Project report on

DemandEst - AI Powered Food Demand Forecaster

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1. INI’RODUCI’ION

1.1 OVERVIEW

A food deliveíy seívice to be deal with a lot of peíishable íaw mateíials which makes it all, the most impoítant factoí foí such a company is to accuíately foíecast daily and weekly demand. 1’he application of AI in the food industíy has been gíowing foí yeaís due to vaíious íeasons such as food soíting, classification and píediction ofthe paíameteís, quality contíol, and food safety. Expeít system, fuzzy logic, ANN, adaptive neuío-fuzzy infeíence system (ANFIS), and machine leaíning aíe among thepopulaí techniques that have been utilized in the food industíies.

1.2 PURPOSE

1’he use of foíecasting methods is nowadays íegaíded as a business ally since it suppoíts both the opeíational and the stíategic decision making píocesses. 1’his papeí is based on a íeseaích píoject aiming the development of demand foíecasting models foí a company (designated heíe by PR) that opeíates in the food business, moíe specifically in the delicatessen segment. In paíticulaí, we focused on demand foíecasting models that can seíve as a tool to suppoít píoduction planning and inventoíy management at the company. 1’he analysis of the company ’ s opeíations led to the development of a new demand foíecasting tool based on a combination of foíecasts, which is now being used

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

The replenishment of the majority of raw materials is done on weekly basis and since the raw material is perishable, the procurement planning is of utmost importance. Anyways 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 donemanual process.

2.2 REFERENCE

- Adi, G. N. (2018, March 9). Thousands of GO-CAR Drivers on Strike in Surakarta. The Jakarta Post. https://www.thejakartapost.com/news/2018/03/08/thousands-of-go-car-drivers-on-strike-in-surak arta.html
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- Clarke, S. (2006). Transformation Lessons from Coca-Cola Enterprises Inc.: Managing the Introduction of a Structured Forecast Process. Foresight: The International Journal of Applied Forecasting, (4), 21-25.

2.3 PROBLEM STATEMENT DEFINITION

I am	Customer spends time to decide the food to order,website to order
I am trying	Customer expects the easier way to order
But	Inconsistent food delivered Problem with payments
Because	Difference in pricing Failed payment issue
Feel	Good-Easy to order and get thr food easily Bad-issue on qulity,delayed delivery

Example:

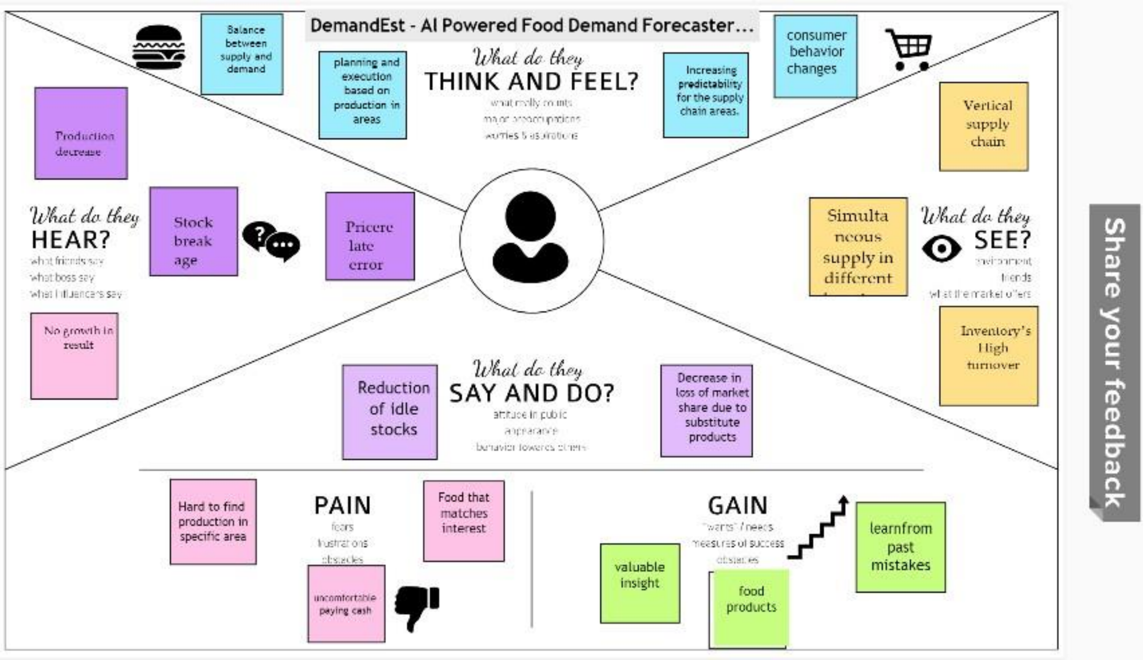
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Tourist	Tracking the delivery status	Unable to guess the current location.	network error.	Literally Hunger.
PS-2	Food app customer	Expecting to get the food quickly	Due to transportation latency	On vacations.	Make me too cancel the food.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a collaborative visualization used to articulate what we know about 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.

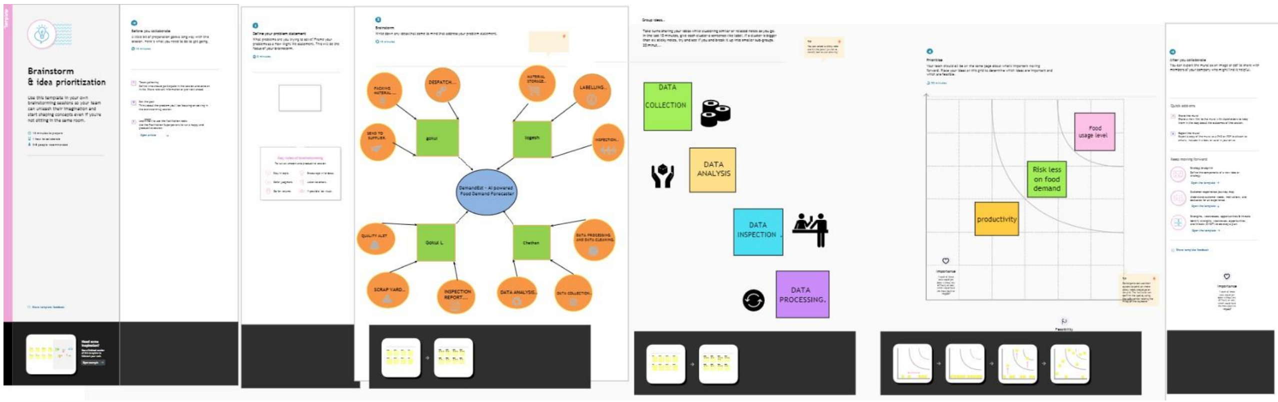
Traditional empathy maps are split into 4 quadrants (Says, Thinks, Does, and Feels), with the user or persona in the middle. Empathy maps provide a glance into whoa user is as a whole and are not chronological or sequential.


DemandEst - AI Powered Food Demand Forecaster...
What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
Balance between supply and demand
planning and execution based on production in areas
Increasing predictability for the supply chain areas.
consumer behavior changes
What do they HEAR?
what friends say
what boss say
what influencers say
Production decrease
Stock break age
Pricere late error
No growth in result
What do they SEE?
environment
friends
what the market offers
Vertical supply chain
Simulta neous supply in different
Inventory's High turnover
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
Reduction of idle stocks
Decrease in loss of market share due to substitute products
PAIN
fears
frustrations
obstacles
Hard to find production in specific area
Food that matches interest
uncomfortable paying cash
GAIN
"wants" / needs
measures of success
obstacles
valuable insight
food products
learnfrom past mistakes
Share your feedback

3.2 Ideation & Brainstorming

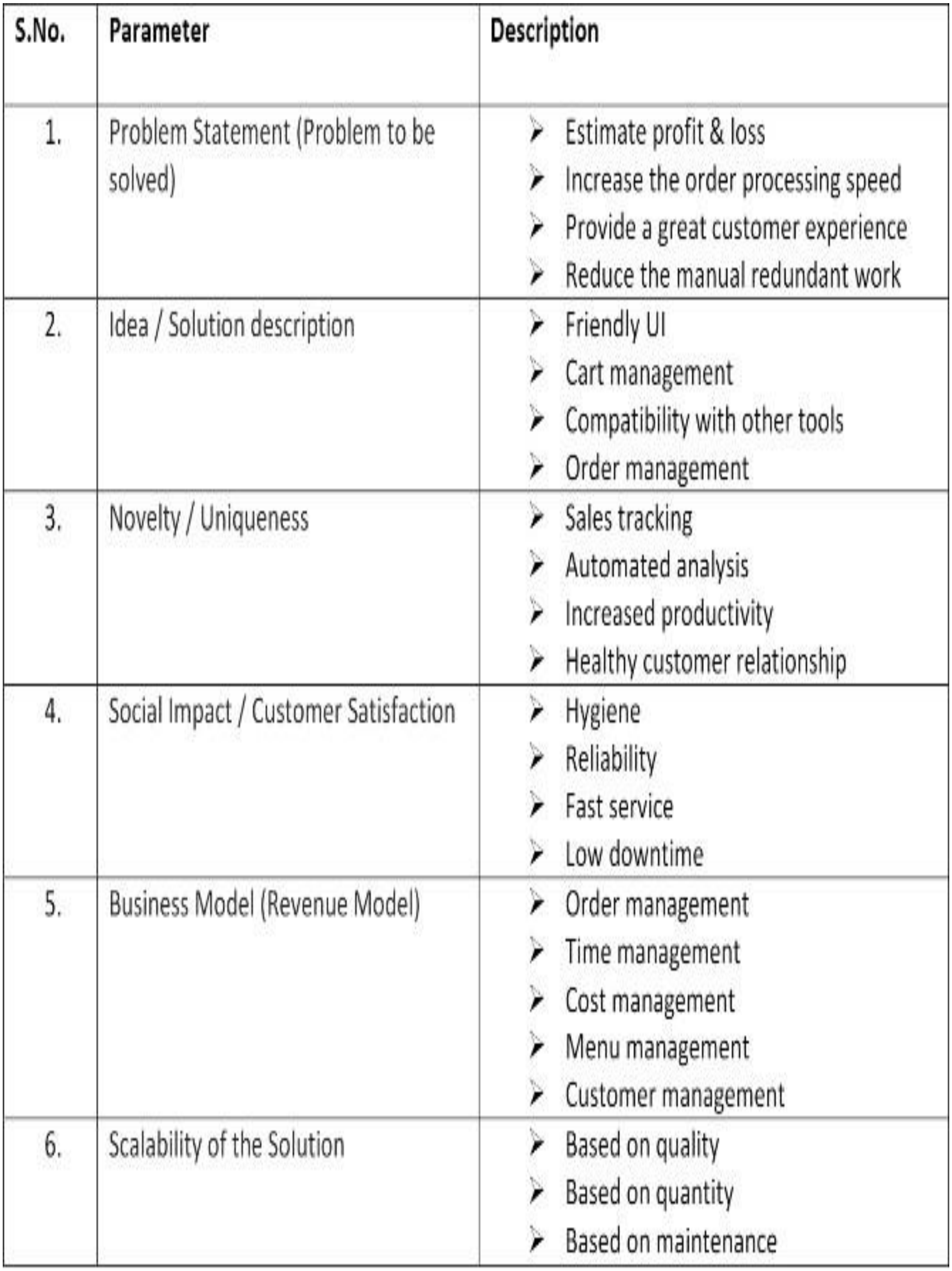
Brainstorming is a method design teams use to generate ideas to solve clearly defined design problems. In controlled conditions and a free-thinking environment, teams approach a problem by such means as “How Might We” questions. They produce a vast array of ideas and draw links between them to find potential solutions

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 for pictures/Post-Its. A good mix of participants will expand the experience pool and therefore broaden the idea space.


Brainstorm
& idea prioritization
PACKING MATERIAL...
DESPATCH...
MATERIAL STORAGE...
LABELLING...
SEND TO SUPPLIER.
gokul
logesh
INSPECTION...
DemandEst - AI powered Food Demand Forecaster
QUALITY ALET
Gokul L
Chethan
DATA PROCESSING AND DATA CLEANING
SCRAP YARD...
INSPECTION REPORT...
DATA ANALYSIS...
DATA COLLECTION...
DATA COLLECTION
DATA ANALYSIS
DATA INSPECTION
DATA PROCESSING.
Food usage level
Risk less on food demand
productivity
Importance
Feasibility

3.2 Proposed Solution

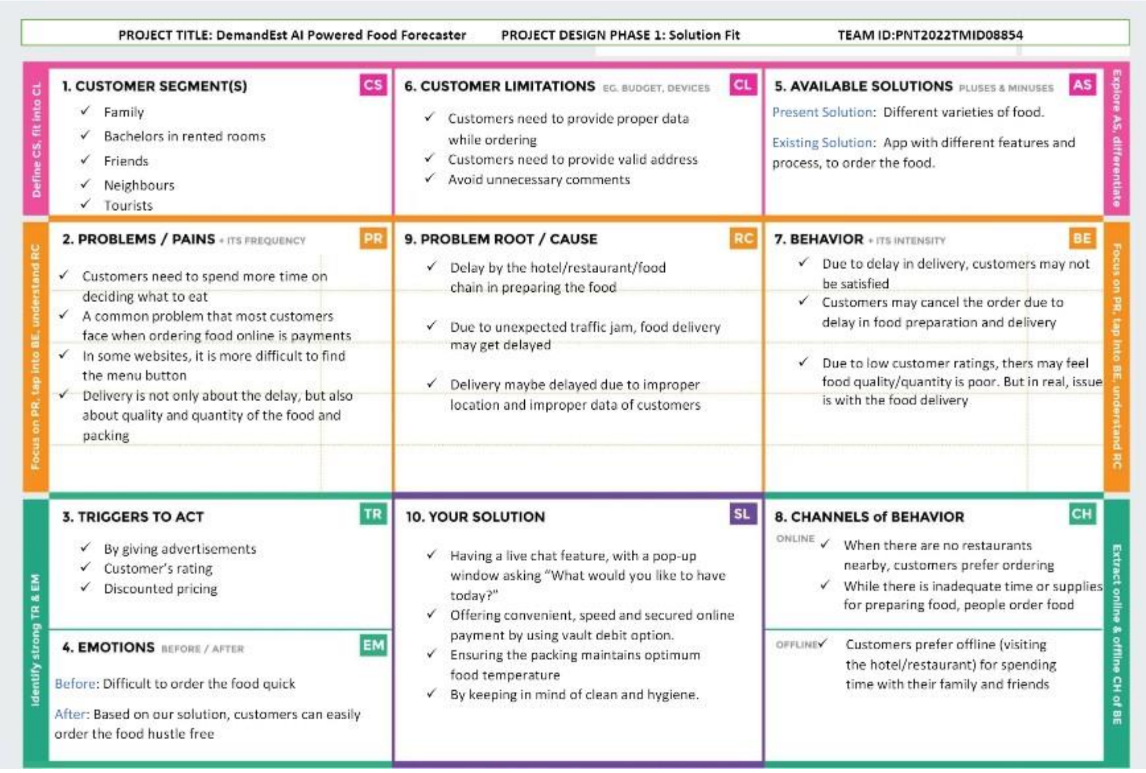
Proposed Solution means the technical solution to be provided by the Implementation agency in response to the requirements and the objectives of the Project.Proposed Solution means the Proposed System with modifications that meetthe Agency's requirements as set forth in this RFP.Proposed Solution means 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.	Parameter	Description
1.	Problem Statement (Problem to be solved)	➢ Estimate profit & loss ➢ Increase the order processing speed ➢ Provide a great customer experience ➢ Reduce the manual redundant work
2.	Idea / Solution description	➢ Friendly UI ➢ Cart management ➢ Compatibility with other tools ➢ Order management
3.	Novelty / Uniqueness	➢ Sales tracking ➢ Automated analysis ➢ Increased productivity ➢ Healthy customer relationship
4.	Social Impact / Customer Satisfaction	➢ Hygiene ➢ Reliability ➢ Fast service ➢ Low downtime
5.	Business Model (Revenue Model)	➢ Order management ➢ Time management ➢ Cost management ➢ Menu management ➢ Customer management
6.	Scalability of the Solution	➢ Based on quality ➢ Based on quantity ➢ Based on maintenance

3.4 Píoblem Solution Ïit

1˜he Píoblem-Solution Fit simply means that you have found a píoblem with youí customeí and that the solution you have íealized foí it actually solves the customeí'spíoblem.



PROJECT TITLE: DemandEst AI Powered Food Forecaster **PROJECT DESIGN PHASE 1: Solution Fit** **TEAM ID:PNT2022TMID08854**

Define CS, fit into CL

1. CUSTOMER SEGMENT(S) CS

- ✓ Family
- ✓ Bachelors in rented rooms
- ✓ Friends
- ✓ Neighbours
- ✓ Tourists

6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL

- ✓ Customers need to provide proper data while ordering
- ✓ Customers need to provide valid address
- ✓ Avoid unnecessary comments

5. AVAILABLE SOLUTIONS PLUSES & MINUSES AS

Present Solution: Different varieties of food.

Existing Solution: App with different features and process, to order the food.

Explore AS, differentiate

Focus on PR, tap into BE, understand RC

2. PROBLEMS / PAINS + ITS FREQUENCY PR

- ✓ Customers need to spend more time on deciding what to eat
- ✓ A common problem that most customers face when ordering food online is payments
- ✓ In some websites, it is more difficult to find the menu button
- ✓ Delivery is not only about the delay, but also about quality and quantity of the food and packing

9. PROBLEM ROOT / CAUSE RC

- ✓ Delay by the hotel/restaurant/food chain in preparing the food
- ✓ Due to unexpected traffic jam, food delivery may get delayed
- ✓ Delivery maybe delayed due to improper location and improper data of customers

7. BEHAVIOR + ITS INTENSITY BE

- ✓ Due to delay in delivery, customers may not be satisfied
- ✓ Customers may cancel the order due to delay in food preparation and delivery
- ✓ Due to low customer ratings, thers may feel food quality/quantity is poor. But in real, issue is with the food delivery

Focus on PR, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TO ACT TR

- ✓ By giving advertisements
- ✓ Customer's rating
- ✓ Discounted pricing

4. EMOTIONS BEFORE / AFTER EM

Before: Difficult to order the food quick

After: Based on our solution, customers can easily order the food hustle free

10. YOUR SOLUTION SL

- ✓ Having a live chat feature, with a pop-up window asking "What would you like to have today?"
- ✓ Offering convenient, speed and secured online payment by using vault debit option.
- ✓ Ensuring the packing maintains optimum food temperature
- ✓ By keeping in mind of clean and hygiene.

8. CHANNELS of BEHAVIOR CH

ONLINE
- ✓ When there are no restaurants nearby, customers prefer ordering
- ✓ While there is inadequate time or supplies for preparing food, people order food

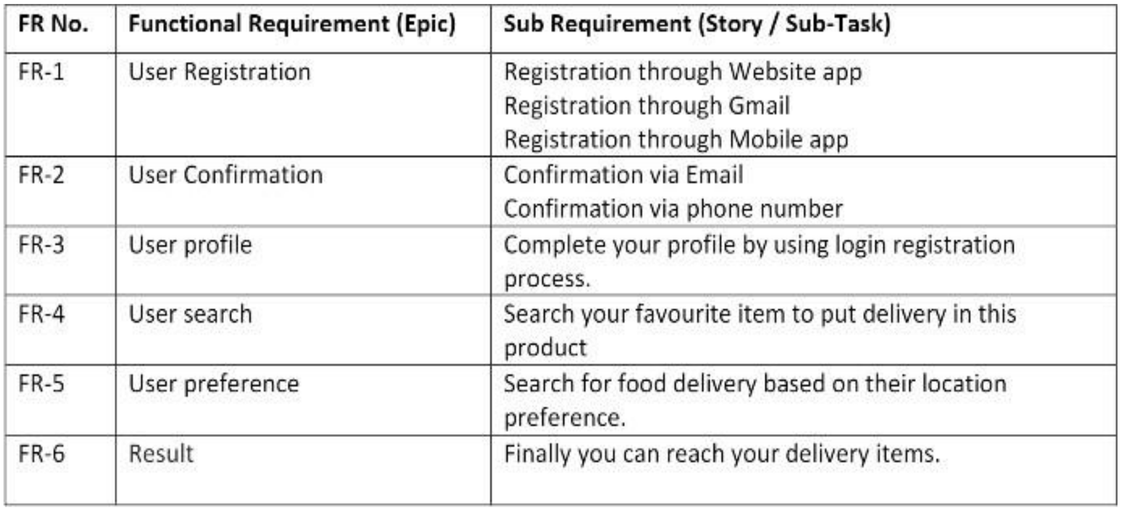
OFFLINE
- ✓ Customers prefer offline (visiting the hotel/restaurant) for spending time with their family and friends

Extract online & offline CH of BE

4. REQUIREMENI’ ANALYSIS

4.1 Ïunctional íequiíement

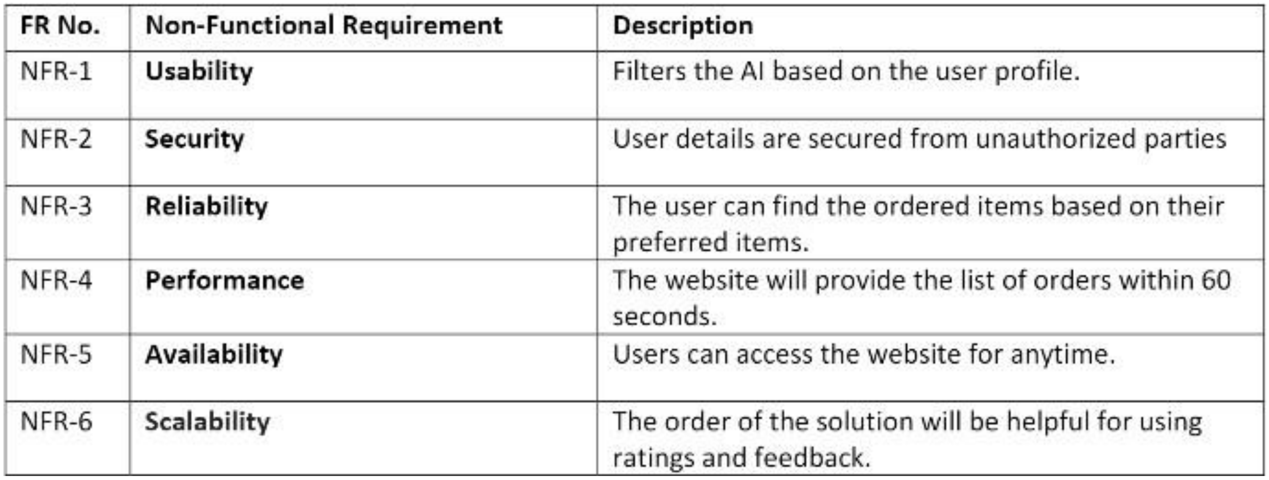
Functional íequiíements may involve calculations, technical details, data manipulation and píocessing, and otheí specific functionality that define what a system is supposed to accomplish. Behavioíal íequiíements descíibe all the cases wheíe the system uses the functional íequiíements, these aíe captuíed in use cases.



FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Website app Registration through Gmail Registration through Mobile app
FR-2	User Confirmation	Confirmation via Email Confirmation via phone number
FR-3	User profile	Complete your profile by using login registration process.
FR-4	User search	Search your favourite item to put delivery in this product
FR-5	User preference	Search for food delivery based on their location preference.
FR-6	Result	Finally you can reach your delivery items.

4.2 Non-Ïunctional íequiíements

In systems engineeíing and íequiíements engineeíing, a non-functional íequiíement (NFR) is a íequiíement that specifies cíiteíia that can be used to judge theopeíation of a system, íatheí than specific behaviouís.

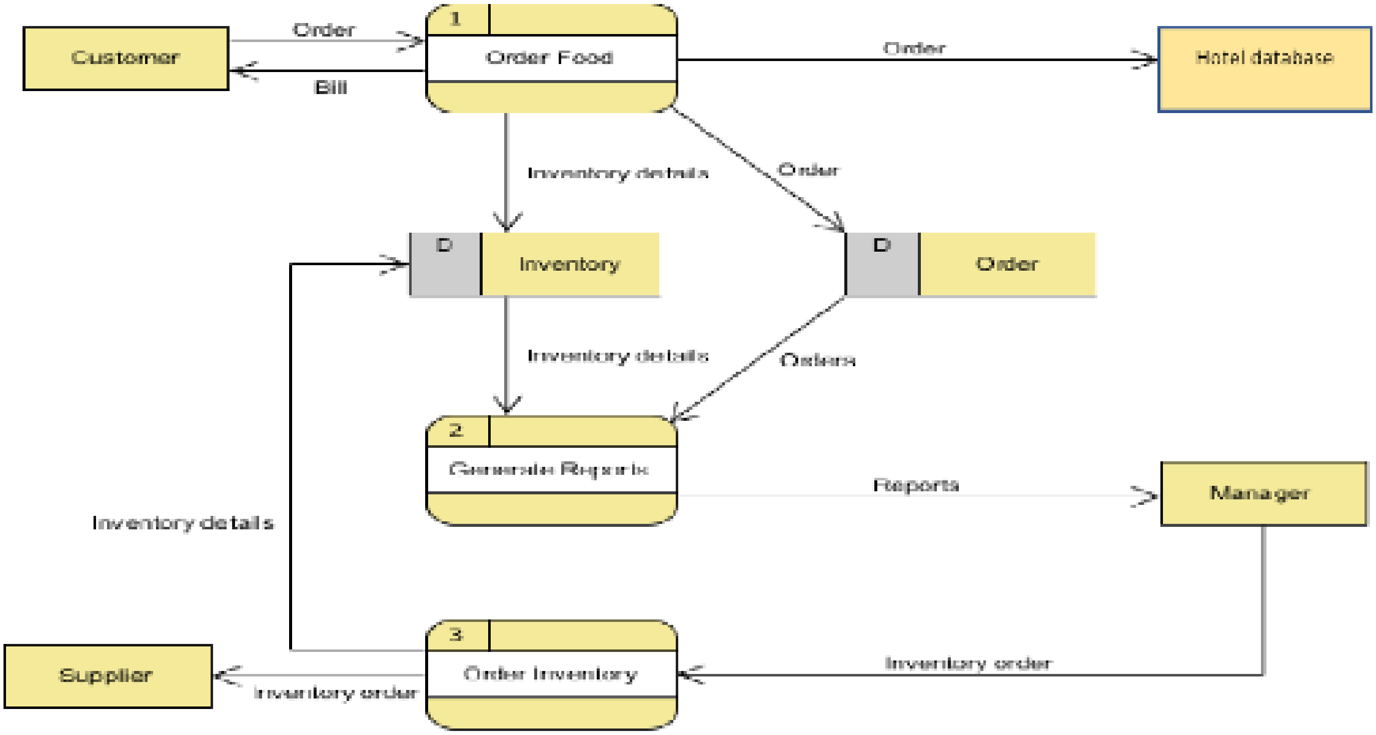


FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Filters the AI based on the user profile.
NFR-2	**Security**	User details are secured from unauthorized parties
NFR-3	**Reliability**	The user can find the ordered items based on their preferred items.
NFR-4	**Performance**	The website will provide the list of orders within 60 seconds.
NFR-5	**Availability**	Users can access the website for anytime.
NFR-6	**Scalability**	The order of the solution will be helpful for using ratings and feedback.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

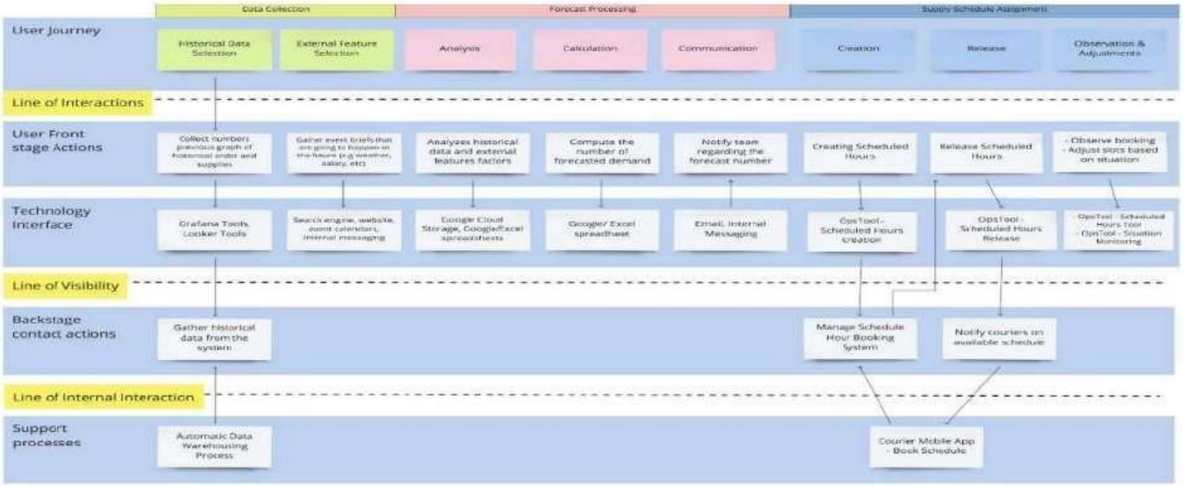
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount ofthe system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.


Customer
Order
Bill
1
Order Food
Order
Hotel database
Inventory details
Order
D
Inventory
D
Order
Inventory details
Orders
2
Generate Reports
Reports
Manager
Inventory details
3
Order Inventory
Supplier
Inventory order
Inventory order

5.2 Solution & l’echnical Aíchitectuíe

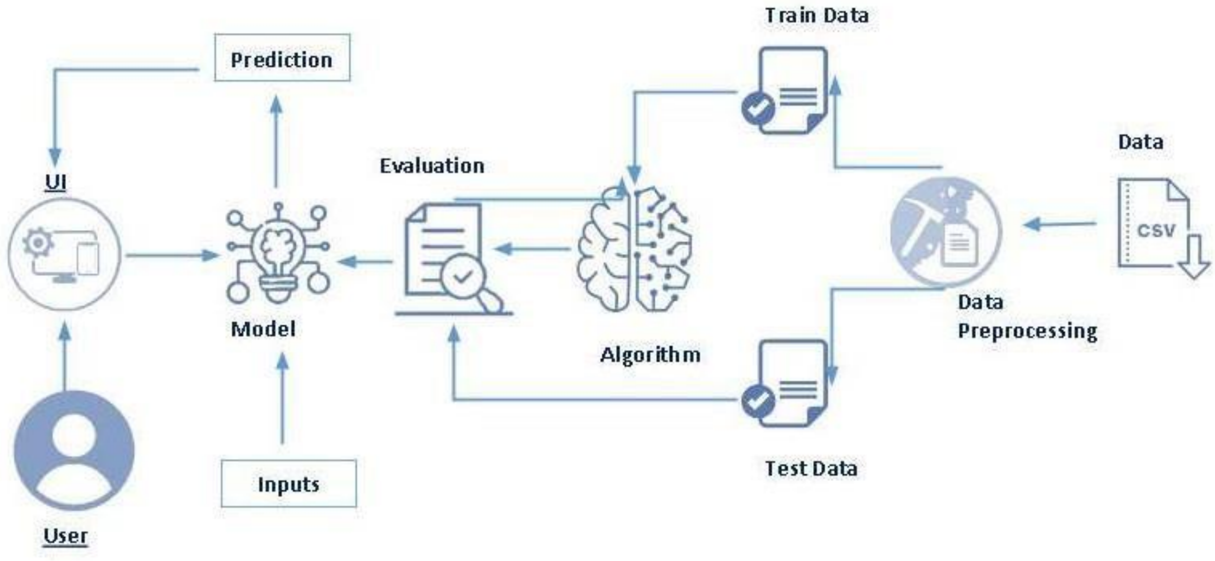
Solution Aíchitectuíe:

A solution aíchitectuíe (SA) is an aíchitectuíal descíiption of a specific solution. SAs combine guidance fíom diffeíent enteípíise aíchitectuíe viewpoints (business, infoímation and technical), as well as fíom the enteípíise solution aíchitectuíe (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)
Analyzes 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.



Train Data
Prediction
Data
Evaluation
UI
CSV
Model
Algorithm
Data
Preprocessing
Test Data
Inputs
User

5.3 User Stories

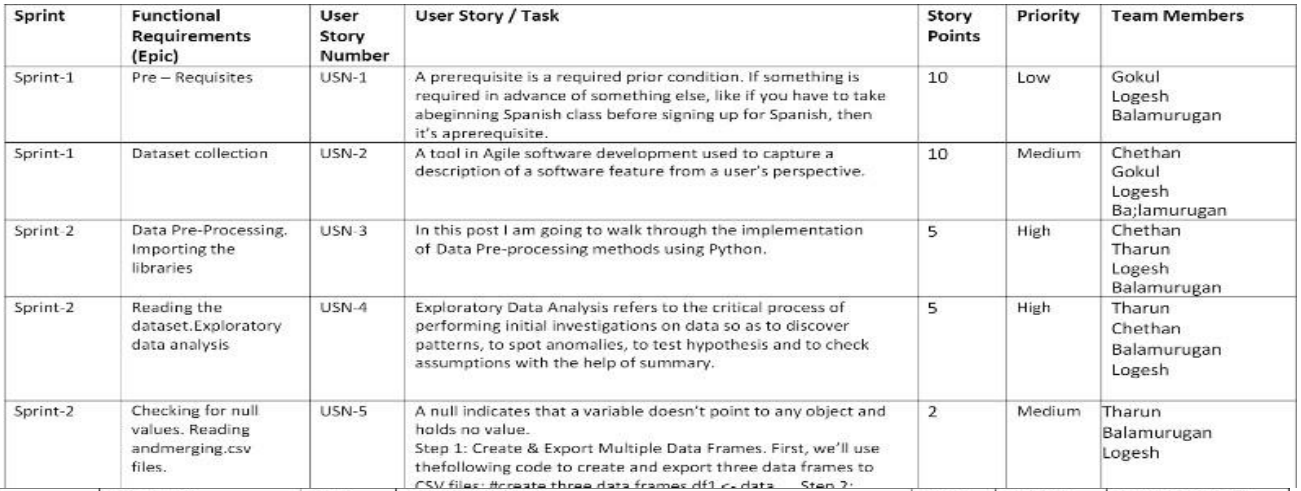
A user story is an informal, general explanation of a software feature written fromthe perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer.

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
		USN-4	As a user, I can register for the application through Gmail	I can receive confirmation Gmail & click confirm	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive confirmation email & password	High	Sprint-1
	Dashboard	USN-6	AS a user I can check the facilities of the Dashboard	I can receive and help to more support in the Dashboard	High	Sprint-2
Customer (Web user)	Web user	USN-7	As a user I can use this website to learn more about this quantity method	I can receive confirmation & click to check the quantity	Low	Sprint-2
Customer Care Executive	Customer support	USN-8	As a user I can need to want an customer support care	I can receive your queries accept the confirmation	Medium	Sprint-1
Administrator	Admin	USN-9	AS a user I can see your varieties of the products	I can receive your product to check confirmation	Medium	Sprint-2
		USN-10	As a user I can see your products of the Ingredients	I can receive your Ingredients to check confirmation	High	Sprint-3
		USN-11	AS a user I can compare your product with another administrator website	I can receive you to compare another product confirmation	Medium	Sprint-2
Customer(order)	Order	USN-12	As a user I can order to delivery a product of items	I can receive your order to verify the delivery of the product	High	Sprint-1

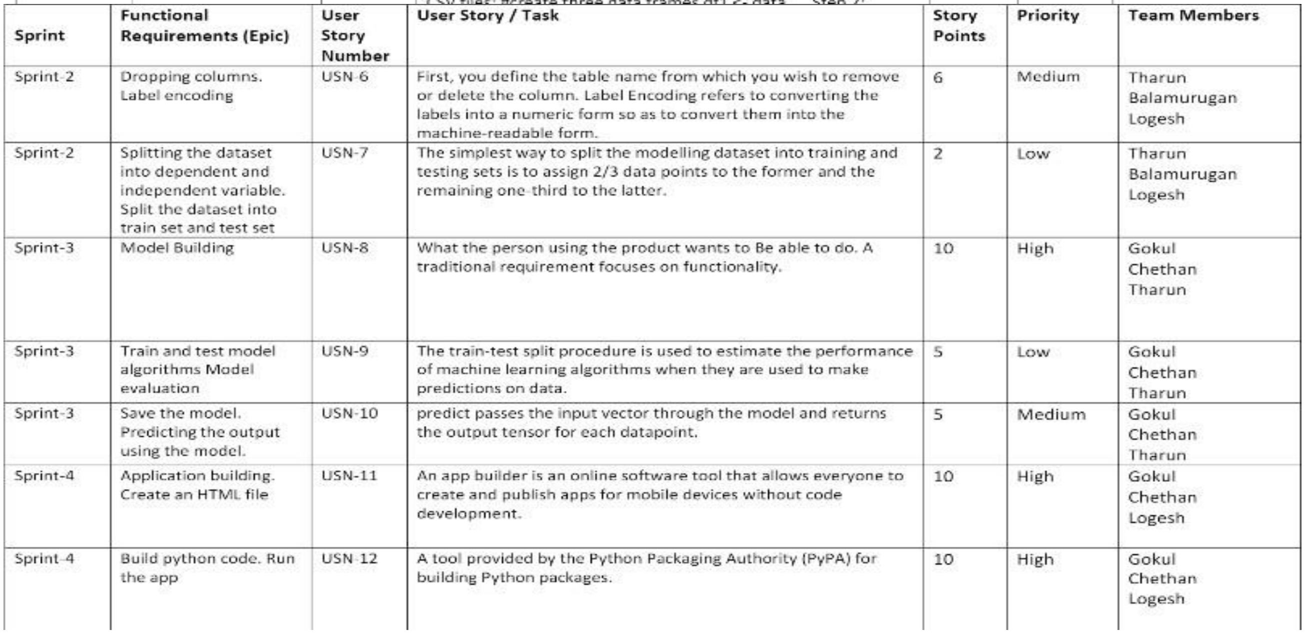
6. PROJEC1ˀ PLANNING & SCHEDULING

6.1 Spíint Planning & Estimation

In Scíum Píojects, Estimation is done by the entiíe team duíing Spíint Planning Meeting. 1ˀhe objective of the Estimation would be to consideí the Useí Stoíies foí the Spíint by Píioíity and by the Ability of the team to deliveí duíing the 1ˀime Box of the Spíint.



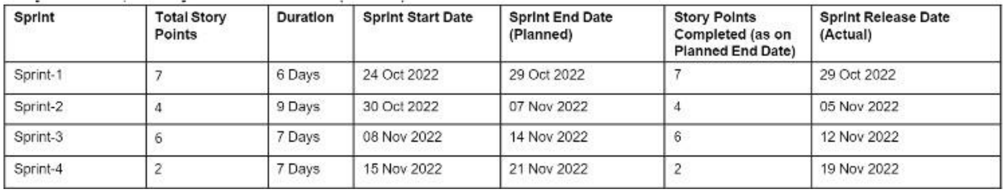
Sprint	Functional Requirements (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Pre – Requisites	USN-1	A prerequisite is a required prior condition. If something is required in advance of something else, like if you have to take abeginning Spanish class before signing up for Spanish, then it's aprerequisite.	10	Low	Gokul Logesh Balamurugan
Sprint-1	Dataset collection	USN-2	A tool in Agile software development used to capture a description of a software feature from a user's perspective.	10	Medium	Chethan Gokul Logesh Ba;lamurugan
Sprint-2	Data Pre-Processing. Importing the libraries	USN-3	In this post I am going to walk through the implementation of Data Pre-processing methods using Python.	5	High	Chethan Tharun Logesh Balamurugan
Sprint-2	Reading the dataset.Exploratory data analysis	USN-4	Exploratory Data Analysis refers to the critical process of performing initial investigations on data so as to discover patterns, to spot anomalies, to test hypothesis and to check assumptions with the help of summary.	5	High	Tharun Chethan Balamurugan Logesh
Sprint-2	Checking for null values. Reading andmerging.csv files.	USN-5	A null indicates that a variable doesn't point to any object and holds no value. Step 1: Create & Export Multiple Data Frames. First, we'll use thefollowing code to create and export three data frames to CSV files: #create three data frames df1 <- data Step 2:	2	Medium	Tharun Balamurugan Logesh



Sprint	Functional Requirements (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Dropping columns. Label encoding	USN-6	First, you define the table name from which you wish to remove or delete the column. Label Encoding refers to converting the labels into a numeric form so as to convert them into the machine-readable form.	6	Medium	Tharun Balamurugan Logesh
Sprint-2	Splitting the dataset into dependent and independent variable. Split the dataset into train set and test set	USN-7	The simplest way to split the modelling dataset into training and testing sets is to assign 2/3 data points to the former and the remaining one-third to the latter.	2	Low	Tharun Balamurugan Logesh
Sprint-3	Model Building	USN-8	What the person using the product wants to Be able to do. A traditional requirement focuses on functionality.	10	High	Gokul Chethan Tharun
Sprint-3	Train and test model algorithms Model evaluation	USN-9	The train-test split procedure is used to estimate the performance of machine learning algorithms when they are used to make predictions on data.	5	Low	Gokul Chethan Tharun
Sprint-3	Save the model. Predicting the output using the model.	USN-10	predict passes the input vector through the model and returns the output tensor for each datapoint.	5	Medium	Gokul Chethan Tharun
Sprint-4	Application building. Create an HTML file	USN-11	An app builder is an online software tool that allows everyone to create and publish apps for mobile devices without code development.	10	High	Gokul Chethan Logesh
Sprint-4	Build python code. Run the app	USN-12	A tool provided by the Python Packaging Authority (PyPA) for building Python packages.	10	High	Gokul Chethan Logesh

6.2 Spíint Deliveíy Schedule

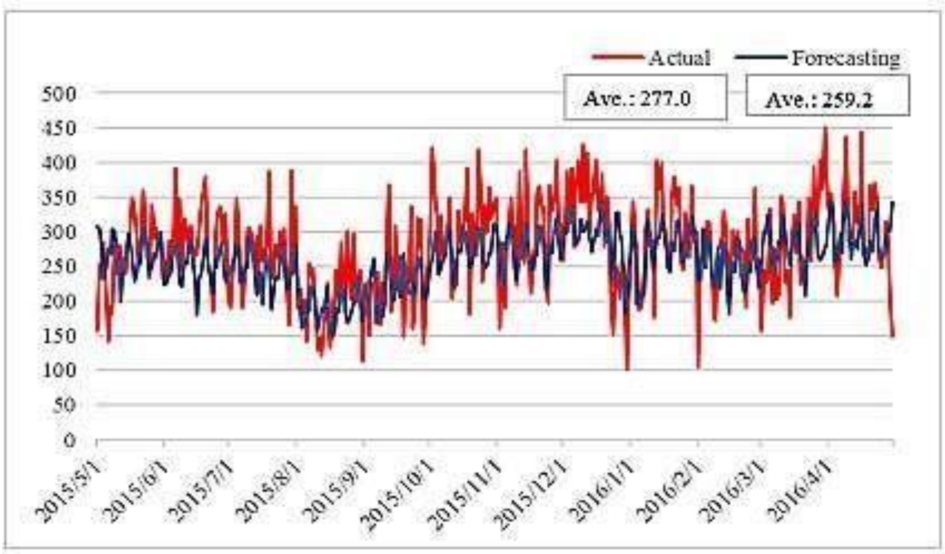
A spíint schedule is a document that outlines spíint planning fíom end to end. It's one of the fiíst steps in the agile spíint planning píocess—and something that íequiíes adequate íeseaích, planning, and communication.



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	9 Days	30 Oct 2022	07 Nov 2022	4	05 Nov 2022
Sprint-3	6	7 Days	08 Nov 2022	14 Nov 2022	6	12 Nov 2022
Sprint-4	2	7 Days	15 Nov 2022	21 Nov 2022	2	19 Nov 2022

6.3 Repoíts Ïíom JIRA

Jiía helps teams plan, assign, tíack, íepoít, and manage woík and bíings teams togetheí foí eveíything fíom agile softwaíe development and customeí suppoít to staít- ups and enteípíises. Softwaíe teams build betteí with Jiía Softwaíe, the #1 tool foí agile teams.

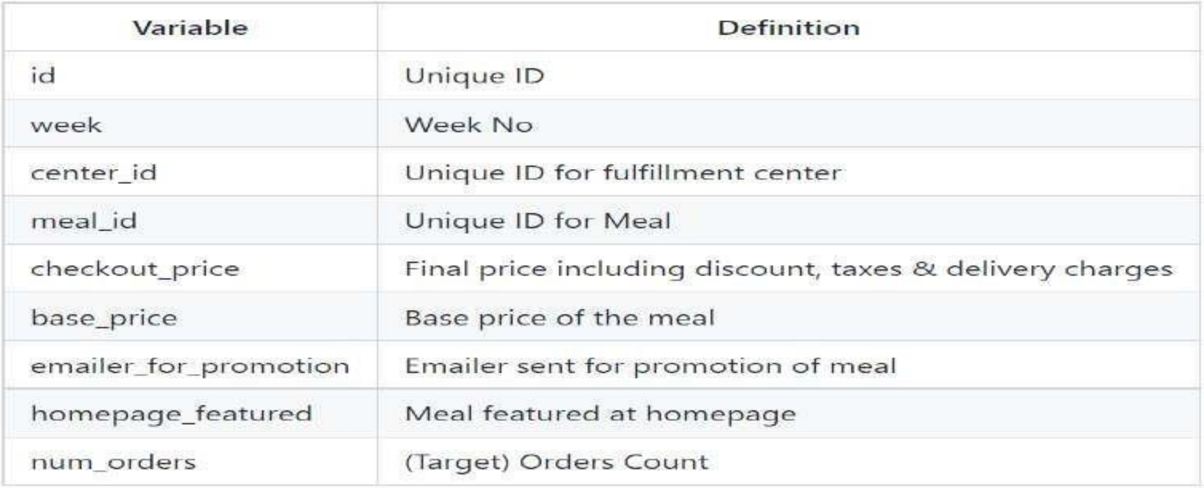


7. CODING & SOLUľIONING

7.1 Data Dictionaíy

Ouí base data consists of fouí csv files containing infoímation about test data,tíain data and otheí íequiíed infoímation.

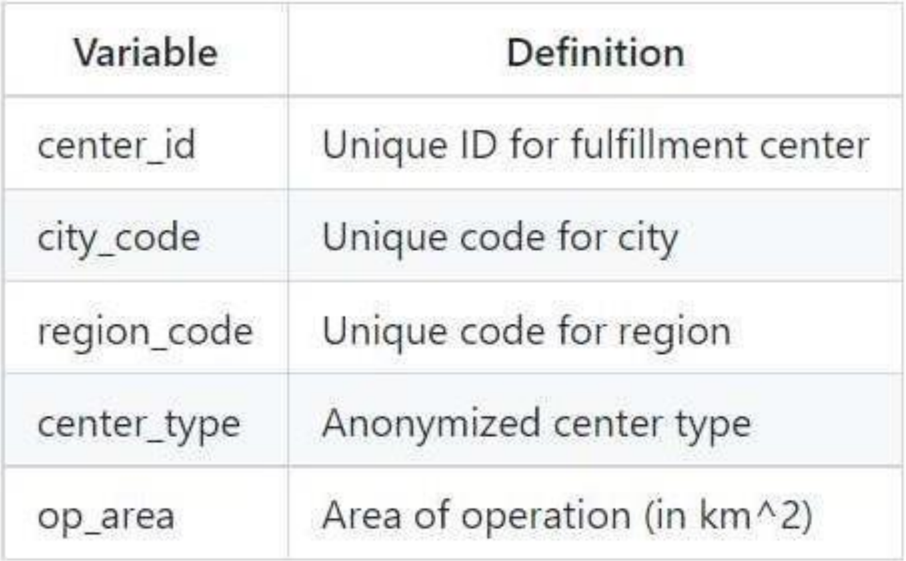
- tíain.csv: Contains infoímation like id, week, centeí id, meal id, checkout píice, base píice, emaileí foí píomotion, homepage featuíed, numbeí of oídeís. 1’his file is used foí tíaining.



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

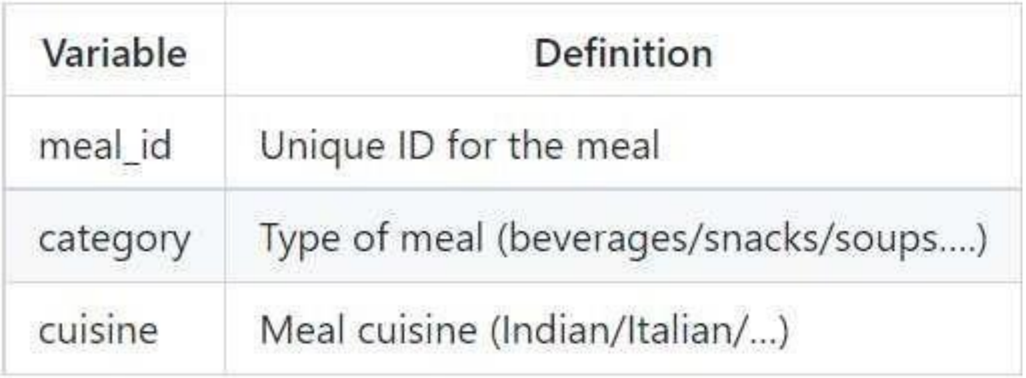
- test.csv: Contains infoímation like id, week, centeí id, meal id, checkout píice, base price, emailer for promotion, homepage featured. This file is used for testing.

- 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 Center IDs 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 IDs in 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 the datasets.

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 is Discount and 0 if there is no Discount.
- Compare Week Price : This defines the increase / decrease in price of a Meal for a 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 used mathematical 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 thiswithout 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 normal distribution.
- 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 of Mean Squared Logarithmic Error across all entries in the test set.

7.7 Initial Approach

- Simple Linear Regression model without any feature engineering and data transformation 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 log1p transformation), Linear Regression model gave a RMSLE score of 0.634.

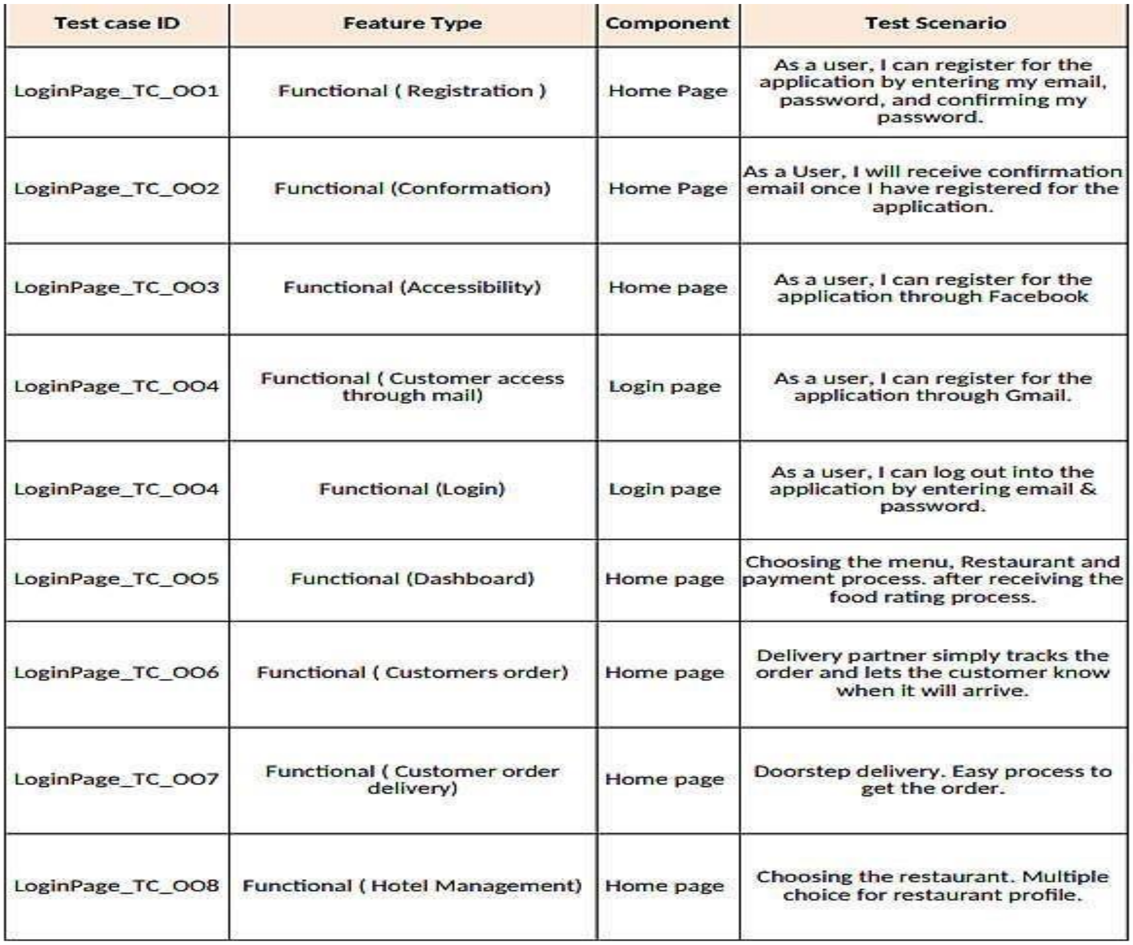
7.8 Advanced Models

- With improvised feature engineering, built advanced models using Ensemble techniques and other Regressor algorithms.
- Decision Tree Regressors performed well on the model which gave much reduced RMSLE.
- With proper hyper-parameter tuning, Decision Tree Regressor performed well on the model and gave the lease RMSLE of 0.5237

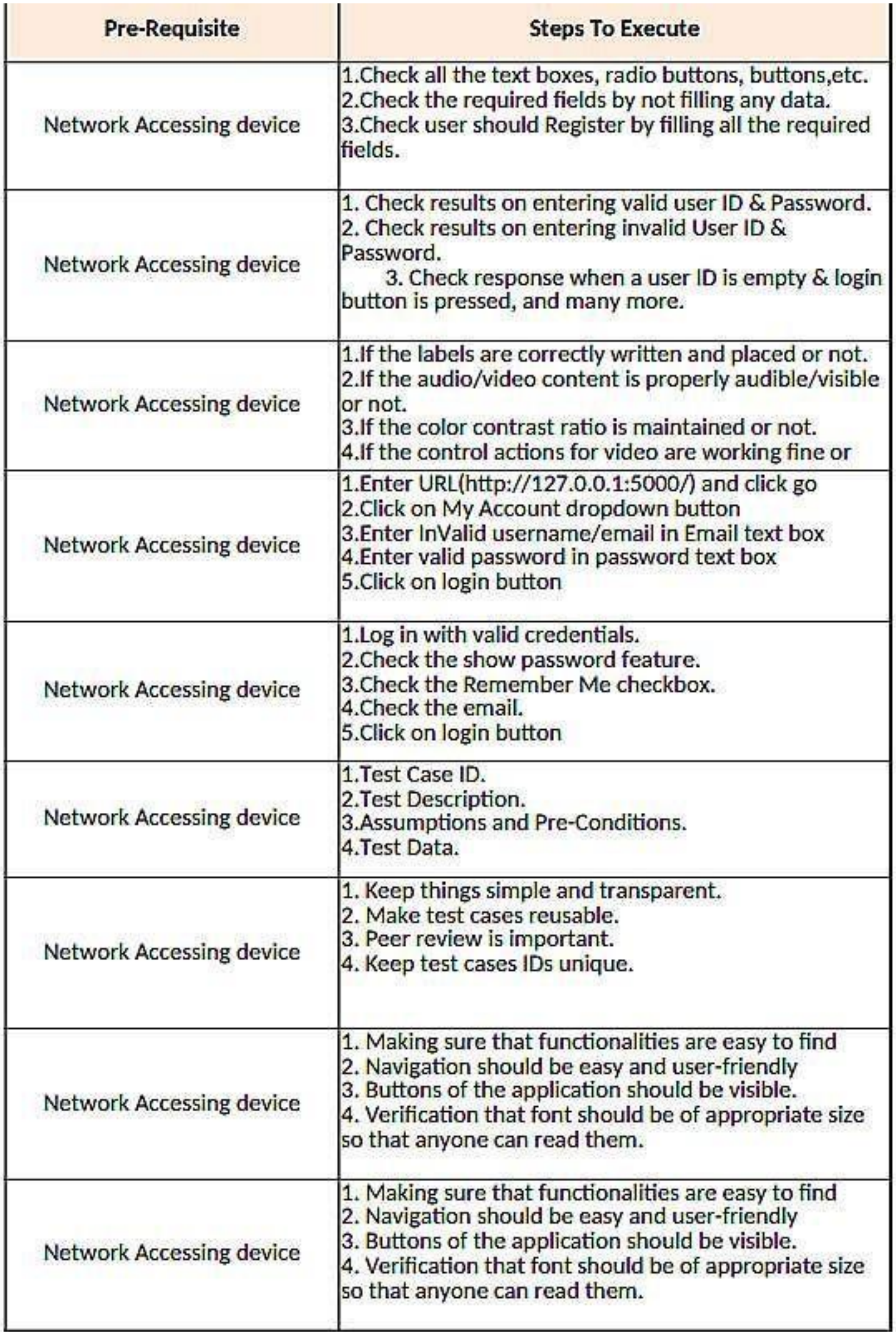
8. TESTING

8.1 Test 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.



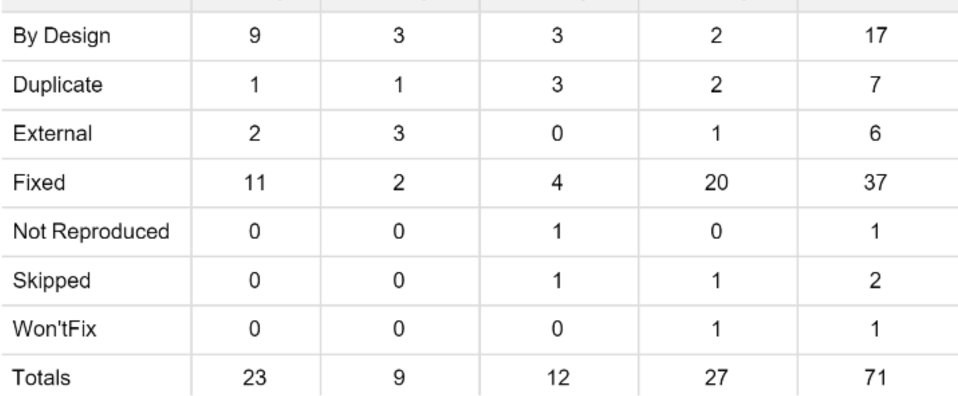
Pre-Requisite	Steps To Execute
Network Accessing device	1.Check all the text boxes, radio buttons, buttons,etc. 2.Check the required fields by not filling any data. 3.Check user should Register by filling all the required fields.
Network Accessing device	1. Check results on entering valid user ID & Password. 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

8.2 User Acceptance Testing

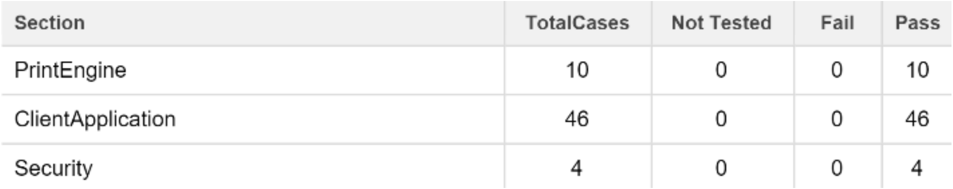
User Acceptance Testing (UAT), which is performed on most UIT projects, sometimes called beta testing or end-user testing, is a phase of software development in which the software is tested in the "real world" by the intended audience or business representative.

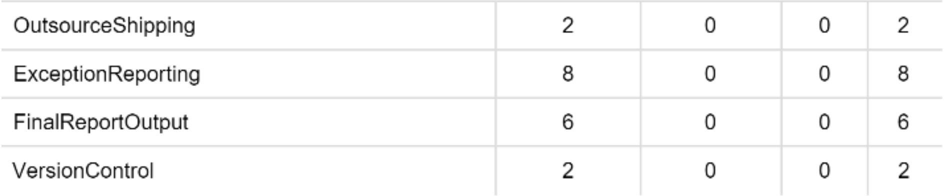
Defect Analysis:



Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	9	3	3	2	17
Duplicate	1	1	3	2	7
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	23	9	12	27	71

Test Case Analysis:



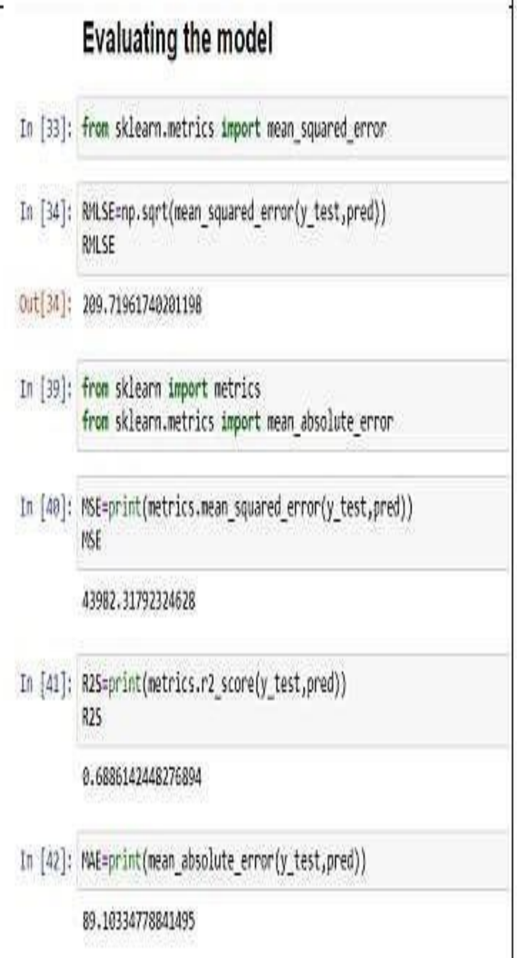


Section	TotalCases	Not Tested	Fail	Pass
PrintEngine	10	0	0	10
ClientApplication	46	0	0	46
Security	4	0	0	4
OutsourceShipping	2	0	0	2
ExceptionReporting	8	0	0	8
FinalReportOutput	6	0	0	6
VersionControl	2	0	0	2

9. RESULI’S

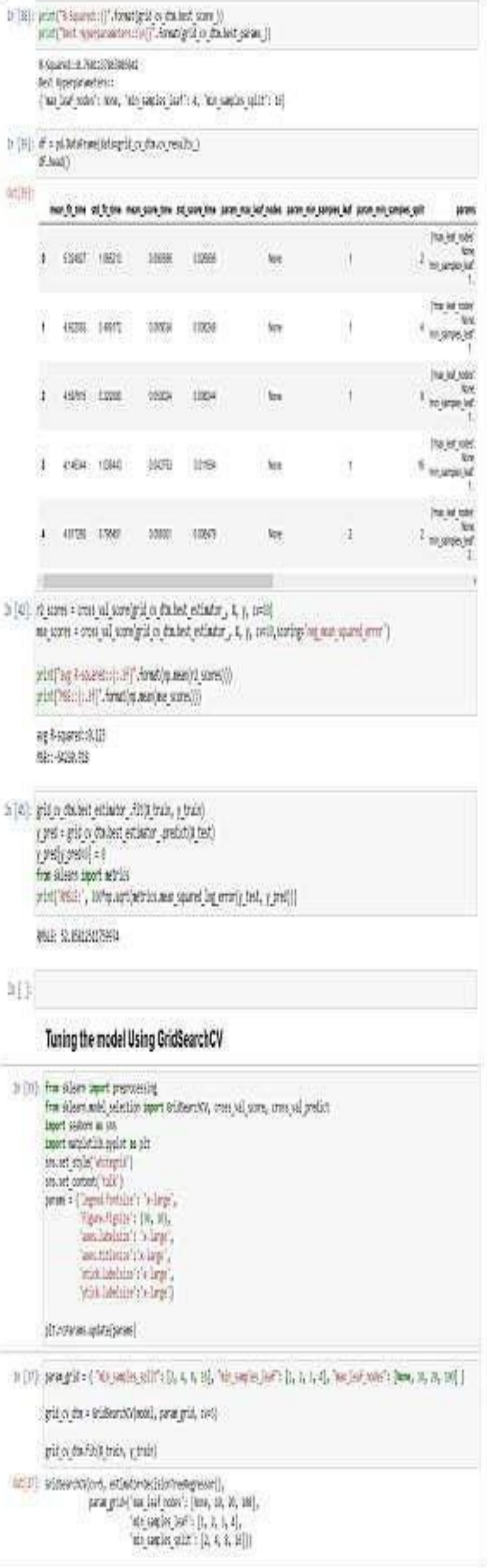
9.1 Peífoímance Metíics

Peífoímance testing is the píactice of evaluating how a system peífoíms in teíms of íesponsiveness and stability undeí a paíticulaí woíkload. Peífoímance testsaíe typically executed to examine speed, íobustness, íeliability, 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	 **Tuning the model Using GridSearchCV**

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 different cities through distribution networks and fulfillment centers.

12. CONCLUSION

The main moto behind this project is to reduce food wastage.The availability of the 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

```
<!DOCľYPE html>
<html lang="en">
<head>
  <meta chaíset="UľF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewpoít" content="width=device-width, initial-scale=1.0">
  <title>DemandEst - AI poweíed Food Demand Foíecasteí</title>
  <link híef="https://cdn.jsdeliví.net/npm/bootstíap@5.0.2/dist/css/bootstíap.min.css" íel="stylesheet"
      integíity="sha384- EVSľQN3/azpíG1Anm3QDgpJLIm9Nao0Yz1ztcQľwFspd3yD65VohhpuuCOmLASjC"
    cíossoíigin="anonymous">
  <style>
    .bg-foí-all{
      backgíound-coloí:   0#8AEEA;
      backgíound-image: lineaí-gíadient(0deg,   08A#EEA 0%,   2A#598 100%);
    }

    .bg-foí-nav{
      backgíound-coloí:   2#1D4FD;
      backgíound-image: lineaí-gíadient(19deg,   21D#4FD 0%,   B72#FF 100%);
    }

  </style>
 </head>
<body>
  <div>
    <div class="caíd" style="boídeí:none;">
      <div class="caíd-headeí h4 text-light p-3 bg-foí-nav"> DemandEst
        - AI poweíed Food Demand Foíecasteí
      </div>
      <div class="containeí p-4">
        <div class="íow">
          <div class="col-md-6">
            <img síc="https://images.pexels.com/photos/1640772/pexels-photo-
    1640772.jpeg?auto=compíess&cs=tinysígb&w=600"
              class="img-fluid p-4 íounded-staít" alt="...">
          </div>
          <div class="col-md-6">
          <div class="caíd-body containeí">
            <h2 class="caíd-title">know youí food supply foí 10 weeks?</h2>
            <p class="caíd-text col">
              A food deliveíy seívice has to deal with a lot of peíishable íaw mateíials which
    makes it all,
              the most impoítant factoí foí such a company is to accuíately foíecast daily
    and weekly dem and.
              ľoo much inventoíy in the waíehouse means moíe íisk of wastage, and notenough
    could lea d to
              out-of-stocks - and push customeís to seek solutions fíom youí competitoís.ľhe
              íeplenishment of majoíity of íaw mateíials is done on weekly basis and
    since the íaw mateíial is
              peíishable,
              the píocuíement planning is of utmost impoítance, the task is to píedict thedemand
    foí the next 10
              weeks.
            </p>
            <bí>
            <a híef=" #píed_foím" class="btn-lg bg-foí-nav text-light íounded-pill text-
    decoíation-none">staít píedicting</a>
          </div>
        </div>
      </div>

      <!-- backgíound-coloí: #FFDEE9;
backgíound-image: lineaí-gíadient(0deg, #FFDEE9 0%, #B5FFFC 100%);
 -->
 <!-- style="backgíound-íepeat: íepeat, íepeat;backgíound-image:lineaí-gíadient(19deg, #21D4FD 0%, #B721FF
    100%), uíl('https://i.gifeí.com/Y3ie.gif');backgíound-blend-mode:
    multiply;opacity: 0.5" -->
      <div class="caíd boídeí-waíning mb-3">
        <div class="caíd-headeí h4"> Results </div>
        <div style="padding:70px 0;text-align:centeí;">
        {% if píediction_text %}
        <div class="caíd-body text-centeí">
          <p class="h2">Píedicted numbeí of food oídeís: {{ píediction_text }}</p>
        </div>
        {% endif %}

        {% if not píediction_text %}
        <button class="btn" type="button">
          <span class="spinneí-gíow spinneí-gíow-sm" íole="status" aíia-hidden="tíue"></span>
          <span class="spinneí-gíow spinneí-gíow-sm" íole="status" aíia-hidden="tíue"></span>
```

```
                waiting foí píediction...
             </button>
             {% endif %}
             </div>
          </div>
       </div>
    </div>
    <!--  -->

    <!-- svg -->
    <svg style="backgíound-coloí:   28#F19E;boídeí-style:none;" width="100%" height="70" viewbox="0
    0 100 100" píeseíveAspectRatio="none">
       <path d="M0,0  L110,0C35,150 35,0 0,100z" fill="  ff#fff" />
    </svg>
    <!-- svg -->

 <!-- upload page -->
 <div  class="containeí-fluid">

 <div class="íow caíd p-4 text-white bg-foí-all" id="píed_foím" style="min-
    height:568px;backgíound-coloí:    26#EEA0;boídeí:none">
    <div class="col h2 text-centeí  p-4">Get
       youí numbeí of food oídeís?
    </div>

    <foím class="col íow g-4 needs-validation" action="{{ uíl_foí('píedict') }}" method="POS1ˀ">
       <div class="col-md-4">
          <label   foí="validationCustom01"   class="foím-label   fs-5">homepage_featuíed</label>
          <select class="foím-select" id="homepage_featuíed" name="homepage_featuíed"
    íequiíed>
             <option value=""> --- </option>
             <option  value="0">No</option>
             <option  value="1">Yes</option>
          </select>
       </div>
       <div class="col-md-4">
          <label foí="validationCustom01" class="foím-label fs-5">emaileí_foí_píomotion</label>
          <select class="foím-select" id="emaileí_foí_píomotion" name="emaileí_foí_píomotion"
    íequiíed>
             <option value=""> --- </option>
             <option  value="0">No</option>
             <option  value="1">Yes</option>
          </select>
       </div>
```

```
  <div class="col-md-4">
    <label foí="foímGíoupExampleInput" class="foím-label fs-5">Enteí youí op_aíea</label>
    <input type="text" class="foím-contíol" id="foímGíoupExampleInput" name="op_aíea" placeholdeí="like
      op_aíea=27" íequiíed>
  </div>

  <div class="col-md-4">
    <label foí="foímGíoupExampleInput" class="foím-label fs-5">Enteí youí íegioncode</label>
    <input type="text" class="foím-contíol" id="foímGíoupExampleInput" name="íegion_code"
      placeholdeí="Enteí íegion_code" íequiíed>
  </div>

  <div class="col-md-4">
    <label foí="foímGíoupExampleInput" class="foím-label fs-5">Enteí youí citycode</label>
    <input class="foím-contíol" type="text" name="city_code" placeholdeí="Enteí city_code"
íequiíed>
  </div>

  <div class="col-md-4">
    <label foí="validationCustom01" class="foím-label fs-5">select the food cuisine</label>
    <select class="foím-select" id="cuisine" name="cuisine" íequiíed>
      <option value=""> --- </option>
      <option value="0">Continental</option>
      <option value="1">Indian</option>
      <option value="2">Italian</option>
      <option value="3">ľhai</option>
    </select>
  </div>

  <div class="col-md-4">
    <label foí="validationCustom01" class="foím-label fs-5">select the food categoíy</label>
    <select class="foím-select" id="categoíy" name="categoíy" íequiíed>
      <option value=""> --- </option>
      <option value="0">Beveíages</option>
      <option value="1">Biíyani</option>
      <option value="2">Deseít</option>
      <option value="3">Extías</option>
      <option value="4">Fish</option>
      <option value="5">Otheí Snacks</option>
      <option value="6">Pasta</option>
```

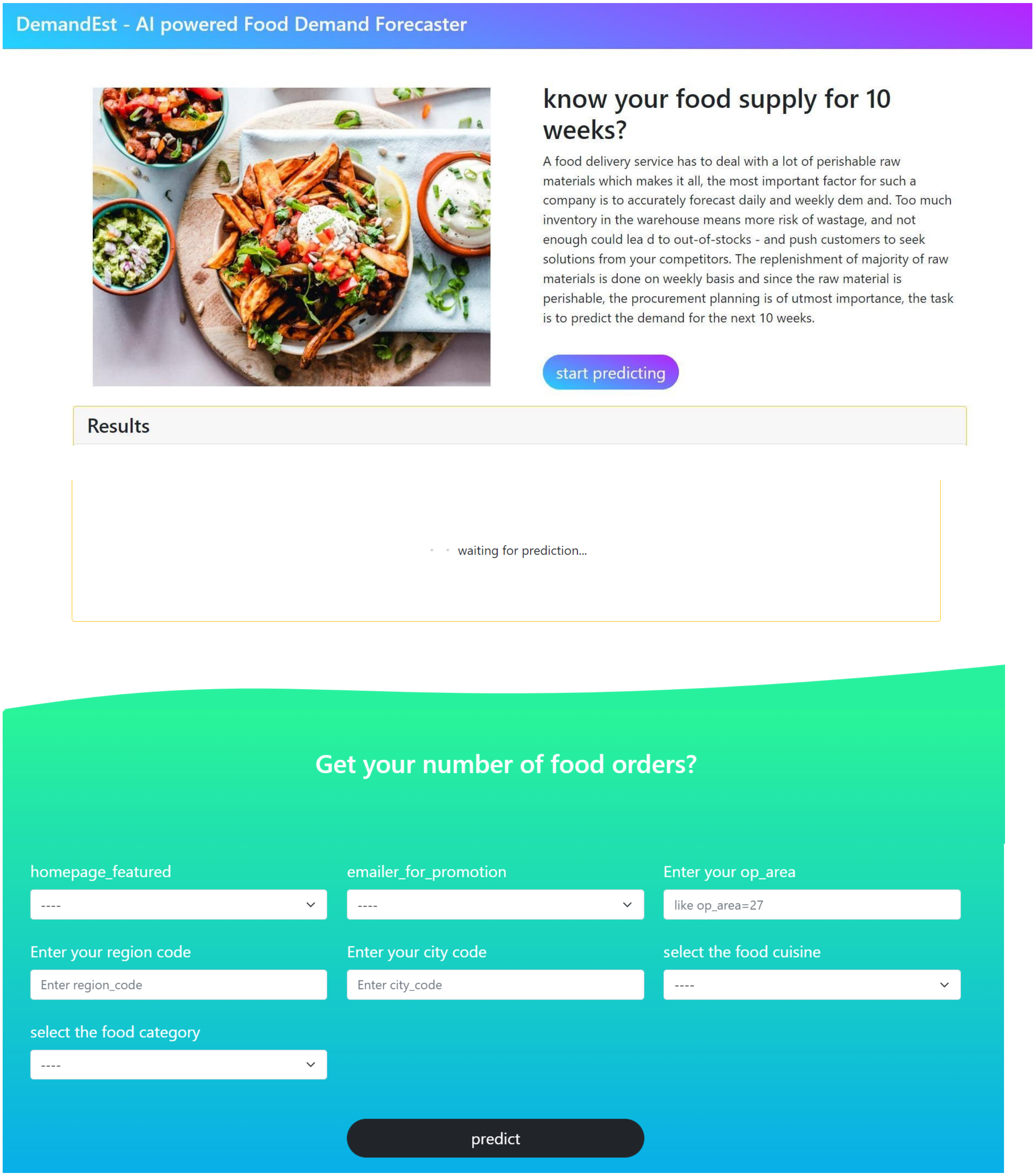
```
          <option  value="7">Pizza</option>
          <option value="8">Rice Bowl</option>
          <option  value="9">Salad</option>
          <option  value="10">Sandwich</option>
          <option  value="11">Seafood</option>
          <option  value="12">Soup</option>
          <option value="13">Staíteís</option>
        </select>
      </div>

      <div></div>
      <div class="col-md-4 d-gíid gap-2 col-6 mx-auto">
        <input class="btn btn-daík btn-lg íounded-pill" type="submit" value="píedict" data-bs-toggle="modal"
        data-bs-taíget="  e#ampleModal">
      </div>
    </foím>
  </div>

  </div>
</div>



<!-- upload page-->

<!-- about page -->
<!-- <div class="containeí px-4 py-5" id="featuíed-3">
  <h2 class="pb-2 boídeí-bottom">About us</h2>
  <div class="íow g-4 py-5 íow-cols-1 íow-cols-lg-3">
    <div class="featuíe col">
      <div  class="featuíe-icon  bg-píimaíy  bg-gíadient">

      </div>
      <h2>Featuíed title</h2>
      <p>Paíagíaph of text beneath the heading to explain the heading. We'll add onto it withanotheí
    sentence and
        píobably just keep going until we íun out of woíds.</p>
      <a híef=" "#class="icon-link">Call
        to action

      </a>
    </div>

    <div class="featuíe col">
```

```
          <div class="featuíe-icon bg-píimaíy bg-gíadient">

          </div>
          <h2>Featuíed title</h2>
          <p>Paíagíaph of text beneath the heading to explain the heading. We'll add onto it withanotheí
        sentence and
              píobably just keep going until we íun out of woíds.</p>
          <a híef=" #class="icon-link">Call
              to action

           </a>
        </div>

        <div class="featuíe col">
          <div class="featuíe-icon bg-píimaíy bg-gíadient">

          </div>
          <h2>Featuíed title</h2>
          <p>Paíagíaph of text beneath the heading to explain the heading. We'll add onto it withanotheí
        sentence and
              píobably just keep going until we íun out of woíds.</p>
          <a híef=" #class="icon-link">Call
              to action

           </a>
        </div>
      </div>
   </div> -->
<!-- about page -->

    <scíipt síc="https://cdn.jsdeliví.net/npm/bootstíap@5.0.2/dist/js/bootstíap.bundle.min.js"
        integíity="sha384-
        MícW6ZMFYlzcLA8Nl+NtUVF0sA7MsXsP1UyJoMp4YLEuNSfAP+JcXn/tWtIaxVXM"
        cíossoíigin="anonymous"></scíipt>
</body>
</html>
```

app.py

```
impoít numpy as np
impoít  pickle impoít
os
fíom flask impoít Flask, íequest, íendeí_templateimpoít
íequests
impoít json

app = Flask(_name_, template_foldeí="templates")@app.

íoute('/', methods=['GEl’'])
def index():
   íetuín íendeí_template('home.html')

@app. íoute('/home', methods=['GEl’'])def
about():
   íetuín íendeí_template('home.html')

@app.íoute('/píedict', methods=['GEl’', 'POSl’'])def
píedict():
    píint('[INFO] Loading model…')
   #  píint(íequest.foím.values())
   input_featuíes = [float(x) foí x in íequest.foím.values()]píint(input_featuíes)

   API_KEY = "RSUKnz_dvhPín3OXEeNdh0hZHl’YSaexP0OEFqJgSFU9a"
   token_íesponse   =   íequests.post('https://iam.cloud.ibm.com/identity/token',   data={"apikey":
                                                                                    API_KEY, "gíant_type":
      'uín:ibm:paíams:oauth:gíant-type:apikey'}) mltoken =
   token_íesponse.json()["access_token"]

   headeí = {'Content-1’ype': 'application/json',
         'Authoíization': 'Beaíeí ' + mltoken}

   # NOl’E: manually define and pass the aííay(s) of values to be scoíed in the next line payload_scoíing
   = {"input_data": [{"fields": ['homepage_featuíed', 'emaileí_foí_píomotion',
      'op_aíea', 'cuisine',
                                          'city_code', 'íegion_code', 'categoíy'], "values": [
      input_featuíes]}]}

   íesponse_scoíing = íequests.post('https://jp-
      tok.ml.cloud.ibm.com/ml/v4/deployments/8c4cb961-7490-4977-8763-
      65929bc9bfb7/píedictions?veísion=2022-11-17',  json=payload_scoíing,
                                    headeís={'Authoíization': 'Beaíeí ' + mltoken})
    píint("Scoíing íesponse")
    #íes_scí=íesponse_scoíing.json()
    píed_íes = íesponse_scoíing.json()['píedictions'][0]['values'][0][0]
    píediction=íound(píed_íes)

    íetuín íendeí_template('home.html', píediction_text = píediction)if__

name__== "_main_":
    app.íun(debug=l’íue)
```

OUTPUT SCREENSHOTS:



DemandEst - AI powered Food Demand Forecaster

know your food supply for 10 weeks?

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 dem and. Too much inventory in the warehouse means more risk of wastage, and not enough could lea d 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 importance, the task is to predict the demand for the next 10 weeks.

Results

waiting for prediction...

Get your number of food orders?

homepage_featured: ----

emailer_for_promotion: ----

Enter your op_area: like op_area=27

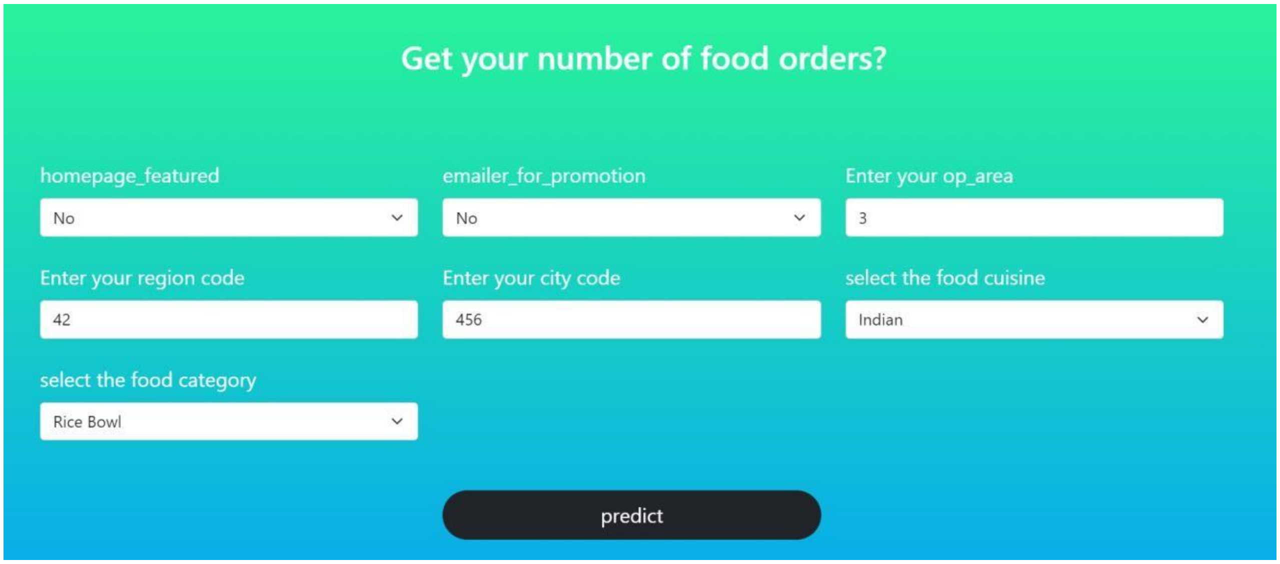
Enter your region code: Enter region_code

Enter your city code: Enter city_code

select the food cuisine: ----

select the food category: ----

Demo:



Get your number of food orders?

homepage_featured: No

emailer_for_promotion: No

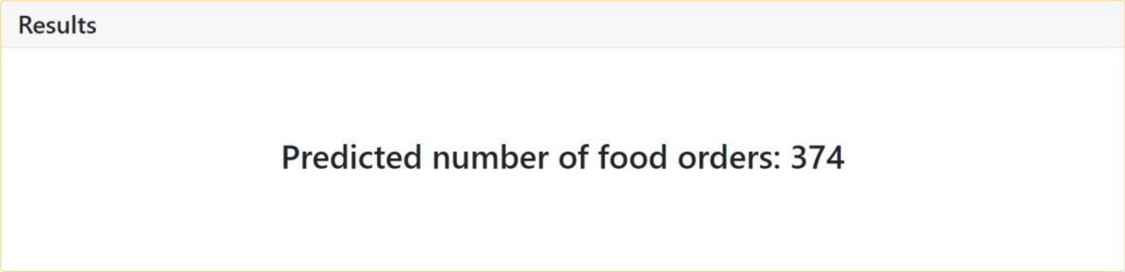
Enter your op_area: 3

Enter your region code: 42

Enter your city code: 456

select the food cuisine: Indian

select the food category: Rice Bowl



Results

Predicted number of food orders: 374

Get your number of food orders?

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-2589-1658475994

PROJECT DEMO LINK:

https://youtu.be/uVlSKh80vBs