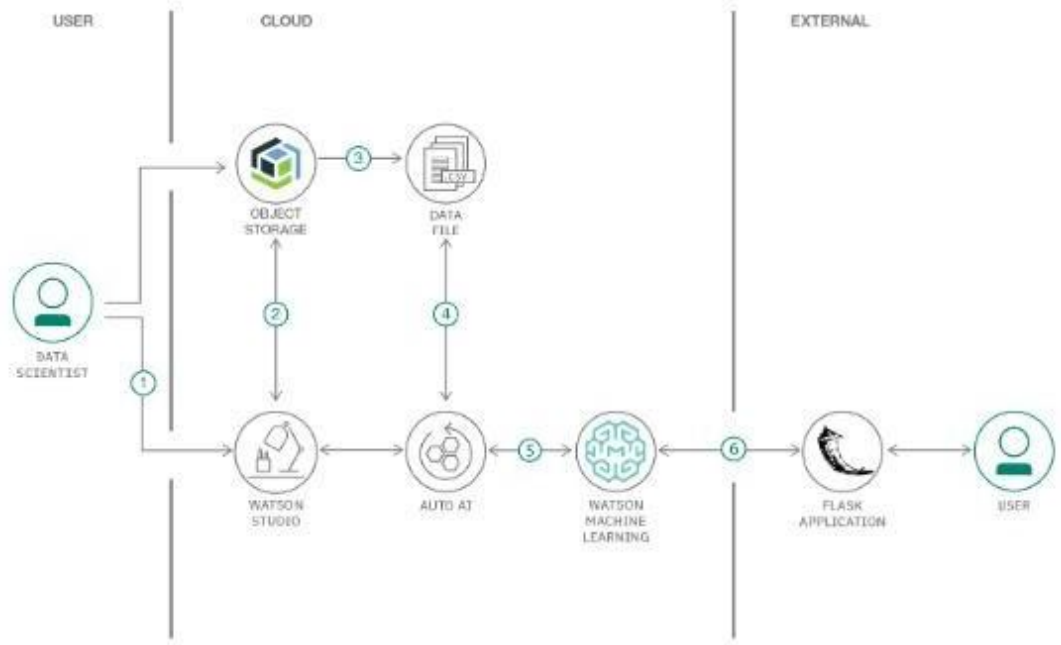
rationalizing supply. AI and ML together can improve timelines and schedule with instant data processing and keep fleets running at peak performance levels.

Machine learning algorithms and the apps running them are capable of analyzing large, diverse data sets fast, improving demand forecasting accuracy. Reducing freight costs, improving supplier delivery performance, and minimizing supplier risk are three of the many benefits machine learning is providing in collaborative supply chain networks. Machine Learning and its core constructs are ideally suited for providing insights into improving supply chain management performance not available from previous technologies. Machine learning excels at visual pattern recognition, opening up many potential applications in physical inspection and maintenance of physical assets across an entire supply chain network. Gaining greater contextual intelligence using machine learning combined with related technologies across supply chain operations translates into lower inventory and operations costs and quicker response times to customers. Forecasting demand for new products including the causal factors that most drive new sales is an area machine learning is been applied to today with strong results. Machine learning is improving production planning and factory scheduling accuracy by taking into account multiple constraints and optimizing for each. Combining machine learning with advanced analytics, IoT sensors, and real-time monitoring is providing end-to-end visibility across many supply chains for the first time.

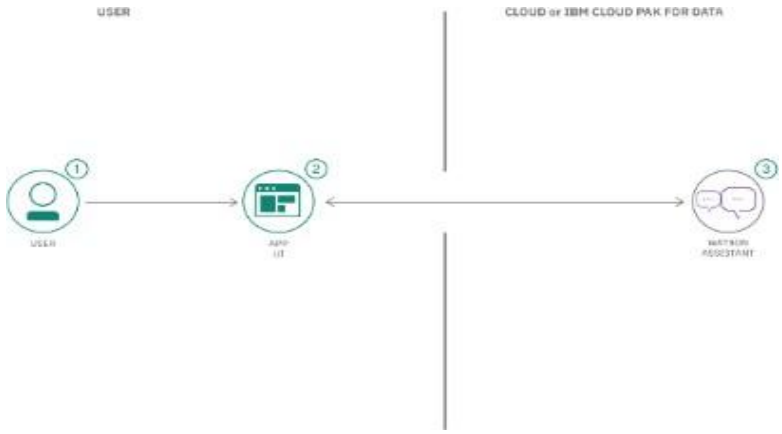
3) THEORITICAL ANALYSIS

Block Diagram

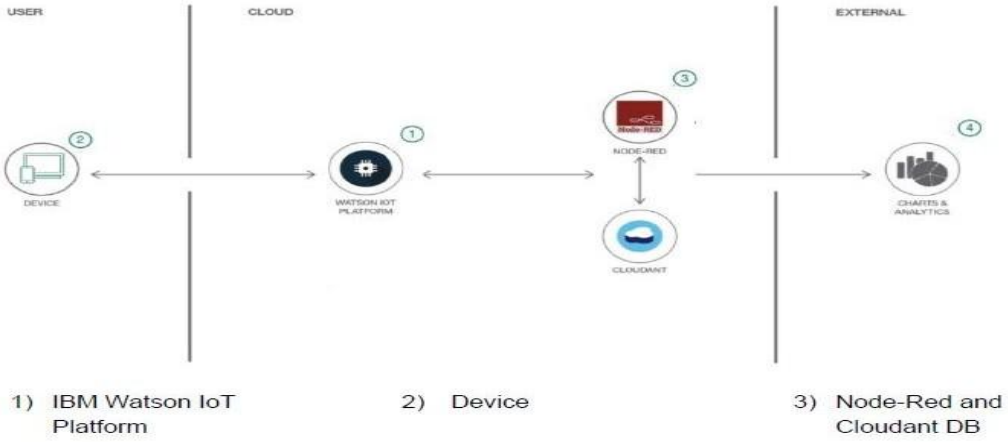
1.AutoAI



2.Chatbot



3.IOT



Hardware / Software designing

1. Create necessary Watson Services.

2. Configure Watson Studio - AutoAI

3. Configure Watson Assistant - Chatbot for transaction purpose

4. Configure Watson IOT - Warehouse Temperature Monitoring

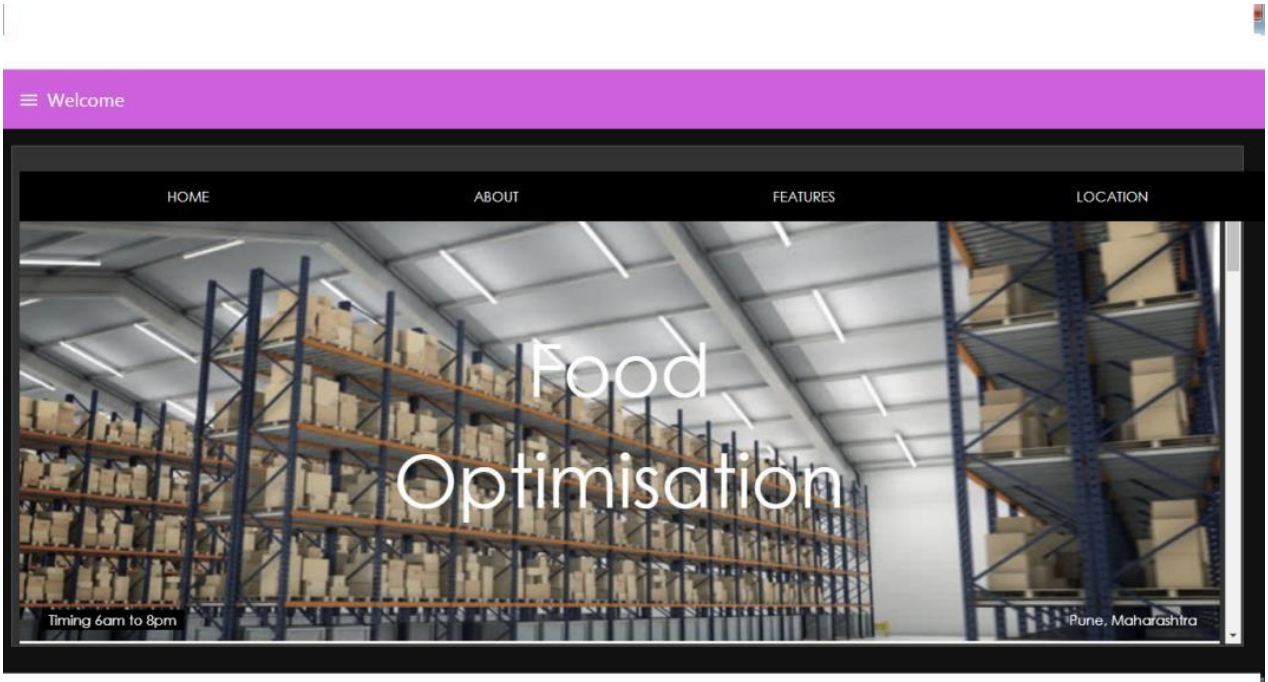
5. Django framework - Stock Management(Local system)

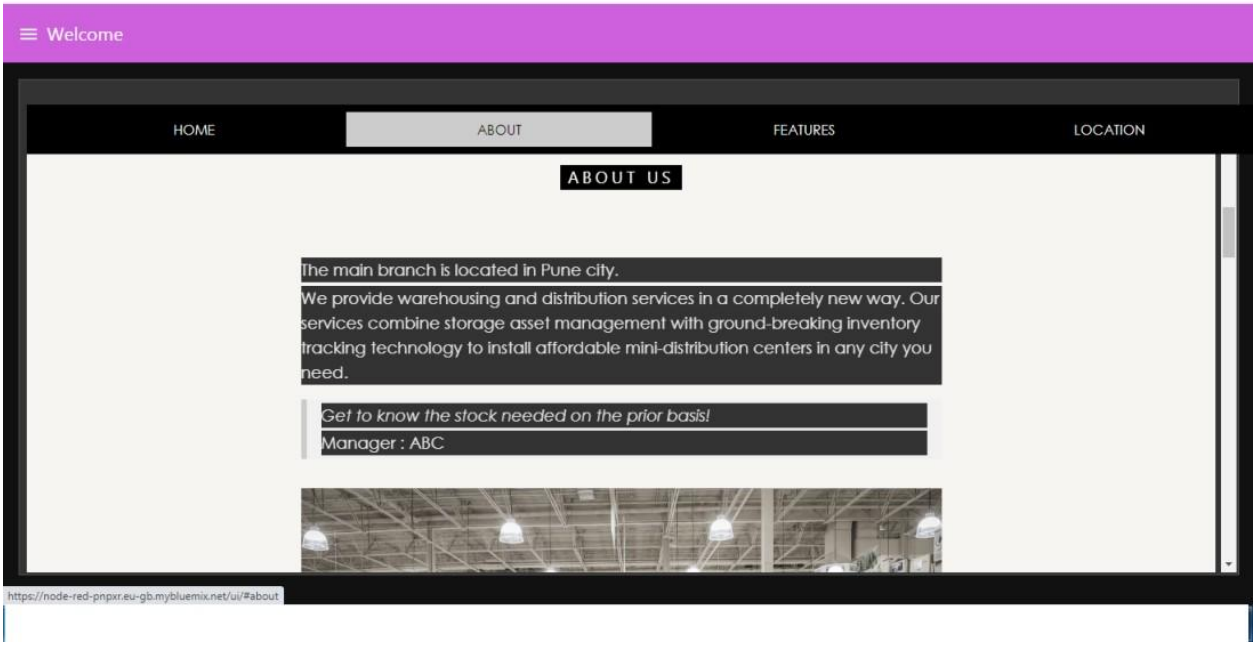
6. Configure Cloudant (Leaflet) – Location of stores

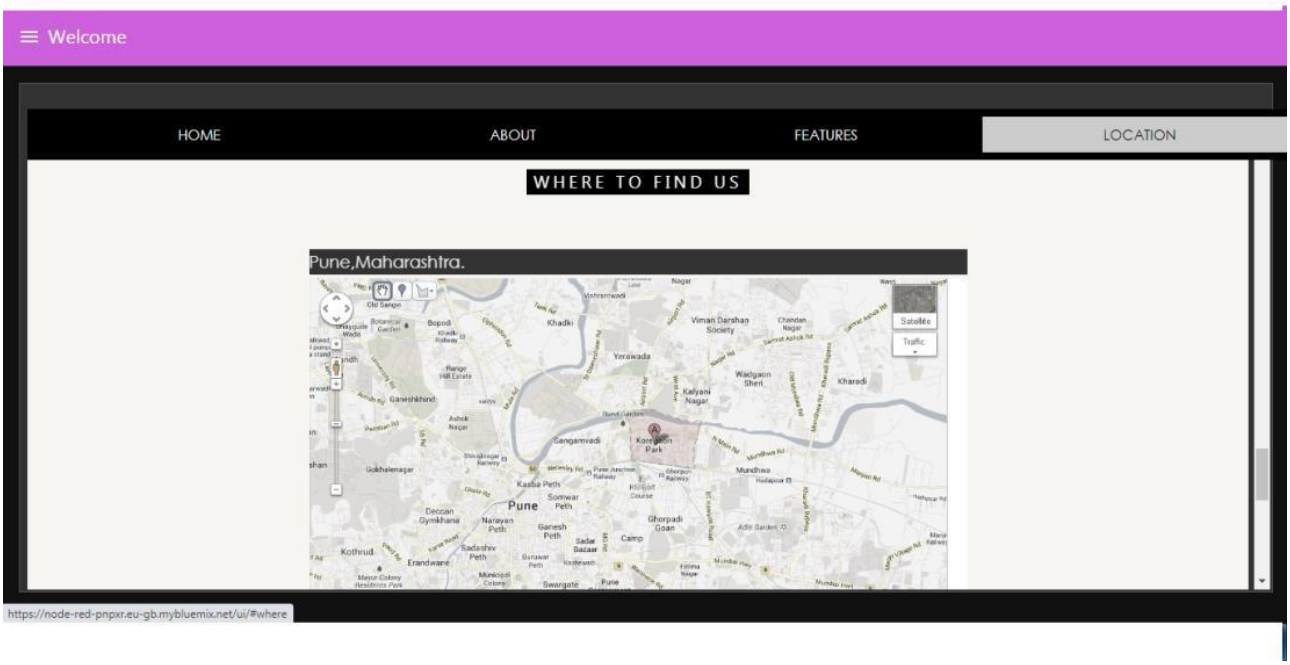
7. Build Node-RED flow to build UI for application

4) EXPERIMENTAL INVESTIGATIONS

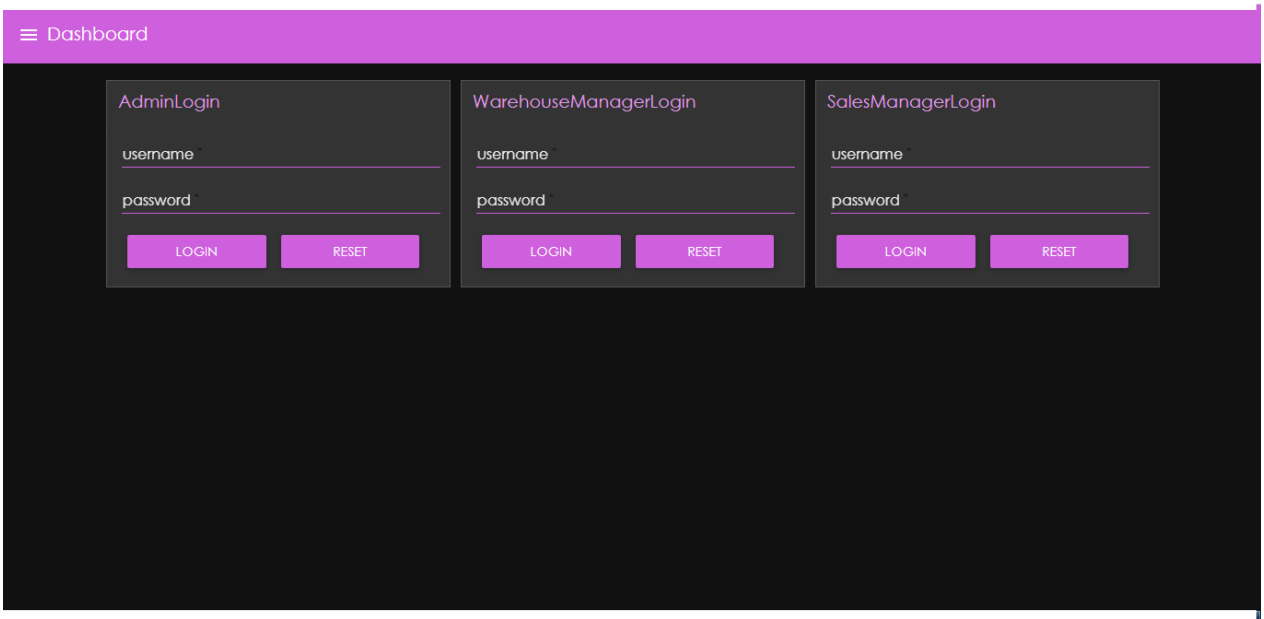
1.HOME PAGE



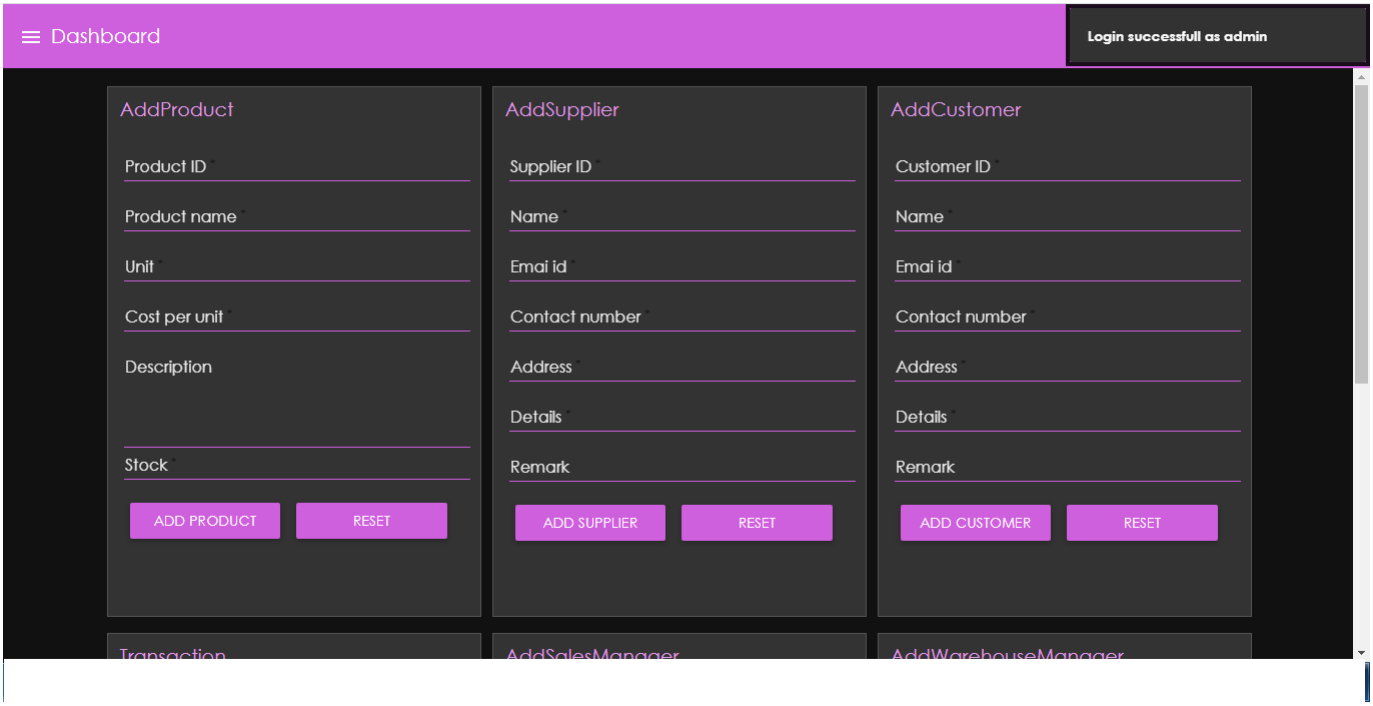




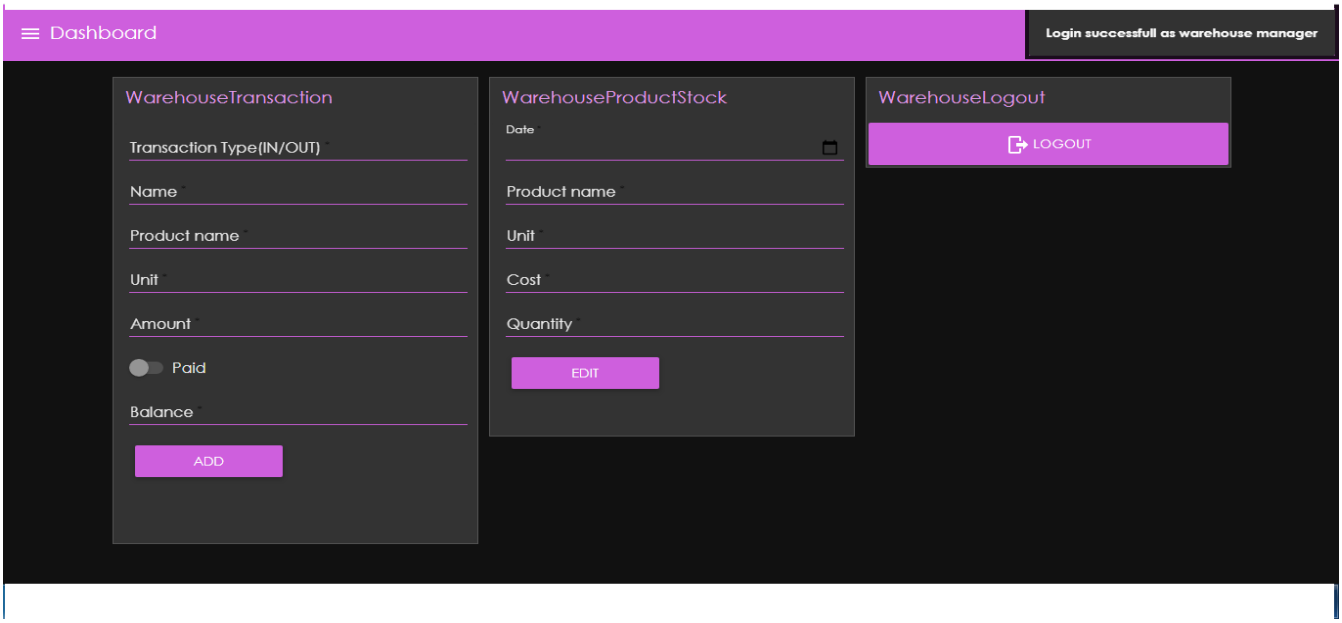
2.Dashboard: Admin, Warehouse Manager, Sales Login



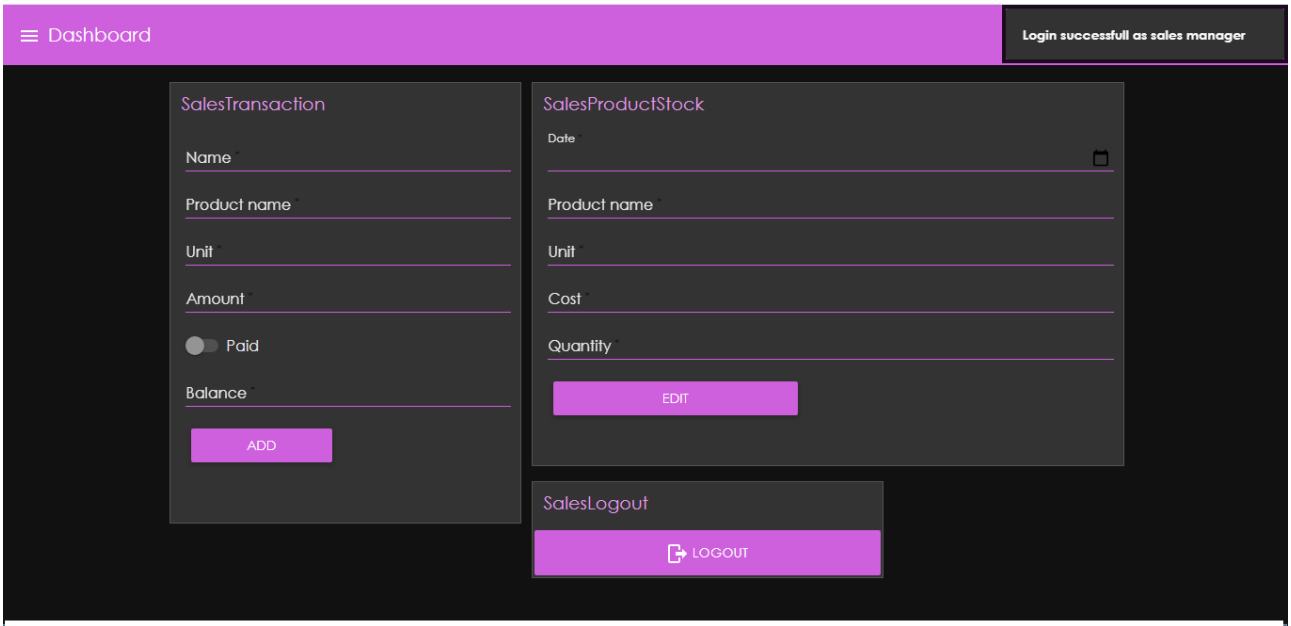
a. Admin Page



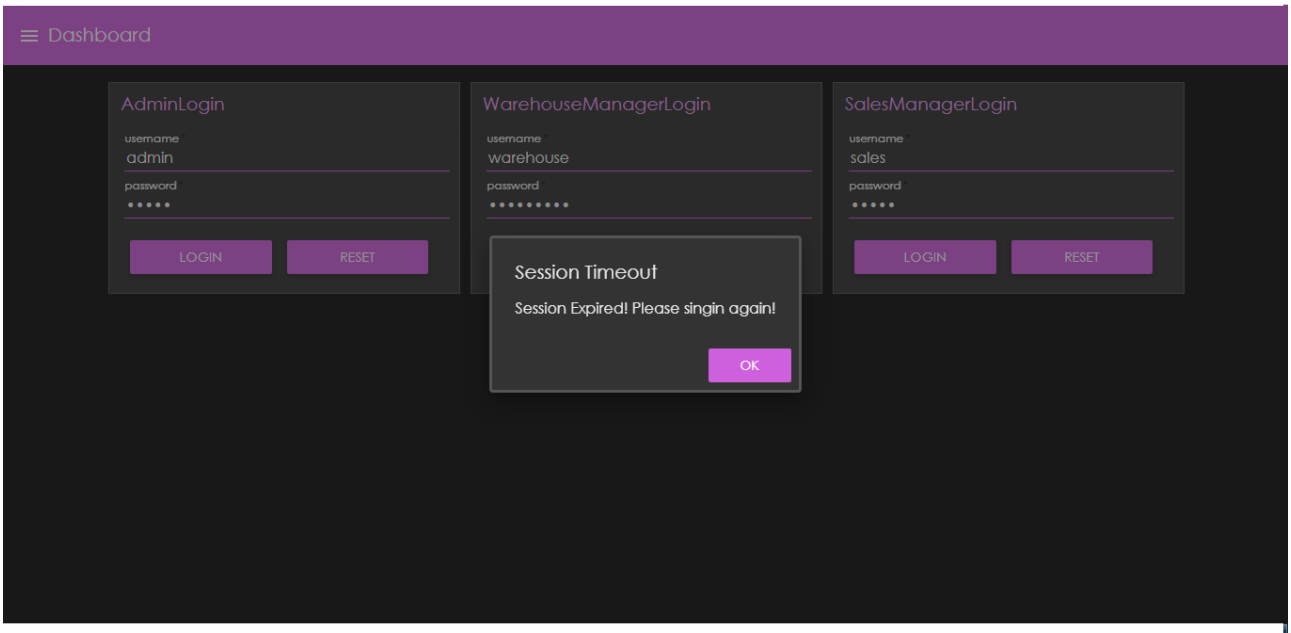
b.Warehouse Manager Page



c. Sales Manager Page



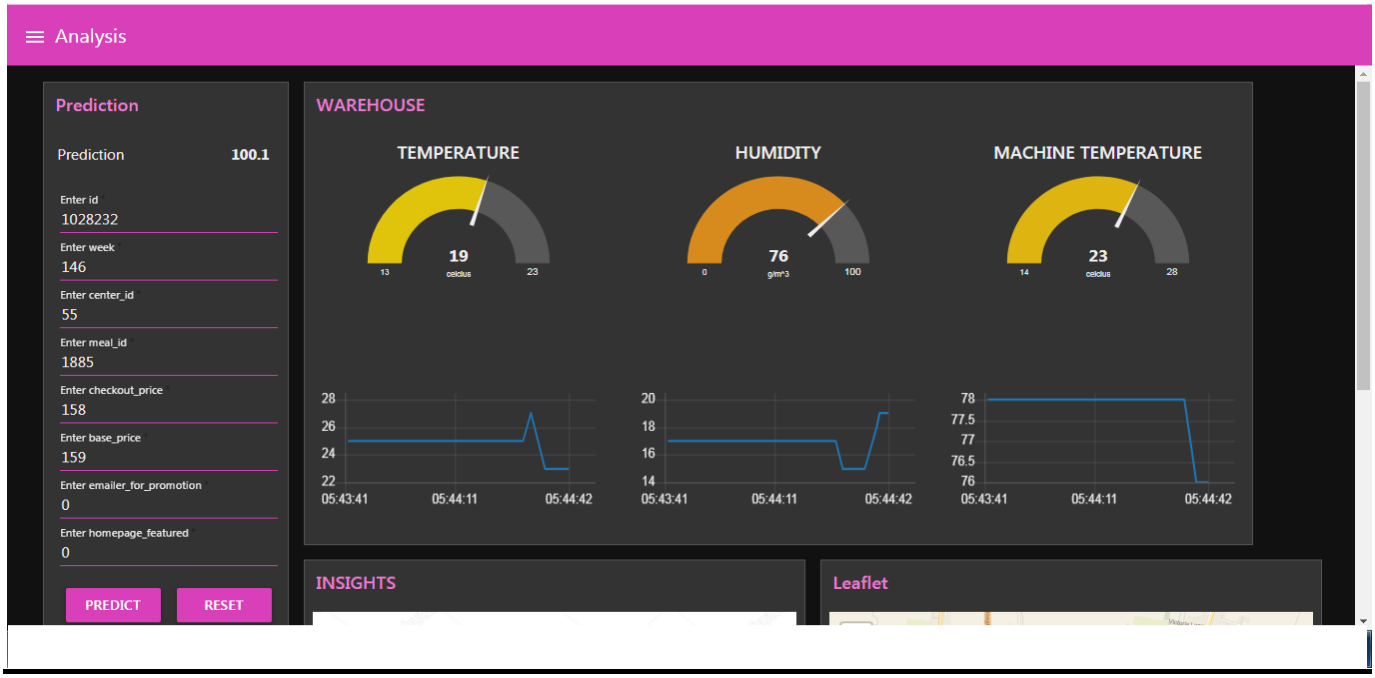
d. Session Management

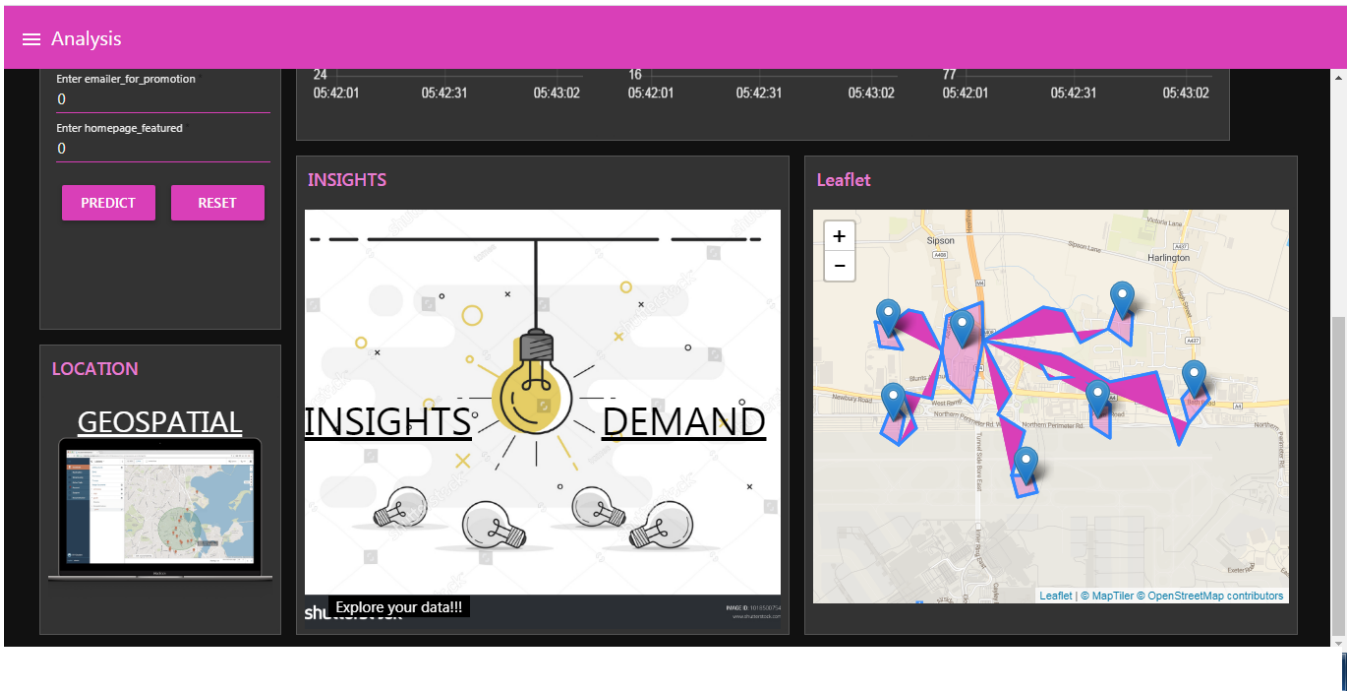


3. Analysis

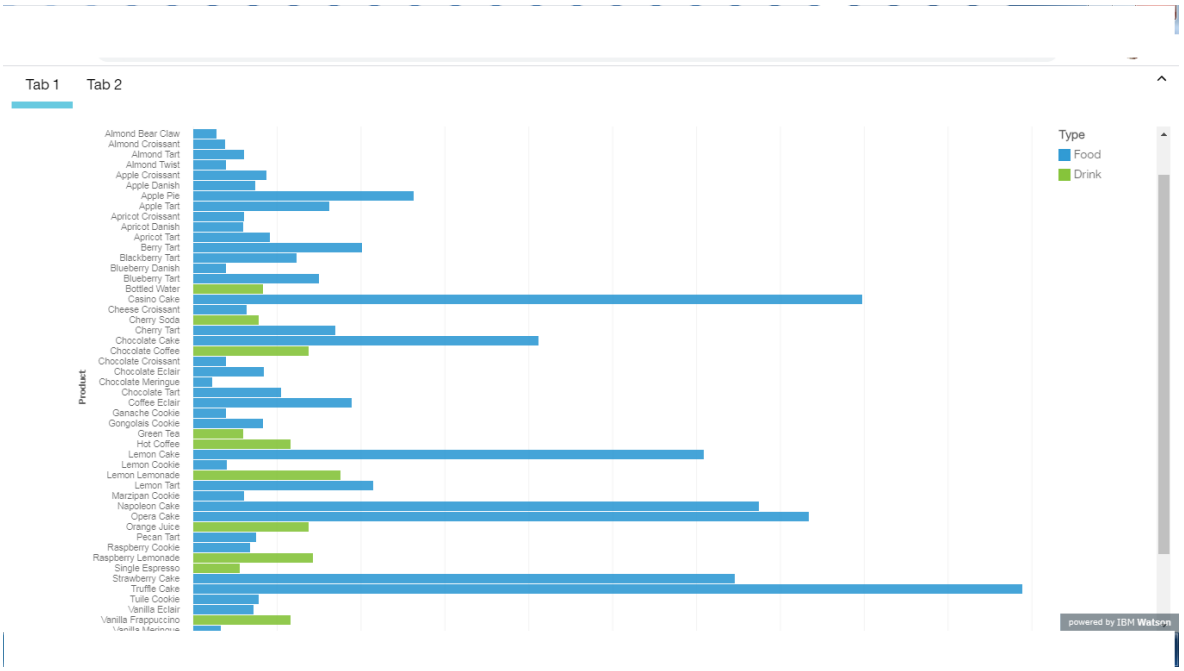
a. Warehouse Temperature Monitoring

b. Prediction Analysis



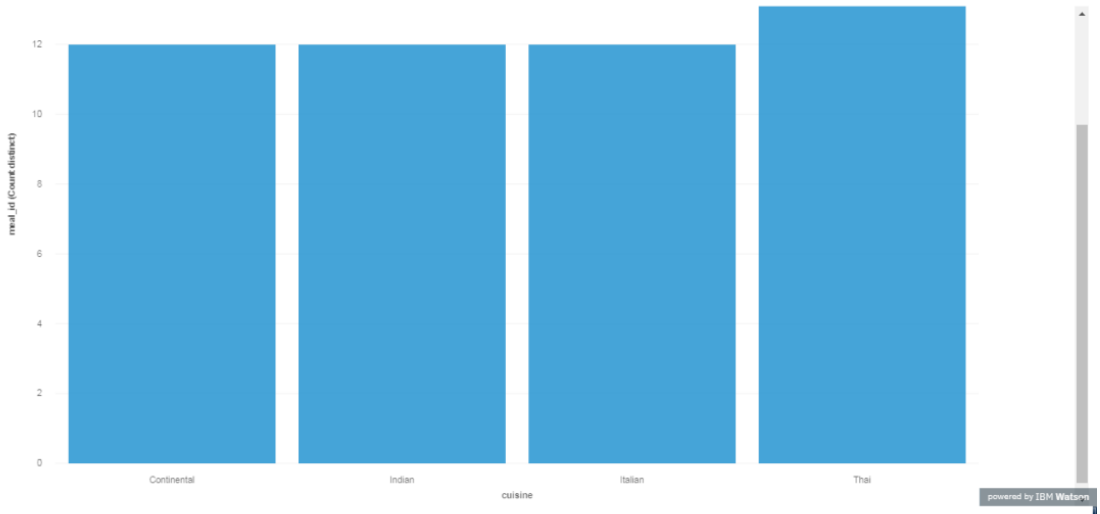


c. Insights

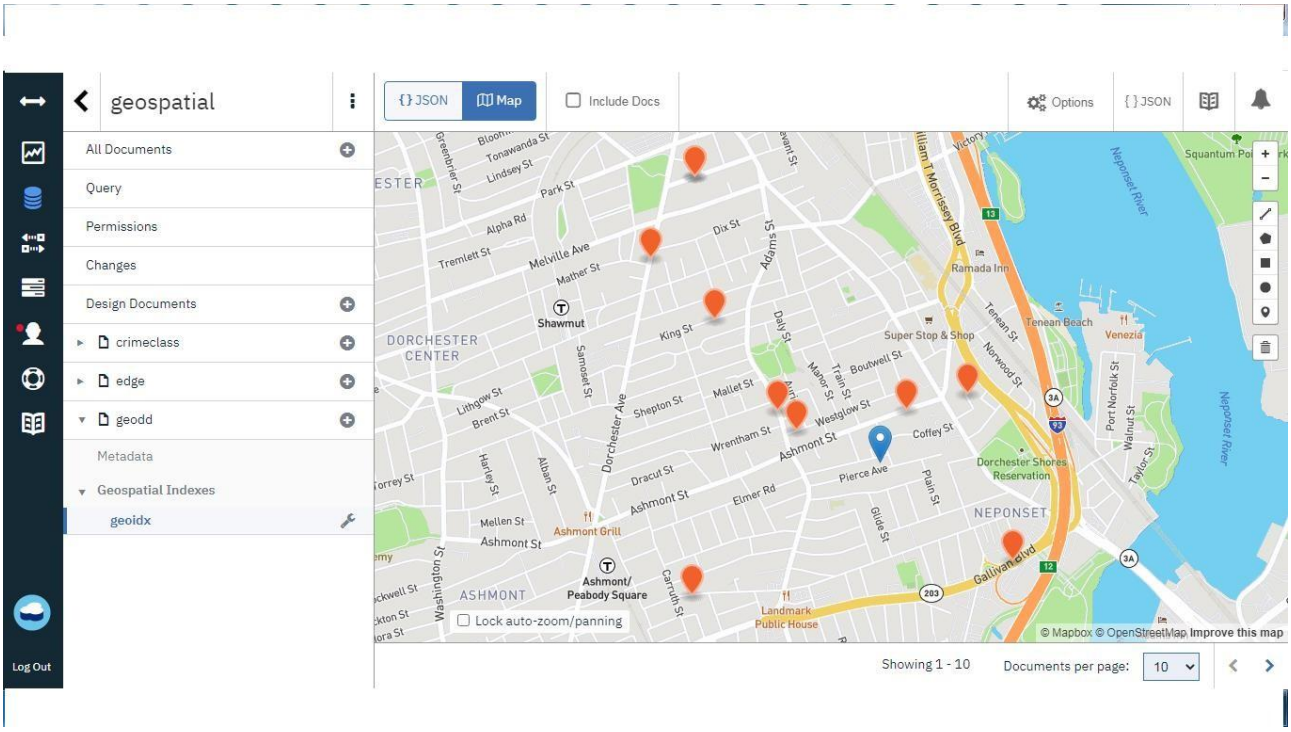

Tab 1
Tab 2
Product
Almond Bear Claw
Almond Croissant
Almond Tart
Almond Twist
Apple Croissant
Apple Danish
Apple Pie
Apple Tart
Apricot Croissant
Apricot Danish
Apricot Tart
Berry Tart
Blackberry Tart
Blueberry Danish
Blueberry Tart
Bottled Water
Casino Cake
Cheese Croissant
Cherry Soda
Cherry Tart
Chocolate Cake
Chocolate Coffee
Chocolate Croissant
Chocolate Eclair
Chocolate Meringue
Chocolate Tart
Coffee Eclair
Ganache Cookie
Gongolais Cookie
Green Tea
Hot Coffee
Lemon Cake
Lemon Cookie
Lemon Lemonade
Lemon Tart
Marzipan Cookie
Napoleon Cake
Opera Cake
Orange Juice
Pecan Tart
Raspberry Cookie
Raspberry Lemonade
Single Espresso
Strawberry Cake
Truffle Cake
Tuile Cookie
Vanilla Eclair
Vanilla Frappuccino
Type
Food
Drink
powered by IBM Watson

Tab 1 Tab 2

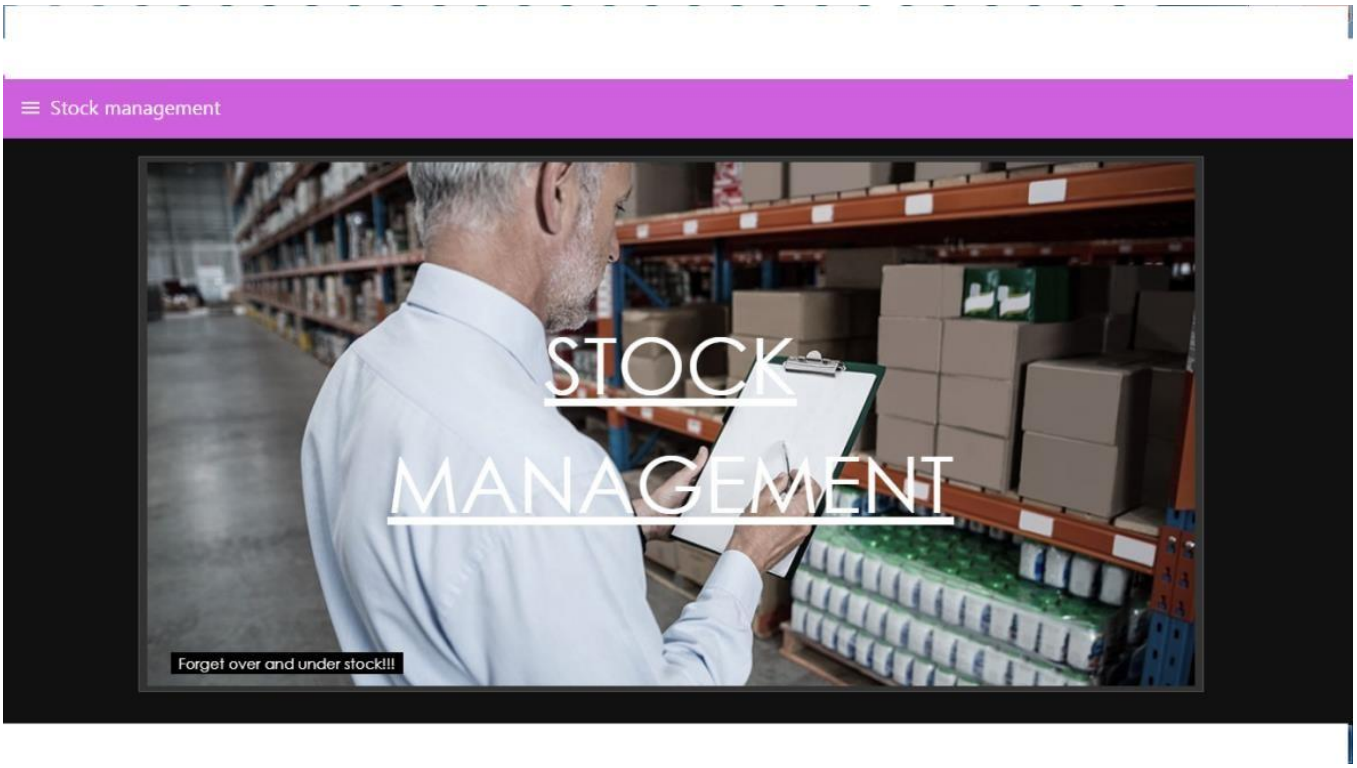
Tab 1



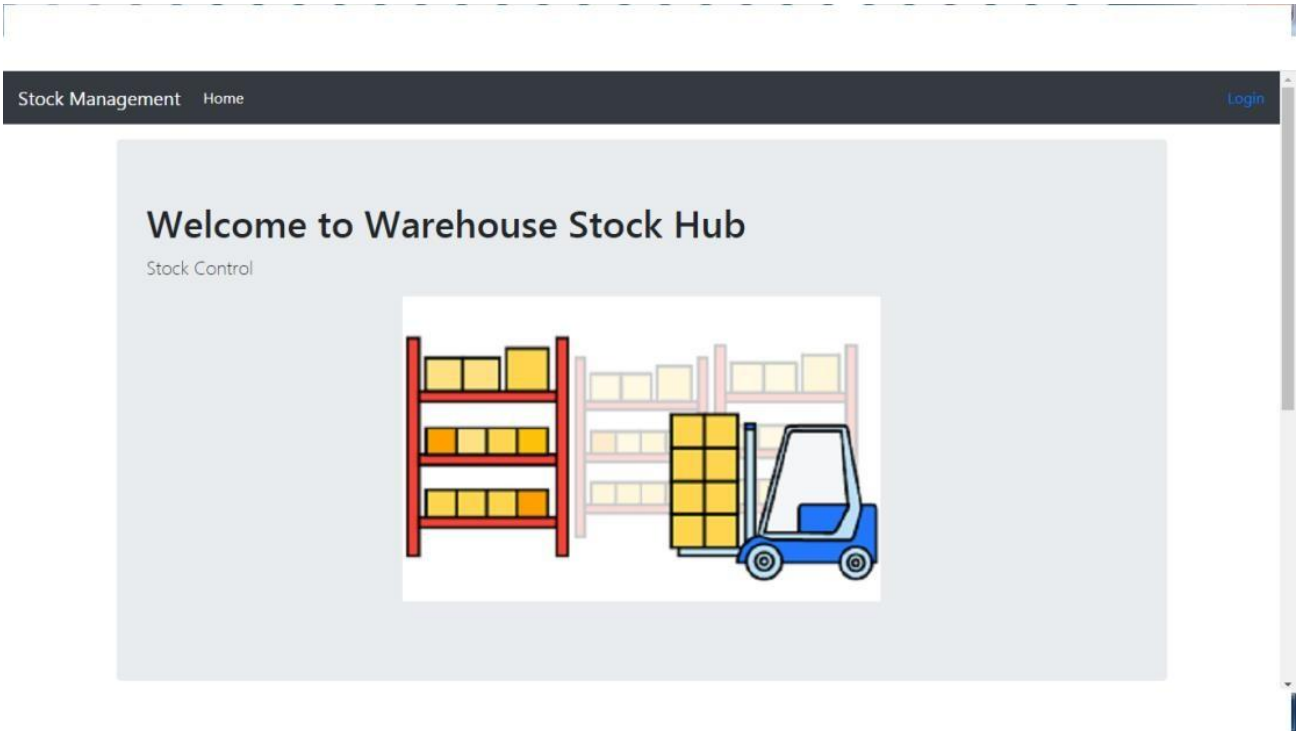
d. Location of stores



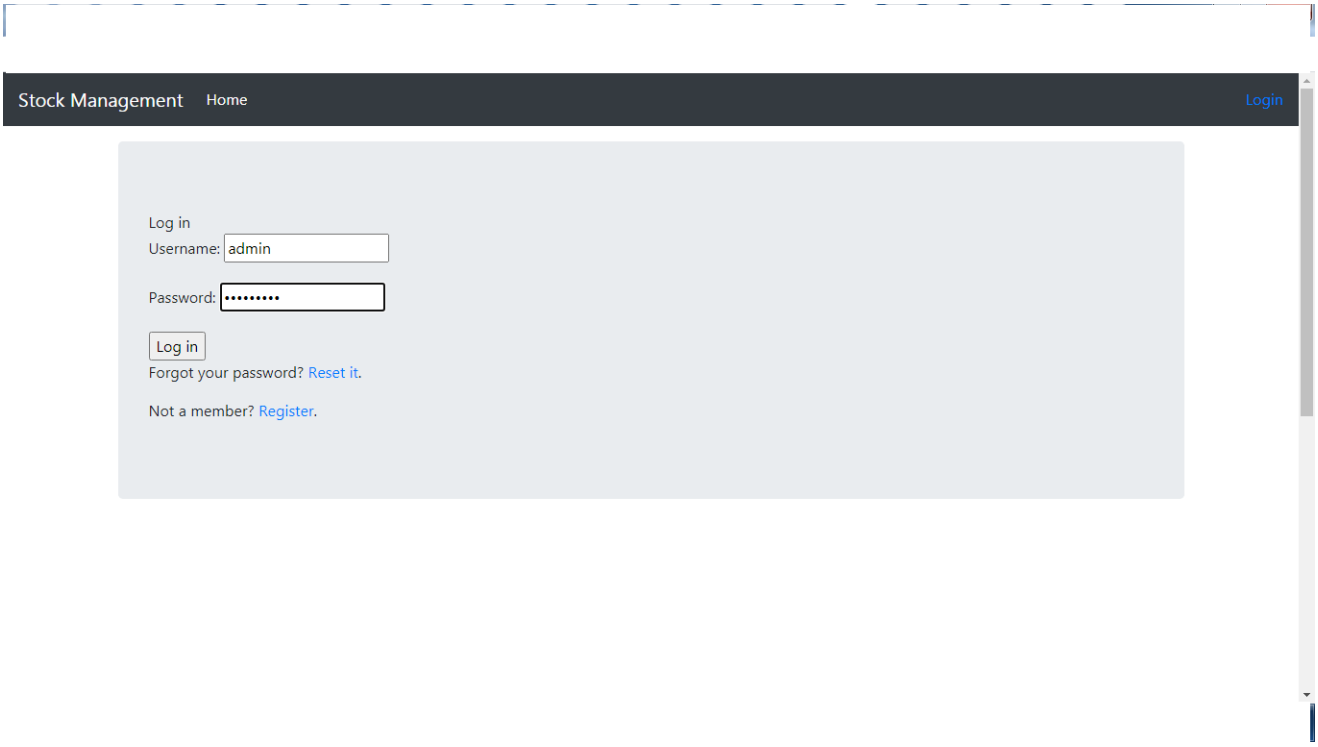
4.STOCK MANAGEMENT



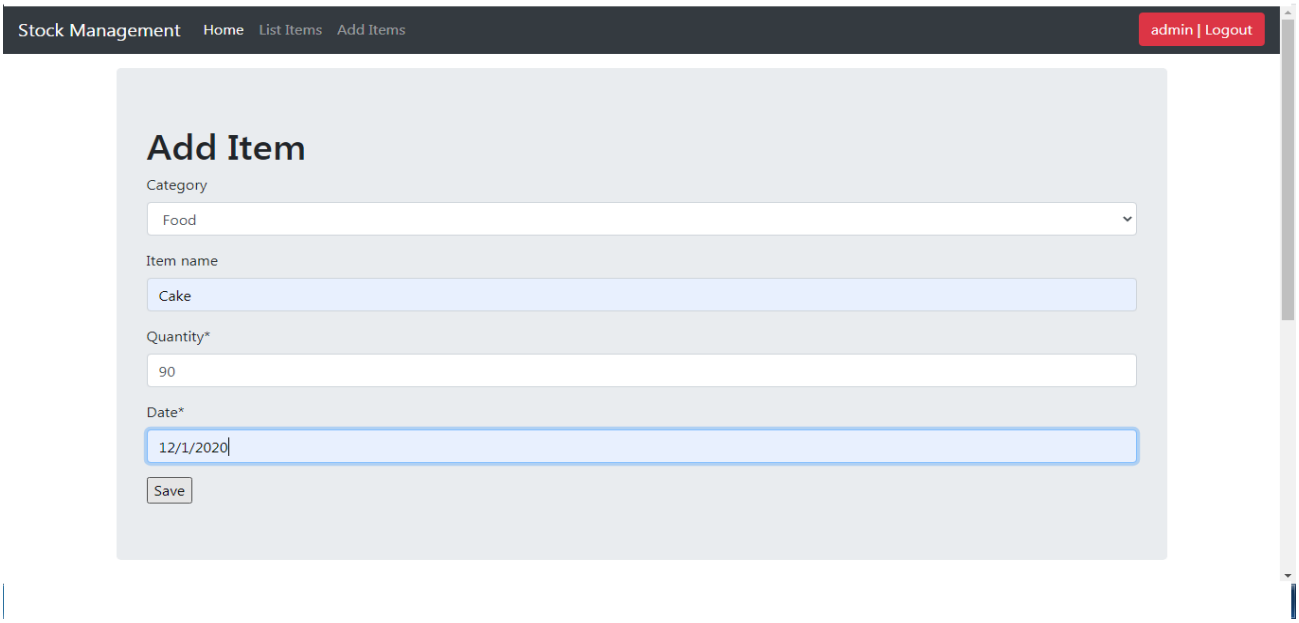
a. Home Page



b. Login Page

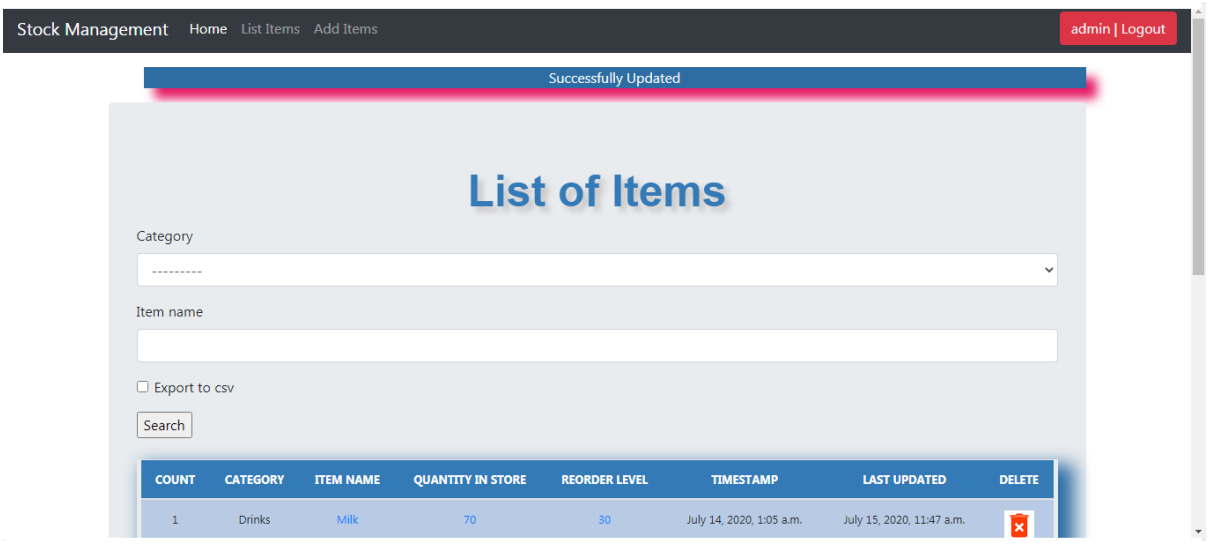


c. Add Item

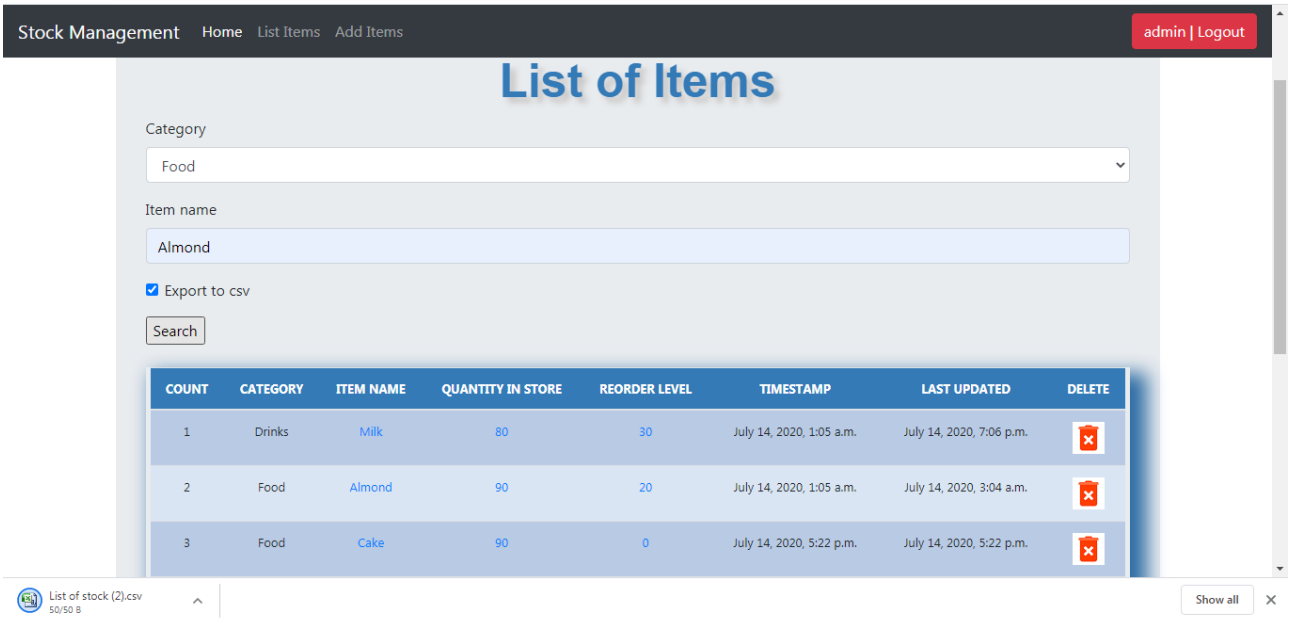


d. List Item

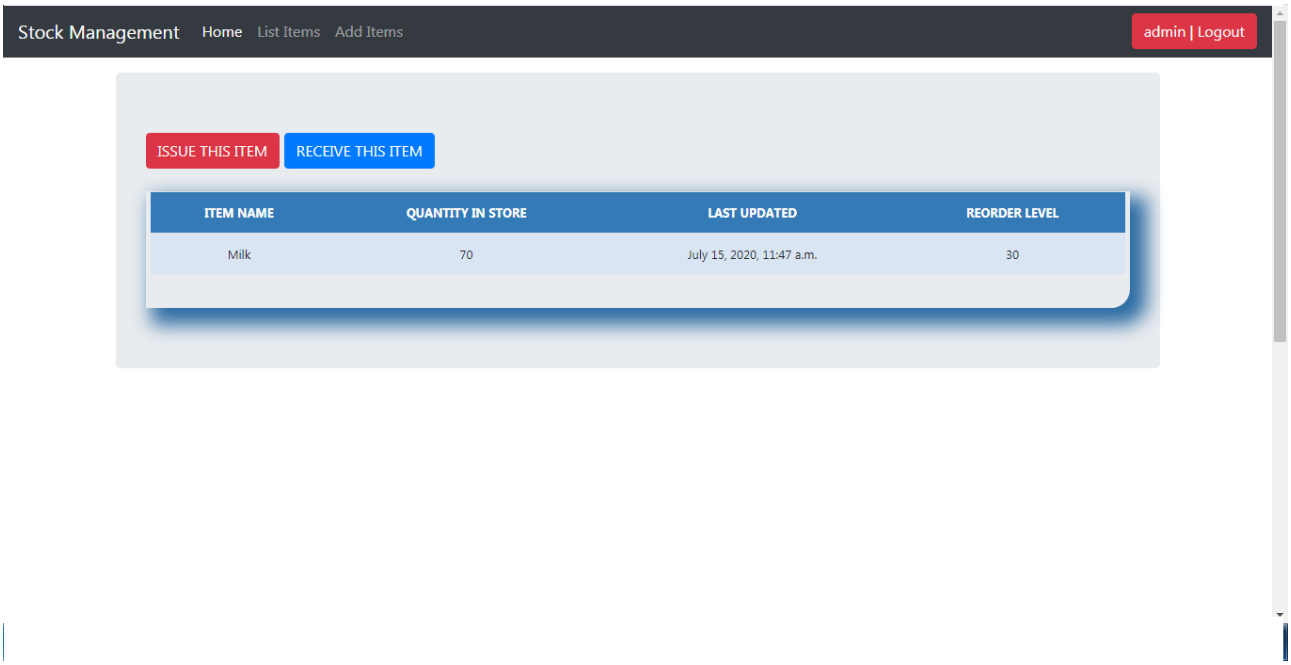
Update an item by clicking on item name in the table



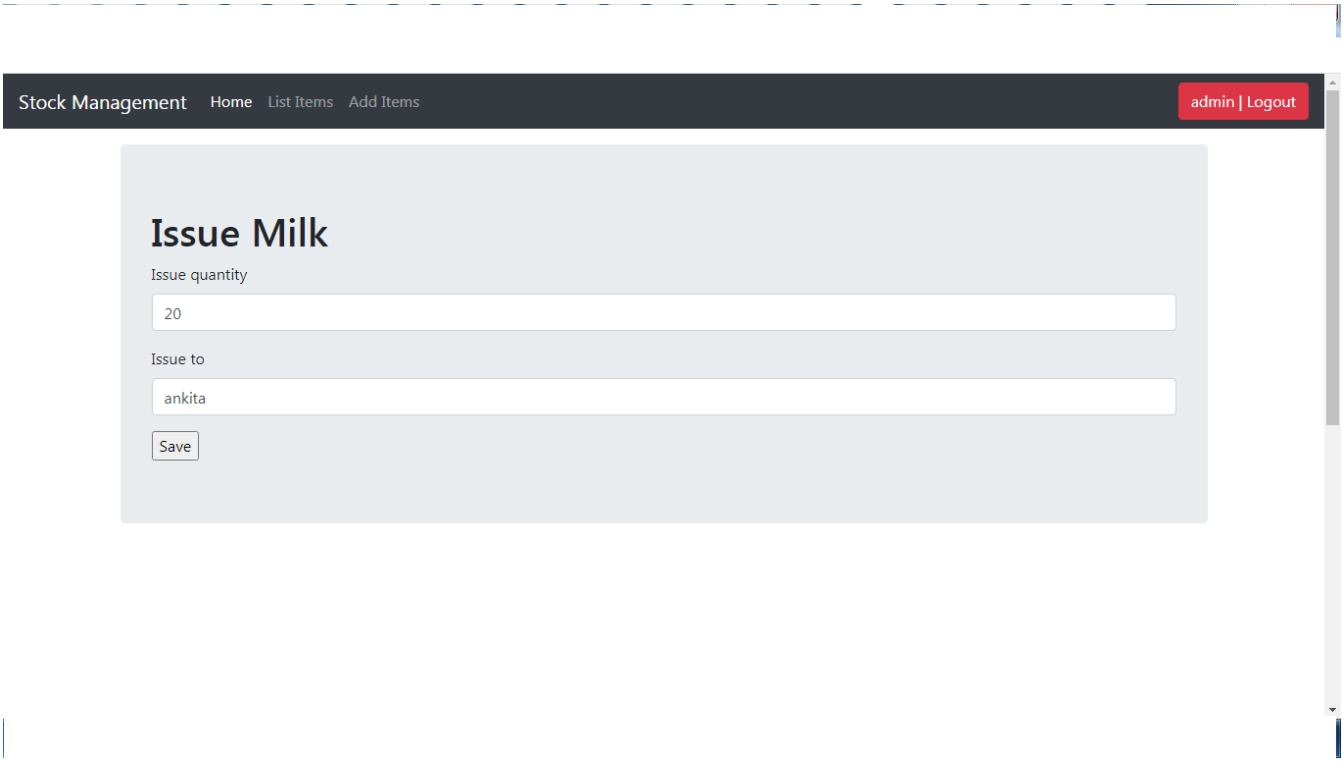
Export csv file



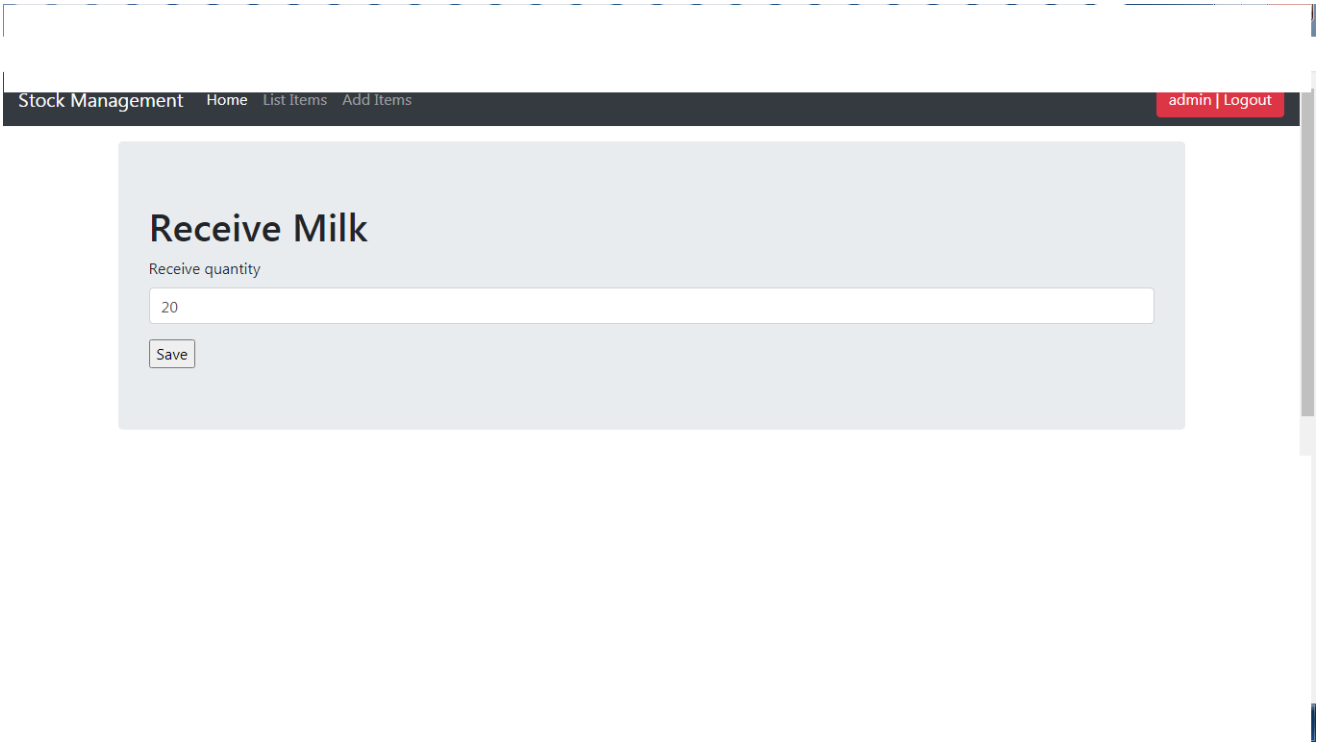
e. Issue and Receive Item



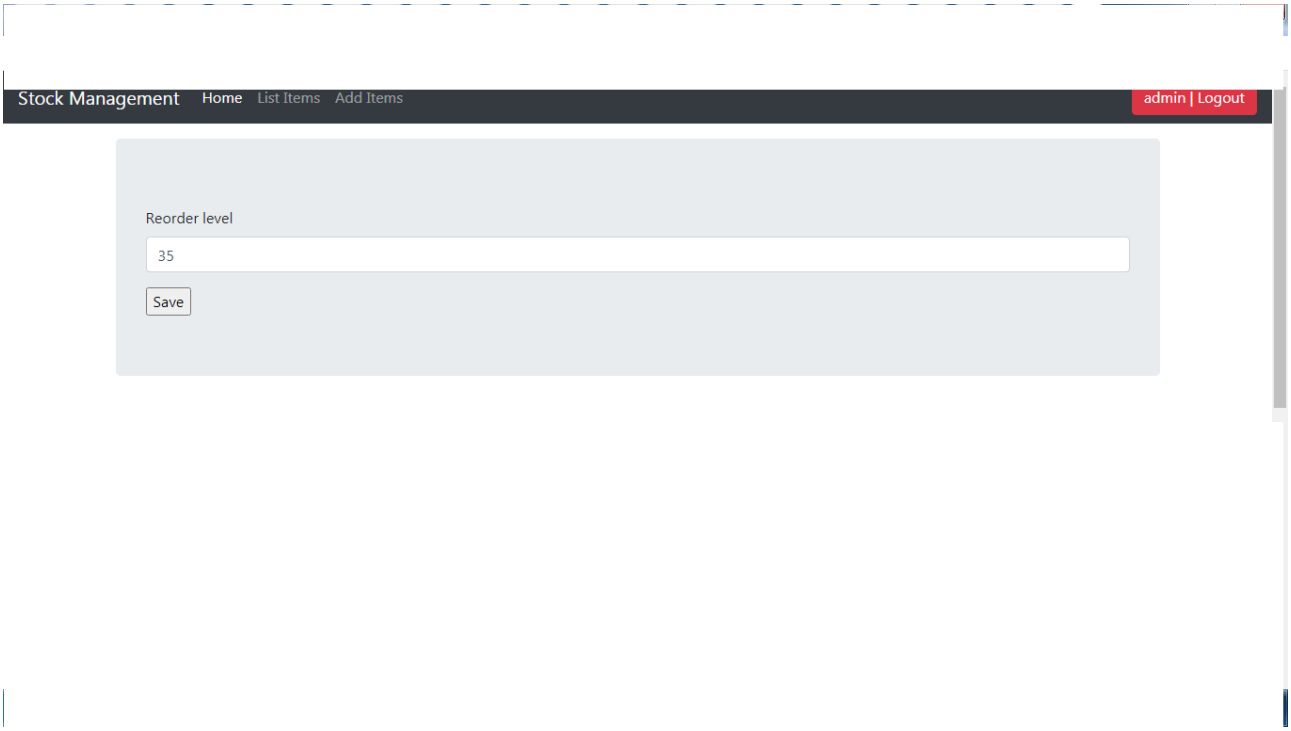
Issue Item



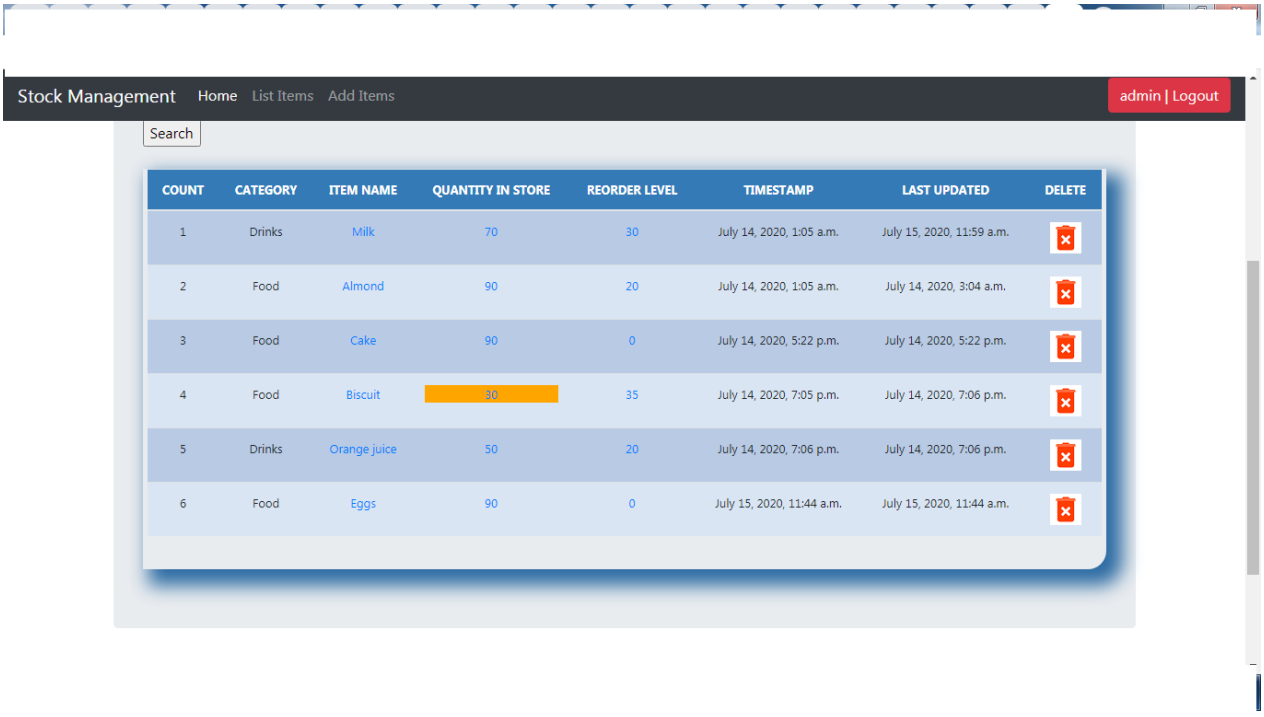
Receive Item



f. Set Reorder Level for each Item

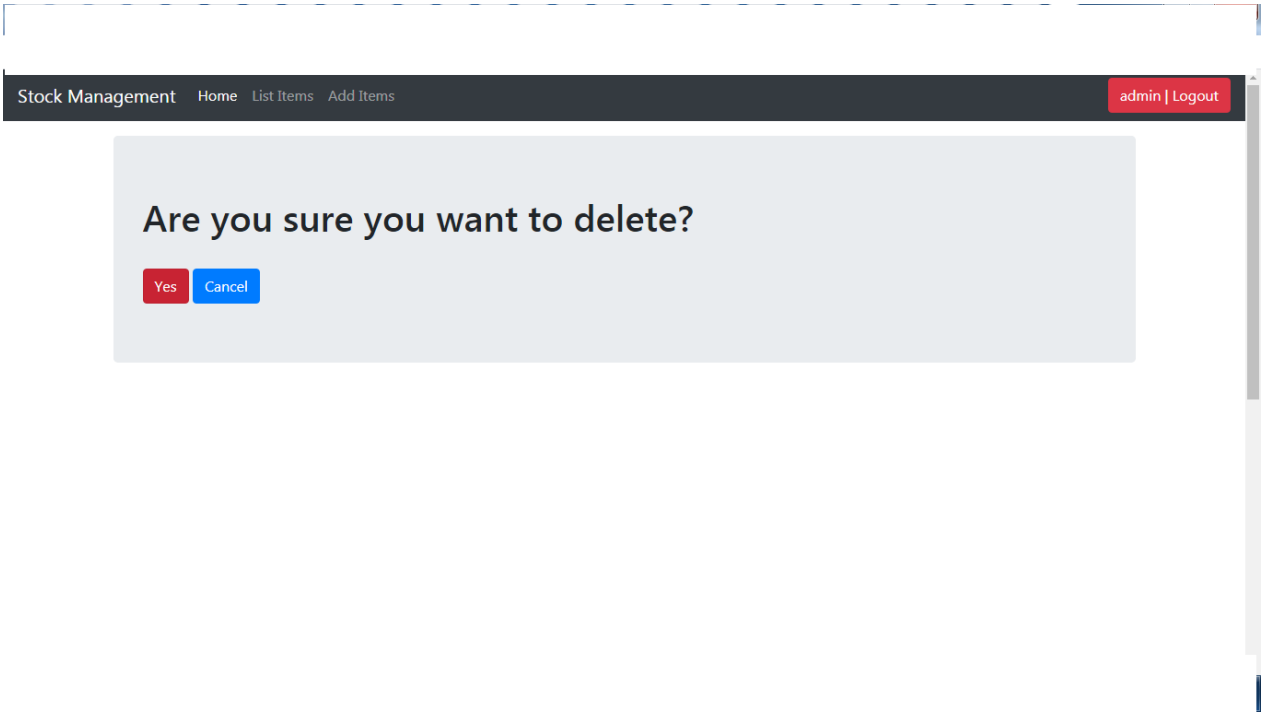


Highlight an item when quantity is reached below reorder level

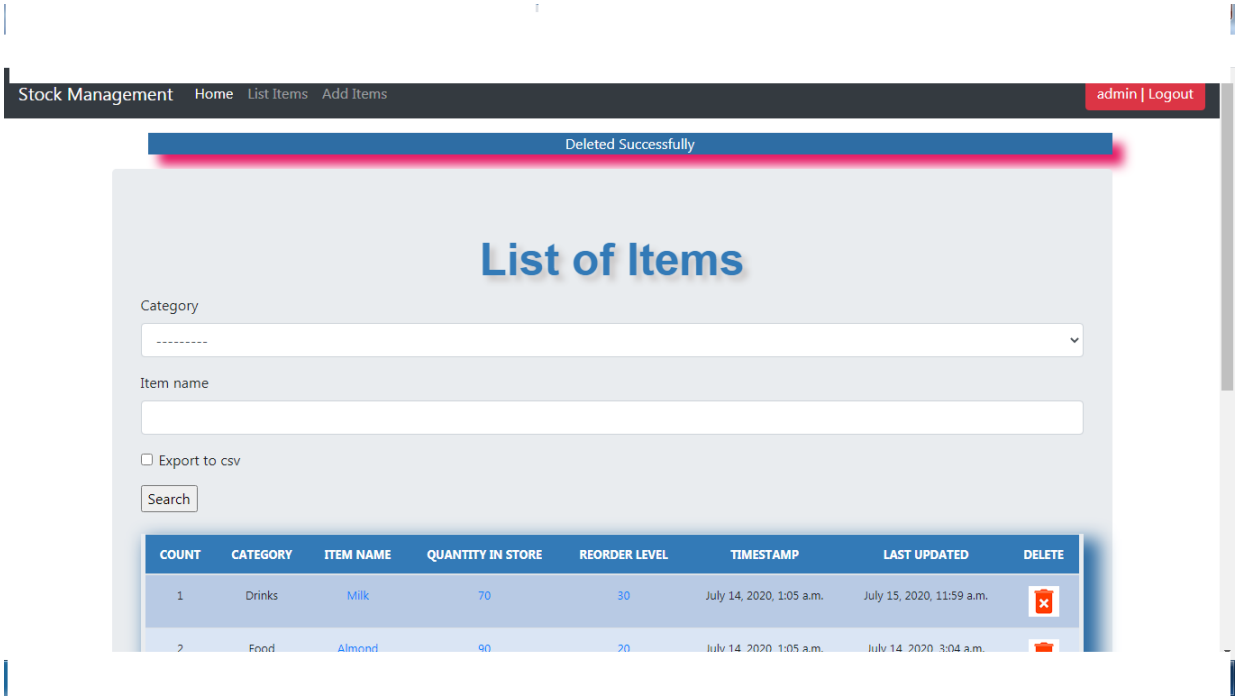


g. Delete Item

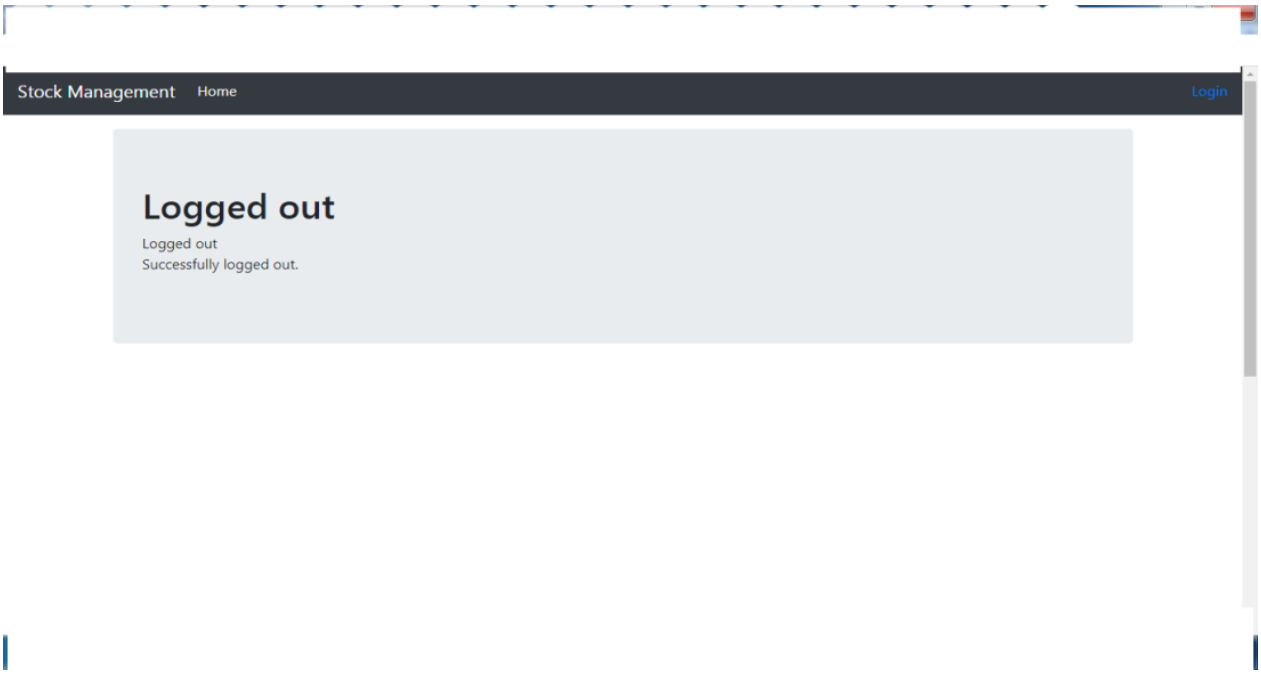
By clicking on bin symbol in front of each item



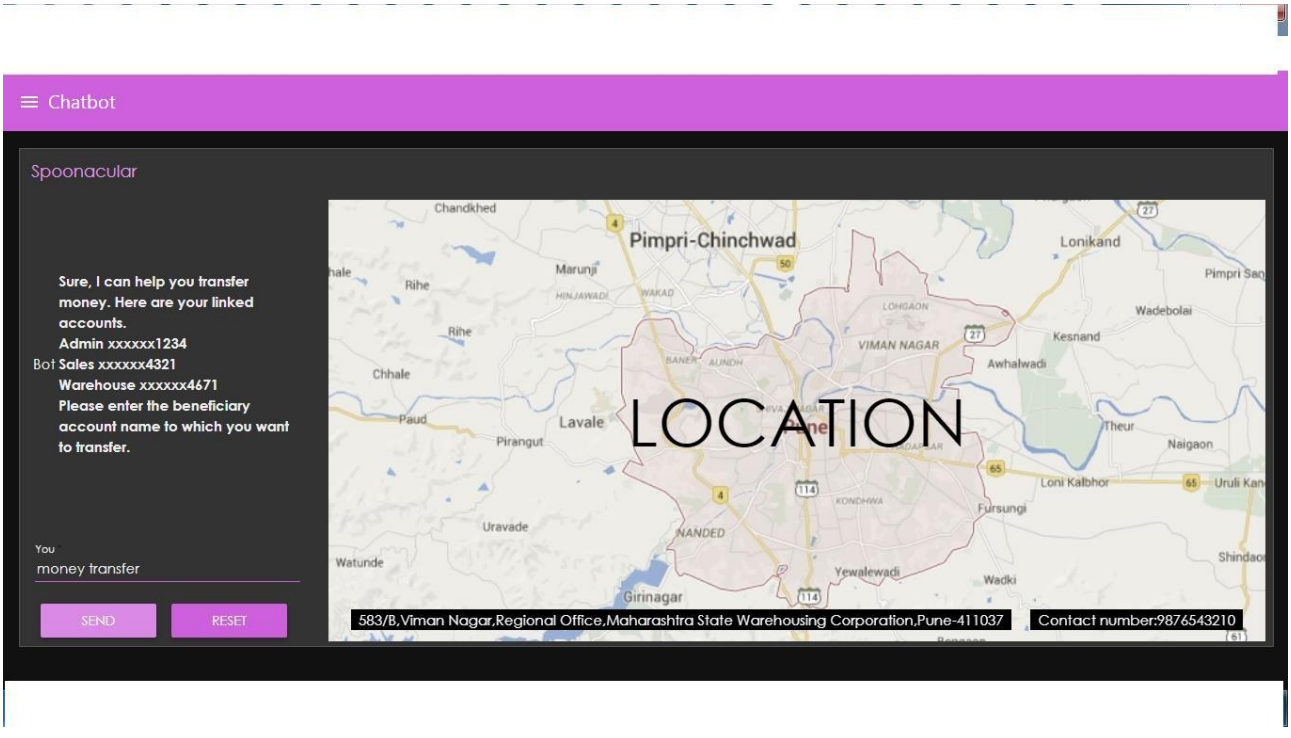
Deleted Successfully



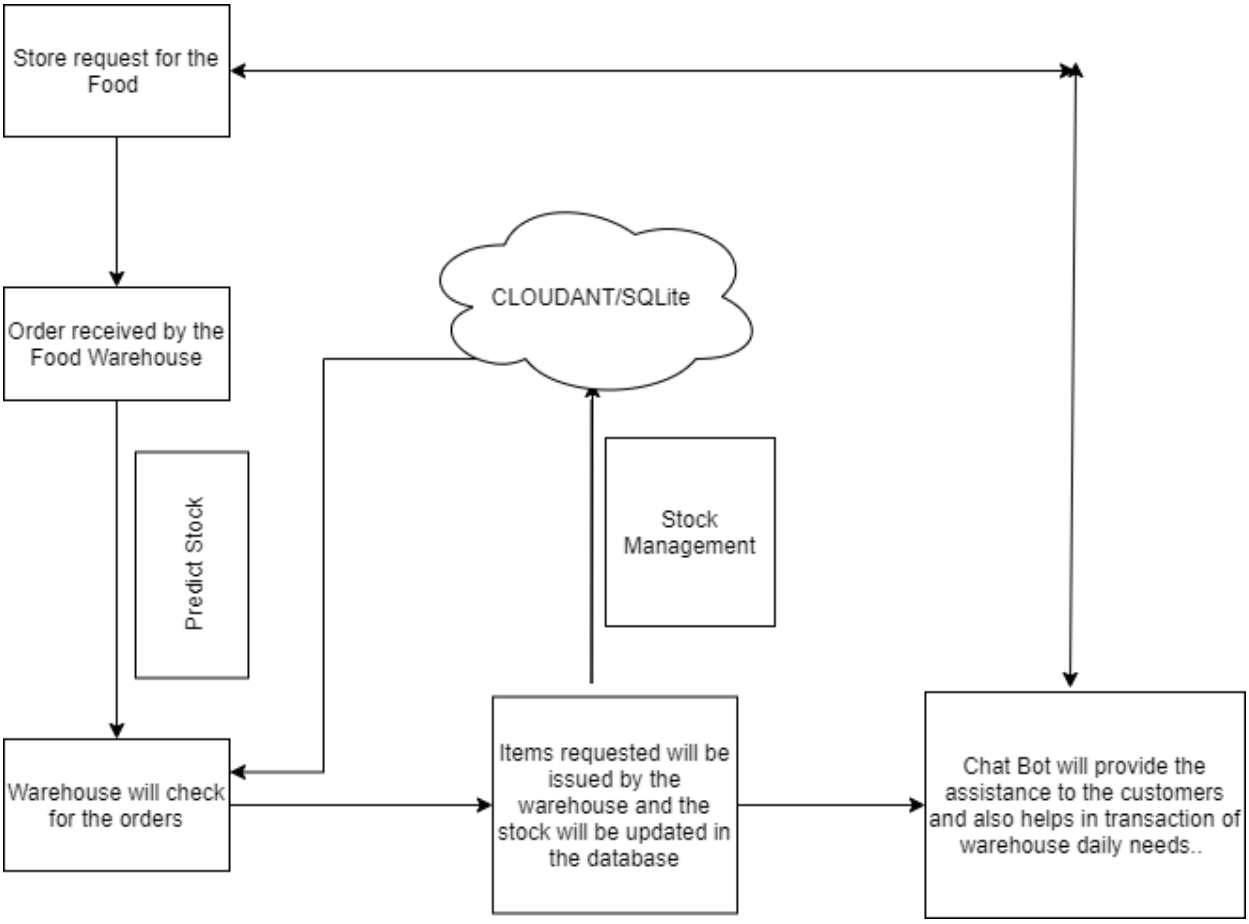
h. Logout



5. CHATBOT



5) FLOWCHART



6) RESULT

Warehouse management is a monumentally complex task with a wide variety of plates to keep spinning. **But getting it right can be the difference between retail success and failure**.

Web based UI was developed by integrating all the services using Node-RED.

URL for UI Dashboard:

https://node-red-dkbjm.eu-gb.mybluemix.net/ui/#!/2?socketid=57HXIdnOOfIsLks5AAEK

7) ADVANTAGES AMD DISADVANTAGES

ADVANTAGE	DISADVANTAGE
No Lost Sales	Additional Administrative Costs
Less Wastage	Not Helpful in increasing Sales
Products Available Every time	

8) APPLICATIONS

a. Prediction of Warehouse Stock requires beforehand.

b. Control of Warehouse Machine Temperature.

c. Customer assistance through chatbot.

d. Solve the issue of over and under stock.

e. Asset tracking.

9) CONCLUSION

The warehouse is a key component of the supply chain in emergencies. It buffers uncertainties and breakdowns that may occur in the supply chain. When properly managed and appropriately stocked a warehouse provides a consistent supply of material when it is needed.

10) FUTURE SCOPE

With the help of AI and Machine Learning the food supply chain can optimize and shrink the demand and supply gap of food produce and food products by assessing market conditions, channeling warehousing requisites, identifying target consumers, forecasting demand, and rationalizing supply. AI and ML together can improve timelines and schedule with instant data processing and keep fleets running at peak performance levels.

Machine learning algorithms and the apps running them are capable of analyzing large, diverse data sets fast, improving demand forecasting accuracy. Reducing freight costs, improving supplier delivery performance, and minimizing supplier risk are three of the many benefits machine learning is providing in collaborative supply chain networks.Machine Learning and its core constructs are ideally suited for providing insights into improving supply chain management performance not available from previous technologies. Machine learning excels at visual pattern recognition, opening up many potential applications in physical inspection and maintenance of physical assets across an entire supply chain network. Gaining greater contextual intelligence using machine learning combined with related technologies across supply chain operations translates into lower inventory and operations costs and quicker response times to customers. Forecasting demand for new products including the causal factors that most drive new sales is an area machine learning is been applied to today with strong results. Machine learning is improving production planning and factory scheduling accuracy by taking into account multiple constraints and optimizing for each. Combining machine learning with advanced analytics, IoT sensors, and real-time monitoring is providing end-to-end visibility across many supply chains for the first time.

The worldwide internet of things in warehouse management market report intensely underlines essential market, value chain, supply chain analysis and Compounded Annual Growth Rate (CAGR) are interpreted in Market.us Research study in a well-defined comprehensive manner.

Structure of 2020 Economic and Business Impacts Analysis of COVID-19 on Internet of Things in Warehouse Management Market

Global COVID-19 pandemic internet of things in warehouse management market has given an unprecedented economic shock to industries across the globe. The impact on internet of things in warehouse management market sales, though indirect, will be far-fetched and majorly rely on the possible vulnerabilities and underlying risks associated with the industry's value chain. Internet of Things in Warehouse Management Market, a key Business used in Warehouse automation continues to face roadblocks with the economic and supply chain challenges thrown up by the COVID-19 crisis.

11) BIBILOGRAPHY

1. **IBM Cloud :**

https://cloud.ibm.com/registration

2. **IBM Watson Studio :**

https://www.youtube.com/watch?v=J9xtw0zjDLY&feature=youtu.be

https://cloud.ibm.com/docs/IoT/devices/device_sim.html

3. **Node-RED :**

https://www.youtube.com/watch?v=WUB6gySRjOg&t=40s

4. **AutoAI :**

https://www.youtube.com/watch?v=O5wqjk_GeJo&feature=youtu.be

5. **UI Building :**

https://www.youtube.com/watch?v=O5wqjk_GeJo&feature=youtu.be

6. **Data Visualization and Dashboard:**
https://developer.ibm.com/technologies/analytics/tutorials/create-interactive-dashboards-on-watson-studio/#:

7. **Watson Assistant:**

https://www.youtube.com/watch?v=6t8C0YRUGec

APPENDIX

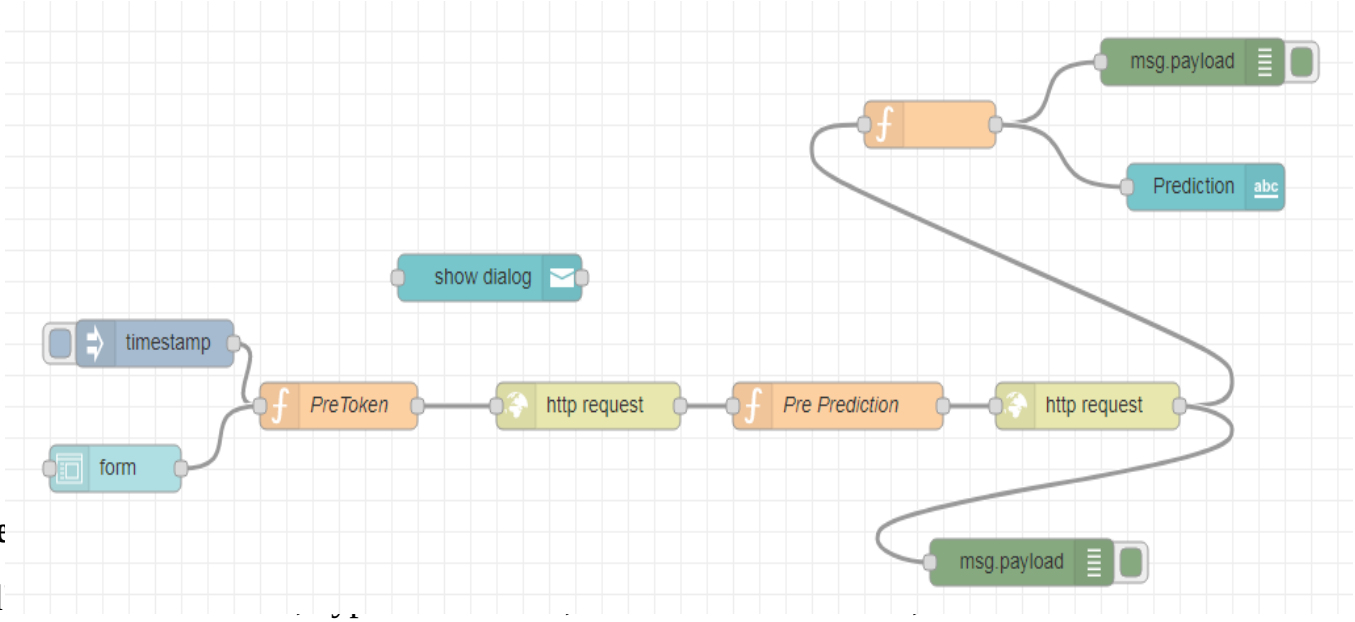
A. Source code

COMPLETE SOURCE CODE:

https://github.com/darekarankita0/Optimized-Warehouse-Management-of-Perishable-Goods-for-a-Food-Delivery-Company

Prediction Feature:

Node-red flow



Code

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