

NALAIYATHIRAN PROJECTS

TEAM NAME: The Incognito peers

project name: DemandEst - AI powered Food
Demand Forecaster.

project ID: PNT2022TMID25899

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INDEX

1. INTRODUCTION

1. Project Overview
2. Purpose

2. LITERATURE SURVEY

1. Existing problem
2. References
3. Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas
2. Ideation & Brainstorming
3. Proposed Solution
4. Problem Solution fit

4. REQUIREMENT ANALYSIS

1. Functional requirement
2. Non-Functional requirements

5. PROJECT DESIGN

1. Data Flow Diagrams
2. Solution & Technical Architecture
3. User Stories

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning & Estimation
2. Sprint Delivery Schedule
3. Reports from JIRA

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

1. Feature 1
2. Feature 2
3. Database Schema (if Applicable)

8. TESTING

1. Test Cases
2. User Acceptance Testing

9. RESULTS

1. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

1.INTRODUCTION

1.1Project 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 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.

1.2Purpose :

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. 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. A web application is built which is integrated with the model built.

2.LITERATURE SURVEY

2.1Existing problem :

- i) Quality of food may suffer.
- ii) Food delivery services are often late.
- iii) Food may get cold.
- iv) Not the same personal touch as in a restaurant
- v) Person who delivers food may not be trustworthy.
- vi) Food delivery may cost some money.
- vii) You may get lazy.
- viii) Food delivery may contribute to social isolation.

2.2References :

- 1.)PAPER TITLE: Using Technology in Smart and Intelligent Food Packages as a Communication al Tool with Consumers.
- 2.)PAPER TITLE: Analysis on the safety design of food delivery packaging in the post-epidemic era.
- 3.)PAPER TITLE: IoT-Based Sensing and Communications Infrastructure for the Fresh Food Supply Chain.
- 4)PAPER TITLE: The Analysis of a Chicken-Based Pet Food Supply Chain: a Case Study of Thailand.
- 5)PAPER TITLE: Systematic review for low-cost and automatic packaging machine with UV disinfection applied to food industry.
- 5)PAPER TITLE: Systematic review for low-cost and automatic packaging machine with UV disinfection applied to food industry.
- 7)PAPER TITLE: Food Quality Demand and Monitoring System.
- 8) PAPER TITLE: Daily Food Demand Forecast with Artificial Neural Networks: Kırıkkale University Case.

9) PAPER TITLE: The design of an intelligent food consumption data collection and analysis system.

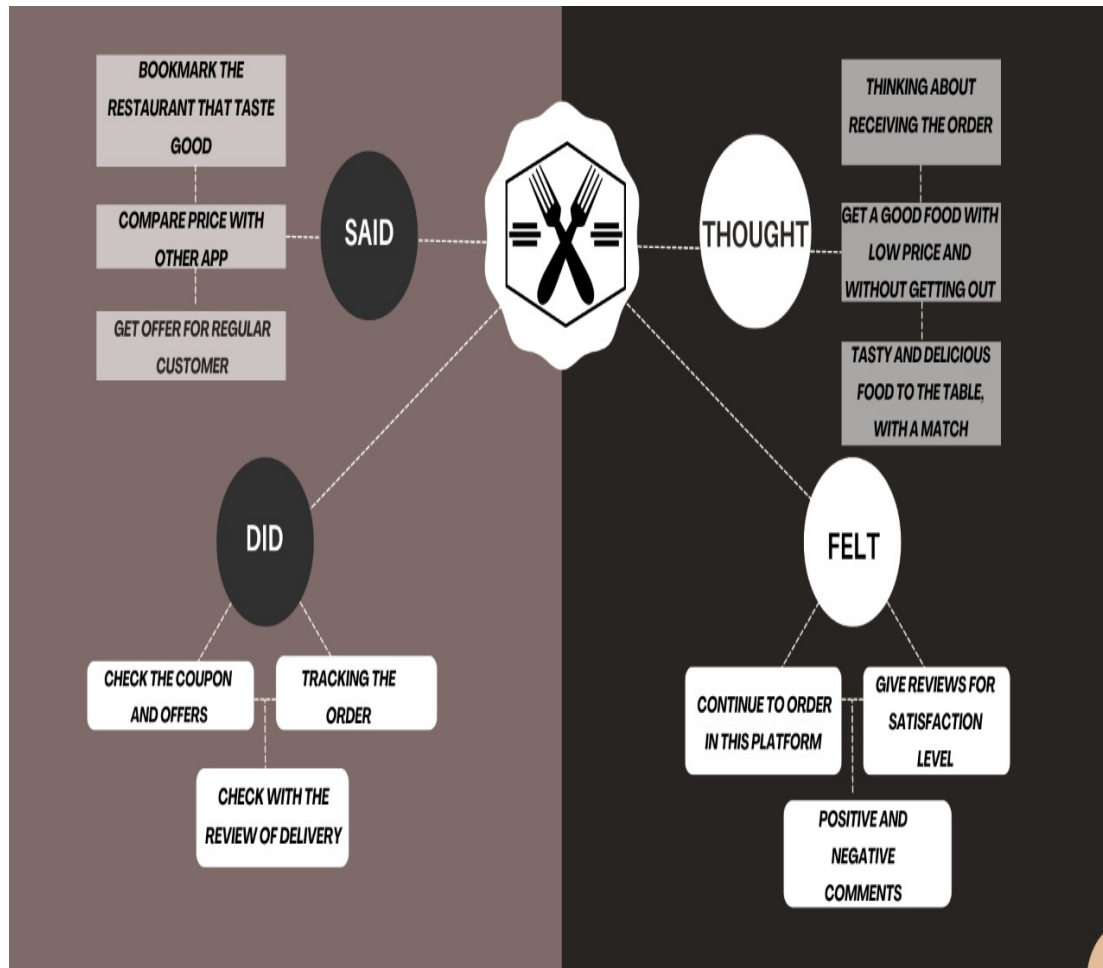
10) PAPER TITLE: Food demand prediction using machine learning.

2.3 Problem Statement Definition :

problem of unreliable data on production and unrecorded trade is unavoidable, but may be serious for many of the most food insecure. The countries in sub-Saharan Africa. The current crisis in Southern Africa highlights this issue. Malawi appears to have been one of the twelve best-performing countries since the early 1990s in improving food security. However, there is currently much debate about the reliability of food production data, particularly for roots and tubers in this country. Trends for countries in which these are important staples, especially in subsistence, and comparisons between these and other countries are a source of ambiguity

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:

2

Brainstorm
Write down any ideas that come to mind that address your problem statement.
⌚ 10 minutes

Pavithran P

System should predict the correct result.	Features should be observed and developed.
System should analyze the weights of food at all times.	It can be managed easily.

Sugbiven M

Useful to people with no prior knowledge.	System should have better navigation system.
It should be useful to animals also.	It should be reviewed and rated by all people.

Sukumar S

It should reach to everyone.	Help and support website should be implemented.
It should forecast at wide range areas.	System servers should always be well performed.

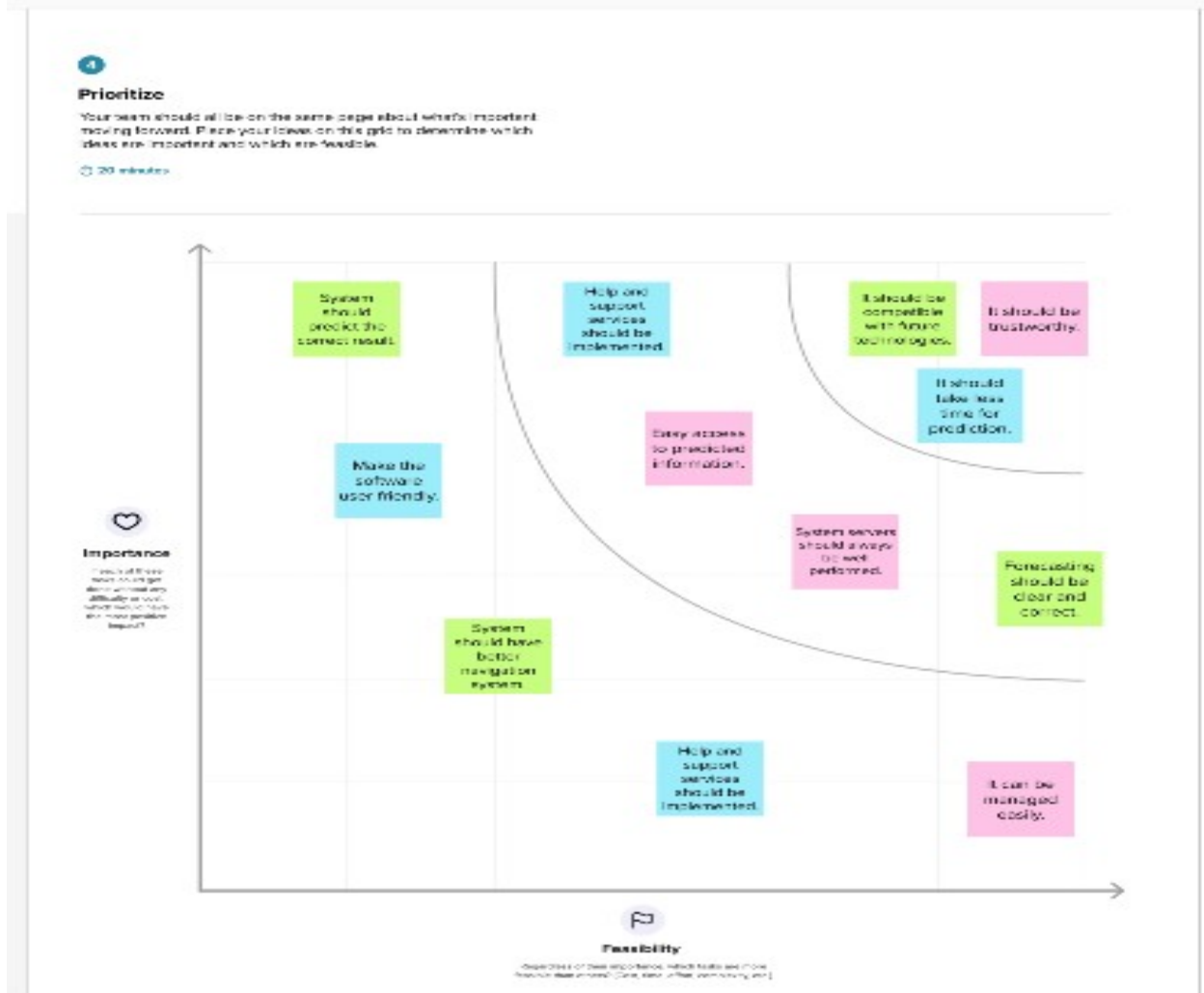
Santhos S

It should be compatible with future technologies.	It should take less time for prediction.
Major causes should be observed easily.	Easy access to predicted information.

Suriya Kumar S

Forecasting should be clear and correct.	It should be trustworthy.
System should find out where food is less affordable.	Make the software user friendly.

3.4 problem solution fit:



3.3Proposed Solution:

S.no	parameter	description
1.	Problem Statement (Problem to be solved)	Your client is a meal delivery company which operates in multiple cities. They have various fulfillment centres in these cities for dispatching meal orders to their customers. The client wants you to help these centres with demand forecasting for upcoming weeks so that these centres will plan the stock of raw materials accordingly. 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. Secondly, staffing of the centres is also one area wherein accurate demand forecasts are really helpful.
2.	Idea / Solution description	The data set is related to a meal delivery company which operates in multiple cities. They have various fulfillment centres in these cities for dispatching meal orders to their customers.The dataset consists of historical data of demand for a product-centre combination for weeks 1 to 145.With the given data and information, the task is to predict the demand for the next 10 weeks(Weeks: 146-

		155) for the centre-meal combinations, so that these fulfilment centres stock the necessary raw materials accordingly.
3.	Novelty / Uniqueness	As an alternative to the traditional demand forecast format, there are opportunities to use market and AI data to assist managers in the S&OP (Sales & Operations Planning) process, as well as in the S&OE (Sales and Operations Execution) process. During the S&OP process, demand forecasting supported by AI facilitates the work of the marketing and sales areas, as well as reducing uncertainty .

4.REQUIREMENT ANALYSIS

4.1Functional requirements:

FR-1

User Registration

Registration through Form

Registration through Gmail

Registration through LinkedIn

FR-2

User Confirmation

Confirmation via Email Confirmation via OTP

FR-3

Executive administration

Guideline of checking the water climate status and administrative consistence like contamination occasion crisis the board, and it incorporates two unique capabilities: early admonition/gauge observing

FR-4

Data handling

File contains water quality metrics for different water bodies

FR-5

Quality analysis

Analyze with the acquired information of the water across various water quality indicator like (PH, Turbidity, TDS, Temperature) using different models.

FR-6

Model prediction

Confirming based on water quality index and shows the machine learning prediction (Good, Partially Good, Poor) with the percentage of presence of various parameter.

FR-7

Remote Visualization

Visualization through charts based on present and past values of all the parameter for future forecast.

FR-8

Notification services

Confirming through notification of water status prediction with parameter presence along with timestamp.

4.2 Non-Functional requirements:

NFR-1

Usability

The system provides a natural interaction with the users. Accurate water quality prediction with short time analysis and provide prediction safe to drink or not using some parameters and provide a great significance for water environment protection.

NFR-2

Security

The model empowers with the high security framework as the client's information won't be shared to the next

NFR-3

Reliability

The framework is entirely solid as it can keep going for extensive stretch of time when it is all around kept up with.

The model can be stretched out in enormous scope by expanding the datasets.

NFR-4

Performance

Our framework ought to run on 32 cycle (x86) or 64 digit (x64) Double center 2.66-GHZ or quicker processor.
It shouldn't surpass 2 GB Slam.

NFR-5

Availability

The framework ought to be accessible for the span of the client access the framework until the client end the entrance.

The framework reaction to demand of the client quicker than expected and the recuperation is done is less time.

NFR-6

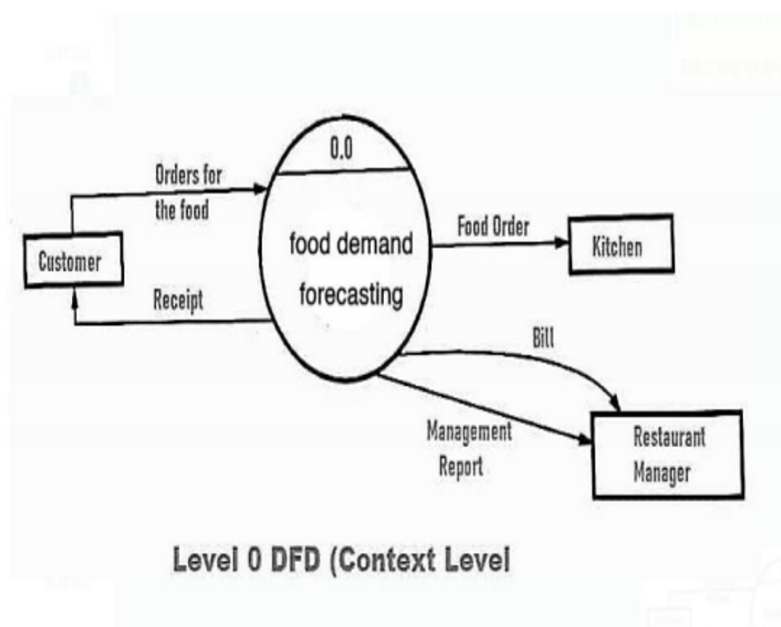
Scalability

It gives a productive result and can increment or lessening the exhibition of the framework in light of the datasets.

5.PROJECT DESIGN

5.1DATA FLOW DIAGRAMS:

A data flow diagram (DFD) maps out the flow of information for any process or system.They are often elements of a formal methodology such as Structured Systems Analysis and Design Method (SSADM).



5.2Solution & Technical Architecture

A solutions architect creates the overall technical vision for a specific solution to a business problem. They design, describe, and manage the solution.

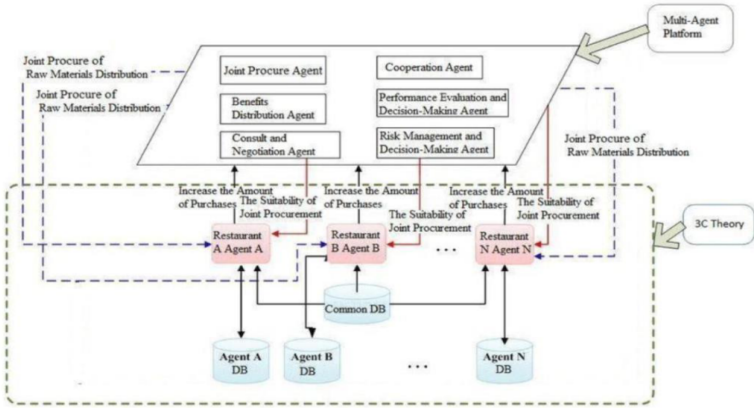
Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	21October,2022
Team ID	PNT2022TMID25899
Project Name	Demand Est. -AI Powered Food Demand Forecaster
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Example: Order processing during pandemics for offline mode



5.3User 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.

Date	17 october 2022
Team ID	PNT2022TMID25899
Project Name	Demand Est – AI Powered Food Demand Forecaster.
Maximum Marks	4 Marks

User Stories For DemandEst

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 register & access the dashboard through Gmail Login	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login to the application by entering respective email & password.	High	Sprint-1
	Dashboard	USN-6	As a user, I can access all the services provided in the dashboard.	I can predict the orders for next 10 weeks and I estimate of raw materials for the same.	High	Sprint-1

Customer (Web user)	Login & Dashboard	USN-8	As a user, I can login through web application and access the resources in the dashboard.	I can login with the credentials required and I can access the services	High	Sprint-1
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
				provided through web application.		
Customer Care Executive	Support	USN-9	As a user I can get support from the help desk and can get my queries cleared.	I can get guidance and any support to use the application.	High	Sprint-2
Administrator	Management	USN-10	As an admin I can maintain the application.	I can perform maintenance of the app even after the release.	Medium	Sprint-1
		USN-11	As an admin I can update the new datasets to the model and train them.	I can periodically update the datasets.	High	Sprint-1
		USN-12	As an admin I can update the features of the app and upgrade it to better versions .	I can perform upgrading of features and versions.	Medium	Sprint-1
		USN-13	As an admin I can maintain all the user details stored and the user's history.	I can maintain the application user's records.	High	Sprint-1

6 . PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Project planning is a high level process that involves defining the overarching framework of a project. It often involves creating a work breakdown structure and takes place before project scheduling.

Project scheduling dives deeper into the details of a project, like tasks to be completed and specific timelines.

Project Planning Phase Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	22 October 2022
Team ID	PNT2022TMID25899
Project Name	Project – DemandEst - AI Powered Food Demand Forecaster
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

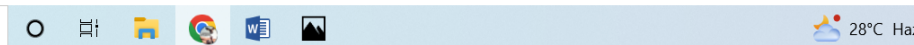
Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
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
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low
Sprint-2		USN-4	As a user, I can register for the application through Gmail	2	Medium
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High
Sprint-1	Dashboard	USN-6	As a user, I can access the services and information provided in the dashboard	2	High

Sprint-1	Login	USN-7	As a user, I can log into the web application and access the dashboard	1	High
Sprint-4	Helpdesk	USN-8	As a user, I can get the guidance from the customer care	1	High
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-3	Management	USN-9	As an administrator, I can collect new datasets and keep the model trained	2	High
Sprint-3		USN-10	As an administrator, I can update other features of the application	2	Medium
Sprint-3		USN-11	As an administrator, I can maintain the information about the user	2	Medium
Sprint-4		USN-12	As an administrator, I can maintain third-party services	1	Low

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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	7	6 Days	24 Oct 2022	29 Oct 2022	7	29 Oct 2022
Sprint-2	4	6 Days	31 Oct 2022	05 Nov 2022	4	05 Nov 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	6	12 Nov 2022
Sprint-4	2	6 Days	14 Nov 2022	19 Nov 2022	2	19 Nov 2022



6.2 SPRINT DELIVERY SCHEDULE

The main event during agile methodology is the sprint, the stage where ideas turn into innovation and valuable products come to life. The path followed by customers through the stages of their relationship with a company, which includes all the interactions between the customer and the business over a variety of channels.

Thoughts icons or emoticons are a picture or image representation of facial expressions indicating a particular emotion—such as a 'smiley face' emoticon to indicate happiness.

PROJECT DESIGN PASE II--CUSTOMER JOURNEY

Date of submission	21-10-2022
Project ID	PNT2022TMID25899
Project name	DemandEst - AI powered Food Demand Forecaster

Stage	Awarness	Consideration	Website Search	Order and Waiting	Receiving	Consuming	Loyalty
Customer Actions	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
Thoughts	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
Customer Experience	Interested , Hesitant	Curious , Excited	Interested in exploring Wide food items	Anticipatory Rush	Excited and Angry	Frustrated	Satisfied , Excited

7.CODING & SOLUTIONING

7.1-7.2Feature 1& Feature 2:

There are a few limits to this exploration. The primary constraint is the low number of test interviewees, because of the OMs' accessibility for this exploration. As this examination is a piece of Wolt's continuous drive, the picked OMs talked with here depended deliberately on their accessibility and experience. Out of the ebb and flow 22 nations working for Wolt, the exploration just consulted OMs from 7 nations. The ongoing settings were not covering every one of the countries that Wolt works in so the review could make them figure process predispositions from these nations. Besides, the information was accumulated through semi-organized

interviews. Consequently, the unwavering quality and precision of the information rely profoundly upon the OMs' mastery when the meeting was directed. It is trying to explore with various arrangements of qualities and elements significant in every country. Notwithstanding, on the grounds that every one of the nations by and large need a similar estimating data to work, the examination would address the majority of the revealed nations' issues. Partners taken as tests are additionally restricted to OMs and do exclude the Business Designer group in Wolt. As the gauging administration would be required across the various groups in Wolt, it would be smarter to take additional examples from various partner needs in an optimal world. Subsequently, the enhancements and issues would be adjusted from various groups and various nations that are reliant or free of Planned Hour. This approach would make much more exhaustive exploration that addresses how the determining system is advancing.

With the exception of Finnish Activities, the wide range of various OMs are situated in various urban communities around the world. The meetings and perceptions were generally done by means of online video gatherings. Consequently, the meetings and perceptions depended on recorded interviews, generally sound, and screens as it were. The greater part of the talked with OMs made sense of the determining system in the web-based interview. Additionally, in light of the fact that the entire anticipating cycle would require a long time to notice, I noticed the OMs just on the particular pieces of the stream, for example, the determining system and the stockpile tasks parts. In the event that there were no general setting requirements, it would be smarter to have the meetings and the perception up close and personal with these OMs. Then, I could notice better on their way of behaving while making these conjectures. These would prompt an itemized perception, both from the issues they make sense of and reality while making the interest figures.

This investigation of interest anticipating administration passes

that on to appreciate the different inner and outside factors that add to the interest guaging administration, further investigation of every country's neighborhood specificities is likewise required. The varieties of neighborhood explicitness and suggestions ought to be considered while pondering how to figure better and how the quantity of interest gauges can help the nearby group expect and anticipate their stockpile tasks and meet their functional focuses in the long haul. Thus, provoking an interest guaging administration that takes care of the estimating administration's neighborhood factors, like climate or eating time ways of behaving in various nations, could essentially improve the help. The ongoing help approach wouldn't fit all business sectors, and there should be a method for redoing the learnings of these variables based on regions in future examination.

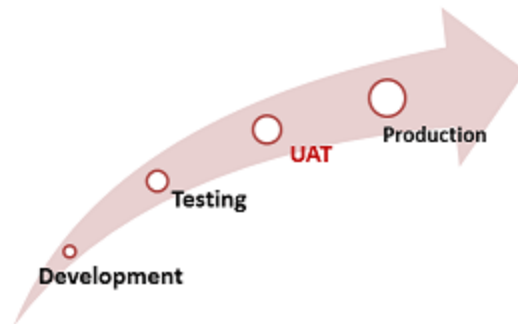
The interest anticipating administration could likewise be extended to the stock determining administration. In light of interest guaging, the OMs need to gauge how much dispatches supply that they ought to must be on the web and convey the food interest in a particular time. In the event that the two pieces of the interest and supply determining estimation are robotized by AI, then, at that point, OMs would screen impromptu or extraordinary cases all the more every now and again. The help would likewise benefit and upgrade their functioning chance to different pieces of the food conveyance activities .

8.TESTING

8.2 user acceptance testing:

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing is done.

Purpose of UAT



The main **Purpose of UAT** is to validate end to end business flow. It does not focus on cosmetic errors, spelling mistakes or system testing. User Acceptance Testing is carried out in a separate testing environment with production-like data setup. It is kind of black box testing where two or more end-users will be involved.

UAT is performed by –

- Client
- End users

Need of User Acceptance Testing

Need of User Acceptance Testing arises once software has undergone Unit, Integration and System testing because developers might have built software based on requirements document by their own understanding and further required changes during development may not be effectively communicated to them, so for testing whether the final product is accepted by client/end-user, user acceptance testing is needed.

1



- Developers have included features on their "own" understanding

2



- Requirements changes "not communicated" effectively to the developers

- Developers code software based on requirements document which is their "own" understanding of the requirements and **may not actually be what the client needs from the software.**
- Requirements changes during the course of the project may not be communicated effectively to the developers.

Prerequisites of User Acceptance Testing:

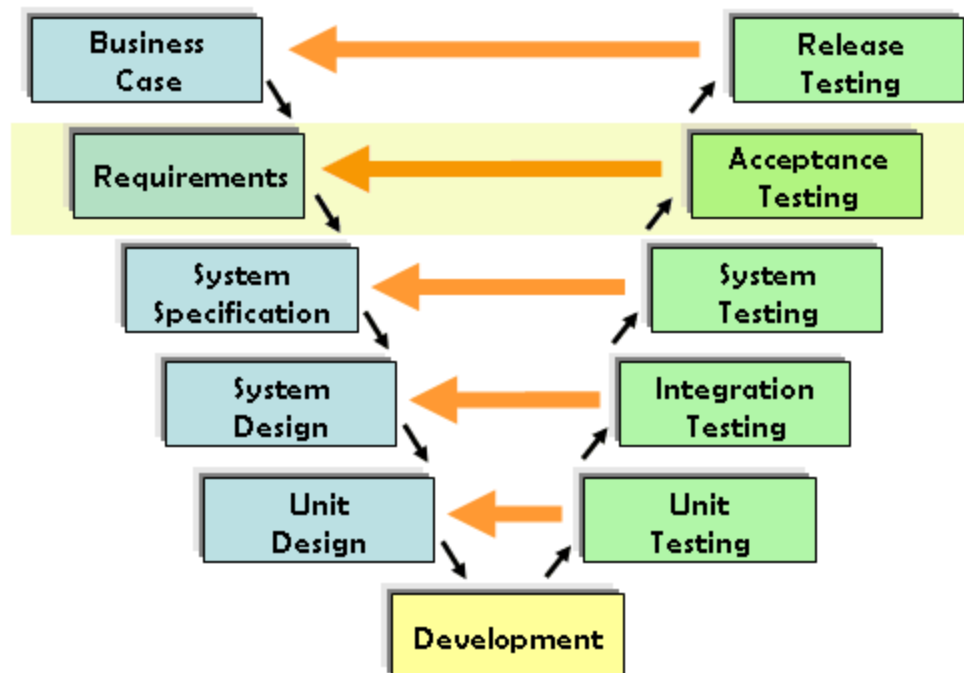
Following are the entry criteria for User Acceptance Testing:

- Business Requirements must be available.
- Application Code should be fully developed
- Unit Testing, Integration Testing & System Testing should be completed
- No Showstoppers, High, Medium defects in System Integration Test Phase –
- Only Cosmetic error is acceptable before UAT
- Regression Testing should be completed with no major defects
- All the reported defects should be fixed and tested before UAT
- Traceability matrix for all testing should be completed
- UAT Environment must be ready

- Sign off mail or communication from System Testing Team that the system is ready for UAT execution

Acceptance Testing and V-Model

In VModel, User acceptance testing corresponds to the requirement phase of the Software Development life cycle(SDLC).



9.RESULTS

9.1performancs metrics:

The RMSE of the naive model is 125236.2. All of the other models will be compared using this baseline error. The lag model has a RMSE of 120976.18 which is a 3.4% decrease in error than the naive model. Although the model is slightly better, the reasoning behind this model is as another baseline depending on the policy of the food delivery company.

The ARIMA model has an RMSE of 105998.30 which is a 15.4% decrease from the error of the baseline naive model and a 12.4% decrease from the error of the lag model. The ARIMA model only uses the order data with lags and moving averages to predict the sales for the next week. The model can be used when the only data collected is the sales data meaning the cost of collecting data and running this model is low compared to other models. However, because of its simplicity the model has the worst error with respect to the models which are not the baseline.

The automatic dynamic regression has an RMSE of 92068.35 which is a 26.5% decrease from the error of the baseline naive model. The automatic dynamic regression takes most of its improvement of the forward stepwise regression however the automatic ARIMA has an order of 0, 0, 0 which essentially finds no model for the residuals of the forward

regression.

The forward stepwise regression model has an R squared of 51.92% and an RMSE of 86833.95. This is a 30.7% decrease from the error of the baseline naive model. This model is

one of the best models since it is an extremely simple model compared to the other ARIMA models.

The best model was the dynamic regression model with the five most important variables from the automatic dynamic regression. The RMSE of this model is 72362.58 which is 42.2% better than the error of the baseline naive model and is 40.2% better than the error of the baseline lag model. This model has the lowest RMSE and was the best model we created for this data. The dynamic regression takes the RMSE improvement from the forward stepwise regression and adds a manually tuned ARIMA model for the residuals which further improves the model error.

10. ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES :

Demand forecasting helps reduce risk and make efficient financial decisions that impact profit margins, cash flow, allocation of resources, opportunities for expansion, inventory accounting, operating costs, staffing, and overall spends. All strategic and operational plans are formulated around forecasting demand. Forecasting projections is one of the toughest things to

get right. Gradual sales or is in high-growth mode. Demand forecasting is the process of using predictive analysis of historical data to estimate and predict customers future demand for a product or service.

10.2 DISADVANTAGES:

Forecasting are never 100% accurate. Lets face it; its hard to predict the future. It can be time -consuming and resource -intensive .Forecasting involves a lot of data gathering ,data organizing, and coordination. It can also be costly .

11. CONCLUSION

This study aims to understand the current demand forecasting service in Wolt and integrate the user-centric design approach to establish a service that supports the forecasting process efficiently. Based on the primary users, the focus group of the research is the OMs in Wolt. The service design methods helped reveal the pain points, wishes, and gaps in redefining how the demand forecast process should move forward in the future. The service design approach helps shape suggestions to match user expectations and needs for the demand forecasting service. The approach explains the OMs' underlying experience when forecasting demand and uncovering the hidden necessities and insights, which are useful to improve the future forecasting service development. With the wisdom of the OMs, the company could suggest better and more robust design solutions to the service. Service design methods also revealed the connection between the service provider and the primary users by clarifying the connection and touchpoints to develop the enhancement ideas. The Affinity Diagram maps that consisted of the OMs insight were useful for uncovering insights and patterns between the OMs on the forecasting process.

Using the diagram, I can cluster the common patterns to understand the current process better. Furthermore, the Persona method displayed the OM's common approach when creating a demand forecasting and supply schedules. The two profiles are Schedule Dependent OMs and Non-Schedule Dependent OMs, each with different approaches and need to gather and process the demand forecasting. These two profiles also differ in how they are using the result of the demand forecasting. The User journey map explained the OM's journey in the demand forecasting cycle. Using the map, I can identify and explore the challenges and opportunities of the current forecasting process with OMs. Moreover, the service blueprint combined all the insights from the previous methods and conveyed all the services' interaction, both the visible and the background process. In the gig-economy industry, planning the right supply to the forecasted demand is one of the most critical factors to reach the efficiency of the giggers and the company cost, as discussed . The extent of this research indicates that the area of order demand forecasting can be effectively improved by automating the process and fine-tuning the results based on external and local factors. In the scope of forecasting service, automated machine learning model-generated results could offer the accuracy and time-efficiency that many companies encounter in this digital era. With the capability to automate the forecasting process and maintenance, the service can be scalable for more country expansion while still bridging the local factors and necessities during the forecasting process. An automated forecasting service would help the OMs become aware of the expected growth changes, which improves the flexibility and precision to prepare the courier supply. By allowing these local OMs to set and tune their local forecasting factors, the forecast results will be more reliable and beneficial for future learnings of the demand forecasting model.

12.FUTURE SCOPE

Predicting future food demand is a critical step for formulating the agricultural, economic and conservation policies required to feed over 9 billion people by 2050 while doing minimal harm to the environment. However, published future food demand estimates range substantially, making it difficult to determine optimal policies. Here we present a systematic review of the food demand literature-including a meta-analysis of papers reporting average global food demand predictions-and test the effect of model complexity on predictions. We show that while estimates of future global kilocalorie demand have a broad range, they are not consistently dependent on model complexity or form. Indeed, time-series and simple income-based models often make similar predictions to integrated assessments (e.g., with expert opinions, future prices or climate influencing forecasts), despite having different underlying assumptions and mechanisms. However, reporting of model accuracy and uncertainty was uncommon, leading to difficulties in making evidence-based decisions about which forecasts to trust. We argue for improved model reporting and transparency to reduce this problem and improve the pace of development in this field.

13.APPENDIX

Food delivery and restaurants benefit from forecasting food demand since it reduces uncertainty and waste increasing margins for the industry. Restaurants in particular need around eighty percent filled-capacity to be profitable and many have not started or partnered with delivery services. By helping restaurants forecast weekly demand we aim to increase the net profit for the industry.

The largest benefit of food demand forecasting is the reduction of inventory, or food waste in the restaurant industry. Food is the highest cost for a restaurant, especially perishable food with a low shelf life. Therefore, reducing food waste has a large environmental and monetary effect for a given restaurant. It also has a marketing benefit, depending on the city the company is located in, since it can be marketed as a green business. Forecasting also helps with understocking since either too much inventory or not enough inventory can lead to customers choosing another restaurant.

Forecasting sales in a given week can help with labor scheduling and cost. The restaurant industry employs around fifteen million people in the US. Since many workers in the industry are part time or depend on hours set around a week to a month ahead some labor cost can be reduced if demand is predicted to be low in a future week or increased if the demand is expected to spike over the average orders.

Reducing uncertainty is a benefit for forecasting in any industry. However, uncertainty in the restaurant and delivery industry has an effect on real lives, since many service jobs in the US are restaurant jobs. Excluding food and labor costs, which are the two largest costs in running a restaurant, reducing uncertainty can help restaurant owners arrange payroll,

utilities, marketing and expansion plans. The savings from forecasting demand can be used for expansion or to add new menu items to draw more customers.

Forecasting food demand has a direct effect on restaurant profits by reducing food and labor costs and reducing uncertainty for other costs. Implementing the forecasting methods in this paper will help the restaurant and food delivery industries manage profits. This project focuses on one food delivery client, such as Favor, which delivers food in many different cities through distribution networks and fulfillment centers, i.e. local restaurants.

8.1 source code:

IBM REPORT(2).