Business Requirement Document (BRD)

Project Name : Food Quantity Prediction Analysis Using SQL

1. Project Overview

1.1 Purpose

The purpose of this project is to develop a predictive analytics model that forecasts daily food quantity requirements for an office canteen based on historical employee attendance and food order data. This will help optimize food procurement, reduce wastage, and improve cost efficiency.

1.2 Project Overview

In PSL IT Company , after the COVID-19 pandemic, the working environment transitioned to a hybrid model where employees work 2 days from the office and 3 days from home out of a 5-day workweek. This hybrid setup created a challenge for the company's canteen operations—as it became difficult to accurately estimate how many employees would be present in the office on any given day to prepare appropriate food quantities.

Due to inaccurate forecasting, the canteen either over-prepared or under-prepared food, resulting in increased food wastage, cost inefficiencies, and employee dissatisfaction.

To address this, the Food Quantity Prediction Analysis project is initiated. Using historical data from the last 3 months, including employee attendance and food order history, the system aims to predict the quantity of Veg and Non-Veg meals required for each day of the week, location-wise.

Example Output:

- If Day = Monday and Location = Mumbai, predict:
  - Veg Meals Required = 120
  - Non-Veg Meals Required = 80

The project includes generating SQL scripts and Power BI visuals for graphical representation of daily food quantity requirements from Monday to Friday

1.2 Business Objectives

- Improve the accuracy of food demand prediction.
- Reduce food waste and optimize inventory.

- Ensure employee satisfaction by maintaining adequate food availability.
- Improve vendor coordination by providing predictive demand insights.

1.3 Scope

- Collect and analyze employee attendance and food order data.
- Develop a machine learning model to predict food quantity requirements.
- Provide real-time dashboards and reports for decision-making.
- Integrate with the existing canteen management system.

2. Key Stakeholders

Role	Responsibility
HR Department	Provides employee attendance data.
Canteen Manager	Manages daily food orders and monitor's demand.
Data Science Team	Develops predictive models for food demand.
IT Team	Ensures data integration and system implementation.
Food Vendors	Adjusts supply based on predictions.

3. Functional Requirements

ID	Requirement Description
FR1	The system should collect daily employee attendance data.
FR2	The system should track canteen food order details.
FR3	The model should predict food demand based on historical trends.
FR4	The system should provide a dashboard with predictive insights.
FR5	Alerts should be generated for unusual demand variations.

4. Data Requirements

4.1 Data Sources

- Employee attendance records.

	A	B	C	D	E	F	G	H
1	Date	Employee ID	Employee Name	Department	Location	Status	Check-in Time	Check-out Time
2	01-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
3	02-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
4	03-10-2024	E1000	Sneha Nair	Marketing	Delhi	Absent		
5	04-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
6	07-10-2024	E1000	Sneha Nair	Marketing	Delhi	Present	08:07:00	16:12:00
7	08-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
8	09-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
9	10-10-2024	E1000	Sneha Nair	Marketing	Delhi	Present	09:25:00	16:19:00
10	11-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
11	14-10-2024	E1000	Sneha Nair	Marketing	Delhi	Present	10:46:00	16:43:00
12	15-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
13	16-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
14	17-10-2024	E1000	Sneha Nair	Marketing	Delhi	Present	09:09:00	16:17:00
15	18-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
16	21-10-2024	E1000	Sneha Nair	Marketing	Delhi	Absent		
17	22-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
18	23-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		
19	24-10-2024	E1000	Sneha Nair	Marketing	Delhi	Present	09:30:00	17:45:00
20	25-10-2024	E1000	Sneha Nair	Marketing	Delhi	Work from Home		

- Canteen food order history.

	Order ID	Order Date	Vendor ID	Vendor Name	Employee ID	Location	Item	Bill Amount	Status
2	O5102	2024-10-01	V3	Food Corner 3	E1002	Hyderabad	Veg	270	Completed
3	O5146	2024-10-01	V5	Food Corner 5	E1003	Chennai	Veg	215	Canceled
4	O5194	2024-10-01	V3	Food Corner 3	E1004	Jaipur	Veg	268	Completed
5	O5239	2024-10-01	V4	Food Corner 4	E1005	Pune	Veg	222	Completed
6	O5282	2024-10-01	V4	Food Corner 4	E1006	Kolkata	Veg	213	Completed
7	O5332	2024-10-01	V5	Food Corner 5	E1007	Delhi	Non-Veg	203	Canceled
8	O5423	2024-10-01	V4	Food Corner 4	E1009	Jaipur	Veg	160	Canceled
9	O5472	2024-10-01	V5	Food Corner 5	E1010	Jaipur	Non-Veg	295	Completed
10	O5518	2024-10-01	V1	Food Corner 1	E1011	Kolkata	Veg	283	Completed
11	O5567	2024-10-01	V4	Food Corner 4	E1012	Jaipur	Non-Veg	219	Canceled
12	O5798	2024-10-01	V1	Food Corner 1	E1017	Lucknow	Non-Veg	117	Canceled
13	O5846	2024-10-01	V2	Food Corner 2	E1018	Mumbai	Non-Veg	215	Canceled
14	O5941	2024-10-01	V3	Food Corner 3	E1020	Kolkata	Veg	249	Completed
15	O6085	2024-10-01	V2	Food Corner 2	E1023	Kolkata	Veg	232	Canceled
16	O6132	2024-10-01	V2	Food Corner 2	E1024	Chennai	Veg	118	Completed
17	O6455	2024-10-01	V5	Food Corner 5	E1031	Mumbai	Veg	229	Completed
18	O6603	2024-10-01	V2	Food Corner 2	E1034	Hyderabad	Veg	259	Canceled
19	O6799	2024-10-01	V5	Food Corner 5	E1038	Lucknow	Veg	134	Completed
20	O6891	2024-10-01	V4	Food Corner 4	E1040	Delhi	Veg	143	Canceled

- Public holiday and festival data.

	Date	Event/Holiday	Location	ImpactFactor
2	02-10-2024	Gandhi Jayanti	India	10
3	01-11-2024	Diwali	India	10
4	25-12-2024	Christmas	India	10
5	16-01-2025	Team Outing	Chennai	8
6	04-02-2025	Team Outing	Hyderabad	8
7	16-12-2024	Product Launch	Bangalore	10
8	10-12-2024	CSR Event	Hyderabad	5
9	29-01-2025	Training Session	Delhi	5
10	23-12-2024	Product Launch	Hyderabad	10
11	13-11-2024	CSR Event	Chennai	5
12	27-09-2024	Product Launch	Mumbai	10
13	11-02-2025	Training Session	Hyderabad	5
14	17-11-2024	Training Session	Hyderabad	5
15				

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4.2 ImpactFactor

Based on your provided event data, here's a **master table** for the ImpactFactor column that classifies the values into **Impact Range**, **Meaning**, and **Percentage Impact for Food Quantity Adjusted Prediction**:

ImpactFactor	Meaning	Percentage Impact on Food Quantity	Formula to Adjust Quantity
-10	Demand Decrease - Major holidays, product launches, Weather Condition- heavy rain	100% decrease	AdjQty = AvgQty * (1 - 1.00)
-9		90% decrease	AdjQty = AvgQty * (1 - 0.90)
-8		80% decrease	AdjQty = AvgQty * (1 - 0.80)
-7		70% decrease	AdjQty = AvgQty * (1 - 0.70)
-6		60% decrease	AdjQty = AvgQty * (1 - 0.60)
-5		50% decrease	AdjQty = AvgQty * (1 - 0.50)
-4		40% decrease	AdjQty = AvgQty * (1 - 0.40)
-3		30% decrease	AdjQty = AvgQty * (1 - 0.30)

-2		20% decrease	AdjQty = AvgQty * (1 - 0.20)
-1		10% decrease	AdjQty = AvgQty * (1 - 0.10)
0	Neutral (No event)	0% change (default)	AdjQty = AvgQty * 1
1	Demand Increase - External guest visit ,Training Session / CSR, In-house training ,Project Session, Visitors Coming	10% increase	AdjQty = AvgQty * (1 + 0.10)
2		20% increase	AdjQty = AvgQty * (1 + 0.20)
3		30% increase	AdjQty = AvgQty * (1 + 0.30)
4		40% increase	AdjQty = AvgQty * (1 + 0.40)
5		50% increase	AdjQty = AvgQty * (1 + 0.50)
6		60% increase	AdjQty = AvgQty * (1 + 0.60)
7		70% increase	AdjQty = AvgQty * (1 - 0.70) *(possibly miscategorized)*
8		80% increase	AdjQty = AvgQty * (1 + 0.80)
9		90% increase	AdjQty = AvgQty * (1 + 0.90)
10		100% increase	AdjQty = AvgQty * (1 + 1.00)

Explanation:

- The range spans from **-10 to 10**, split into **20 buckets**.
- **Negative = demand Decrease**, **Positive = demand Increase**.
- **Higher absolute value = stronger impact**.
- Ranges are adjusted symmetrically for more accurate and scalable prediction models.

SQL Case Statement

```
CASE ImpactFactor

    WHEN -10 THEN AvgQty * (1 - 1.00)  -- -10 → Reduce by 100% → (1 - 1.00) = 0.00

    WHEN -9  THEN AvgQty * (1 - 0.90)  -- -9  → Reduce by 90%  → (1 - 0.90) = 0.10
```

```
    WHEN -8  THEN AvgQty * (1 - 0.80)  -- -8  → Reduce by 80%  → (1 - 0.80) = 0.20
    WHEN -7  THEN AvgQty * (1 - 0.70)  -- -7  → Reduce by 70%  → (1 - 0.70) = 0.30
    WHEN -6  THEN AvgQty * (1 - 0.60)  -- -6  → Reduce by 60%  → (1 - 0.60) = 0.40
    WHEN -5  THEN AvgQty * (1 - 0.50)  -- -5  → Reduce by 50%  → (1 - 0.50) = 0.50
    WHEN -4  THEN AvgQty * (1 - 0.40)  -- -4  → Reduce by 40%  → (1 - 0.40) = 0.60
    WHEN -3  THEN AvgQty * (1 - 0.30)  -- -3  → Reduce by 30%  → (1 - 0.30) = 0.70
    WHEN -2  THEN AvgQty * (1 - 0.20)  -- -2  → Reduce by 20%  → (1 - 0.20) = 0.80
    WHEN -1  THEN AvgQty * (1 - 0.10)  -- -1  → Reduce by 10%  → (1 - 0.10) = 0.90
    WHEN  0  THEN AvgQty               --  0  → No change      → multiplier = 1.00
    WHEN  1  THEN AvgQty * (1 + 0.10)  --  1  → Increase by 10% → (1 + 0.10) = 1.10
    WHEN  2  THEN AvgQty * (1 + 0.20)  --  2  → Increase by 20% → (1 + 0.20) = 1.20
    WHEN  3  THEN AvgQty * (1 + 0.30)  --  3  → Increase by 30% → (1 + 0.30) = 1.30
    WHEN  4  THEN AvgQty * (1 + 0.40)  --  4  → Increase by 40% → (1 + 0.40) = 1.40
    WHEN  5  THEN AvgQty * (1 + 0.50)  --  5  → Increase by 50% → (1 + 0.50) = 1.50
    WHEN  6  THEN AvgQty * (1 + 0.60)  --  6  → Increase by 60% → (1 + 0.60) = 1.60
    WHEN  7  THEN AvgQty * (1 + 0.70)  --  7  → Increase by 70% → (1 + 0.70) = 1.70
    WHEN  8  THEN AvgQty * (1 + 0.80)  --  8  → Increase by 80% → (1 + 0.80) = 1.80
    WHEN  9  THEN AvgQty * (1 + 0.90)  --  9  → Increase by 90% → (1 + 0.90) = 1.90
    WHEN 10  THEN AvgQty * (1 + 1.00)  -- 10  → Increase by 100% → (1 + 1.00) = 2.00
    ELSE AvgQty                        -- Default → No change
END AS AdjQty
```

4.2 Data Attributes

Data Attribute	Description
Employee ID	Unique identifier for employees.
Date	Date of attendance or food order.
Attendance Status	Present, Absent, Work From Home, etc.
Food Order Status	Completed, Canceled, etc.
Item Type	Veg, Non-Veg food ordered.
Quantity Ordered	Number of items ordered per employee.

5. Technical Requirements

- Database: **MS SQL Server** for data storage.
- Machine Learning: Python (Pandas, Scikit-Learn) for predictive modeling.(**T-SQL**)
- Visualization: Power BI or Tableau for dashboards.(**Excel**)
- API Integration: REST API for real-time data updates. (**No**)

6. Risks and Mitigation

Risk	Mitigation Strategy
Data Inconsistency	Implement data validation and cleaning processes.
Prediction Accuracy	Use advanced ML models and refine based on feedback.
System Downtime	Ensure high availability with cloud-based deployment.

7. Success Criteria

- At least 90% accuracy in food demand prediction.
- Reduction in food wastage by 20% within six months.
- Improved employee satisfaction in food availability surveys.

8. SQL Script for Data Prediction

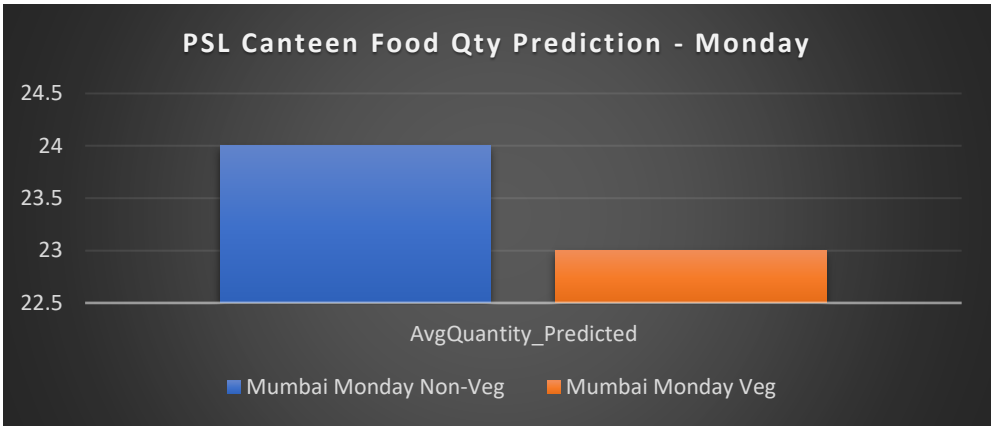
```
--Exec Sp_WeeklyFoodQtyPrediction 'Mumbai','Monday'
ALTER PROCEDURE Sp_WeeklyFoodQtyPrediction
(
 @City VARCHAR(20)
,@TomorrowWeekDay VARCHAR(10)=NULL
```

```
)
AS
BEGIN
	Declare @NoOfWeeks Int
	Set @NoOfWeeks=(select count(distinct (DatePart(week,  a.date)))
	from Employee_Attendance a
	where Status='Present'
	and a.Location=@City
	and DATENAME(WEEKDAY, a.date)=@TomorrowWeekDay
	)

	Select Location,WeekDay,Item,
	sum(OrderQty /@NoOfWeeks) as AvgQuantity_Predicted
	from (
		select o.Location,
		DATENAME(WEEKDAY, o.Order_Date) As WeekDay,
		o.Item,
		count(o.Order_ID) as OrderQty
		from Employee_Food_Orders o
		Inner join Employee_Attendance a on
o.Employee_ID=a.Employee_ID and
				o.Order_Date=a.Date and a.Status='Present'
		left join Employee_Events_Holidays e on o.Order_Date=e.Date and
			e.Location=o.Location
		where o.Location=@City
		and DATENAME(WEEKDAY, a.date)=@TomorrowWeekDay
		and e.date IS NULL
		group by o.Location,DATENAME(WEEKDAY, o.Order_Date),o.Item
	)A
	group by Location,WeekDay,Item
	order by Location,WeekDay
END
```

9. Project Output

Output			
PSL Canteen Food Qty Prediction Week			
Location	WeekDay	Item	AvgQuantity_Predicted
Mumbai	Monday	Non-Veg	24
Mumbai	Monday	Veg	23



10. Approval & Sign-Off

Name Designation Signature Date