

**Optimized Warehouse Management of Perishable Goods for  
Food Delivery Company**

**An Internship Report Submitted To**  
**SMART INTERNZ**  
**IBM Hack Challenge 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 of nearby stores
- 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

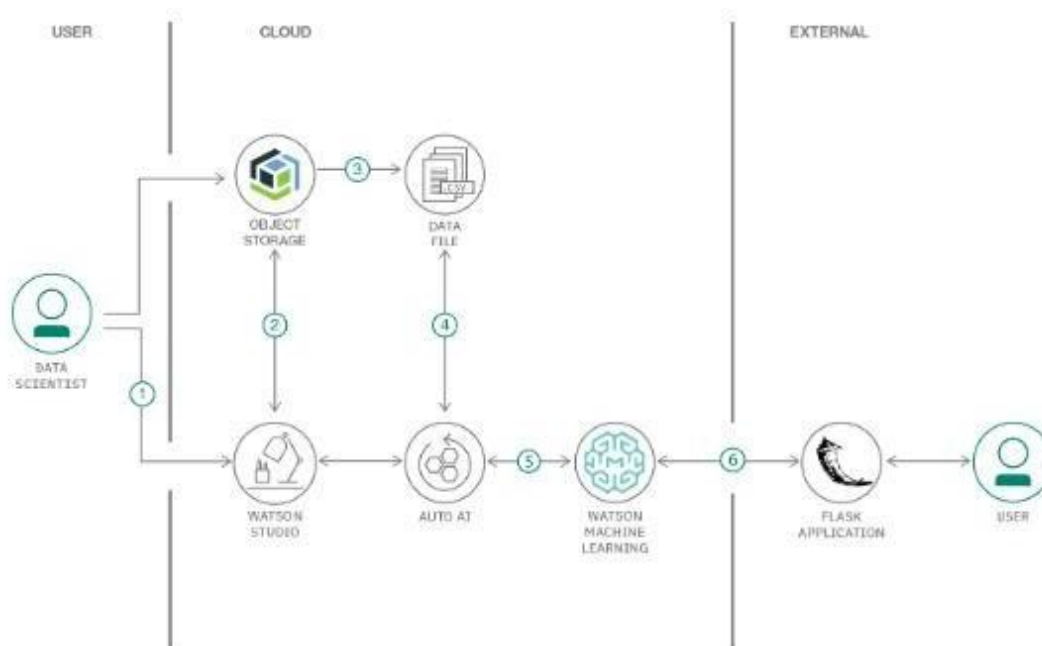
rationalizing supply. AI and ML together can improve timelines and schedule with instant data processing and keep fleets running at peak performance levels.

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.

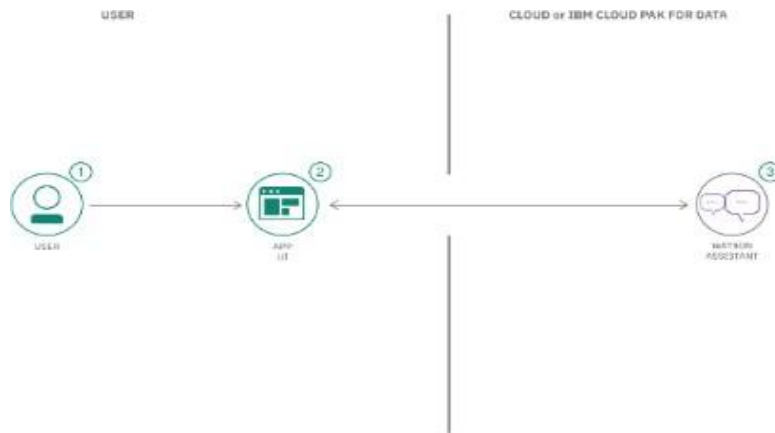
### 3) THEORITICAL ANALYSIS

#### Block Diagram

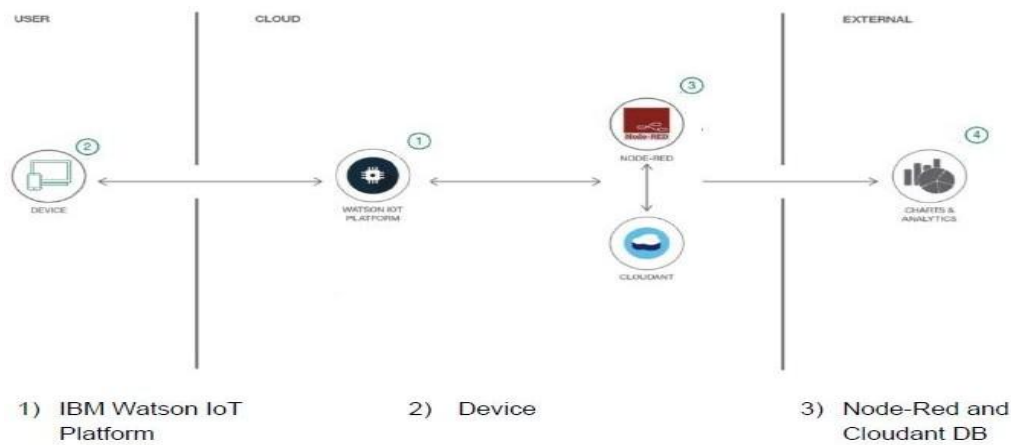
##### 1.AutoAI



## 2.Chatbot



## 3.IOT



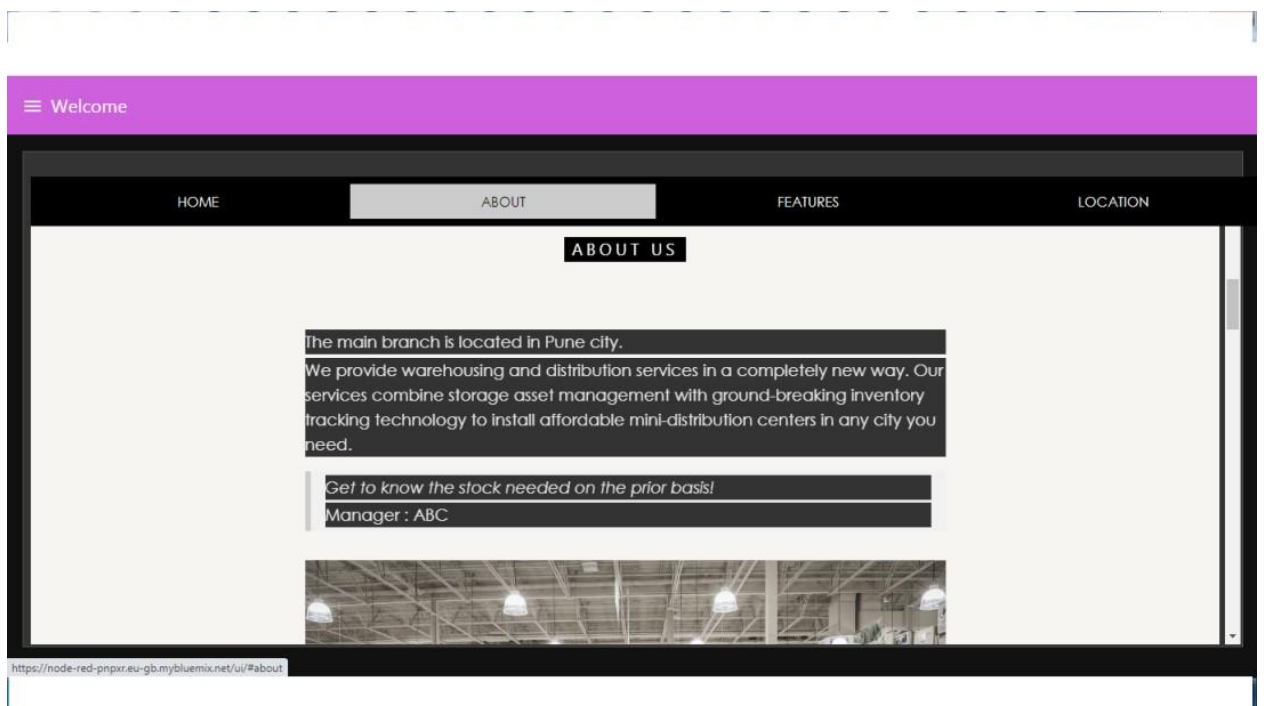
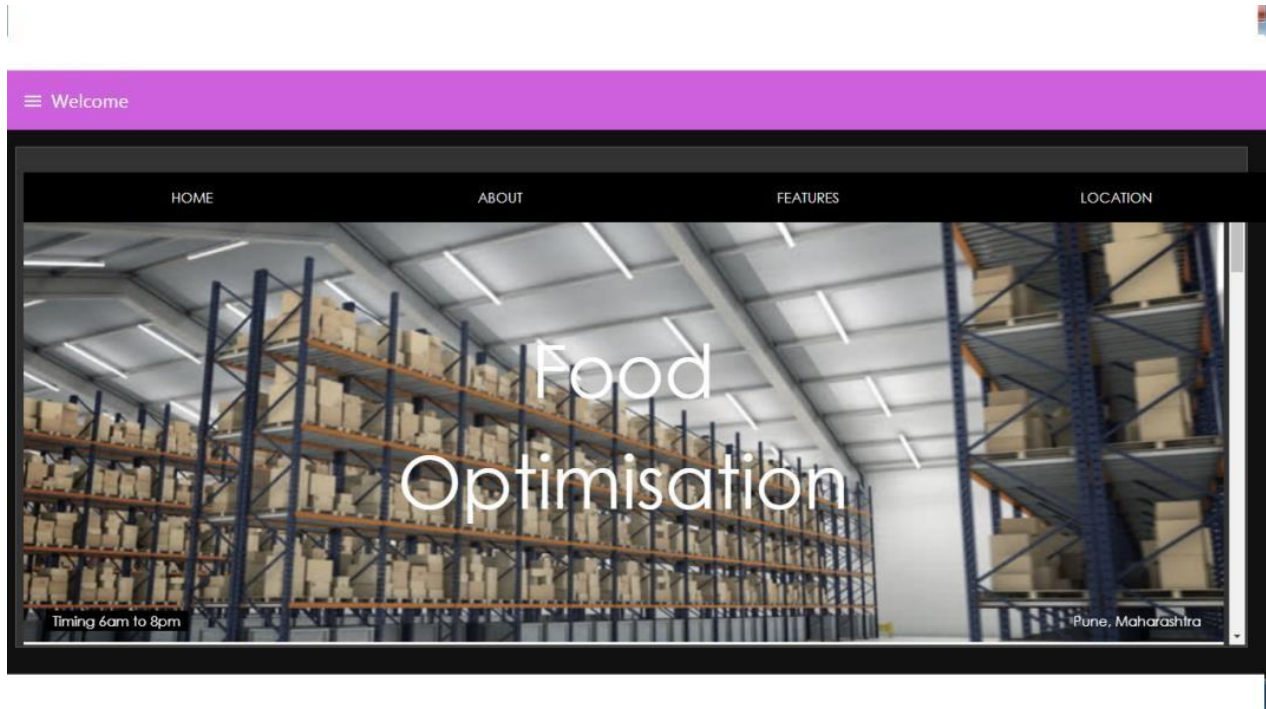
## Hardware / Software designing

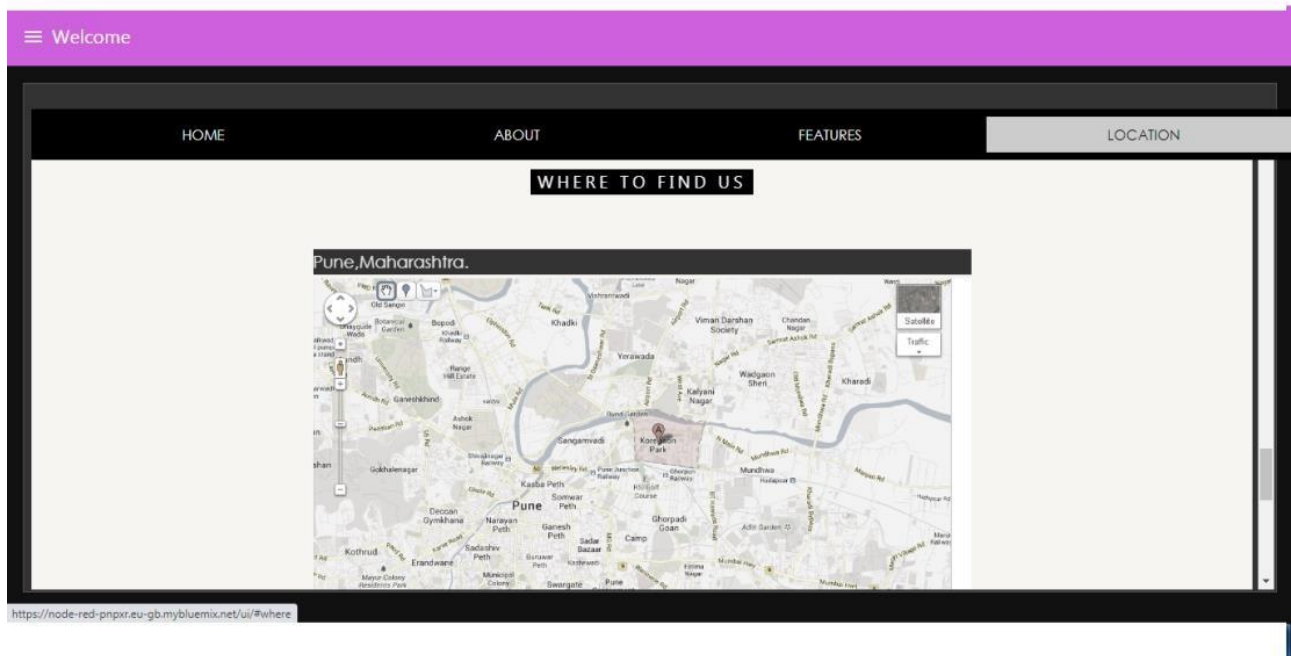
1. Create necessary Watson Services.
2. Configure Watson Studio - AutoAI
3. Configure Watson Assistant - Chatbot for transaction purpose
4. Configure Watson IOT - Warehouse Temperature Monitoring
5. Django framework - Stock Management(Local system)
6. Configure Cloudant – Location of stores

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

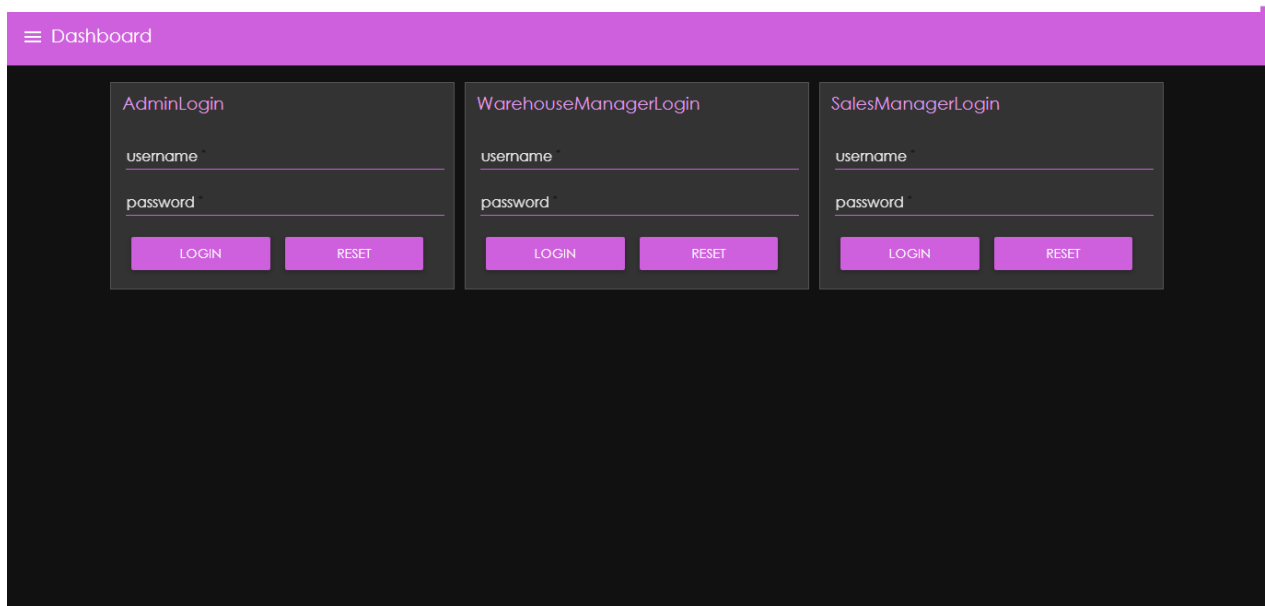
## 4) EXPERIMENTAL INVESTIGATIONS,

### 1.HOME PAGE





## 2. Dashboard: Admin, Warehouse Manager, Sales Login





## a. Admin Page

Dashboard

Login successfull as admin

AddProduct

Product ID

Product name

Unit

Cost per unit

Description

Stock

ADD PRODUCT

RESET

AddSupplier

Supplier ID

Name

Email id

Contact number

Address

Details

Remark

ADD SUPPLIER

RESET

AddCustomer

Customer ID

Name

Email id

Contact number

Address

Details

Remark

ADD CUSTOMER

RESET

Transaction

AddSalesManager

AddWarehouseManager

## b. Warehouse Manager Page

Dashboard

Login successfull as warehouse manager

WarehouseTransaction

Transaction Type(IN/OUT)

Name

Product name

Unit

Amount

☐ Paid

Balance

ADD

WarehouseProductStock

Date

Product name

Unit

Cost

Quantity

EDIT

WarehouseLogout

LOGOUT

### c. Sales Manager Page

Dashboard

Login successfull as sales manager

SalesTransaction

Name

Product name

Unit

Amount

☐ Paid

Balance

ADD

SalesProductStock

Date

Product name

Unit

Cost

Quantity

EDIT

SalesLogout

LOGOUT

### d. Session Management

Dashboard

AdminLogin

username

admin

password

\*\*\*\*\*

LOGIN

RESET

WarehouseManagerLogin

username

warehouse

password

\*\*\*\*\*

Session Timeout

Session Expired! Please singin again!

OK

SalesManagerLogin

username

sales

password

\*\*\*\*\*

LOGIN

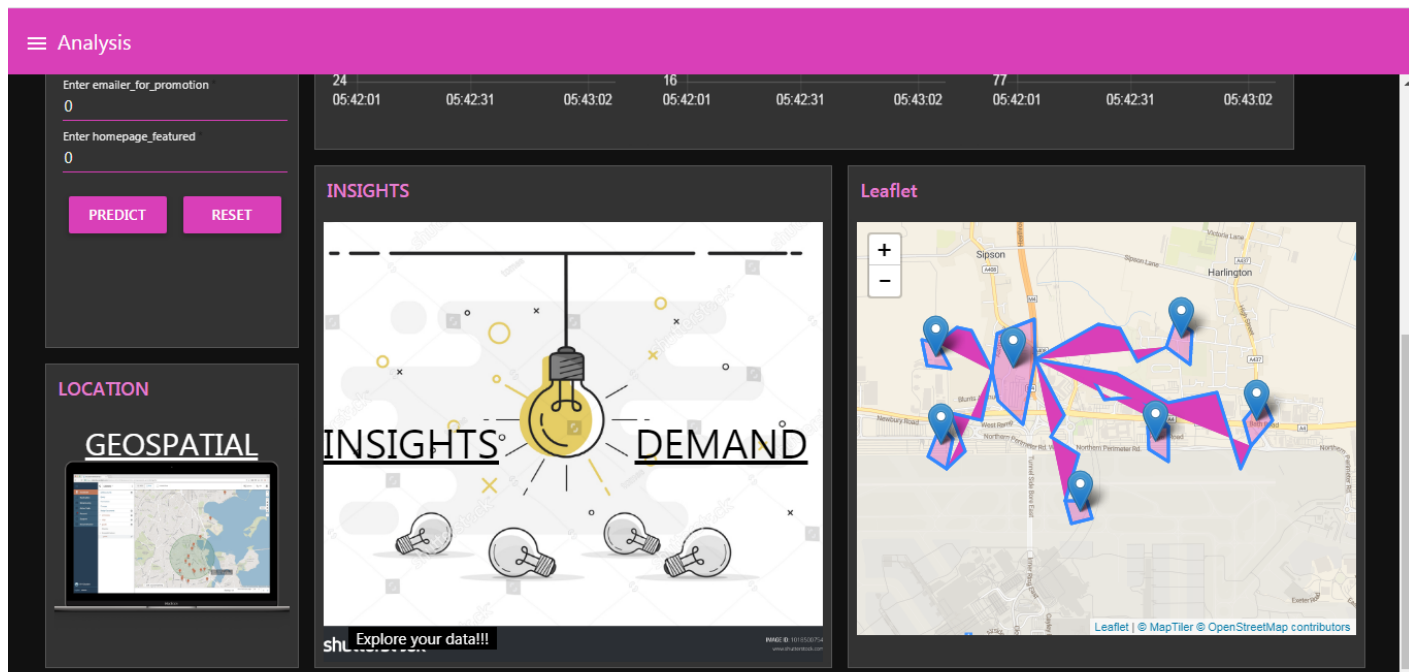
RESET

3.

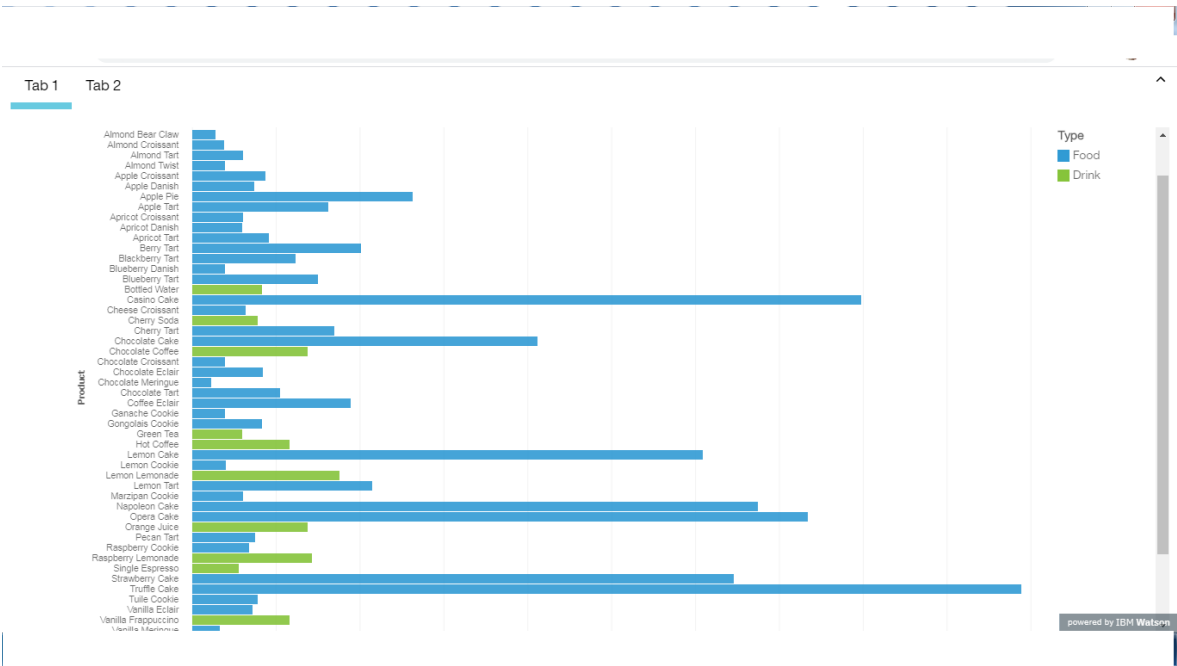
## Analysis

### a. Warehouse Temperature Monitoring

### b. Prediction Analysis



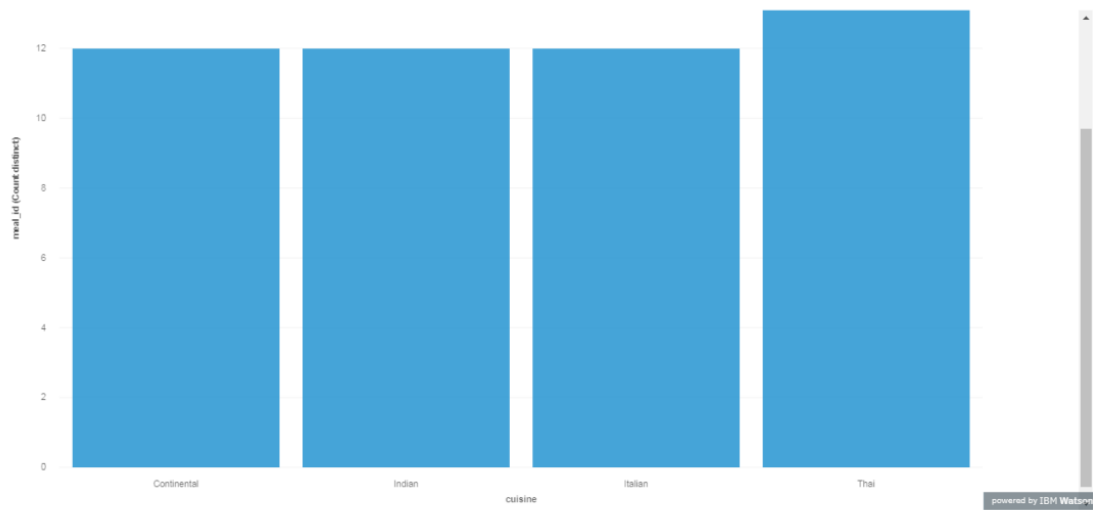
c. Insights



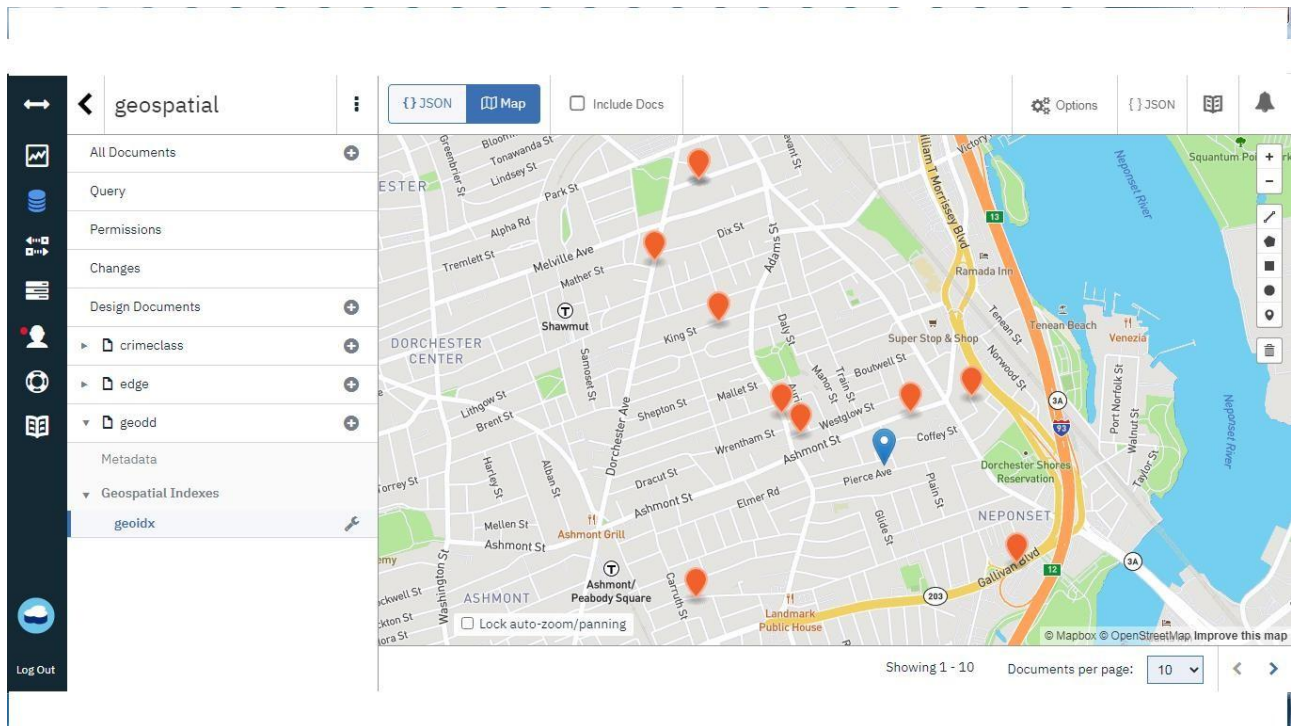
Tab 1    **Tab 2**



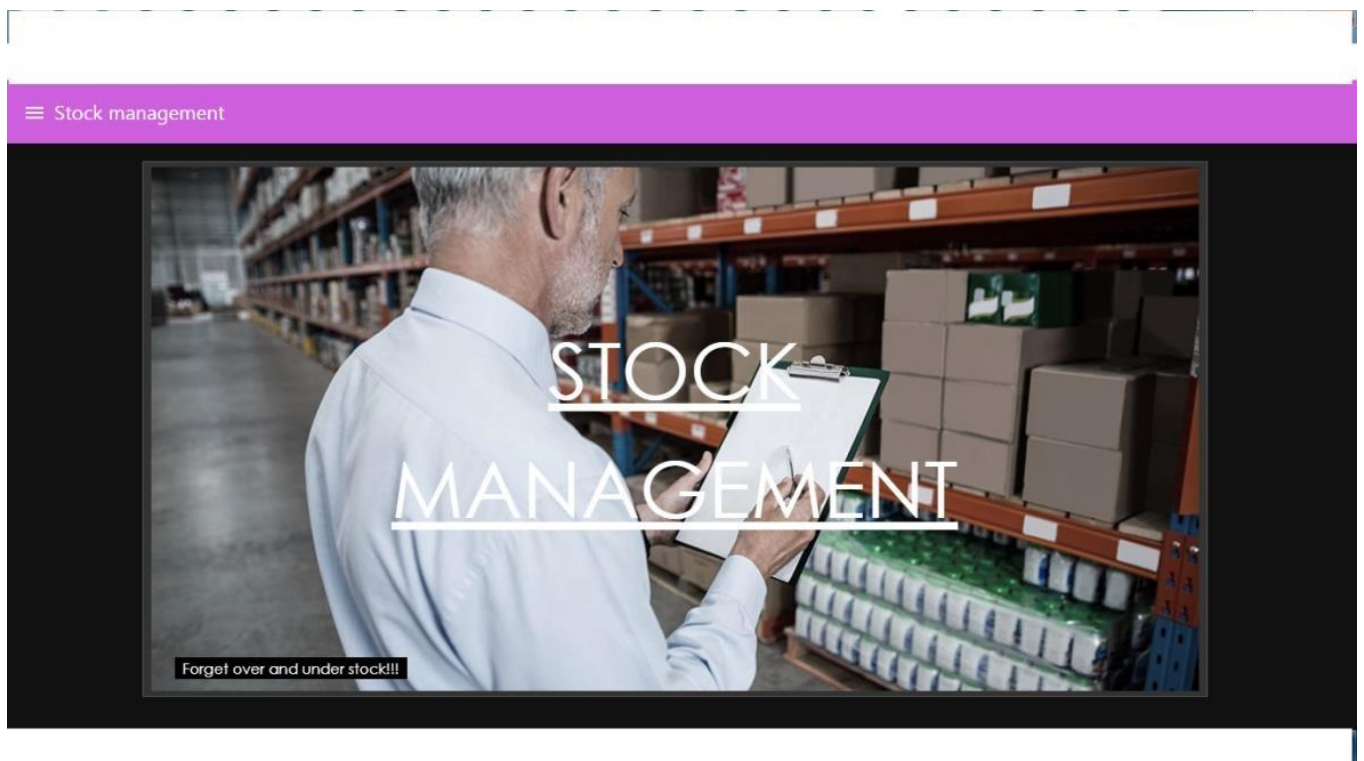
**Tab 1**



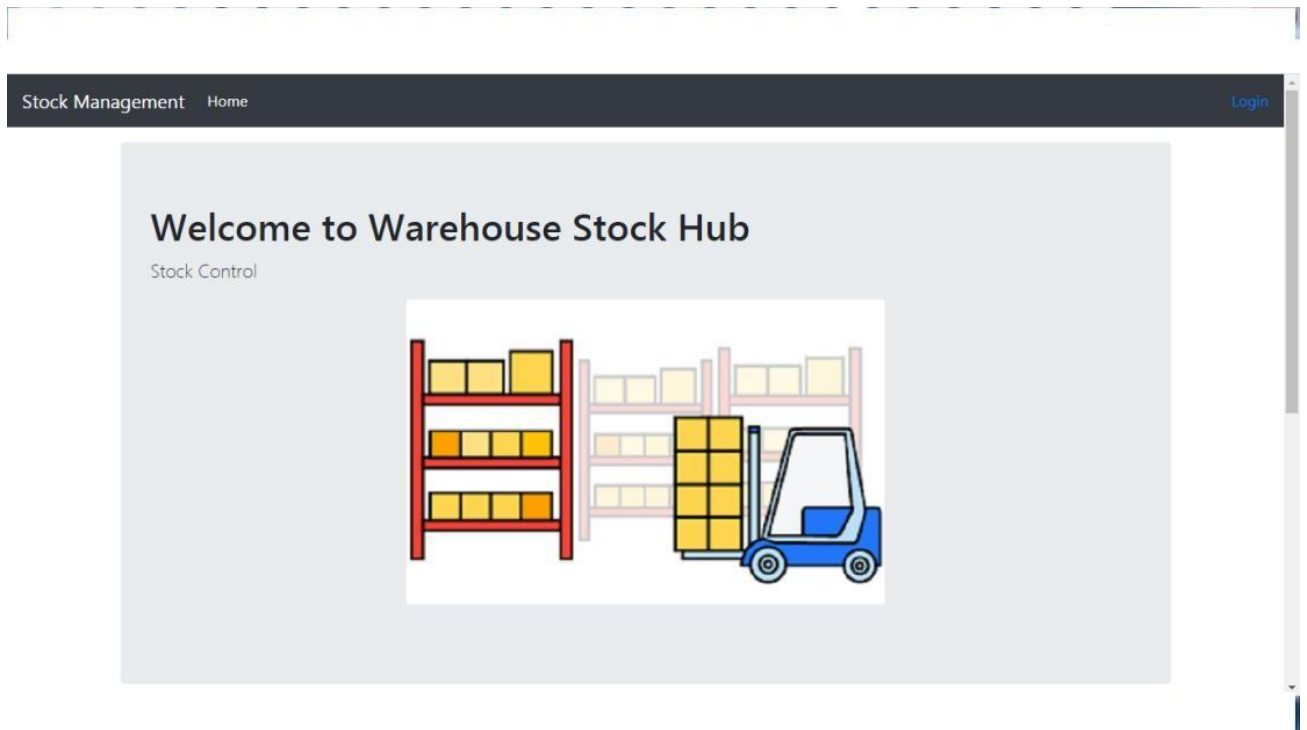
## d. Location of stores



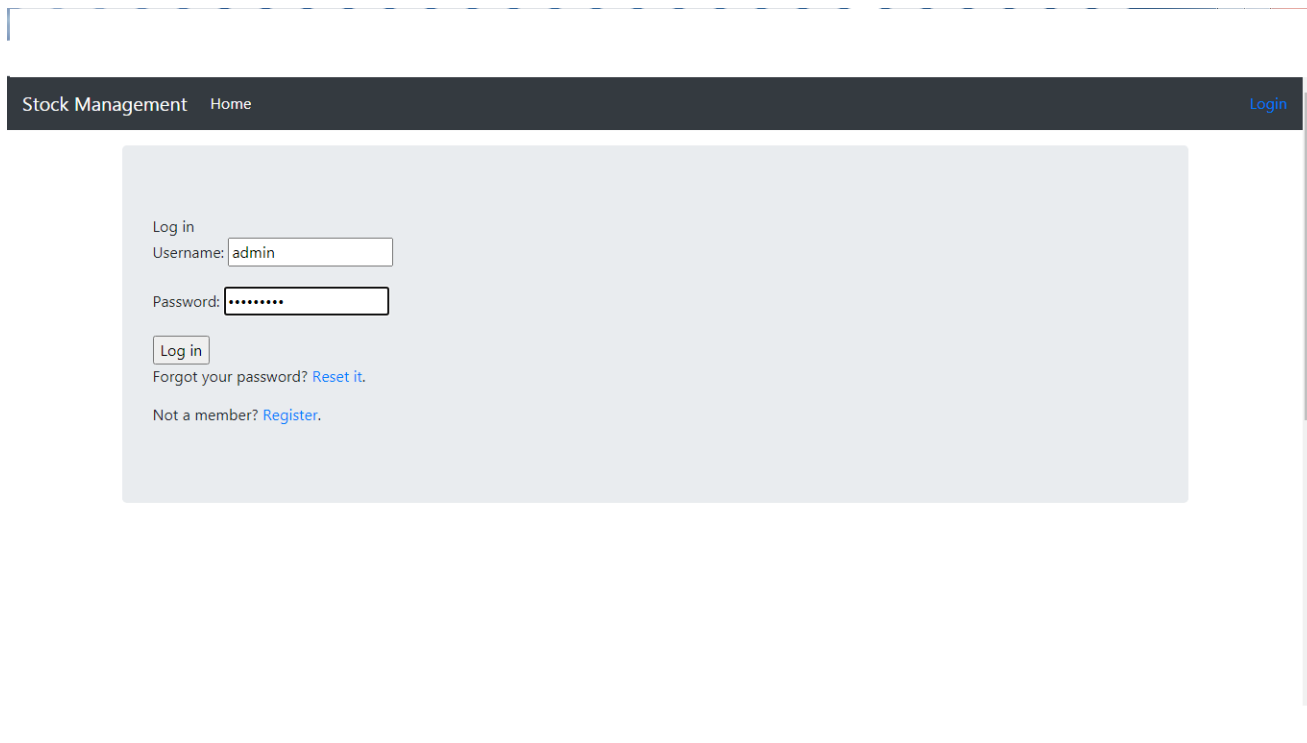
## 4. STOCK MANAGEMENT



## a. Home Page



## b. Login Page



### c. Add Item

Stock Management

Home

List Items

Add Items

admin | Logout

## Add Item

Category

Food

Item name

Cake

Quantity\*

90

Date\*

12/1/2020

Save

### d. List Item

Update an item by clicking on item name in the table

Stock Management

Home

List Items

Add Items

admin | Logout

Successfully Updated

## List of Items


Category

-----

Item name

☐ Export to csv

Search

COUNT	CATEGORY	ITEM NAME	QUANTITY IN STORE	REORDER LEVEL	TIMESTAMP	LAST UPDATED	DELETE
1	Drinks	Milk	70	30	July 14, 2020, 1:05 a.m.	July 15, 2020, 11:47 a.m.	



## Export csv file

Stock Management

Home

List Items

Add Items

admin | Logout

### List of Items

Category  
Food

Item name  
Almond

☒ Export to csv

Search

COUNT	CATEGORY	ITEM NAME	QUANTITY IN STORE	REORDER LEVEL	TIMESTAMP	LAST UPDATED	DELETE
1	Drinks	Milk	80	30	July 14, 2020, 1:05 a.m.	July 14, 2020, 7:06 p.m.	
2	Food	Almond	90	20	July 14, 2020, 1:05 a.m.	July 14, 2020, 3:04 a.m.	
3	Food	Cake	90	0	July 14, 2020, 5:22 p.m.	July 14, 2020, 5:22 p.m.	

List of stock (2).csv  
50/50 B

Show all

## e. Issue and Receive Item

Stock Management

Home

List Items

Add Items

admin | Logout

ISSUE THIS ITEM

RECEIVE THIS ITEM

ITEM NAME	QUANTITY IN STORE	LAST UPDATED	REORDER LEVEL
Milk	70	July 15, 2020, 11:47 a.m.	30

## Issue Item

Stock Management

Home

List Items

Add Items

admin | Logout

### Issue Milk

Issue quantity

20

Issue to

ankita

Save

## Receive Item

Stock Management

Home

List Items

Add Items

admin | Logout

### Receive Milk

Receive quantity

20

Save

## f. Set Reorder Level for each Item

Stock Management

Home

List Items

Add Items

admin | Logout

Reorder level

Save

## Highlight an item when quantity is reached below reorder level

Stock Management

Home

List Items

Add Items

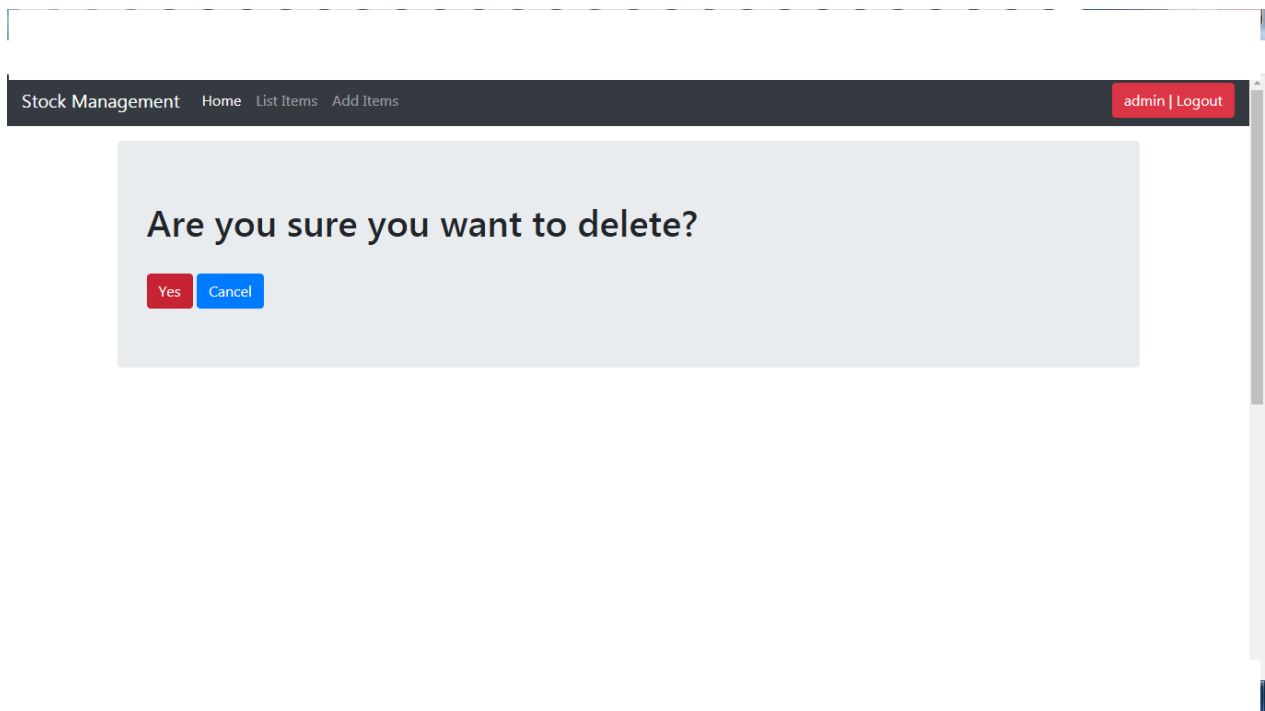
admin | Logout

Search

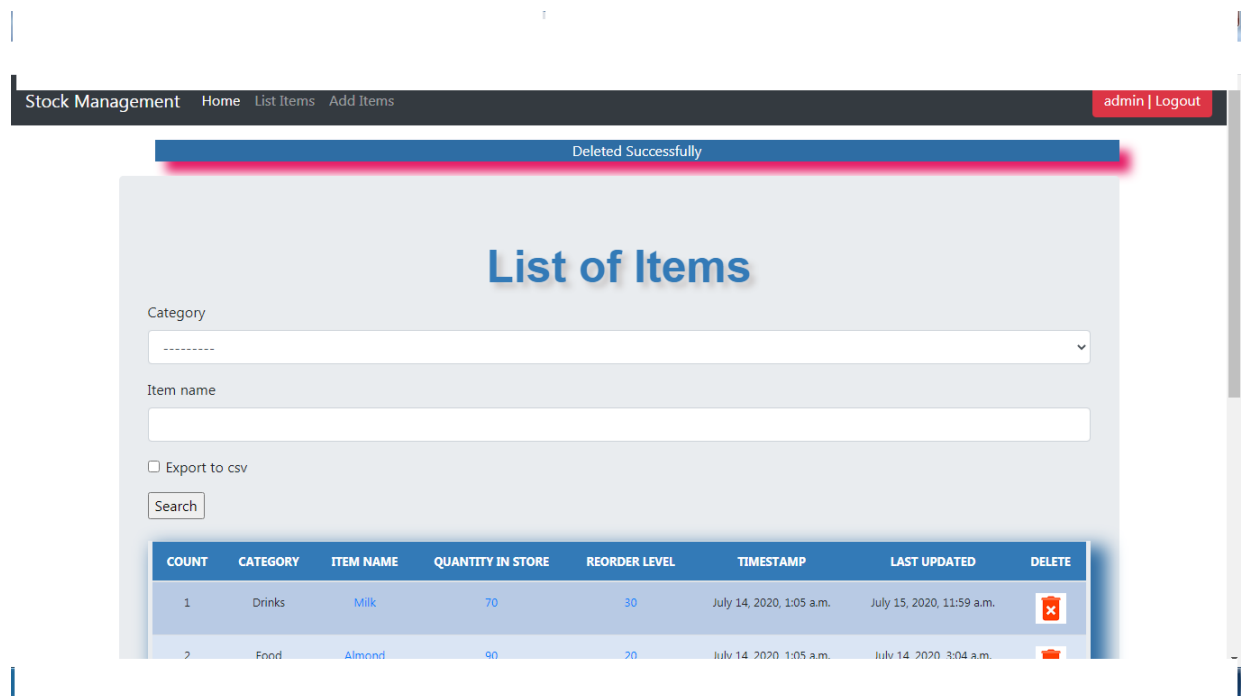
COUNT	CATEGORY	ITEM NAME	QUANTITY IN STORE	REORDER LEVEL	TIMESTAMP	LAST UPDATED	DELETE
1	Drinks	Milk	70	30	July 14, 2020, 1:05 a.m.	July 15, 2020, 11:59 a.m.	
2	Food	Almond	90	20	July 14, 2020, 1:05 a.m.	July 14, 2020, 3:04 a.m.	
3	Food	Cake	90	0	July 14, 2020, 5:22 p.m.	July 14, 2020, 5:22 p.m.	
4	Food	Biscuit	30	35	July 14, 2020, 7:05 p.m.	July 14, 2020, 7:06 p.m.	
5	Drinks	Orange juice	50	20	July 14, 2020, 7:06 p.m.	July 14, 2020, 7:06 p.m.	
6	Food	Eggs	90	0	July 15, 2020, 11:44 a.m.	July 15, 2020, 11:44 a.m.	

## g. Delete Item

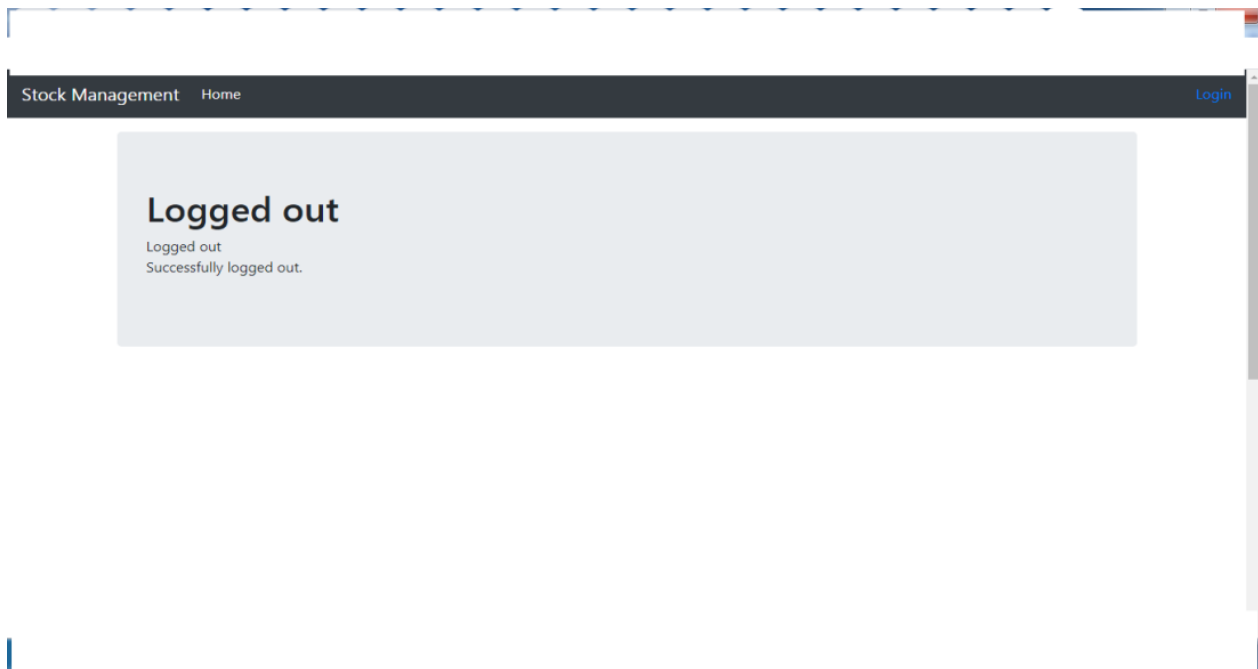
By clicking on bin symbol in front of each item



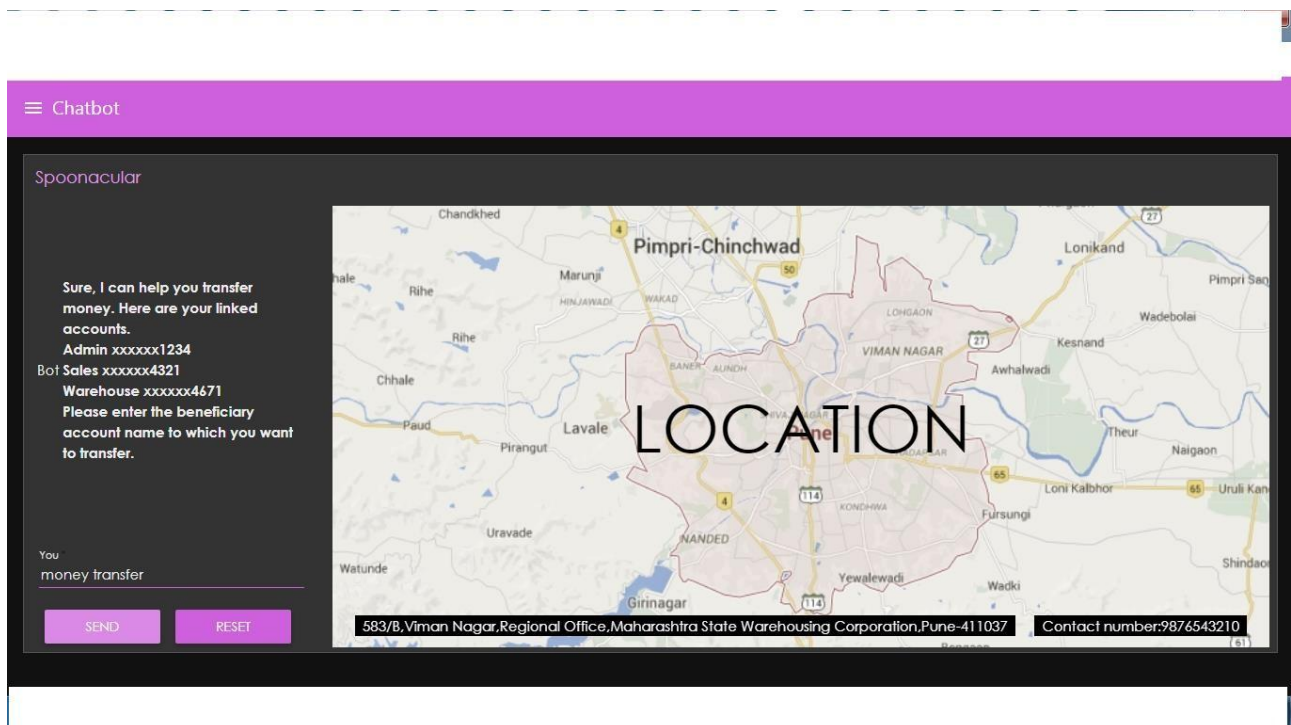
## Deleted Successfully



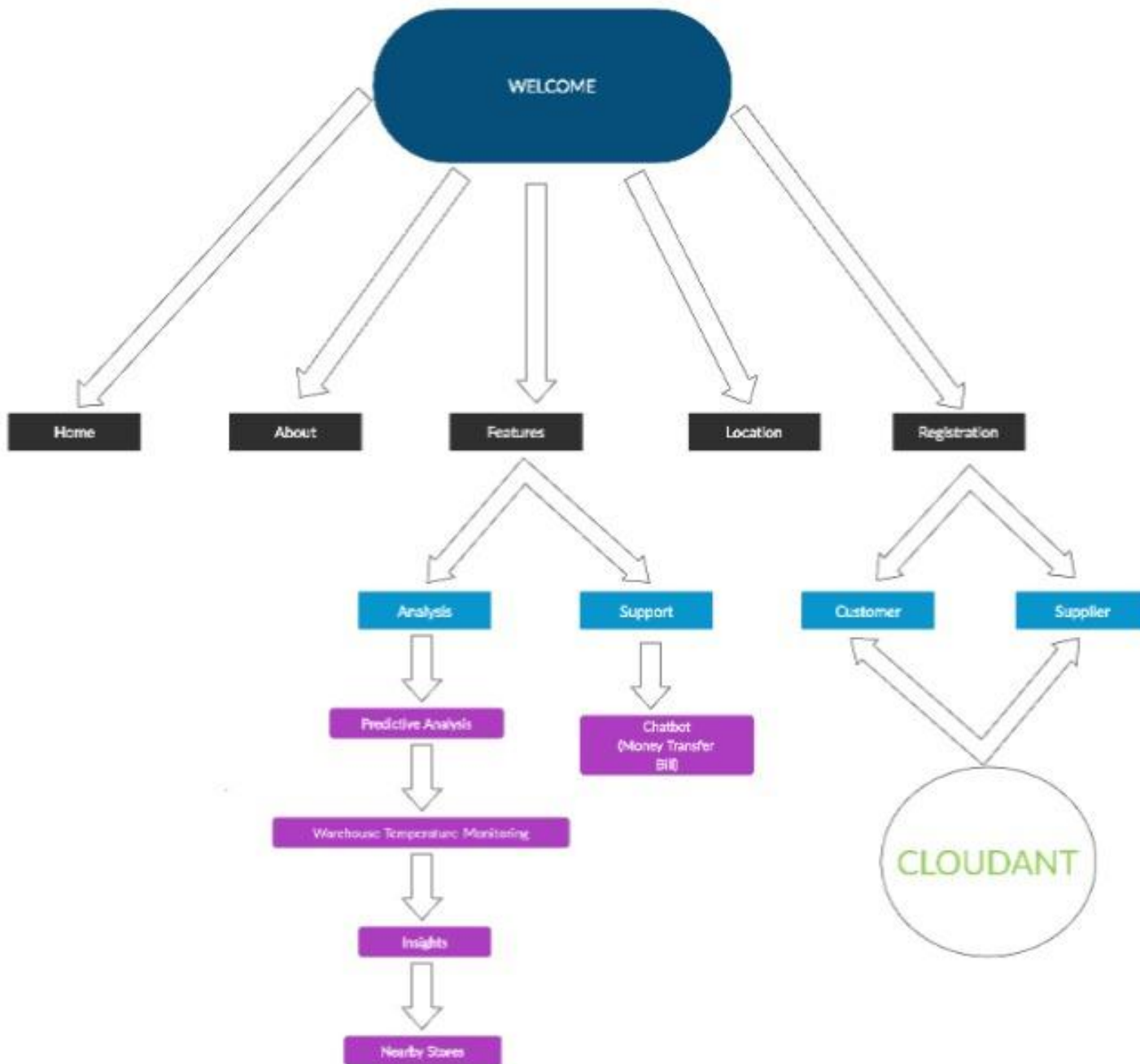
## h. Logout

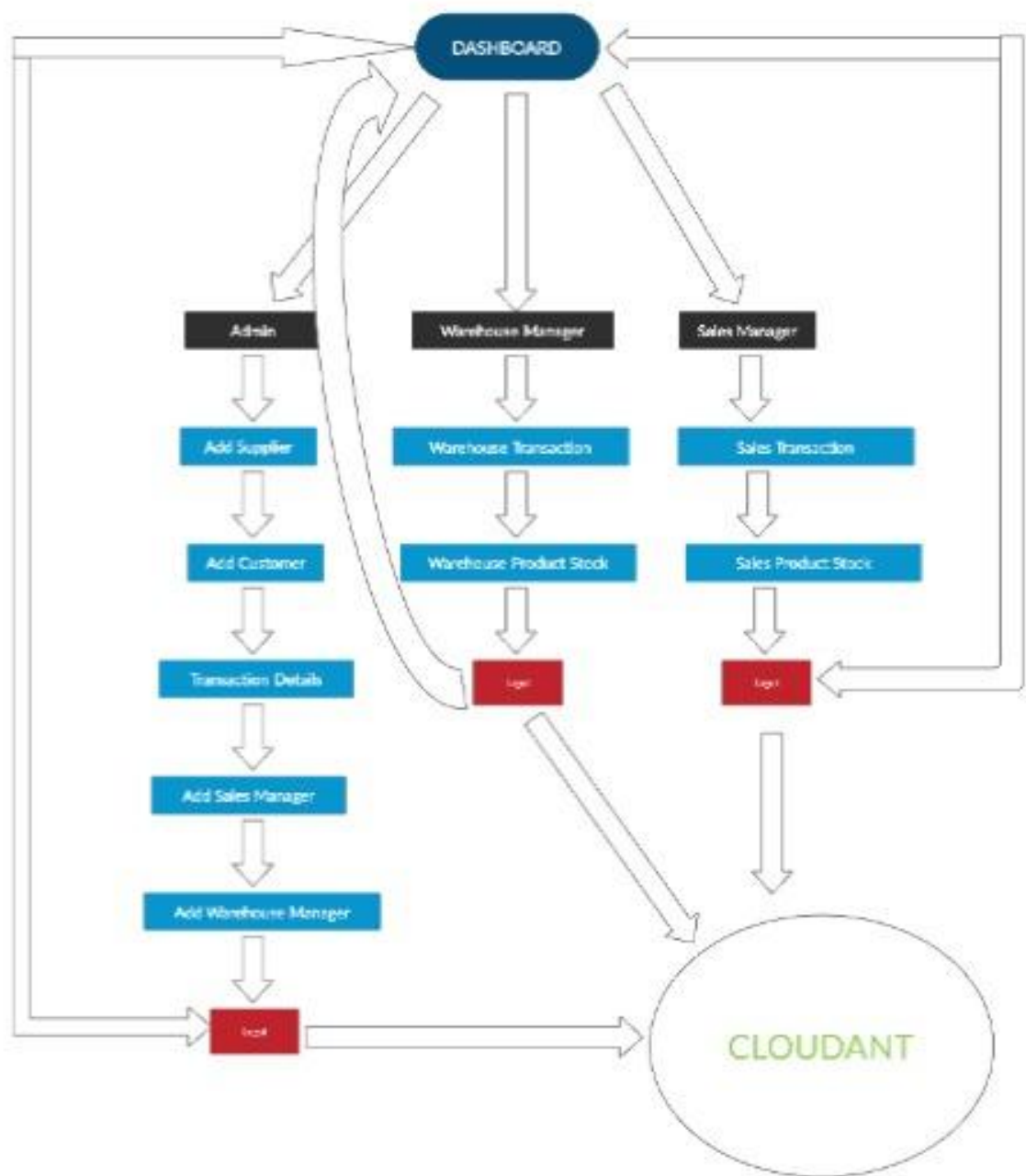


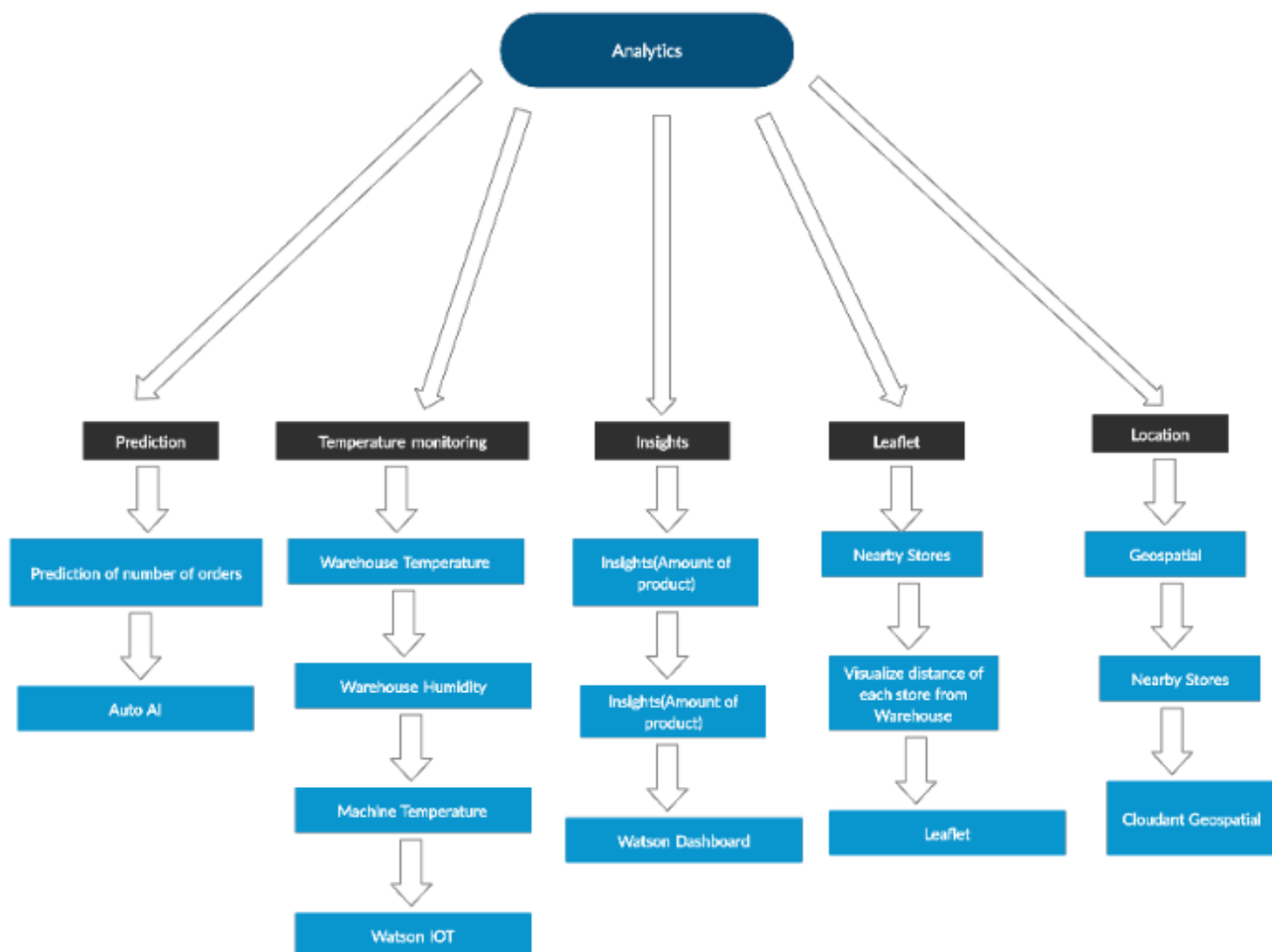
## 5. CHATBOT



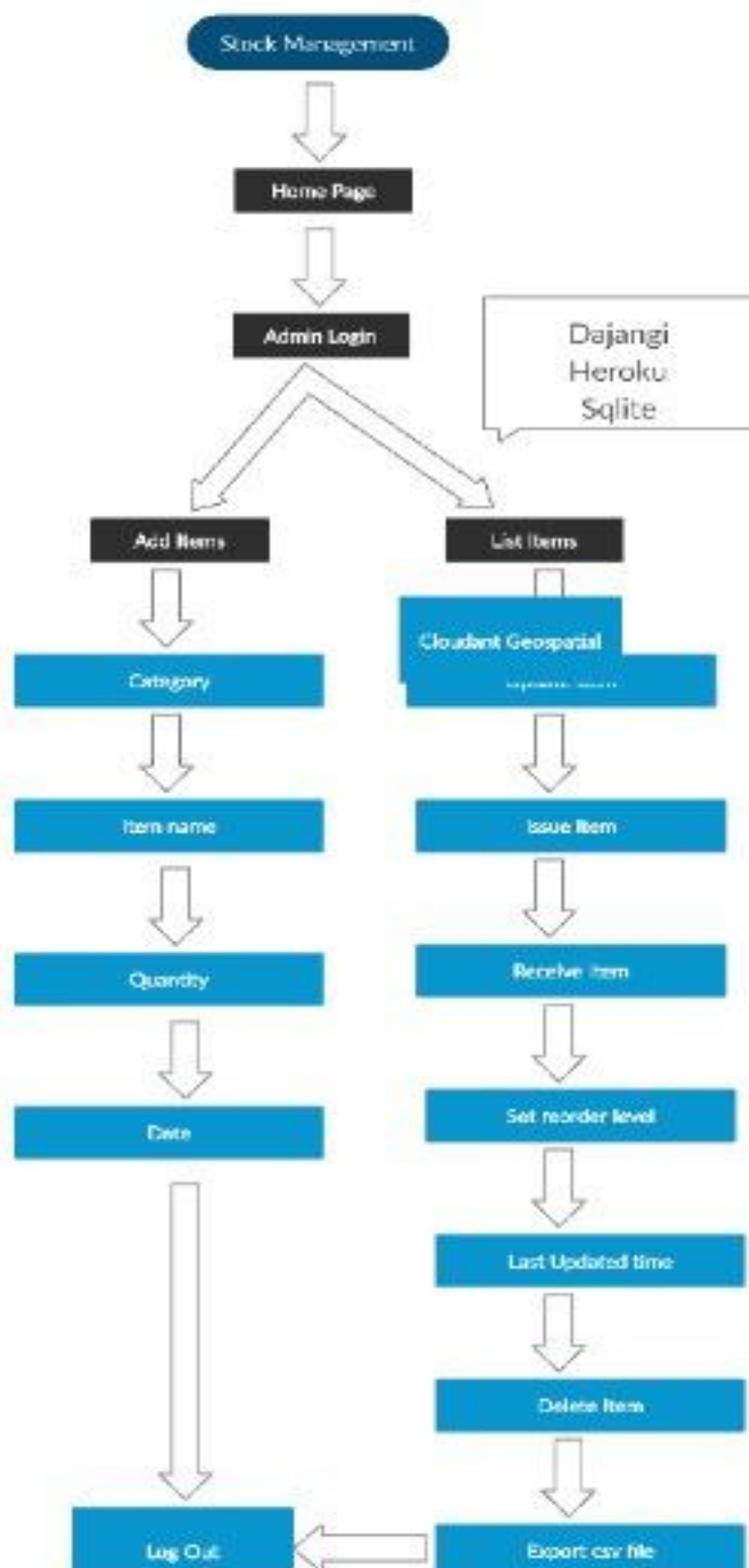
## 5) ARCHITECTURE/FLOWCHART



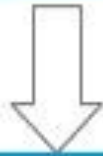






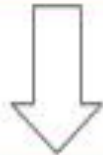


Chatbot

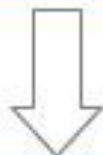


Greetings

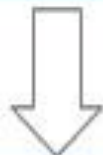
Watson Assistant



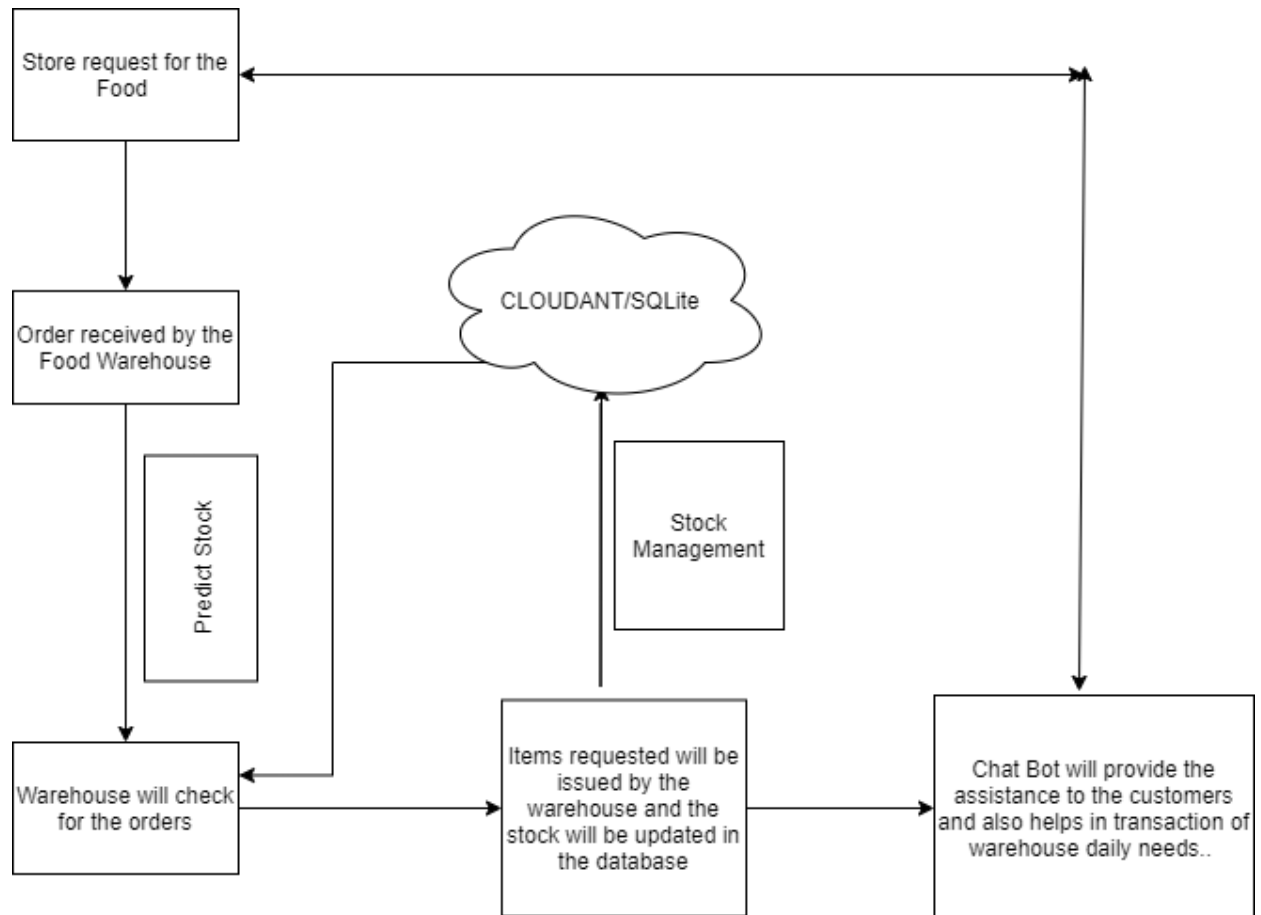
Money Transfer



Bill



Conclude



## 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-pnpxr.eu-gb.mybluemix.net/ui/#!/0?socketid=uK9REjePfM6Fs25pAAA5>

## 7) ADVANTAGES AND 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 being 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](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](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](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>

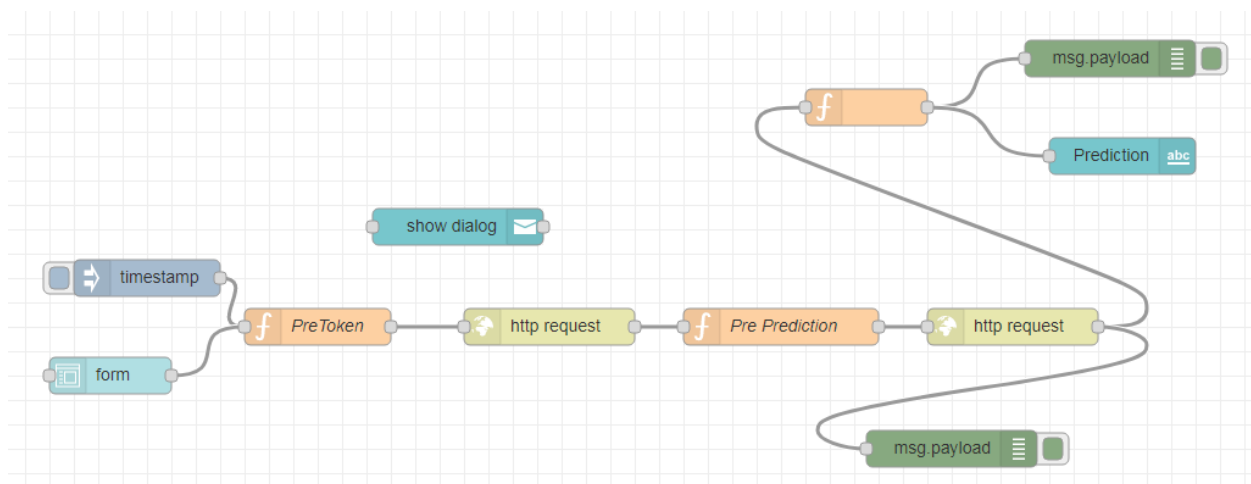
## APPENDIX

### A. Source code

#### FULL SOURCE CODE

<https://github.com/SmartPracticeschool/SBSPS-Challenge-3577-Optimized-Warehouse-Management-of-Perishable-Goods-for-a-Food-Delivery-Company>::

#### Prediction Feature: Node-red flow



#### Code:

```
[{"id":"b7f75c17.9df38","type":"function","z":"a0f974bf.e5cab8","name":"PreToken","func":"global.set(\"id\",msg.payload.id)\nglobal.set(\"week\",msg.payload.week)\nglobal.set(\"center_id\",msg.payload.center_id)\nglobal.set(\"meal_id\",msg.payload.meal_id)\nglobal.set(\"checkout_price\",msg.payload.checkout_price)\nglobal.set(\"base_price\",msg.payload.base_price)\nglobal.set(\"emailer_for_promotion\",msg.payload.emailer_for_promotion)\nglobal.set(\"homepage_featured\",msg.payload.homepage_featured)\nvar\napikey=\"3EeSsy09CD89stzkpigSNoPeITAAArgOx3odz4pD72NzE\";\nmsg.header\ns={\"content-type\":\"application/x-www-form-urlencoded\"}\nmsg.payload={\"grant_type\":\"urn:ibm:params:oauth:grant-type:apikey\", \"apikey\":apikey}\nreturn\nmsg;","outputs":1,"noerr":0,"x":260,"y":1340,"wires":[["ae60c177.224bd"]]}, {"id":"ae60c177.224bd","type":"http"}]
```

```

request", "z": "a0f974bf.e5cab8", "name": "", "method": "POST", "ret": "obj", "paytoqs":
false, "url": "https://iam.cloud.ibm.com/identity/token", "tls": "", "persist": false, "prox
y": "", "authType": "", "x": 450, "y": 1340, "wires": [{"de2ab11e.149a1"}], {"id": "69d60
ae1.1960b4", "type": "inject", "z": "a0f974bf.e5cab8", "name": "", "topic": "", "payload":
"", "payloadType": "date", "repeat": "", "crontab": "", "once": false, "onceDelay": 0.1, "x
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bug", "z": "a0f974bf.e5cab8", "name": "", "active": true, "tosidebar": true, "console": fals
e, "tostatus": false, "complete": "payload", "targetType": "msg", "x": 910, "y": 1120, "wir
es": []}, {"id": "de2ab11e.149a1", "type": "function", "z": "a0f974bf.e5cab8", "name": "
Pre Prediction", "func": "var id = global.get('id')\nvar week = global.get('week')\nvar
center_id = global.get('center_id')\nvar meal_id = global.get('meal_id')\nvar
checkout_price = global.get('checkout_price')\nvar base_price =
global.get('base_price')\nvar emailer_for_promotion =
global.get('emailer_for_promotion')\nvar homepage_featured =
global.get('homepage_featured')\nvar token=msg.payload.access_token\nvar
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[ \"id\", \"week\", \"center_id\", \"meal_id\", \"checkout_price\", \"base_price\", \"email
er_for_promotion\", \"homepage_featured\" ], \"values\":
[[id, week, center_id, meal_id, checkout_price, base_price, emailer_for_promotion, ho
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