

*Project report on*

# **DemandEst - AI Powered Food Demand Forecaster**

|                           |                         |
|---------------------------|-------------------------|
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## **1. INTRODUCTION**

### **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 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.

### **PURPOSE**

The main aim of this project is to create an appropriate machine learning model to 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 food or 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 which is integrated with the model.

## **2. LITERATURE SURVEY**

### **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. Also the recruiting of staff members at the fulfillment center is an prospect wherein the prediction of orders would be beneficial. Although this is a process that can be done manually.

### **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

- Alkhatib, A., & Bernstein, M. (2019, May). Street-level algorithms: A theory at the gaps between policy and decisions. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-13).
- Brown, Tim. (2008). Design Thinking. Harvard Business Review. 86. 84-92, 141.
- Colley, A., & Häkkinen, J. (2018, November). Service Design Methods for Human Computer Interaction. In Proceedings of the 17th International Conference on Mobile and Ubiquitous Multimedia (pp. 563-566).
- 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.

## 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.

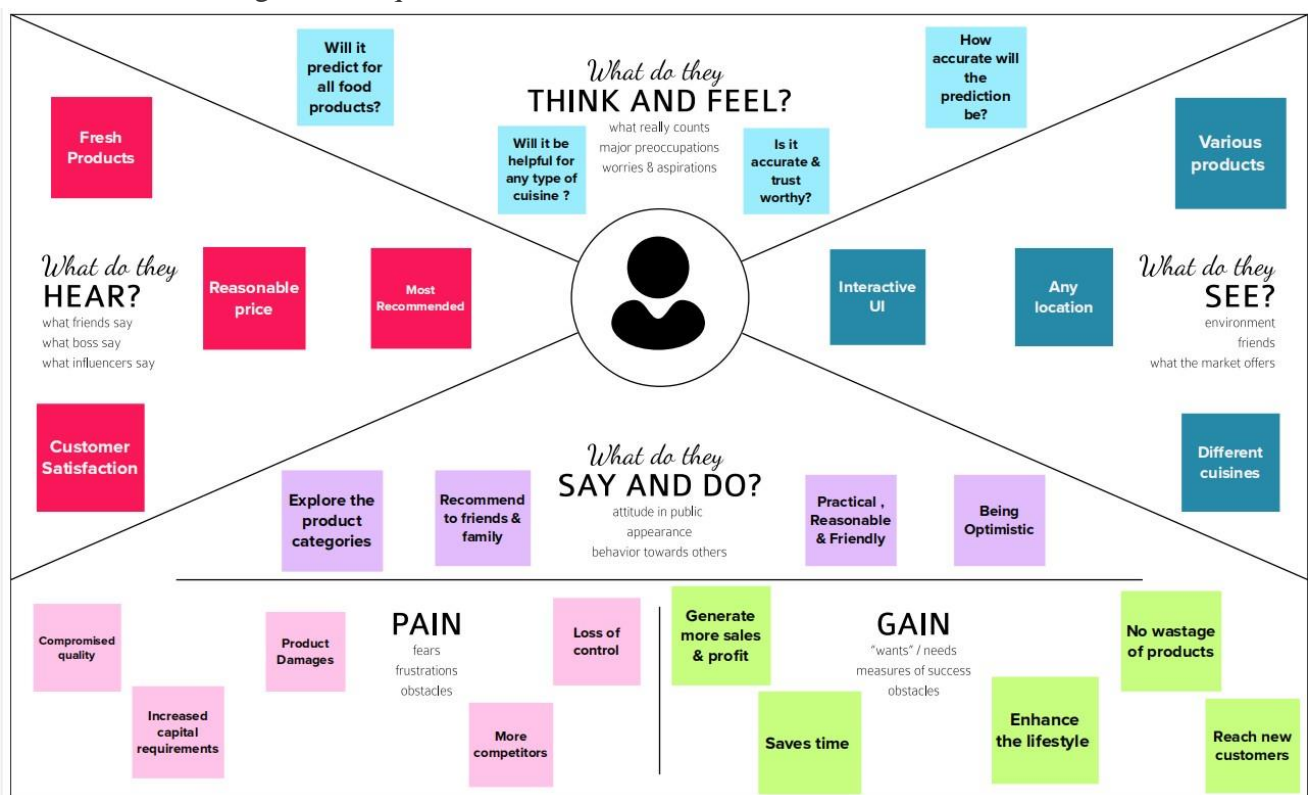
| Problem Statement (PS) | I am (Customer)       | I'm trying to  | But   | Because   | Which makes me feel  |
|------------------------|-----------------------|--|---|---|--|
| PS-1                   | Food Delivery Company | (i) buy raw materials.<br>(ii) Plan to predict the demand.   | (i) It leads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

### 3. IDEATION & PROPOSED SOLUTION

#### 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.

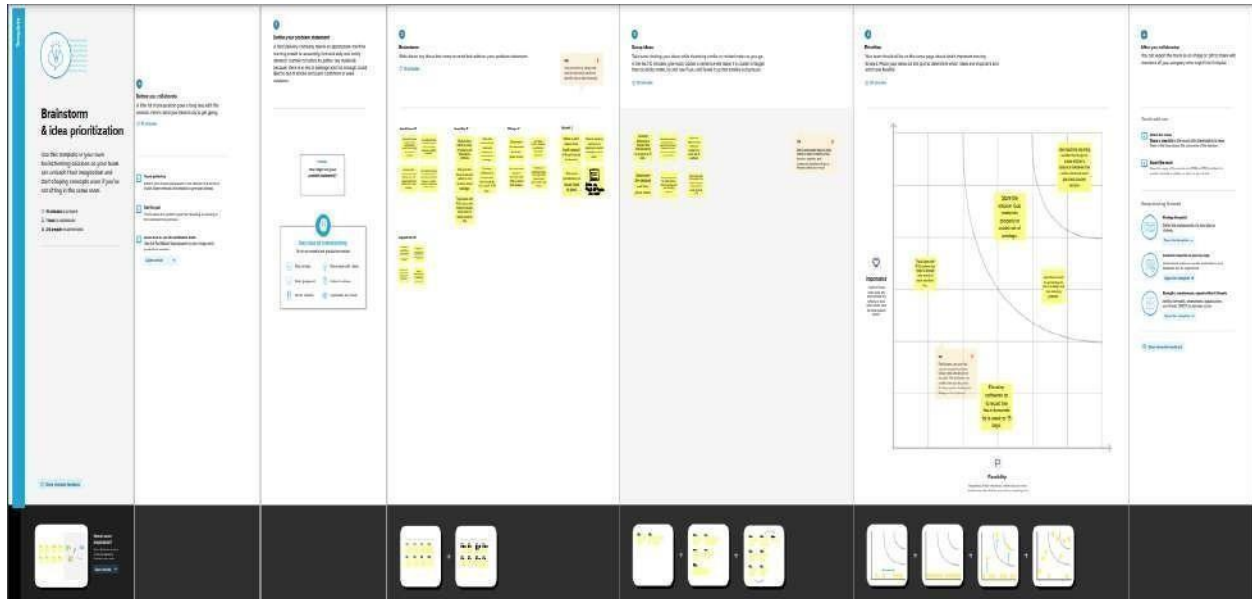
Traditional empathy maps are split into 4 quadrants (Says, Thinks, Does, and Feels), with the user or persona in the middle. Empathy maps provide a glance into who a user is as a whole and are not chronological or sequential.



#### 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.



### 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 support services) necessary to implement the solution described by Vendor in its Proposal.

| S.No. | Parameter                                | Description  |
|-------|--|--|
| 1.    | Problem Statement (Problem to be solved) | 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.                                      |
| 2.    | Idea / Solution description              | The main aim of this project is to create an appropriate machine learning model to forecast the number of orders to gather raw materials for next ten weeks.   |
| 3.    | Novelty / Uniqueness                     | Accurately estimating the demand for the next 10 weeks will help the client to maintain perishable raw materials. Secondly staffing of the centers is also one area wherein accurate demand forecasts are really helpful.  |
| 4.    | Social Impact / Customer Satisfaction    | 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. So these problems of the food delivery service centers will be solved by our model.       |
| 5.    | Business Model (Revenue Model)           | This project will help the food delivery service centers to accurately predict the number of orders for the next 10 weeks which will help them to make necessary arrangements such as perishable raw materials, staffing in centers to avoid any type of losses. |
| 6.    | Scalability of the Solution              | The project focuses in applying methods to forecast the demand for products of a food industry, which directs its sales to the food service market, in order to base the short to medium term production planning.   |



### 3.4 Problem Solution Fit

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



### 4. REQUIREMENT ANALYSIS

#### Functional requirement

Functional requirements may involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a system is 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.<br>Manage their account.<br>Login to the system.<br>Navigate the restaurant's menu.<br>Select an item from the menu.<br>Review their current order.                                    |
| FR-2   | Menu Management system        | Add a new/update/delete vendor to/from the menu.<br>Add a new/update/delete food category to/from the menu.<br>Add a new/update/delete food item to/from the menu.<br>Update price for a given food item. |
| FR-3   | Order Retrieval system        | Retrieve new orders from the database.<br>Display the orders in an easily readable, graphical way.<br>Mark an order as having been processed and remove it from the list of active orders.                |

### Non-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 the operation of a system, rather than specific behaviours.

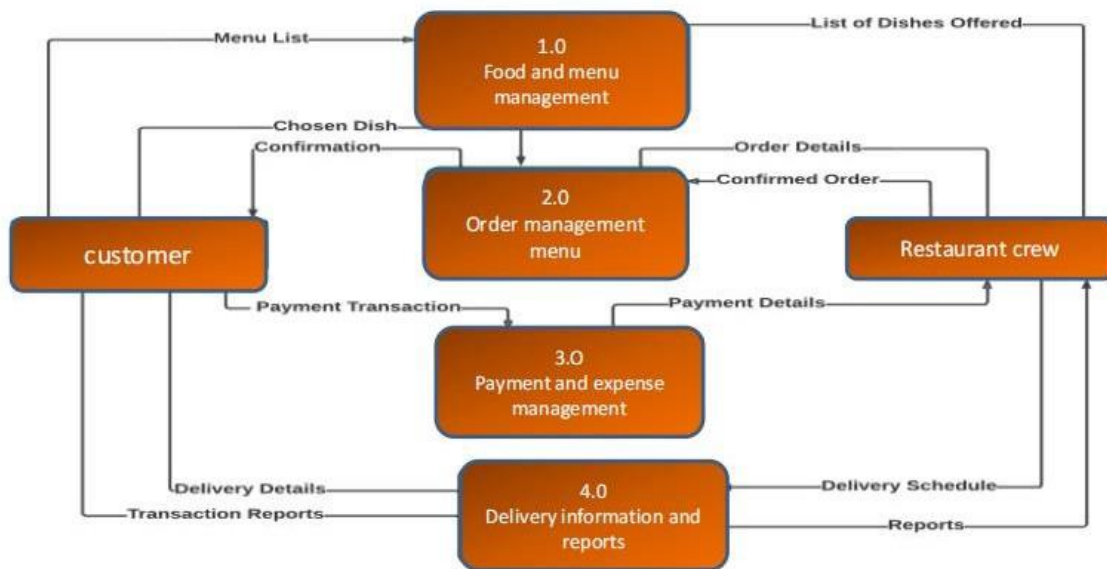
| FR No. | Non-Functional Requirement | Description  |
|--------|----------------------------|--|
| NFR-1  | <b>Usability</b>           | The system should provide an interactive user-friendly interface that is easily understandable for all users.                        |
| NFR-2  | <b>Security</b> 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

|       |                        |   |
|-------|------------------------|---|
| NFR-5 | <b>Availability</b>    | 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 | <b>Configurability</b> | Configurability is just as important as integrability.  |

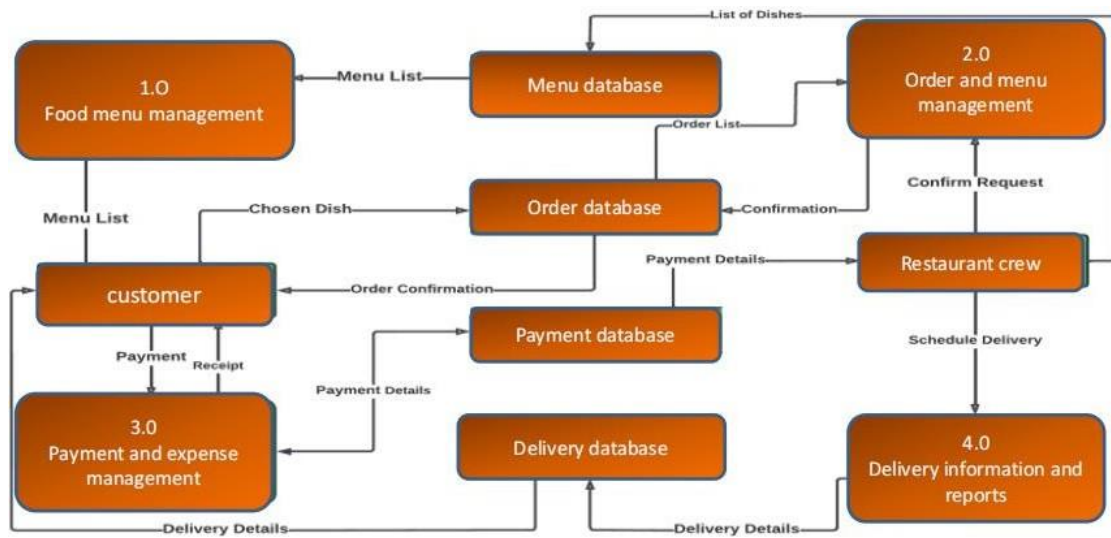
## 5. PROJECT DESIGN

### 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 of the 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

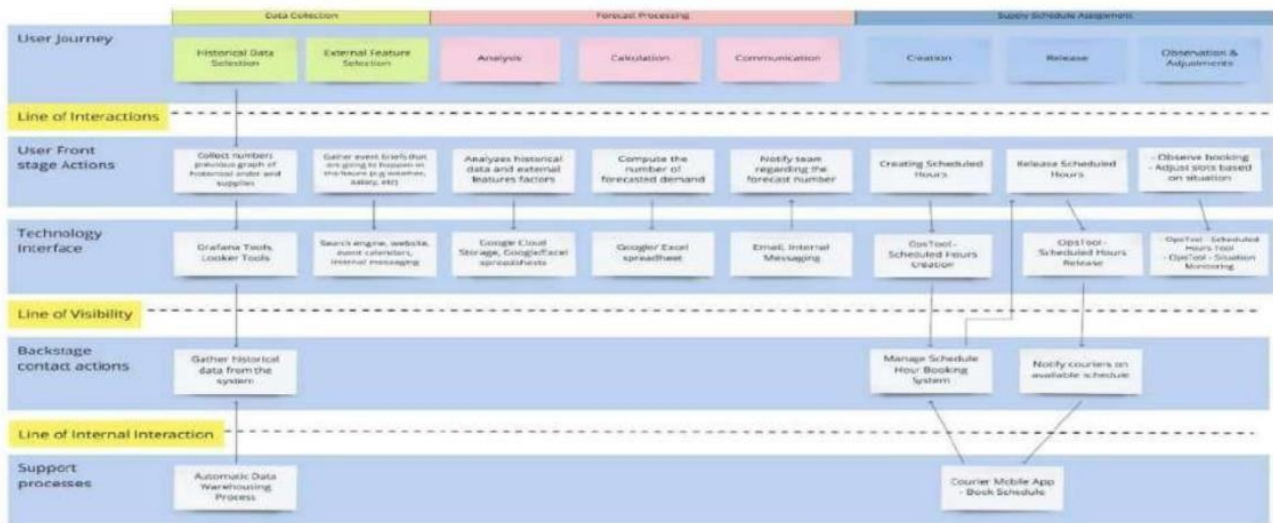


DATA FLOW DIAGRAM –LEVEL 2

## Solution & Technical Architecture

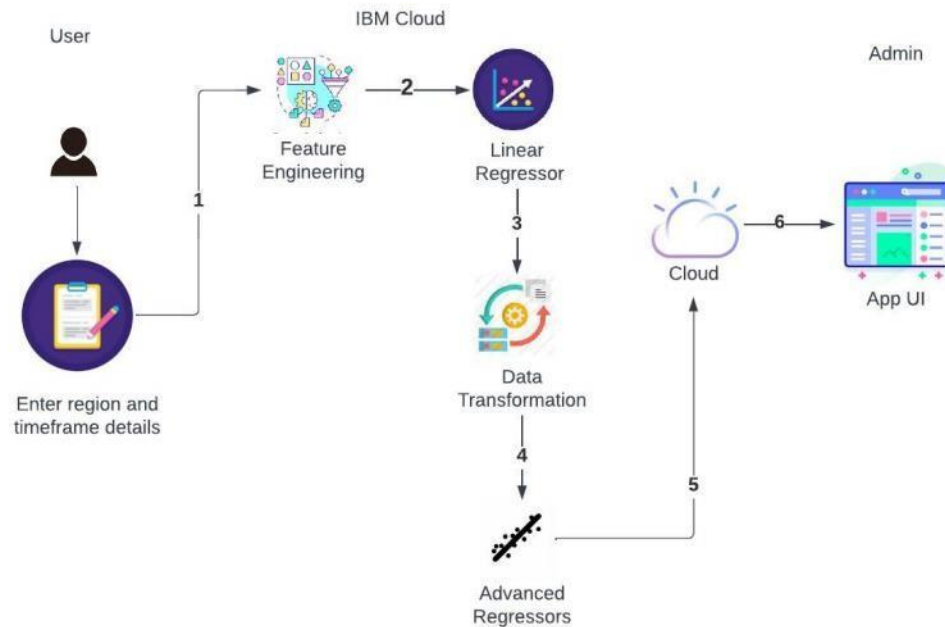
Solution Architecture:

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).



## 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 to the arrangement, interaction, and interdependence of all elements so that system- relevant requirements are met.



## User Stories

A user story is an informal, general explanation of a software feature written from the 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.



| Stage                      | Awareness   | Consideration  | Website Search                              | Order and Waiting   | Receiving                          | Consuming  | Loyalty  |
|----------------------------|---|--|---|---|------------------------------------|--|--|
| <b>Customer Actions</b>    | Plans to Order Out  | User looks through the food choice                     | Browses the entire menu and place the Order | Search for the website that promise delivery under 30mins | Goes to collect the order food     | Unpack the items and enjoy the food                | Order again and share the Experience                         |
| <b>Thoughts</b>            | Recommendation from friends, post on social media, ads in app Store | The App  | Food will be Delivered at home              | Does not want to wait for more than Expected time         | Hope food has excellent Quantity   | Love the amount and taste                          | User Finds the App   |
| <b>Customer Experience</b> | Interested , Hesitant   | Curious , Excited                                      | Interested in exploring Wide food items     | Anticipatory Rush   | Excited and Angry                  | Frustrated   | Satisfied , Excited  |
| <b>Business Goal</b>       | Increase Awareness Interest   | To order a delicious take away as soon as Possible     | Increase Website Visitors                   | For the food to arrive Fast and hot                       | Excited and Angry                  | To Resolve the issue Quickly, Satisfied and Enrich | Generate Positive Reviews and order another take away        |
| <b>Opportunities</b>       | Make use of E-Mail and Social Media Marketing                       | According to taste and Preference , Show them the best | Prioritize Menu Display on Website          | Add a order option on Website                             | Use Clean and Recyclable Packaging | Encourage them to leave a review on Mobile App     | Make Use of Proper Packaging and Branding to make them aware |

## 6. PROJECT PLANNING & SCHEDULING

### Sprint Planning & Estimation

In Scrum Projects, Estimation is done by the entire team during Sprint Planning Meeting. The objective of the Estimation would be to consider the User Stories for the Sprint 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-1 | Registration                  | USN-1             | As a user, I can register for the application by entering my email, password, and confirming my password. | 2            | High     | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-1 |                               | USN-2             | As a user, I will receive confirmation email once I have registered for the application                   | 1            | High     | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-2 |                               | USN-3             | As a user, I can register for the application through Facebook  | 2            | Low      | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-1 |                               | USN-4             | As a user, I can register for the application through Gmail   | 2            | Medium   | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-1 | Login                         | USN-5             | As a user, I can log into the application by entering email & password                                    | 1            | High     | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-1 | Dashboard                     | USN-6             | As a user, I can access the services and information provided in the dashboard                            | 2            | High     | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |
| Sprint-1 | Login                         | USN-7             | As a user, I can log into the web application and access the dashboard                                    | 1            | High     | Vignesh E<br>U.Vivek Krishna<br>Rishabendran R<br>Sri hari Krishnan R |

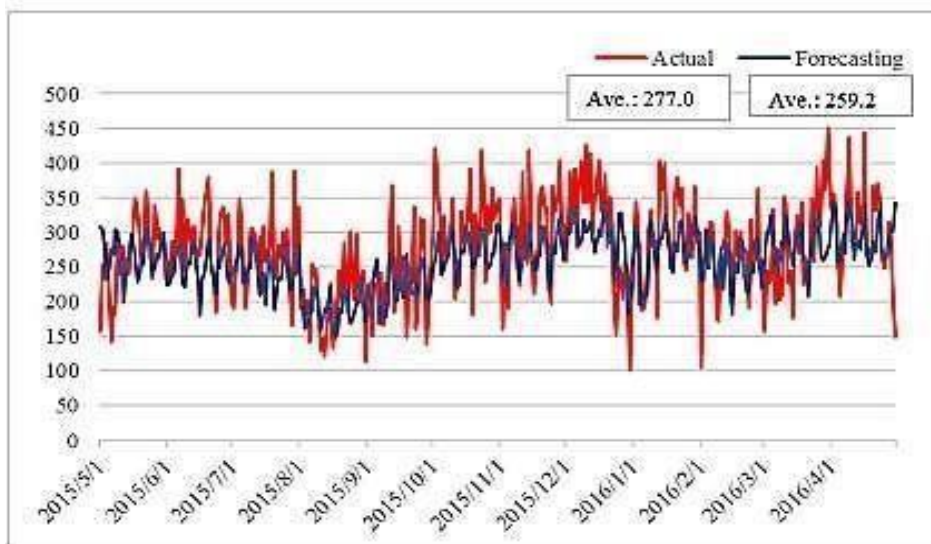
## Sprint Delivery Schedule

A sprint schedule is a document that outlines sprint planning from end to end. It's one of the first steps in the agile sprint planning process—and something that requires adequate research, 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                  | 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                  |

## 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.





## 7. CODING & SOLUTIONING

### 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 file is 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 for testing.

- fulfilment\_center\_info.csv: Contains information of each fulfillment 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 <sup>2</sup> ) |

- 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/...)         |

### Libraries Used

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

### 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 to be 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 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.

### **Feature Engineering**

Feature engineering is the process of using domain knowledge of the data to create features that improve the performance of the machine learning models.

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

- 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 increased and 0 if the price decreased compared to the previous week.
- Quarter : Based on the given number of weeks, derived a new feature named as Quarter which defines the Quarter of the year.
- Year : Based on the given number of weeks, derived a new feature named as Year which defines the Year.

### **Data Transformation**

- Logarithm transformation (or log transform) is one of the most commonly used mathematical transformations in feature engineering. It helps to handle skewed data 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 performance of 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.

### **Evaluation Metric**

The evaluation metric for this competition is  $100 \times \text{RMSLE}$  where RMSLE is Root of Mean Squared Logarithmic Error across all entries in the test set.

### **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 perform well and could not 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.

### **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 least RMSLE of 0.5237

## 8. TESTING

### Test Cases

A test case includes information such as test steps, expected results and data while 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 | <ol style="list-style-type: none"> <li>1.Check all the text boxes, radio buttons, buttons,etc.</li> <li>2.Check the required fields by not filling any data.</li> <li>3.Check user should Register by filling all the required fields.</li> </ol>  |
| Network Accessing device | <ol style="list-style-type: none"> <li>1. Check results on entering valid user ID &amp; Password.</li> <li>2. Check results on entering invalid User ID &amp; Password.</li> <li>3. Check response when a user ID is empty &amp; login button is pressed, and many more.</li> </ol>  |
| Network Accessing device | <ol style="list-style-type: none"> <li>1.If the labels are correctly written and placed or not.</li> <li>2.If the audio/video content is properly audible/visible or not.</li> <li>3.If the color contrast ratio is maintained or not.</li> <li>4.If the control actions for video are working fine or</li> </ol>                      |
| Network Accessing device | <ol style="list-style-type: none"> <li>1.Enter URL(<a href="http://127.0.0.1:5000/">http://127.0.0.1:5000/</a>) and click go</li> <li>2.Click on My Account dropdown button</li> <li>3.Enter InValid username/email in Email text box</li> <li>4.Enter valid password in password text box</li> <li>5.Click on login button</li> </ol> |
| Network Accessing device | <ol style="list-style-type: none"> <li>1.Log in with valid credentials.</li> <li>2.Check the show password feature.</li> <li>3.Check the Remember Me checkbox.</li> <li>4.Check the email.</li> <li>5.Click on login button</li> </ol>   |
| Network Accessing device | <ol style="list-style-type: none"> <li>1.Test Case ID.</li> <li>2.Test Description.</li> <li>3.Assumptions and Pre-Conditions.</li> <li>4.Test Data.</li> </ol>  |
| Network Accessing device | <ol style="list-style-type: none"> <li>1. Keep things simple and transparent.</li> <li>2. Make test cases reusable.</li> <li>3. Peer review is important.</li> <li>4. Keep test cases IDs unique.</li> </ol>   |
| Network Accessing device | <ol style="list-style-type: none"> <li>1. Making sure that functionalities are easy to find</li> <li>2. Navigation should be easy and user-friendly</li> <li>3. Buttons of the application should be visible.</li> <li>4. Verification that font should be of appropriate size so that anyone can read them.</li> </ol>                |
| Network Accessing device | <ol style="list-style-type: none"> <li>1. Making sure that functionalities are easy to find</li> <li>2. Navigation should be easy and user-friendly</li> <li>3. Buttons of the application should be visible.</li> <li>4. Verification that font should be of appropriate size so that anyone can read them.</li> </ol>                |



| Test Data   | Expected Result   | Actual Result       | Status |
|---|---|---------------------|--------|
| <a href="http://127.0.0.1:5000">http://127.0.0.1:5000</a>     | Login/Signup popup should display   | Working as expected | Pass   |
| <a href="http://127.0.0.1:5000">http://127.0.0.1:5000</a>     | Application should show below UI elements:<br>a.email text box<br>b.password text box<br>c.Login button with orange colour<br>d.New customer? Create account link | Working as expected | Pass   |
| Username: jdk@gmail.com<br>password: FDF123                   | User should navigate to user account homepage   | Working as expected | Pass   |
| Username: jdk@gmail<br>password: FDF123                       | Application should show 'Incorrect email or password ' validation message.  | Working as expected | Pass   |
| Username: jdk@gmail.com<br>password:<br>FDF123678686786876876 | Application should show 'Incorrect email or password ' validation message.  | Working as expected | Pass   |
| Username: jdk<br>password:<br>FDF123678686786876876           | Application should show 'Incorrect email or password ' validation message.  | Working as expected | Pass   |
| Username: jdk@gmail<br>password: FDF123                       | Everything that a customer expects from a product, service or organisation.   | Working as expected | Pass   |
| Username: jdk@gmail<br>password: FDF123                       | It should be made clear how many days a delivery might take to process.   | Working as expected | Pass   |
| Username: jdk@gmail<br>password: FDF123                       | It will be commercially accountable for budgeting and financial management and will need to plan, organise and direct all hotel services.                         | Working as expected | Pass   |

## 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      | 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't Fix      | 0         | 0         | 0         | 1         | 1        |
| Totals         | 24        | 9         | 11        | 26        | 71       |

### Test Case Analysis:


| Section            | Total Cases | 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

### Performance Metrics

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

| S.No. | Parameter | Values  | Screenshot  |
|-------|-----------|---|---|
| 1.    | Metrics   | <b>Regression Model:</b><br>MAE 89.10334778841495,<br>MSE - 43129.82977026746,<br>RMSLE -207.67722496765856,<br>R2 score -0.6946496854280233, |  <p><b>Evaluating the model</b></p> <pre>In [33]: from sklearn.metrics import mean_squared_error</pre> <pre>In [34]: RMSE=np.sqrt(mean_squared_error(y_test,pred)) RMSE</pre> <pre>Out[34]: 209.71961740201198</pre> <pre>In [39]: from sklearn import metrics from sklearn.metrics import mean_absolute_error</pre> <pre>In [40]: MSE=print(metrics.mean_squared_error(y_test,pred)) MSE</pre> <pre>43982.31792324628</pre> <pre>In [41]: R2S=print(metrics.r2_score(y_test,pred)) R2S</pre> <pre>0.6886142448276894</pre> <pre>In [42]: MAE=print(mean_absolute_error(y_test,pred))</pre> <pre>89.10334778841495</pre> |



## **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 on the 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 Demand
Forecasting</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 of utmost importance, the task is to predict the demand for the next 10
weeks.</p>
</center>
</div>

```

```
</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 the
op_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 packages
import pandas as pd
import numpy as np
import 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'])

```

```

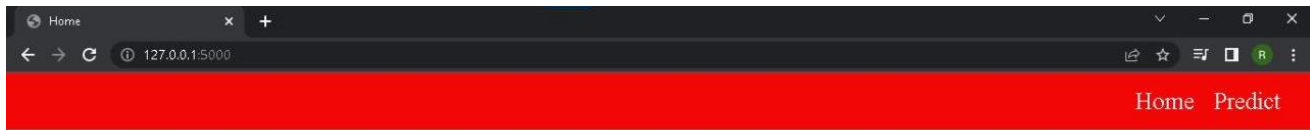
def page():
    return render_template('upload.html')
@app.route('/predict', methods=['GET', 'POST'])def
predict():
    print("[INFO] loading model...")
    model = pickle.load(open('fdemand.pkl', 'rb'))
    input_features = [float(x) for x in request.form.values()]
    features_value = [np.array(input_features)]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

```

## OUTPUT SCREENSHOTS:



# Food Demand Forecasting

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 importance, the task is to predict the demand for the next 10 weeks.



# Food Demand Forecasting

homepage\_featured ▼

emailer\_for\_promotion ▼

Enter the op\_area(2-7)

Cuisine ▼

Enter city\_code

Enter region\_code

Category ▼

Predict

**Number of orders: 169.0**

## GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-14515-1659586459.git>