IBM-NALAIYATHIRAN PROJECT

DemandEst - AI Powered Food Demand Forecaster

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ABSTRACT

A food delivery service has to deal with a lot of perishable raw materials which makes it all,the most important factor for such a company is to accurately forecast daily and weekly demand.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. The replenishment of majority of raw materials is done on weekly basis and since the raw material is perishable,the procurement planning is of utmost importamne,the task is to predict the demand for the next 10weeks. The main aim of this project is to create an appropriate machine learning model to forecast the number of orders to gather raw materialsfor next ten weeks. To achieve this, we should know the information about of fulfilment center like area, city etc., and meal information like category of food sub category of food price of the food or discount in particular week. By using this data, we can use any classification algorithm to forecast the quantity for 10 weeks. A web application is built which is integrated with the model built.

CONTENTS

1. INTRODUCTION

1.1 OVERVIEW

A food delivery service has to deal with a lot of perishable raw materials which makes it all, the most important factor for such a company is to accurately forecast daily and weekly demand. 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. The replenishment of the majority of raw materials isdone on weekly basis and since the raw material is perishable, the procurement planning is of utmost importance, the task is to predict the demand for the next 10 weeks.

1.2 PURPOSE

The main aim of this project is to create an appropriate machine learning modelto forecast then number of orders to gather raw materials for next ten weeks. To achieve this, we should know the information about of fulfillment center like area, city etc., and meal information like category of food, sub category of food, price of the foodor discount in particular week. By using this data, we can use any classification algorithm to forecast the quantity for 10 weeks. For this a web application is built whichis integrated with the model.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

The replenishment of the majority of raw materials is done on weekly basis andsince the raw material is perishable, the procurement planning is of utmost importance.Also the recruiting of staff members at the fulfillment center is an prospect wherein theprediction of orders would be beneficial. Although this is a process that can be done

manually.

2.2 REFERENCE

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2.3 PROBLEM STATEMENT DEFINITION

Problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

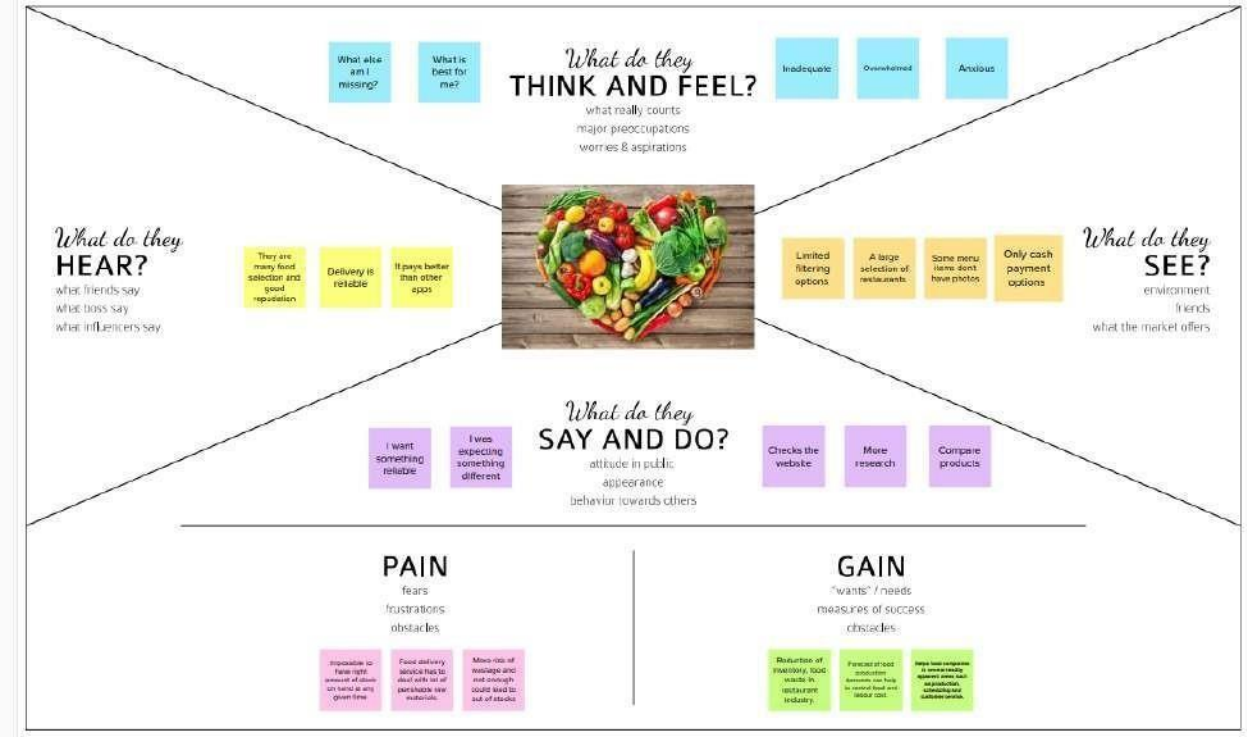
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Food Delivery Company	(i) buy raw materials. (ii) Plan to predict the demand.	(i) It leads to risk of wastage or out-of-stock. (ii) It takes long time to check the stock.	(i) They don't know the amount of raw materials to be purchased (ii) The prediction is not correct	(i) waste of cost. (ii) Frustrated.
PS-2	Restaurant	(i) Expect sales in a particular period of time. (ii) Predict the amount of sales done in a week.	(i) It is not correct in seasonal days. (ii) not to predict the amount of materials need to buy.	(i) In seasonal days more customers will come. (ii) It leads to out of stock or wastage.	(i) less profitability. (ii) Reduce turnover. (iii) To be complicated.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

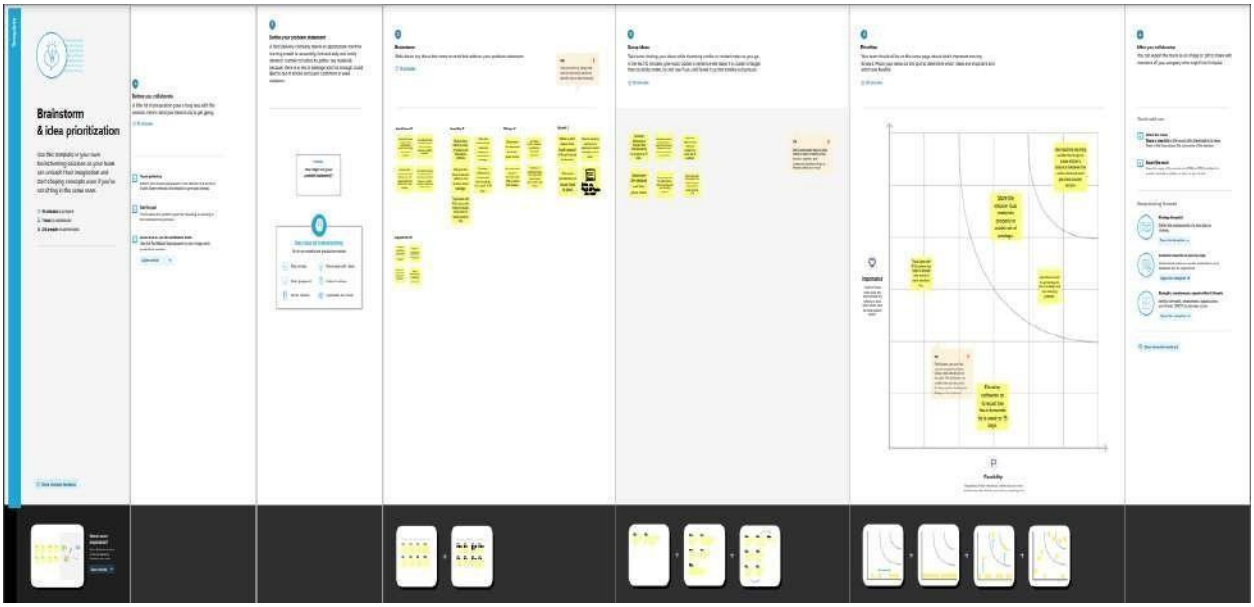
An empathy map is a collaborative visualization used to articulate what we knowabout a particular type of user. It externalizes knowledge about users in order to 1) create a shared understanding of user needs, and 2) aid in decision making.

Traditional empathy maps are split into 4 quadrants (Says, Thinks, Does, and Feels), with the user or persona in the middle. Empathy maps provide a glance into whoa user is as a whole and are not chronological or sequential.



3.2 Ideation & Brainstorming

Everyone in a design team should have a *clear* definition of the target problem. They typically gather for a brainstorming session in a room with a large board/wall forpictures/Post-Its. A good mix of participants will expand the experience pool and therefore broaden the idea space.



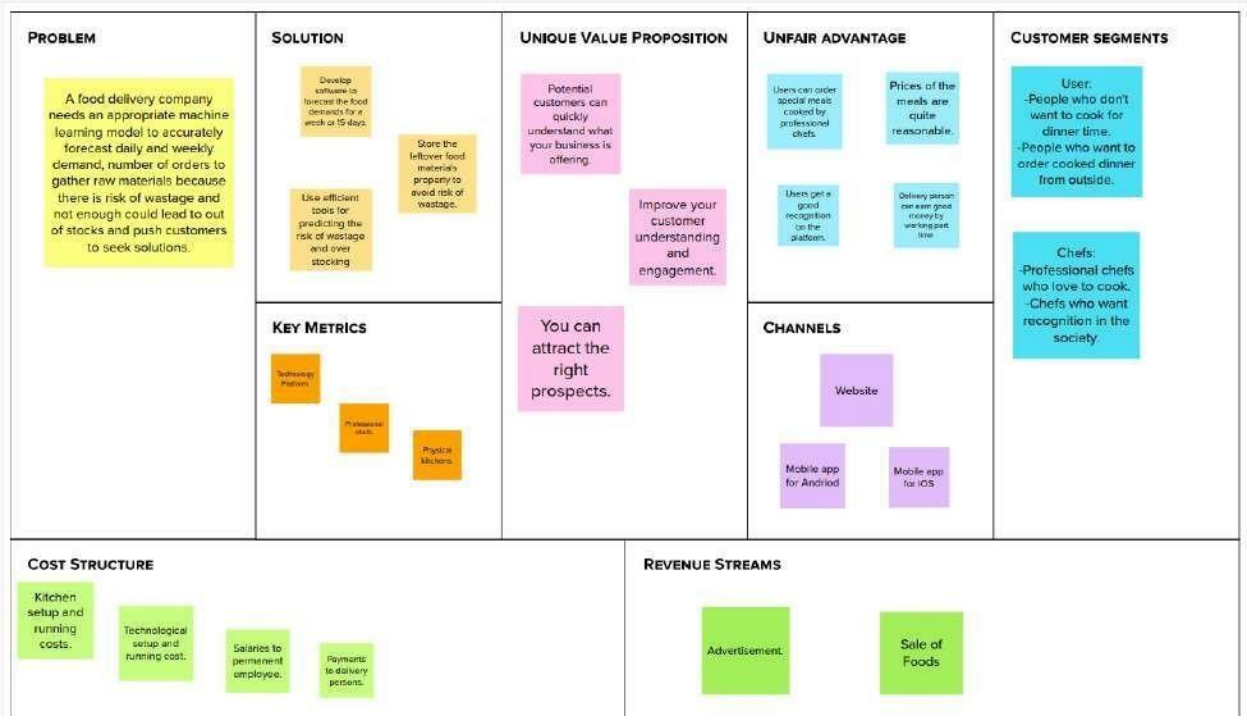
3.2 Proposed Solution

Proposed Solution means the technical solution to be provided by the Implementation agency in response to the requirements and the objectives of the Project.Proposed Solution means the Proposed System with modifications that meet the Agency's requirements as set forth in this RFP.Proposed Solution means the combination of software, hardware, other products or equipment, and any and all services (including any installation, implementation, training, maintenance and supportservices) necessary to implement the solution described by Vendor in its Proposal.

S.No	TOPIC	CONTENT
1.	Problem Statement	A food delivery company needs an appropriate machine learning model to accurately forecast daily and weekly demand, number of orders to gather raw materials because there is a risk of wastage and not enough could lead to out of stocks and push customers to seek solutions.
2.	Solution	✔Develop software to forecast the food demands for a week or 15 days. ✔Use Machine learning model that help to make efficient balance between the order demand and planned courier service. ✔Store the leftover food materials properly to avoid risk of wastage. ✔Determine the demand and then place order. ✔Use efficient tools for predicting the risk of wastage and over stocking problem. ✔Track sales with POS system that helps to decide how much stock needs to buy.
3.	Business Model	The replenishment of raw materials is done only weekly and since the raw material is perishable, the procurement planning is of utmost importance. Therefore predicting the demand helps in reducing the wastage of raw materials which would result in the reduced cost of operation. Increased customer satisfaction by timely fulfilling their expectations and requirements.
4.	Novelty	AI powered demand forecasting is the strongest method by which to grow revenue and increase profit. The increased accuracy that AI demand forecasts provides results in precise future replenishment quantity predictions. This data reduces missed sales opportunities through stock outs, and also reduces waste, which both directly impact overall profits.
5.	Scalability of Solution	Most demand forecasting solutions focus on small to medium-sized applications that offer low scalability. However, modern food industry businesses are highly diversified in the products that they provide through large chains of network stores. This scale of business presents a significant challenge for traditional demand forecasting software, which is why startups are providing cloud-based solutions geared towards large-scale operations.

3.4 Problem Solution Fit

The Problem-Solution Fit simply means that you have found a problem with yourcustomer and that the solution you have realized for it actually solves the customer's problem.



4. REQUIREMENT ANALYSIS

4.1Functional requirement

Functional requirements may involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a systemis supposed to accomplish. Behavioral requirements describe all the cases where the system uses the functional requirements, these are captured in use cases.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	The web ordering system	Create an account. Manage their account. Login to the system. Navigate the restaurant's menu. Select an item from the menu. Review their current order.
FR-2	Menu Management system	Add a new/update/delete vendor to/from the menu. Add a new/update/delete food category to/from the menu. Add a new/update/delete food item to/from the menu. Update price for a given food item.
FR-3	Order Retrieval system	Retrieve new orders from the database. Display the orders in an easily readable,graphical way. Mark an order as having been processed and remove it from the list of active orders.

4.2Non-Functional requirements

In systems engineering and requirements engineering, a non-functional requirement (NFR) is a requirement that specifies criteria that can be used to judge theoperation of a system, rather than specific behaviours.

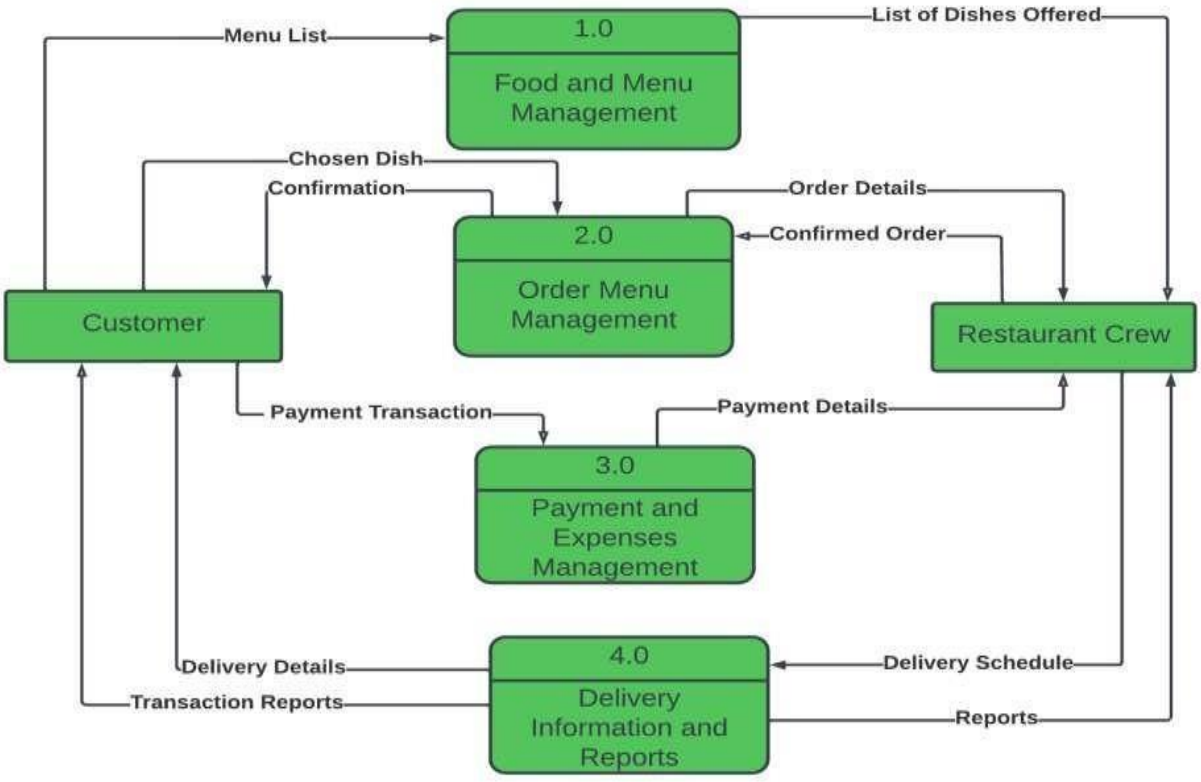
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The system should provide an interactive user-friendly interface that is easily understandable for all users.
NFR-2	**Security**	Only authorized users must be able to access the system and view and modify the data.
NFR-3	**Maintainability**	The software should be easily maintainable and adding new features and making changes to the software must be as simple as possible.
NFR-4	**Dependability**	The system should provide consistent performance with easy tracking of records and updating of records.

NFR-5	**Availability**	The system should be available at least during the restaurant operating hours and must be recovered within an hour or less if it fails. The system should respond to the requests within two seconds or less.
NFR-6	**Configurability**	Configurability is just as important as integrability.

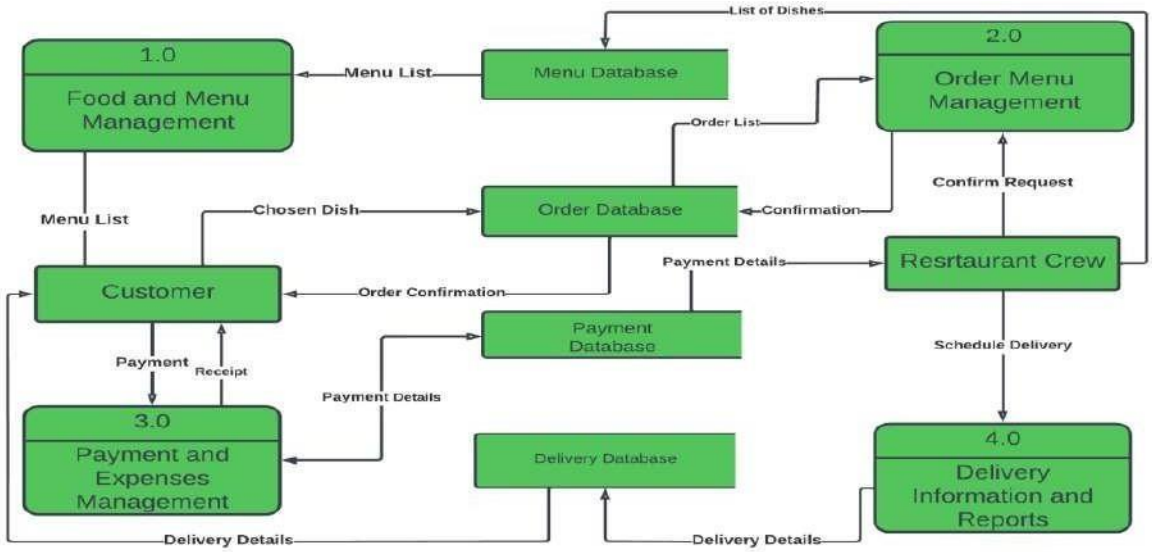
5. PROJECT DESIGN

5.1Data Flow Diagrams

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 ofthe system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



DATA FLOW DIAGRAM –LEVEL 1



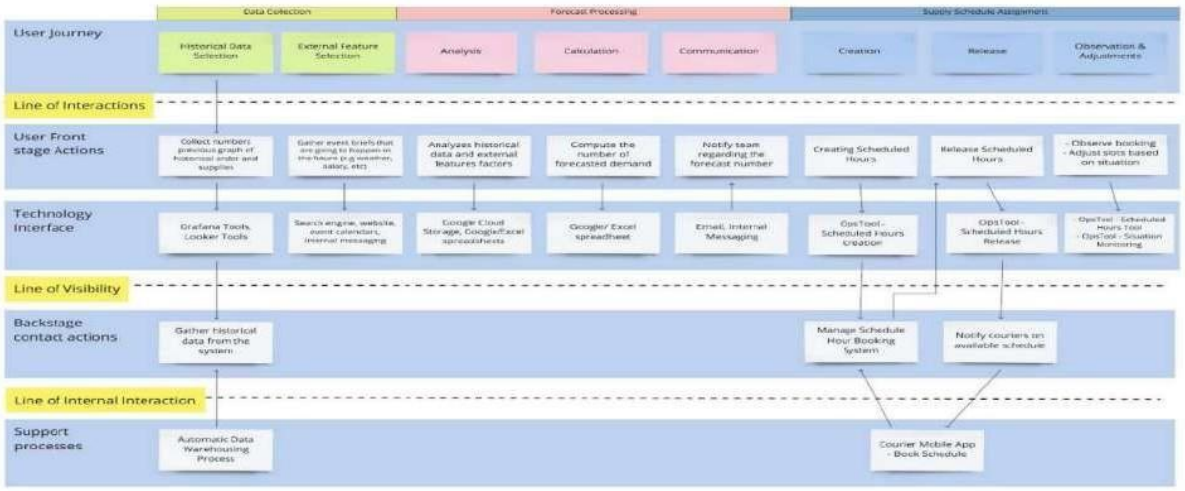
DATA FLOW DIAGRAM –LEVEL 2

5.2 Solution & Technical Architecture

Solution Architecture:

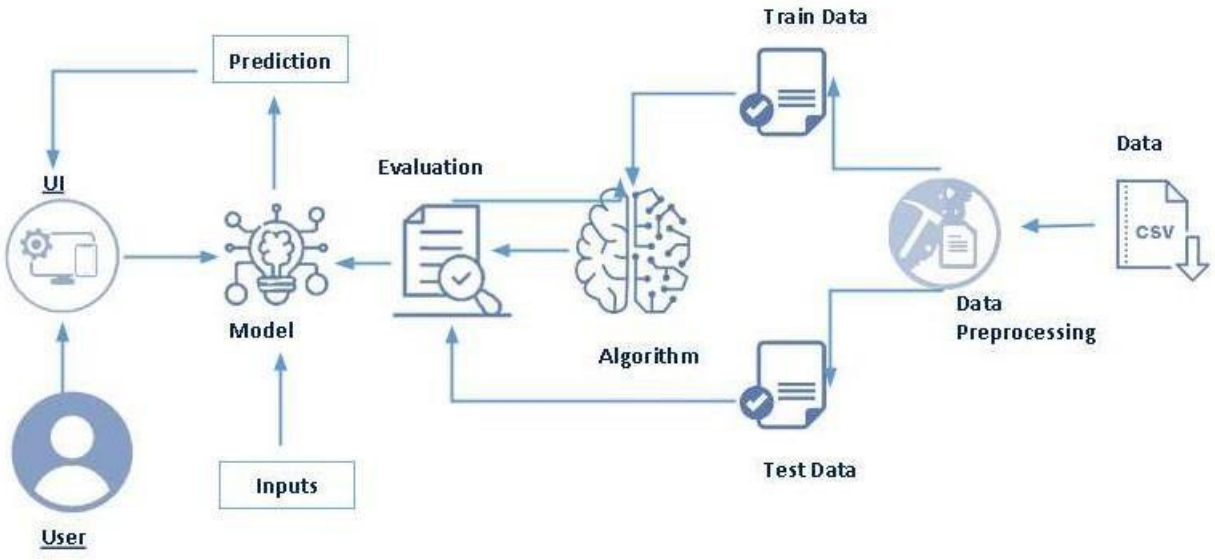
> A solution architecture (SA) is an architectural description of a specific solution.

SAs combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).


Data Collection
Forecast Processing
Supply Schedule Assignment
User Journey
Historical Data Selection
External Feature Selection
Analysis
Calculation
Communication
Creation
Release
Observation & Adjustments
Line of Interactions
User Front stage Actions
Collect numbers previous graph of historical order and supplies
Gather event briefs that are going to happen in the future (e.g weather, salary, etc)
Analyses historical data and external features factors
Compute the number of forecasted demand
Notify team regarding the forecast number
Creating Scheduled Hours
Release Scheduled Hours
- Observe booking - Adjust slots based on situation
Technology Interface
Grafana Tools, Looker Tools
Search engine, website, event calendars, internal messaging
Google Cloud Storage, Google/Excel spreadsheets
Google/ Excel spreadsheet
Email, Internal Messaging
OpsTool - Scheduled Hours Creation
OpsTool - Scheduled Hours Release
OpsTool - Scheduled Hours Tool - OpsTool - Situation Monitoring
Line of Visibility
Backstage contact actions
Gather historical data from the system
Manage Schedule Hour Booking System
Notify couriers on available schedule
Line of Internal Interaction
Support processes
Automatic Data Warehousing Process
Courier Mobile App - Book Schedule

Technical Architecture:

Technical Architecture (TA) is a form of IT architecture that is used to design computer systems. It involves the development of a technical blueprint with regard tothe arrangement, interaction, and interdependence of all elements so that system- relevant requirements are met.



5.3 User Stories

A user story is an informal, general explanation of a software feature written fromthe perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer.

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	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.	2	High	Rupesh R, Prabhakaran T, Mayilsamy M, GokulKannan R, Santhosh K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-2		USN-4	As a user, I can register for the application through Gmail	2	Medium	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-1	Dashboard	USN-6	As a user, I can access the services and information provided in the dashboard	2	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-1	Login	USN-7	As a user, I can log into the web application and access the dashboard	1	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-4	Helpdesk	USN-8	As a user, I can get the guidance from the customer care	1	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

In Scrum Projects, Estimation is done by the entire team during Sprint PlanningMeeting. The objective of the Estimation would be to consider the User Stories for theSprint by Priority and by the Ability of the team to deliver during the Time Box of the Sprint.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Management	USN-9	As an administrator, I can collect new datasets and keep the model trained	2	High	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-3		USN-10	As an administrator, I can update other features of the application	2	Medium	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-3		USN-11	As an administrator, I can maintain the information about the user	2	Medium	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K
Sprint-4		USN-12	As an administrator, I can maintain third-party services	1	Low	Rupesh.R Prabhakaran.T Mayilsamy.M Gokul Kannan.R Santhosh.K

6.2 Sprint Delivery Schedule

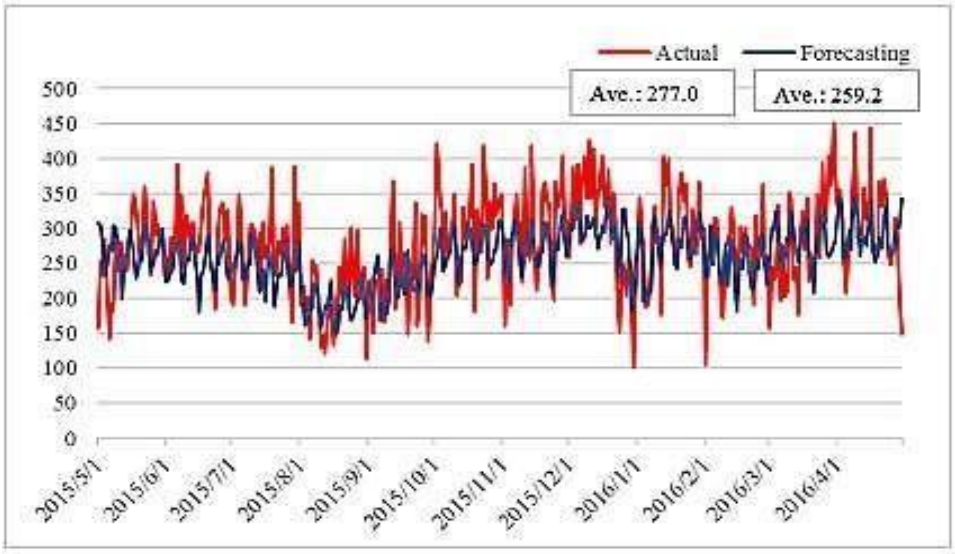
A sprint schedule is a document that outlines sprint planning from end to end. It'sone of the first steps in the agile sprint planning process—and something that requiresadequate research, planning, and communication.

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	7	6 Days	24 Oct 2022	29 Oct 2022	7	29 Oct 2022
Sprint-2	4	6 Days	31 Oct 2022	05 Nov 2022	4	05 Nov 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	6	12 Nov 2022
Sprint-4	2	6 Days	14 Nov 2022	19 Nov 2022	2	19 Nov 2022

6.3 Reports From JIRA

Jira helps teams plan, assign, track, report, and manage work and brings teams together for everything from agile software development and customer support to start-ups and enterprises. Software teams build better with Jira Software, the #1 tool for agileteams.



7. CODING & SOLUTIONING

7.1 Data Dictionary

Our base data consists of four csv files containing information about test data,train data and other required information.

- train.csv: Contains information like id, week, center id, meal id, checkout price, base price, emailer for promotion, homepage featured, number of orders. This fileis used for training.

Variable	Definition
id	Unique ID
week	Week No
center_id	Unique ID for fulfillment center
meal_id	Unique ID for Meal
checkout_price	Final price including discount, taxes & delivery charges
base_price	Base price of the meal
emailer_for_promotion	Emailer sent for promotion of meal
homepage_featured	Meal featured at homepage
num_orders	(Target) Orders Count

- test.csv: Contains information like id, week, center id, meal id, checkout price,

base price, emailer for promotion, homepage featured. This file is used fortesting.

- fulfilment_center_info.csv: Contains information of each fulfilment center.

Variable	Definition
center_id	Unique ID for fulfillment center
city_code	Unique code for city
region_code	Unique code for region
center_type	Anonymized center type
op_area	Area of operation (in km^2)

- meal_info.csv: Contains information of each meal being served.

Variable	Definition
meal_id	Unique ID for the meal
category	Type of meal (beverages/snacks/soups....)
cuisine	Meal cuisine (Indian/Italian/...)

7.2 Libraries Used

pandas, numpy, scikit learn, matplotlib, seaborn, xgboost, lightgbm, catboost

7.3 Data Pre-Processing

- There are no Missing/Null Values in any of the three datasets.
- Before proceeding with the prediction process, all the three data

sheets need tobe merged into a single dataset. Before performing the merging operation, primary feature for combining the datasets needs to be validated.

- The number of Center IDs in train dataset is matching with the number of CenterIDs in the Centers Dataset i.e 77 unique records. Hence, there won't be any missing values while merging the datasets together.
- The number of Meal IDs in train dataset is matching with the number of Meal IDsin the Meals Dataset i.e 51 unique records. Hence, there won't be any missing values while merging the datasets together.
- As checked earlier, there were no Null/Missing values even after merging thedatasets.

7.4 Feature Engineering

Feature engineering is the process of using domain knowledge of the data tocreate features that improves the performance of the machine learning models.

With the given data, We have derived the below features to improve our modelperformance.

- Discount Amount : This defines the difference between the “base_Price” and“checkout_price”.
- Discount Percent : This defines the % discount offer to customer.
- Discount Y/N : This defines whether Discount is provided or not - 1 if there isDiscount and 0 if there is no Discount.
- Compare Week Price : This defines the increase / decrease in price of a Meal fora particular center compared to the previous week.
- Compare Week Price Y/N : Price increased or decreased - 1 if the Price increasedand 0 if the price decreased compared to the previous week.
- Quarter : Based on the given number of weeks, derived a new feature named asQuarter which defines the Quarter of the year.
- Year : Based on the given number of weeks, derived a new feature

named as Yearwhich defines the Year.

7.5 Data Transformation

- Logarithm transformation (or log transform) is one of the most commonly usedmathematical transformations in feature engineering. It helps to handle skeweddata and after transformation, the distribution becomes more approximate to normal.

- In our data, the target variable ‘num_orders’ is not normally distributed. Using this without applying any transformation techniques will downgrade the performanceof our model.
- Therefore, we have applied Logarithm transformation on our Target feature ‘num_orders’ post which the data seems to be more approximate to normaldistribution.
- After Log transformation, We have observed 0% of Outlier data being present within the Target Variable – num_orders using 3 IQR Method.

7.6 Evaluation Metric

The evaluation metric for this competition is 100*RMSLE where RMSLE is Root ofMean Squared Logarithmic Error across all entries in the test set.

7.7 Initial Approach

- Simple Linear Regression model without any feature engineering and datatransformation which gave a RMSE : 194.402
- Without feature engineering and data transformation, the model did not performwell and could'nt give a good score.
- Post applying feature engineering and data transformation (log and log1ptransformation), Linear Regression model gave a RMSLE score of 0.634.

7.8 Advanced Models

- With improvised feature engineering, built advanced models using Ensembletechniques and other Regressor algorithms.
- Decision Tree Regressors performed well on the model which gave muchreduced RMSLE.
- With proper hyper-parameter tuning, Decision Tree Regressor

performed well onthe model and gave the lease RMSLE of 0.5237

8. TESTING

8.1Test Cases

A test case includes information such as test steps, expected results and datawhile a test scenario only includes the functionality to be tested.

Test case ID	Feature Type	Component	Test Scenario
LoginPage_TC_OO1	Functional (Registration)	Home Page	As a user, I can register for the application by entering my email, password, and confirming my password.
LoginPage_TC_OO2	Functional (Conformation)	Home Page	As a User, I will receive confirmation email once I have registered for the application.
LoginPage_TC_OO3	Functional (Accessibility)	Home page	As a user, I can register for the application through Facebook
LoginPage_TC_OO4	Functional (Customer access through mail)	Login page	As a user, I can register for the application through Gmail.
LoginPage_TC_OO4	Functional (Login)	Login page	As a user, I can log out into the application by entering email & password.
LoginPage_TC_OO5	Functional (Dashboard)	Home page	Choosing the menu, Restaurant and payment process. after receiving the food rating process.
LoginPage_TC_OO6	Functional (Customers order)	Home page	Delivery partner simply tracks the order and lets the customer know when it will arrive.
LoginPage_TC_OO7	Functional (Customer order delivery)	Home page	Doorstep delivery. Easy process to get the order.
LoginPage_TC_OO8	Functional (Hotel Management)	Home page	Choosing the restaurant. Multiple choice for restaurant profile.

Pre-Requisite	Steps To Execute
Network Accessing device	1.Check all the text boxes, radio buttons, buttons,etc. 2.Check the required fields by not filling any data. 3.Check user should Register by filling all the required fields.
Network Accessing device	1. Check results on entering valid user ID & Password. 2. Check results on entering invalid User ID & Password. 3. Check response when a user ID is empty & login button is pressed, and many more.
Network Accessing device	1.If the labels are correctly written and placed or not. 2.If the audio/video content is properly audible/visible or not. 3.If the color contrast ratio is maintained or not. 4.If the control actions for video are working fine or
Network Accessing device	1.Enter URL(http://127.0.0.1:5000/) 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
Network Accessing device	1.Log in with valid credentials. 2.Check the show password feature. 3.Check the Remember Me checkbox. 4.Check the email. 5.Click on login button
Network Accessing device	1.Test Case ID. 2.Test Description. 3.Assumptions and Pre-Conditions. 4.Test Data.
Network Accessing device	1. Keep things simple and transparent. 2. Make test cases reusable. 3. Peer review is important. 4. Keep test cases IDs unique.
Network Accessing device	1. Making sure that functionalities are easy to find 2. Navigation should be easy and user-friendly 3. Buttons of the application should be visible. 4. Verification that font should be of appropriate size so that anyone can read them.
Network Accessing device	1. Making sure that functionalities are easy to find 2. Navigation should be easy and user-friendly 3. Buttons of the application should be visible. 4. Verification that font should be of appropriate size so that anyone can read them.

Test Data	Expected Result	Actual Result	Status
http://127.0.0.1:5000	Login/Signup popup should display	Working as expected	Pass
http://127.0.0.1:5000	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	Working as expected	Pass
Username: jdk@gmail.com password: FDF123	User should navigate to user account homepage	Working as expected	Pass
Username: jdk@gmail password: FDF123	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass
Username: jdk@gmail.com password: FDF123678686786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass
Username: jdk password: FDF123678686786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass
Username: jdk@gmail password: FDF123	Everything that a customer expects from a product, service or organisation.	Working as expected	Pass
Username: jdk@gmail password: FDF123	It should be made clear how many days a delivery might take to process.	Working as expected	Pass
Username: jdk@gmail password: FDF123	It will be commercially accountable for budgeting and financial management and will need to plan, organise amd direct all hotel services.	Working as expected	Pass

8.2User Acceptance Testing

User Acceptance Testing (UAT), which is performed on most UIT projects, sometimes called beta testing or end-user testing, is a phase of software developmentin which the software is tested in the "real world" by the intended audience or businessrepresentative.

Defect Analysis:

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won'tFix	0	0	0	1	1
Totals	24	9	11	26	71

Test Case Analysis:

Section	TotalCases	Not Tested	Fail	Pass
PrintEngine	7	0	0	7
ClientApplication	51	0	0	51
Security	2	0	0	2
OutsourceShipping	3	0	0	3
ExceptionReporting	9	0	0	9
FinalReportOutput	4	0	0	4
VersionControl	2	0	0	2

9. RESULTS

9.1 Performance Metrics

Performance testing is the practice of evaluating how a system performs in terms of responsiveness and stability under a particular workload. Performance testsare typically executed to examine speed, robustness, reliability, and application size.

S.No.	Parameter	Values	Screenshot
1.	Metrics	**Regression Model:** MAE 89.10334778841495, MSE - 43129.82977026746, RMSLE -207.67722496765856, R2 score -0.6946496854280233,	

Evaluating the model

```
In [33]: from sklearn.metrics import mean_squared_error

In [34]: RMLSE=np.sqrt(mean_squared_error(y_test,pred))
         RMLSE
Out[34]: 209.71961740201198

In [39]: from sklearn import metrics
         from sklearn.metrics import mean_absolute_error

In [40]: MSE=print(metrics.mean_squared_error(y_test,pred))
         MSE

         43982.31792324628

In [41]: R2S=print(metrics.r2_score(y_test,pred))
         R2S

         0.6886142448276894

In [42]: MAE=print(mean_absolute_error(y_test,pred))

         89.10334778841495
```

2.	Tune the Model	**Hyperparameter Tuning -** RMSLE- 52.85812511759974 avg R-squared- 0.123 MSE: -64230.918	

10. ADVANTAGES & DISADVANTAGES

Advantages:

1. Food wastage will be minimized.
2. Simple and easy to use framework.

Disadvantages:

1. The output obtained may not be precised, due to the use of limited datasets.

11. APPLICATIONS

This project focuses on one food delivery client, which delivers food in many differentcities through distribution networks and fulfillment centers.

12. CONCLUSION

The main moto behind this project is to reduce food wastage.The availability ofthe food items makes the society better. Our purposed model would definitely come handy to a company for predicting then number of food orders and help them to servetheir customers better.

13. FUTURE SCOPE

1. Working on the frontend to make the framework more dynamic.
2. In the future, we also plan to improve forecasting accuracy and research onthe efficiency of store management.

14. APPENDIX

SOURCE CODE:

home.html

```
<!DOCTYPE html>
<html>
<head>
<title>Home</title>
<style>
.navbar
{
margin: 0px;
padding:20px;
background-
color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-
serif;font-style: italic;
border-
radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-
decoration:none;
font-
style:normal;
```

```
padding-
right:20px;
}
a:hover{
background-
color:black;
color:white;
border-
radius:15px;0
font-size:30px;
padding-
left:10px;
```

```
}
p
{
color:white;
font-
style:italic;
font-
size:30px;
}
body
{
background-image: url("https://img.freepik.com/free-photo/grilled-chicken-rice-spicy-chickpeas-avocado-cabbage-pepper-buddha-bowl-dark-top-view_127032- 1966.jpg?w=2000");
background-size: cover;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/pred">Predict</a>
<a href="/home">Home</a>
<br>
</div>
<br>
<center><b><font color="yellow" size="15" font-family="Comic Sans MS" >Food DemandForecasting</font></b></center>
<div>
<br>
<center>
<p>A food delivery service has to deal with a lot of perishable raw materials which makes it all, the most important factor for such a company is to accurately forecast daily and weekly demand. 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. The replenishment of majority of raw materials is done on weekly basis and since the raw material is perishable, the procurement planning is ofutmost importance, the task is to predict the demand for the next 10 weeks.</p>

```
</body>
</html>
```

upload.html

```
<html lang="en">

  <head>
    <title>Predict</title>
    <link
href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
  <style>
  .bar
  {
  margin: 0px;
  padding:20px;
  background-
  color:white;
  opacity:0.6;
  color:black;
  font-family:'Roboto',sans-
  serif;font-style: italic;
  border-
  radius:20px;
  font-size:25px;
  }
```

```
a
{
color:red;
float:right;
text-
decoration:none;
font-
style:normal;
```

```
padding-right:20px;
}
a:hover{
background-
color:black;
color:white;
border-
radius:15px;0
font-size:30px;
padding-
left:10px;
}
body
{
background-image:
url("https://images.pexels.com/photos/1640777/pexels-photo-
1640777.jpeg?cs=srgb&dl=pexels-ella-olsson-
1640777.jpg&fm=jpg");
background-size: cover;
}
p
{
color:white;
font-
style:italic;
font-
size:30px;
}
```

```
h1,h2
{
 color:0101DF;
}
</style>
</head>

<body>

 <div class="bar">
  <a href="/pred">Predict</a>
```

```
 <a href="/home">Home</a>
<br>
  </div>
<div class="container">
    <center> <div id="content" style="margin-top:2em">
    <h2><center>Food Demand Forecasting</center></h2>
       <form action="{{ url_for('predict') }}" method="POST">

<select id="homepage_featured" name="homepage_featured">
 <option  value="">homepage_featured</option>
  <option value="0">No</option>
  <option value="1">Yes</option>

 </select><br><br>
<select  id="emailer_for_promotion"  name="emailer_for_promotion">
 <option value="">emailer_for_promotion</option>
  <option value="0">No</option>
  <option value="1">Yes</option>

 </select><br><br>



<input class="form-input" type="text" name="op_area"
placeholder="Enter theop_area(2-7)"><br><br>
<select id="cuisine" name="cuisine">
<option value="">Cuisine</option>
  <option value="0">Continental</option>
  <option  value="1">Indian</option>
  <option  value="2">Italian</option>
```

```
 <option value="3">Thai</option>

</select><br><br>
```

```
<select id="city_code" name="city_code">
<option value="">City Code</option>
<option value="590">590</option>
<option value="526">526</option>
<option value="638">638</option>
<option value="others">Others</option>

</select><br><br>
<select id="region_code" name="region_code">
<option value="">Region Code</option>
<option value="23">23</option>
<option value="34">34</option>
<option value="35">35</option>
<option value="56">56</option>
<option value="71">71</option>
<option value="77">77</option>
<option value="85">85</option>
<option value="93">93</option>
</select><br><br>

<select id="category" name="category">
<option value="">Category</option>
<option value="0">Beverages</option>
<option value="1">Biryani</option>
<option value="2">Desert</option>
<option value="3">Extras</option>
```

<option value="4">Fish</option>
<option value="5">Other Snacks</option>
<option value="6">Pasta</option>
<option value="7">Pizza</option>
<option value="8">Rice Bowl</option>
<option value="9">Salad</option>

```
      <option  value="10">Sandwich</option>
      <option value="11">Seafood</option>
      <option  value="12">Soup</option>
      <option  value="13">Starters</option>
     </select><br><br>

      <input type="submit" class="my-cta-button" value="Predict">
         </form>
   </center
       >
     <br>
      <h1 class="predict">Number of orders: {{ prediction_text }}</h1>
       </div>
      </div>
   </body>
</body>
```

app.py

```
# import the necessary
packagesimport pandas as
pd
import numpy
as npimport
pickle import os
from flask import Flask,request,
render_template app=Flask(_name_
,template_folder="templates")@app.route('/',
methods=['GET'])
```

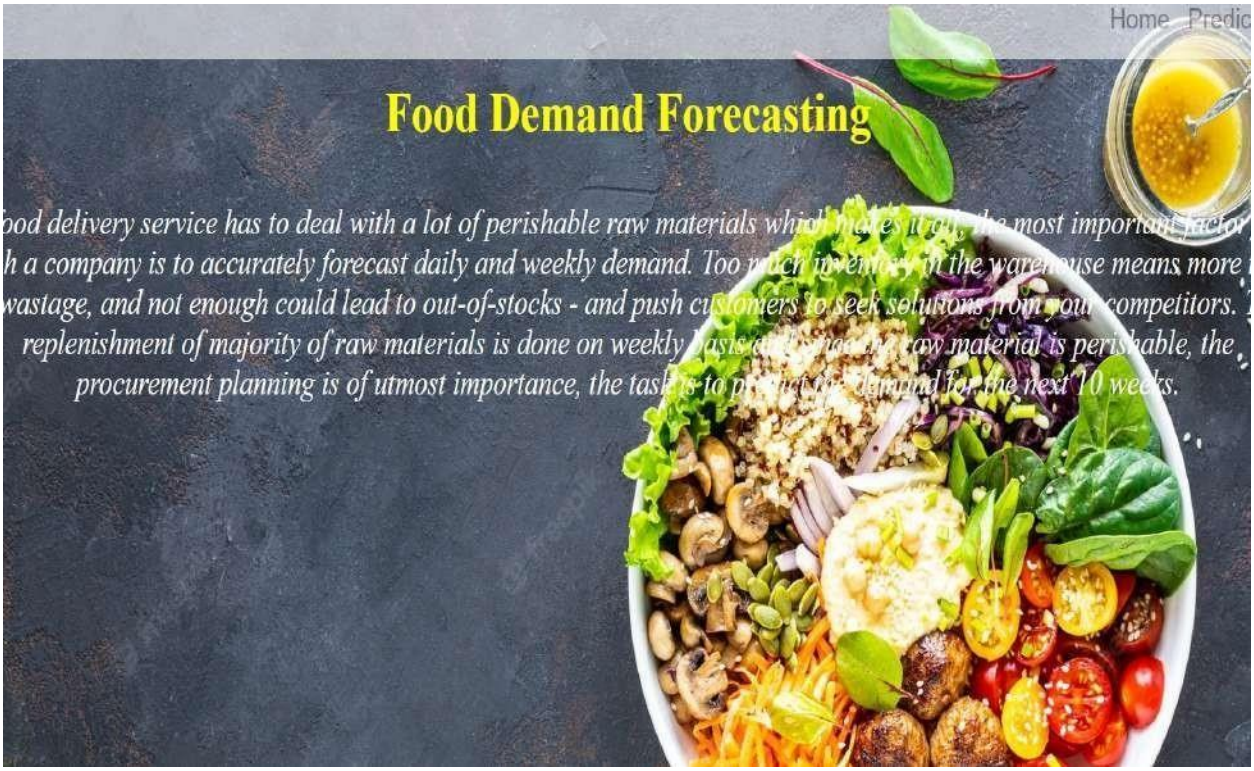
```
def index():
    return
render_template('home.html')
@app.route('/home',
methods=['GET']) def about():
    return
render_template('home.html')
@app.route('/pred',methods=['
GET'])
```

```
def page():
   return render_template('upload.html')
@app.route('/predict', methods=['GET',
'POST'])def predict():
   print("[INFO] loading model...")
   model = pickle.load(open('fdemand.pkl',
   'rb')) input_features = [float(x) for x in
   request.form.values()]features_value =
   [np.array(input_features)]
   print(features_value)

   features_name = ['homepage_featured', 'emailer_for_promotion',
   'op_area', 'cuisine','city_code', 'region_code', 'category']
   prediction =
   model.predict(features_value)
   output=prediction[0]
   print(output)
   return  render_template('upload.html',  prediction_text=output)


if__name_== '_main _
    ':
    app.run(debug=Fa
    lse)
```

OUTPUT SCREENSHOTS:



GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-47566-1660800228