UNIVERSITY OF ASIA PACIFIC

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Title: Database Systems Lab

Course Code: CSE 212

Project Name : Agriculture Yield Prediction Management System

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AGRITULTURE YIELD PREDICTION MANAGEMENT SYSTEM

Topic

The Agriculture Yield Production Management System (AYPMS) is a smart tool that helps farmers improve their work and grow more crops efficiently. It technology like data analysis to keep track of important factors like soil quality, weather, crop growth, and pest problems. With real-time updates, AYPMS helps farmers make better decisions for their fields. This system is very useful for sustainable farming because it ensures resources like water and fertilizers are used wisely. In today's world, where climate change, limited resources, and a growing population are big challenges, tools like AYPMS are essential. By collecting and analyzing data from various sources, it helps farmers predict crop yields more accurately, cut costs, and boost food production to meet global needs.

Description

An agriculture yield prediction management system is a comprehensive database or repository that collects, organizes, and manages various types of agricultural data to support the efficient and accurate forecasting of crop yields. This type of system is designed to handle the vast and complex relationships between different types of data, which can include:

1. Information on soil quality and composition: Detailed data about soil nutrients, pH levels, and other factors that impact crop growth.

2. Weather and climate data: Historical and real-time data about rainfall, temperature, humidity, and other climatic conditions essential for predicting agricultural yields.

3. Crop and seed data: Information about different crops, seed varieties, growth patterns, and optimal planting and harvesting times.

4. Fertilizer and pesticide usage: Data on the types and amounts of fertilizers and pesticides applied, their effects on crops, and the timing of applications.

5. Pest and disease management: Records of pest infestations and disease outbreaks, including preventive and curative measures taken.

By utilizing a yield prediction management system, agricultural enterprises and farmers can overcome issues related to data inconsistency, where different datasets may exist in various formats across multiple sources. This level of integration helps in automating various processes, from data collection and analysis to generating forecasts and reports. With better access to organized and precise data, decision-makers can optimize planting schedules, resource allocation, and risk management strategies, leading to more efficient agricultural practices and improved yield predictions.

Core Benefits:

- **Improved decision-making** through comprehensive data access.
- **Automated processes** for efficient data collection and management.
- **Accurate yield predictions** using data-driven analytics.
- **Enhanced risk management** for weather and market conditions.
- **Optimized resource use** to promote sustainable practices.

Database Name

The name of the database will be "**AYP_ Database _System**". It will consist of 14 tables, each designed to manage and organize data related to agriculture yield production efficiently. The database will serve as a centralized platform, enabling farmers, agronomists, and administrators to access, analyze, and utilize agricultural data.The database will facilitate data collection from various sources, weather monitoring systems and user inputs.

Users

The Agriculture Yield Production Management System (AYPMS) serves multiple stakeholders to enhance agricultural productivity and decision-making. Key users include:

1. Farmers
- Access data on crop health, soil conditions, and weather, and log farming activities for progress tracking.

2. Agronomists
- Analyze data to provide recommendations on pest control, fertilization, and crop rotation to improve yield.

3. Administrators
- Manage system access, ensure data integrity, and oversee compliance with agricultural regulations.

4. Central Data Management
- Manages the database, ensures consistency, runs queries, and generates analytic to support all users.

Table

1. SoilData
2. Weather Data
3. Crop Data
4. Yield Data
5. Farmer Profile
6. Recommendations
7. Alerts
8. Budget
9. Fertilizer Data
10. Fertilizer Usage
11. Pest Control
12. Agronomist
13. Appointment
14. Loan

Table columns / attributes

1. SoilData (SoilTypeID, Region, NutrientLevels, CropCompatibility)

2. WeatherData (WeatherID, Date, Temperature, Humidity, Rainfall, WindSpeed, Region)

3. CropData (CropID, Name, Season, AverageYield, CompatibleSoilTypeID)

4. YieldData (YieldID, Region, CropID, Year, ActualYield)

5. FarmerProfile (FarmerID, Name, Region, ContactInfo)

6. Recommendations (RecommendationID, FarmerID, CropID, Date, Season)

7. Alerts (AlertID, FarmerID, AlertType, Date)

8. Budget (BudgetID, FarmerID, CropID, LoanID, Year, EstimatedCost, ActualCost, Revenue, Profit)

9. FertilizerData (FertilizerID, Name, Type, CostPerUnit)

10. FertilizerUsage (UsageID, CropID, FertilizerID, AmountUsed, ApplicationDate)

11. PestControl (PestControlID, CropID, PesticideUsed, ApplicationDate, Cost)

12. Agronomist (AgronomistID, Name, Specialization, ContactInfo, Region)

13. Appointment (Appointment_ID, FarmerID, AgronomistID, AppointmentDate)

14. Loan (LoanID, FarmerID, LoanAmount, InterestRate, LoanStartDate, LoanEndDate, Status)

Primary key, Foreign key/Relation

1. SoilData

SoilType_ID PRIMARY KEY,
Region,
NutrientLevels,
CropCompatibility

2. WeatherData

Weather_ID PRIMARY KEY,
Date,
Temperature,
Humidity,
Rainfall,
WindSpeed,
Region FOREIGN KEY

3. CropData

Crop_ID PRIMARY KEY,
Name,
Season PRIMARY KEY,
AverageYield,
CompatibleSoilType_ID FOREIGN KEY

4. YieldData

Yield_ID PRIMARY KEY,
Region,
Crop_ID FOREIGN KEY,
Year,ActualYield

5. FarmerProfile

Farmer_ID PRIMARY KEY,
Name,
Region,
ContactInfo

6. Recommendations

Recommendation_ID PRIMARY KEY,
Farmer_ID FOREIGN KEY,

Crop_ID FOREIGN KEY,
Date,
Season FOREIGN KEY

7. Alerts

Alert_ID PRIMARY KEY,
Farmer_ID FOREIGN KEY,
AlertType VARCHAR(50),
Date

8. Budget

Budget_ID PRIMARY KEY,
Farmer_ID FOREIGN KEY,
Crop_ID FOREIGN KEY,
Loan_ID FOREIGN KEY,
Year,
EstimatedCost,
ActualCost,
Revenue,
Profit

9. FertilizerData

Fertilizer_ID PRIMARY KEY,
Name,
Type,
CostPerUnit

10. FertilizerUsage

Usage_ID PRIMARY KEY,
Crop_ID FOREIGN KEY,
Fertilizer_ID FOREIGN KEY,
AmountUsed ,
ApplicationDate

11. PestControl

PestControl_ID PRIMARY KEY,
Crop_ID FOREIGN KEY,
PesticideUsed,
ApplicationDate,
Cost

12. Agronomist

Agronomist_ID PRIMARY KEY,
Name,
Specialization,
ContactInfo,
Region

13. Appointment

Appointment_ID PRIMARY KEY,
FarmerID FOREIGN KEY,
AgronomistID FOREIGN KEY,
AppointmentDate

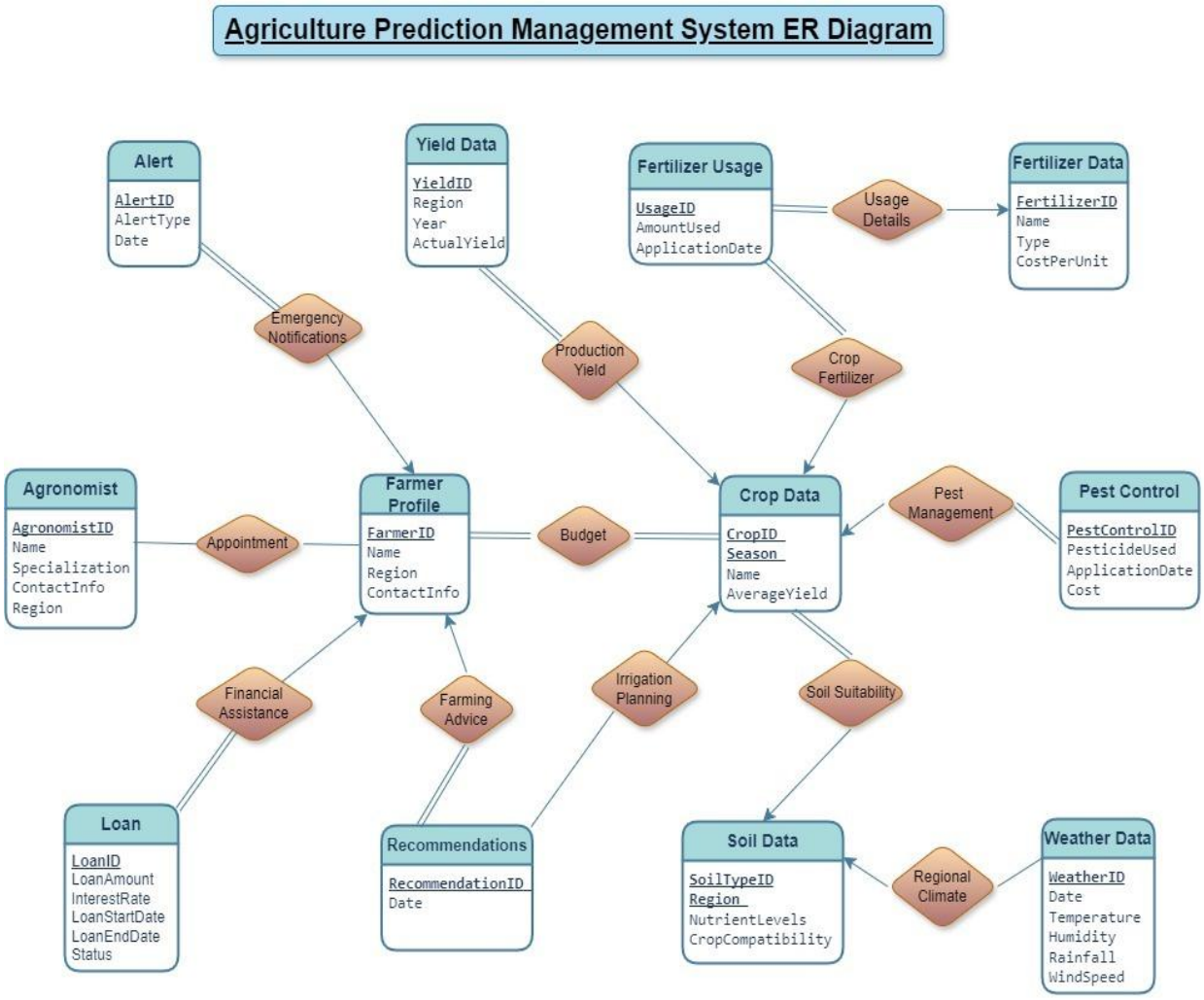
14. Loan

Loan_ID PRIMARY KEY,
Farmer_ID FOREIGN KEY,
LoanAmount,
InerestRate,
LoanStartDate,
LoanEndDate,
Status

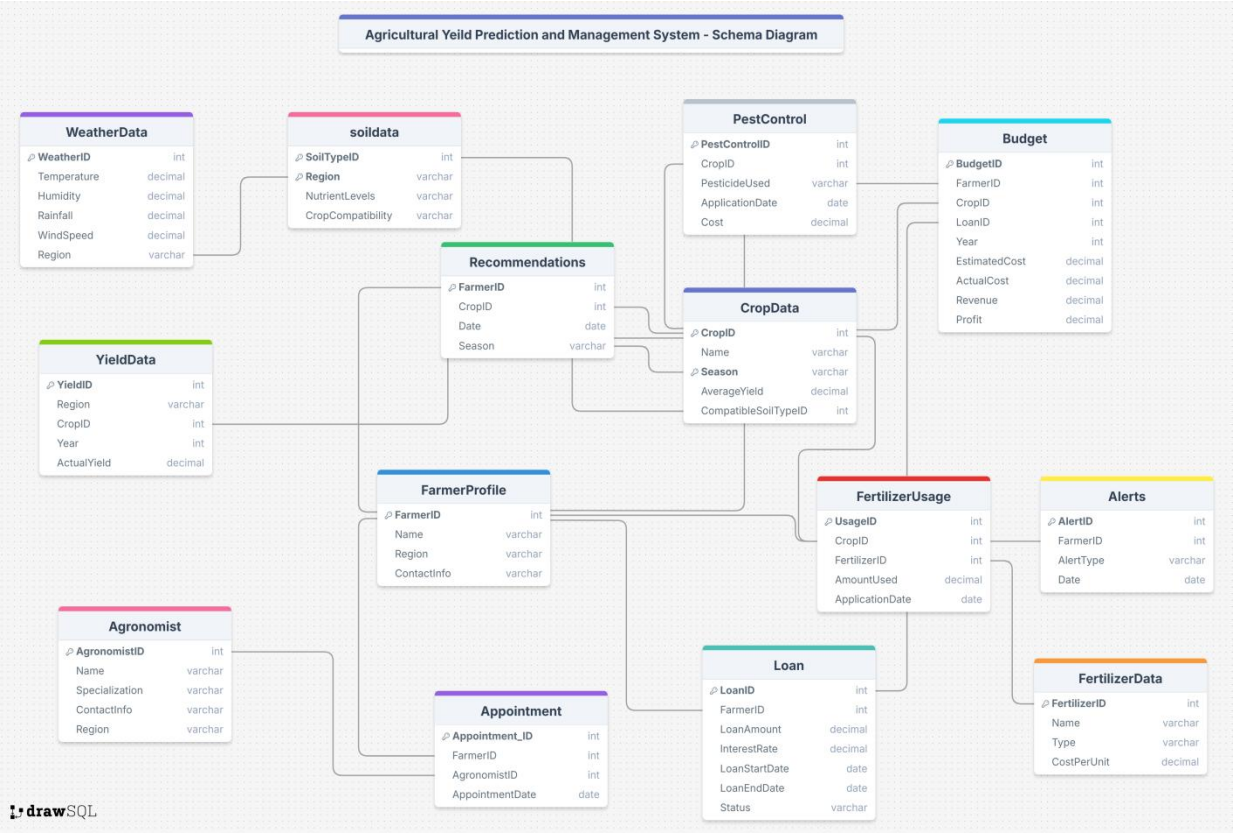
Entity Relationship

Entity Name 1	Entity Name 2	Relationship Name	Relationship Type	Participation
SoilData	WeatherData	Regional Climate	One-to-Many	Partial for both
SoilData	CropData	Soil Suitability	One-to-Many	Partial for SoilData, Total for YieldData
CropData	PestControl	Pest Management	One-to-Many	Partial for CropData, Total for PestControl
CropData	Recommendations	Irrigation Planning	One-to-Many	Partial for both
CropData	YieldData	Production Yield	One-to-Many	Partial for CropData, Total for YieldData
FarmerProfile	Loan	Financial Assistance	One-to-Many	Partial for FarmerProfile,Total for Loan
FarmerProfile	Agronomist	appointment	Many-to-Many	Partial for both
FarmerProfile	Recommendations	Farming Advice	One-to-Many	Partial for FarmerProfile, Total for Recommendations
FarmerProfile	Alerts	Emergency Notifications	One-to-Many	Partial for FarmerProfile, Total for Alerts
FarmerProfile	CropData	Budget	Many-to-Many	Total for both
FertilizerData	FertilizerUsage	Usage Details	One-to-Many	Partial for FertilizerData, Total for FertilizerUsage
CropData	FertilizerUsage	Crop Fertilizer Management	one-to-Many	Partial for CropData, Total for FertilizerUsage

ER Diagram


Agriculture Prediction Management System ER Diagram
Alert
AlertID
AlertType
Date
Yield Data
YieldID
Region
Year
ActualYield
Fertilizer Usage
UsageID
AmountUsed
ApplicationDate
Usage Details
Fertilizer Data
FertilizerID
Name
Type
CostPerUnit
Emergency Notifications
Production Yield
Crop Fertilizer
Agronomist
AgronomistID
Name
Specialization
ContactInfo
Region
Appointment
Farmer Profile
FarmerID
Name
Region
ContactInfo
Budget
Crop Data
CropID
Season
Name
AverageYield
Pest Management
Pest Control
PestControlID
PesticideUsed
ApplicationDate
Cost
Financial Assistance
Farming Advice
Irrigation Planning
Soil Suitability
Loan
LoanID
LoanAmount
InterestRate
LoanStartDate
LoanEndDate
Status
Recommendations
RecommendationID
Date
Soil Data
SoilTypeID
Region
NutrientLevels
CropCompatibility
Regional Climate
Weather Data
WeatherID
Date
Temperature
Humidity
Rainfall
WindSpeed

Schema Diagram



Queries

--display all the data stored in the SoilData table

```
SELECT * FROM SoilData;
```

Results | Messages

	SoilTypeID	Region	NutrientLevels	CropCompatibility
1	1001	Dhaka	High Nitrogen, Medium Phosphorus	Rice, Wheat
2	1002	Chittagong	High Phosphorus, Low Potassium	Tea, Rice
3	1003	Sylhet	High Organic Matter	Tea, Vegetables
4	1004	Rajshahi	Low Nitrogen, Medium Phosphorus	Mango, Wheat
5	1005	Khulna	Saline Soil	Shrimp, Rice
6	1006	Barisal	Acidic Soil	Rice, Jute
7	1007	Rangpur	High Potassium	Potato, Rice
8	1008	Mymensingh	Medium Nitrogen	Vegetables, Rice
9	1009	Comilla	Medium Phosphorus	Jute, Rice
10	1010	Noakhali	Sandy Loam	Rice, Vegetables

--list all distinct seasons recorded in the CropData table

```
SELECT DISTINCT Season FROM CropData;
```

Results | Messages

	Season
1	All Seasons
2	Aman
3	Kharif
4	Monsoon
5	Rabi
6	Rainy
7	Summer
8	Winter

--display all fertilizer names in uppercase from the FertilizerData table.

```
SELECT UPPER(Name) AS FertilizerName FROM FertilizerData;
```

Results | Messages

	FertilizerName
1	UREA
2	TSP
3	MOP
4	DAP
5	GYPSUM
6	ZINC SULPHATE
7	COMPOST
8	VERMICOMPOST
9	BIOFERTILIZER
10	LIME

--display Name, Region data stored in the FarmerProfile table

```
SELECT Name, Region FROM FarmerProfile;
```

Results | Messages

	Name	Region
1	Abdul Karim	Dhaka
2	Hasina Begum	Sylhet
3	Mizanur Rahman	Chittagong
4	Fatema Khatun	Rajshahi
5	Jamal Uddin	Khulna
6	Ayesha Sultana	Barisal
7	Rafiq Hossain	Dhaka
8	Nasima Akter	Sylhet
9	Kabir Chowdhury	Rajshahi
10	Shahidul Islam	Khulna
11	Abdullah Jubayer	Barisal

--count the total number of crops listed in the CropData table

```
SELECT COUNT(*) AS TotalCrops FROM CropData;
```

Results | Messages

	TotalCrops
1	10

--calculate the average estimated cost from the Budget table

```
SELECT AVG(EstimatedCost) AS AvgUtilization FROM Budget;
```

Results | Messages

	AvgUtilization
1	36500.000000

--find the minimum and maximum cost per unit of fertilizers from the FertilizerData table.

```
SELECT MIN(CostPerUnit) AS MinPrice,
MAX(CostPerUnit) AS MaxPrice FROM
FertilizerData;
```

Results Messages

	MinPrice	MaxPrice
1	8.00	30.00

--calculate the total amount of fertilizer used from the FertilizerUsage table.

```
SELECT SUM(AmountUsed) AS
TotalFertilizerUsed FROM
FertilizerUsage;
```

Results Messages

	TotalFertilizerUsed
1	290.00

--all records from the Alerts table where the AlertType contains the word "Warning"

```
SELECT * FROM Alerts
WHERE AlertType LIKE '%Warning%';
```

Results Messages

	AlertID	FarmerID	AlertType	Date
1	40401	1001	Weather Warning	2024-01-15
2	40407	1007	Flood Risk Warning	2024-07-10

--find all fertilizer data where the cost per unit is between 10 and 20.

```
SELECT * FROM FertilizerData
WHERE CostPerUnit BETWEEN 10 AND 20;
```

Results Messages

	FertilizerID	Name	Type	CostPerUnit
1	801	Urea	Nitrogen	12.50
2	803	MOP	Potassium	18.00
3	805	Gypsum	Sulfur	15.00
4	806	Zinc Sulphate	Micronutrient	20.00
5	807	Compost	Organic	10.00
6	808	Vermicompost	Organic	15.00

--find all loans where the loan amount is greater than 50,000.

```
SELECT * FROM Loan
WHERE LoanAmount > 50000
```

Results Messages

	LoanID	FarmerID	LoanAmount	InterestRate	LoanStartDate	LoanEndDate	Status
1	20	1002	100000.00	6.50	2022-01-01	2025-01-01	Active
2	30	1006	75000.00	7.00	2023-06-01	2026-06-01	Completed
3	40	1004	60000.00	8.00	2024-01-01	2027-01-01	Pending
4	50	1009	120000.00	6.50	2023-03-01	2028-03-01	Active

--find the total yield for each region, only for those regions where the total yield is greater than 4.

```
SELECT Region, SUM(ActualYield) AS
TotalYield FROM YieldData
GROUP BY Region
HAVING SUM(ActualYield) > 4;
```

Results Messages

	Region	TotalYield
1	Rajshahi	5.10
2	Rangpur	4.10

--Calculate the average yield for each region from the YieldData table, grouping the results by Region."

```
SELECT Region, AVG(ActualYield) AS
AvgYield FROM YieldData

GROUP BY Region;
```

Results Messages

	Region	AvgYield
1	Barisal	2.850000
2	Chittagong	1.900000
3	Comilla	2.900000
4	Dhaka	3.600000
5	Khulna	1.300000
6	Mymensingh	3.050000
7	Noakhali	3.700000
8	Rajshahi	5.100000
9	Rangpur	4.100000
10	Sylhet	1.750000

--Calculate the total yield for each region from the YieldData table for the year 2023, where the total yield is greater than 4, grouping the results by Region.

```
SELECT Region, SUM(ActualYield) AS
TotalYield FROM YieldData

WHERE Year = 2023

GROUP BY Region

HAVING SUM(ActualYield) > 4
```

Results Messages

	Region	TotalYield
1	Rajshahi	5.10
2	Rangpur	4.10

--all records from the FertilizerData table and order them by CostPerUnit in ascending order.

```
SELECT * FROM FertilizerData

ORDER BY CostPerUnit ASC;
```

Results Messages

	FertilizerID	Name	Type	CostPerUnit
1	810	Lime	pH Balancer	8.00
2	807	Compost	Organic	10.00
3	801	Urea	Nitrogen	12.50
4	808	Vermicompost	Organic	15.00
5	805	Gypsum	Sulfur	15.00
6	803	MOP	Potassium	18.00
7	806	Zinc Sulphate	Micronutrient	20.00
8	804	DAP	Nitrogen-Phosphorus	22.50
9	802	TSP	Phosphorus	25.00
10	809	Biofertilizer	Microbial	30.00

--all the records from the FarmerProfile table, ordered by FarmerID in descending order.

```
SELECT * FROM FarmerProfile

ORDER BY FarmerID desc
```

Results Messages

	FarmerID	Name	Region	ContactInfo
1	1020	Junaid Rafi	Barisal	01843670901
2	1019	Kabir Singh	Chittagong	01656499012
3	1018	Asif Nazim	Sylhet	01923556580
4	1017	Rakib Khan	Dhaka	01734583892
5	1016	Afia Sultana	Khulna	01823326789
6	1015	Jamal Jitu	Rajshahi	01567894021
7	1014	Shuhurat Khatun	Chittagong	01611367890
8	1013	Nadeem Rahman	Sylhet	01985554321
9	1012	Sheikh Hasina	Dhaka	01798755432
10	1011	Abdullah Jubayer	Barisal	01812335578
11	1010	Shahidul Islam	Khulna	01845678905
12	1009	Kabir Chowdhury	Rajshahi	01656789012
13	1008	Nasima Akter	Sylhet	01923456780
14	1007	Rafiq Hossain	Dhaka	01734567892
15	1006	Ayesha Sultana	Barisal	01823456789
16	1005	Jamal Uddin	Khulna	01567894321
17	1004	Fatema Khatun	Rajshahi	01612347890
18	1003	Mizanur Rahman	Chittagong	01987654321
19	1002	Hasina Begum	Sylhet	01798765432
20	1001	Abdul Karim	Dhaka	01812345678

--find the FarmerIDs that are present in both the Loan and Alerts tables.

```
SELECT FarmerID FROM Loan

INTERSECT

SELECT FarmerID FROM Alerts;
```

Results Messages

	FarmerID
1	1001
2	1002
3	1009

--combine the FarmerID values from the Loan and Alerts tables, ensuring there are no duplicates.

```
SELECT FarmerID FROM Loan

UNION

SELECT FarmerID FROM Alerts;
```

Results Messages

	FarmerID
1	1001
2	1002
3	1003
4	1004
5	1005
6	1006
7	1007
8	1009
9	1010
10	1014
11	1016
12	1018

--names of farmers and their respective agronomists from the FarmerProfile and Agronomist tables, based on the Appointment table.

```
SELECT f.Name AS FarmerName, agr.Name AS
AgronomistName FROM FarmerProfile f

JOIN Appointment ap ON f.FarmerID =
ap.FarmerID

JOIN Agronomist agr ON ap.AgronomistID =
agr.AgronomistID;
```

Results Messages

	FarmerName	AgronomistName
1	Abdul Karim	Dr. Mahmud Ali
2	Junaid Rafi	Dr. Parveen Sultana
3	Mizanur Rahman	Dr. Rahman Khan
4	Shuhurat Khatun	Dr. Fatima Rahim
5	Jamal Uddin	Dr. Jamil Ahmed
6	Afia Sultana	Dr. Mahmud Ali
7	Rafiq Hossain	Dr. Parveen Sultana
8	Asif Nazim	Dr. Rahman Khan
9	Kabir Chowdhury	Dr. Fatima Rahim
10	Shahidul Islam	Dr. Jamil Ahmed

--FarmerID values from the Loan table that do not exist in the Alerts table.

```
SELECT FarmerID FROM Loan

EXCEPT

SELECT FarmerID FROM Alerts;
```

Results Messages

	FarmerID
1	1004
2	1006

--count the number of loans issued in each region by joining the FarmerProfile and Loan tables.

```
SELECT Region, COUNT(LoanID) AS LoanCount

FROM FarmerProfile f JOIN Loan l ON
f.FarmerID = l.FarmerID

GROUP BY Region;
```

Results Messages

	Region	LoanCount
1	Barisal	1
2	Dhaka	1
3	Rajshahi	2
4	Sylhet	1

--find the names of farmers who have not taken any loans

```
SELECT Name FROM FarmerProfile

WHERE FarmerID NOT IN (SELECT FarmerID
FROM Loan);
```

Results | Messages

	Name
1	Mizanur Rahman
2	Jamal Uddin
3	Rafiq Hossain
4	Nasima Akter
5	Shahidul Islam
6	Abdullah Jubayer
7	Sheikh Hasina
8	Nadeem Rahman
9	Shuhurat Khatun
10	Jamal Jitu
11	Afia Sultana
12	Rakib Khan
13	Asif Nazim
14	Kabir Singh
15	Junaid Rafi

--all alerts for farmers located in the 'Dhaka' or 'Sylhet' regions.

```
SELECT * FROM Alerts

WHERE FarmerID IN (SELECT FarmerID FROM
FarmerProfile WHERE Region IN ('Dhaka',
'Sylhet'));
```

Results | Messages

	AlertID	FarmerID	AlertType	Date
1	40401	1001	Weather Warning	2024-01-15
2	40402	1002	Fertilizer Usage Reminder	2024-02-01
3	40407	1007	Flood Risk Warning	2024-07-10
4	40408	1018	Drought Alert	2024-08-25

--count the number of loans issued in each region by joining the FarmerProfile and Loan tables.

```
SELECT Region, COUNT(LoanID) AS LoanCount

FROM FarmerProfile f JOIN Loan l ON
f.FarmerID = l.FarmerID

GROUP BY Region;
```

Results | Messages

	Region	LoanCount
1	Barisal	1
2	Dhaka	1
3	Rajshahi	2
4	Sylhet	1

--find the names of farmers who have not taken any loans

```
SELECT Name FROM FarmerProfile WHERE FarmerID NOT IN ( SELECT DISTINCT FarmerID FROM Loan);
```

Results | Messages

	Name
1	Mizanur Rahman
2	Jamal Uddin
3	Rafiq Hossain
4	Nasima Akter
5	Shahidul Islam
6	Abdullah Jubayer
7	Sheikh Hasina
8	Nadeem Rahman
9	Shuhurat Khatun
10	Jamal Jitu
11	Afia Sultana
12	Rakib Khan
13	Asif Nazim
14	Kabir Singh
15	Junaid Rafi

--names of farmers who have used organic fertilizers

```
SELECT Name FROM FarmerProfile

WHERE FarmerID IN (SELECT FarmerID FROM FertilizerUsage fu

JOIN FertilizerData fd ON fu.FertilizerID = fd.FertilizerID  WHERE fd.Type = 'Organic');
```

Results | Messages

	Name
1	Abdul Karim
2	Hasina Begum
3	Mizanur Rahman
4	Fatema Khatun
5	Jamal Uddin
6	Ayesha Sultana
7	Rafiq Hossain
8	Nasima Akter
9	Kabir Chowdhury
10	Shahidul Islam
11	Abdullah Jubayer
12	Sheikh Hasina
13	Nadeem Rahman
14	Shuhurat Khatun
15	Jamal Jitu
16	Afia Sultana
17	Rakib Khan
18	Asif Nazim
19	Kabir Singh
20	Junaid Rafi

--create a view named LoanSummary that selects the FarmerID, LoanID, LoanAmount, and Status from the Loan table, and then retrieve all the data from the LoanSummary view.

```
CREATE VIEW LoanSummary AS

SELECT FarmerID, LoanID, LoanAmount, Status

FROM Loan;

select * from LoanSummary
```

Results | Messages

	FarmerID	LoanID	LoanAmount	Status
1	1001	10	50000.00	Active
2	1002	20	100000.00	Active
3	1006	30	75000.00	Completed
4	1004	40	60000.00	Pending
5	1009	50	120000.00	Active

--Create a view named CropBasicInfo that includes the CropID, Name (aliased as CropName), Season, and AverageYield columns from the CropData table. Then, retrieve all records from the CropBasicInfo view."

```
CREATE VIEW CropBasicInfo AS

SELECT CropID, Name AS CropName, Season, AverageYield FROM CropData;

select * from CropBasicInfo
```

Results | Messages

	CropID	CropName	Season	AverageYield
1	10001	Rice	Aman	3.50
2	10002	Tea	Kharif	1.80
3	10003	Mango	Summer	5.00
4	10004	Wheat	Rabi	2.50
5	10005	Potato	Winter	4.00
6	10006	Jute	Monsoon	2.80
7	10007	Shrimp	Rainy	1.20
8	10008	Vegetabl...	All Sea...	3.00
9	10009	Banana	Summer	6.00
10	10010	Tomato	Winter	2.20

CEP mapping

Our project is a solution to a complex engineering problem because it can't be resolved without in depth engineering knowledge. There is no obvious solution to and requires some amount of abstract thinking depending on the Database model.

➢ **How Knowledge Profiles (K's) are addressed through the project and mapping among**

K's, COs and POs :

Code	Competency	Description	Related COs	Related POs
K3	**Engineering Fundamentals**	Our project leverages core engineering principles such as relational database design, programming fundamentals (SQL), and system analysis to create a robust agricultural management system.	C01, C02	5(e), 2(b)
K4	**Specialist Knowledge**	Requires in-depth knowledge of soil science, weather data, and crop management to design predictive models for improved agricultural yield.	C05, C07	3(c)
K5	**Engineering Design**	The project incorporates ER diagrams, schema creation, normalization, and efficient database management, ensuring logical relationships between entities like farmers, crops, and agronomists.	C03, CO4	1(a), 2(b)
K6	**Engineering Practice**	We have used SQL in Microsoft SQL Server for managing and querying the database, along with Illustrator for creating the ER diagram	C01, CO2	5(e), 2(b)

➢ **How Complex Engineering problem solving (P's) are addressed through the project and mapping among**

P's, COs and POs :

Code	Performance	Description	Related COs	Related POs
P1	**Depth of knowledge requirements**	The project requires study of SQL in Microsoft SQL Server(K6), normalization, ER diagram, Schema diagram(K5), join, subquery etc.	CO2, CO4	2(b), 2(b)
P2	**Range of conflicting requirements**	Developed a database system to address real-world agricultural challenges, such as optimizing crop yield while balancing limited resources like fertilizers, budgets, and pest control	CO5	3(c)
P3	**Depth of data analysis**	Designed tables to store, process, and analyze soil data, weather data, and crop yield, ensuring accurate insights for decision-making and Utilized SQL queries to extract insights from large datasets	CO2, CO3	2(b), 1(a)
P7	**Interdependence**	Developed a system where various components such as soil data, weather conditions, crop information, and financial aspects are interdependent, ensuring that changes in one area impact others.	CO8	9(i)

- **How Complex Engineering Activities (A's) are addressed through the project and mapping among**

A's, COs and POs :

Code	Attribute	Description	Related COs	Related POs
A1	**Range of resources**	Leveraged a wide range of resources, including online platforms, agricultural data sources, and public records, to effectively map and develop the agriculture yield prediction system.	C05, CO9	3(c), 10(j)
A2	**Level of Interaction**	Designed a system with a high level of interaction, allowing farmers to actively engage with the platform for personalized recommendations, yield predictions, and budget tracking.	C08	9(i)
A5	**Familiarity**	Demonstrated a high level of familiarity with key technologies and concepts required to design and implement the agriculture yield prediction system, including SQL for database management and data analysis, and tools like Microsoft SQL Server for efficient query processing.	CO5	3(c)