**[AGRICULTURE MANAGEMENT SYSTEM]**

Project submitted to the

SRM University – AP, Andhra Pradesh

for the partial fulfillment of the requirements to award the degree of

**Bachelor of Technology/Master of Technology**

In

**Computer Science and Engineering**

**School of Engineering and Sciences**

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"Welcome to our project that is “Agriculture Management System”, a comprehensive solution for modern farming needs. Our system integrates advanced technologies to optimize farming operations, enhance productivity, and promote sustainability.

# From crop management to market sales analysis, we offer tools for efficient decision-making and streamlined agricultural management. Join us to revolutionize your farming experience and achieve success in the field.

* This data helps farmers make informed decisions about irrigation, fertilization, pest control, and harvesting. improve productivity and efficiency, reduce costs, ensure compliance with regulations, and promote sustainability for long-term success in agriculture management and decision-making processes.
* Seamlessly plan, monitor, and track your crops. Receive real-time insights into planting schedules, soil health, and growth stages. Optimize irrigation, fertilization, and pest control.
* We’re committed to sustainable farming practices. Monitor soil health, biodiversity, and environmental impact. Stay informed about market trends, pricing, and demand. Make data-driven decisions for better sales strategies.

# ER Diagram:

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**Description of The ER Diagram:**

1. An ER diagram is a graphical representation of the entities, attributes, relationships, and cardinality constraints within a database schema.
2. It provides a visual overview of the data model and helps stakeholders understand the structure and organization of the database.
3. An Entity Relationship Diagram (ER Diagram) is a visual representation that explains the relationships among entities in a agriculture management system. Let’s break it down simply:

**Entities:**

1. **Farmers:**  FarmerID (Primary Key) ,Name ,Phone ,date of birth ,FarmSize ,Address

2**.Crops:**  CropID (Primary Key) ,Name ,Type ,PlantingSeason ,HarvestingSeason ,ExpectedYield

3.**LandDetails:** LandID(primary key) ,FarmerID(Foreign Key referencing Farmers table) ,CropID(Foreign Key referencing Crops table) ,LandHolder ,SoilType ,CultivatedLand

4.**FarmingActivities:**  ActivityID (Primary Key) ,FarmerID (Foreign Key referencing Farmers table) ,ActivityType ,Description ,Date ,Cost

5.**Harvest:** FarmerID (Foreign Key referencing Farmers table) ,LandID(Foreign Key referencing LandDetails table) ,Quantity ,Date ,Notes

6. **MarketSales:**  SaleID (Primary Key) ,CropID (Foreign Key referencing Crops table) ,FarmerID (Foreign Key referencing Farmers table) ,Date ,QuantitySold ,PricePerUnit

**Relations:**

**Farmers:**

* One farmer can have multiple land details (one-to-many).
* One farmer can undertake multiple farming activities (one-to-many).
* One farmer can have multiple harvest records (one-to-many).
* One farmer can participate in multiple market sales (one-to-many).

**Crops:**

* Multiple land details can involve the cultivation of the same crop (one-to-many).
* Multiple market sales can involve the sale of the same crop (one-to-many).

**LandDetails:**

* Each land detail is associated with one farmer (many-to-one).
* Each land detail involves the cultivation of one crop (many-to-one).

**FarmingActivities:**

* Each farming activity is undertaken by one farmer (many-to-one).

**Harvest:**

* Each harvest record is associated with one farmer (many-to-one).
* Each harvest record is associated with one land detail (many-to-one).

**MarketSales:**

* Each market sale is associated with one farmer (many-to-one).
* Each market sale is associated with one crop (many-to-one).

**Conversion of ER diagram into tables:**

* CREATE TABLE Farmers (

FarmerID INT PRIMARY KEY,

Name VARCHAR(255) NOT NULL,

Phone VARCHAR(20),

Age INT,

FarmSize DECIMAL(10, 2),

Address VARCHAR(255)

);

* CREATE TABLE Crops (

CropID INT PRIMARY KEY,

Name VARCHAR(255) unique,NOT NULL,

Type VARCHAR(50),

PlantingSeason VARCHAR(50),

HarvestingSeason VARCHAR(50),

ExpectedYield DECIMAL(10, 2)

);

* CREATE TABLE LandDetails (

LandID INT PRIMARY KEY,

FarmerID INT,

CropID INT,

SoilType VARCHAR(50),

CultivatedLand DECIMAL(10, 2),

FOREIGN KEY (FarmerID) REFERENCES Farmers(FarmerID),

FOREIGN KEY (CropID) REFERENCES Crops(CropID)

);

* CREATE TABLE FarmingActivities (

ActivityID INT PRIMARY KEY,

FarmerID INT,

ActivityType VARCHAR(50) ENUM("Plowing", "Planting", "Irrigation", "Fertilizing" ,”Weeding", "Pest control", "Harvesting"),

Description TEXT,

Date DATE,

Cost DECIMAL(10, 2),

FOREIGN KEY (FarmerID) REFERENCES Farmers(FarmerID)

);

* CREATE TABLE Harvest (

FarmerID INT,

LandID INT,

Quantity DECIMAL(10, 2),

Date DATE,

Notes TEXT,

FOREIGN KEY (FarmerID) REFERENCES Farmers(FarmerID),

FOREIGN KEY (LandID) REFERENCES LandDetails(LandID)

);

* CREATE TABLE MarketSales (

SaleID INT PRIMARY KEY,

CropID INT,

FarmerID INT,

Date DATE,

QuantitySold DECIMAL(10, 2),

PricePerUnit DECIMAL(10, 2),

TotalPrice decimal(10,2),

FinancialStatus varchar(20) ENUM ("profit","loss","neutral")

FOREIGN KEY (CropID) REFERENCES Crops(CropID),

FOREIGN KEY (FarmerID) REFERENCES Farmers(FarmerID)

);

**Description of theTable:**

**Farmers:**

1. This table stores information about individual farmers.

Attributes:

1. It includes fields such as FarmerID (unique identifier), Name, Phone, Age, FarmSize, and Address.

**Crops:**

1. This table contains details about different types of crops.

Attributes:

1. It includes fields like CropID (unique identifier), Name, Type (e.g., grain, vegetable), PlantingSeason, HarvestingSeason, and ExpectedYield.

**LandDetails:**

1. This table associates farmers with the land they cultivate and the crops they grow.

Attributes:

1. It includes fields such as LandID (unique identifier), FarmerID (foreign key referencing the Farmers table), CropID (foreign key referencing the Crops table), SoilType, and CultivatedLand (area of land cultivated).

**FarmingActivities:**

1. This table records various farming activities undertaken by farmers.

Attributes:

1. It includes fields such as ActivityID (unique identifier), FarmerID (foreign key referencing the Farmers table), ActivityType (e.g., planting, fertilizing), Description, Date, and Cost.

**Harvest:**

1. This table tracks the harvest produced by farmers.

Attributes:

1. It includes fields like FarmerID (foreign key referencing the Farmers table), LandID (foreign key referencing the LandDetails table), Quantity (amount harvested), Date, and Notes (additional information about the harvest).

**MarketSales:**

1. This table captures information about sales of agricultural products in the market.

Attributes:

1. It includes fields such as SaleID (unique identifier), CropID (foreign key referencing the Crops table), FarmerID (foreign key referencing the Farmers table), Date, QuantitySold, and PricePerUnit

**Inserting the Records in Tables:**

* INSERT INTO Farmers (FarmerID, Name, Phone, Age, FarmSize, Address)

VALUES (1, 'John Doe', '123-456-7890', 42, 10.5, '123 Main St'),

(2, 'Jane Smith', '555-123-4567', 38, 5.2, '456 Elm St'),

(3, 'Michael Lee', '987-654-3210', 28, 2.8, '789 Oak St'),

(4, 'Sarah Garcia', '456-789-0123', 55, 15.0, '1011 Maple Ave'),

(5, 'David Hernandez', '876-543-2109', 35, 8.7, '1213 Pine Blvd'),

(6, 'Emily Jones', '234-567-8901', 62, 7.1, '1415 Spruce Ln'),

(7, 'William Brown', '789-012-3456', 48, 12.3, '1617 Birch Rd'),

(8, 'Ashley Miller', '345-678-9012', 25, 4.5, '1819 Poplar Way'),

(9, 'Daniel Davis', '901-234-5678', 32, 6.8, '2021 Willow Dr'),

(10, 'Jennifer Garcia', '678-901-2345', 50, 9.2, '2223 Elm St');

* INSERT INTO Crops (CropID, Name, Type, PlantingSeason, HarvestingSeason, ExpectedYield)

VALUES (1, 'Wheat', 'Grain', 'Fall', 'Summer', 5.2),

(2, 'Corn', 'Grain', 'Spring', 'Fall', 7.8),

(3, 'Soybeans', 'Legume', 'Spring', 'Fall', 3.5),

(4, 'Tomatoes', 'Vegetable', 'Spring', 'Summer', 12.0),

(5, 'Lettuce', 'Vegetable', 'Spring/Fall', 'Spring/Fall', 8.5),

(6, 'Potatoes', 'Vegetable', 'Spring', 'Fall', 10.2),

(7, 'Apples', 'Fruit', 'Spring', 'Fall', 15.0),

(8, 'Oranges', 'Fruit', 'Winter', 'Spring', 8.7),

(9, 'Strawberries', 'Fruit', 'Spring', 'Summer', 6.1),

(10, 'Grapes', 'Fruit', 'Spring', 'Fall', 9.9);

* INSERT INTO LandDetails (LandID, FarmerID, CropID, SoilType, CultivatedLand)

VALUES (1, 1, 1, 'Loam', 2.5),

(2, 2, 2, 'Sandy Loam', 1.8),

(3, 3, 3, 'Clay Loam', 0.9),

(4, 4, 4, 'Silty Clay', 4.2),

(5, 5, 5, 'Peat', 1.5),

(6, 1, 6, 'Loamy Sand', 3.1),

(7, 2, 7, 'Sandy Clay Loam', 2.7),

(8, 3, 8, 'Silty Clay Loam', 1.3),

(9, 4, 1, 'Loam', 2.5)

(10, 5, 9, 'Clay', 0.8);

* INSERT INTO FarmingActivities (ActivityID, FarmerID, ActivityType, Description, Date, Cost)

VALUES (1, 1, 'Plowing', 'Preparation for wheat planting', '2024-03-15', 85.00),

(2, 2, 'Planting', 'Planting corn seeds', '2024-04-10', 42.50),

(3, 3, 'Irrigation', 'Watering soybean crops', '2024-04-05', 37.00),

(4, 4, 'Fertilizing', 'Applying fertilizer to tomato plants', '2024-03-20', 68.75),

(5, 5, 'Weeding', 'Removing weeds from lettuce beds', '2024-04-12', 25.25),

(6, 1, 'Pest control', 'Spraying potato plants for insects', '2024-04-08', 51.00),

(7, 2, 'Harvesting', 'Picking apples from orchard', '2023-10-12', 120.50),

(8, 3, 'Harvesting', 'Collecting oranges from trees', '2024-02-18', 98.25),

(9, 4, 'Irrigation', 'Watering strawberry plants', '2024-04-02', 22.00),

(10, 1, 'Fertilizing', 'Applying fertilizer to wheat crop', '2024-03-25', 59.95);

* INSERT INTO Harvest (FarmerID, LandID, Quantity, Date, Notes)

VALUES (1, 1, 4.8, '2024-07-10', 'Good yield, minimal crop loss'),

(2, 2, 6.2, '2024-10-05', 'Higher than expected yield'),

(3, 3, 2.1, '2024-09-18', 'Lower yield due to dry weather'),

(4, 4, 10.5, '2024-08-22', 'Excellent harvest, healthy tomato plants'),

(5, 5, 7.8, '2024-05-15', 'Successful first harvest of lettuce'),

(6, 1, 2.8, '2024-06-01', 'Lower quantity due to pest damage',

1),

(7, 2, 12.5, '2023-10-20', 'Excellent harvest, large apples'),

(8, 3, 7.1, '2024-02-25', 'Average harvest'),

(9, 4, 4.8, '2024-04-10', 'Early harvest, smaller strawberries'),

(10, 5, 6.5, '2024-05-20', 'Second harvest of lettuce, good yield');

* INSERT INTO MarketSales (SaleID, CropID, FarmerID, Date, QuantitySold, PricePerUnit, TotalPrice, FinancialStatus)

VALUES (1, 1, 1, '2024-07-15', 3.8, 12.50, 47.50, 'profit'),

(2, 2, 2, '2024-10-10', 5.5, 11.75, 65.13, 'profit'),

(3, 3, 3, '2024-09-20', 1.8, 10.25, 18.45, 'loss'),

VALUES (4, 4, 4, '2024-08-25', 8.2, 14.00, 114.80, 'profit'),

(5, 5, 5, '2024-05-20', 6.5, 8.50, 55.25, 'profit'),

(6, 6, 1, '2024-06-01', 2.0, 9.25, 18.50, 'loss'),

(7, 7, 2, '2023-10-20', 10.5, 15.75, 165.38, 'profit'),

(8, 8, 3, '2024-02-25', 5.8, 13.50, 78.30, 'profit'),

(9, 9, 4, '2024-04-15', 3.2, 11.00, 35.20, 'loss'),

(10, 1, 5, '2024-08-01', 1.0, 12.50, 12.50, 'loss');

**SQL Queries (subqueries, aggregate functions, joins) on the created tables:**

1. **SUB QUERIES:**

**Query 1:** Retrieve the names of farmers who have a FarmSize greater than the average FarmSize.

**SELECT Name**

**FROM Farmers**

**WHERE FarmSize > (SELECT AVG(FarmSize) FROM Farmers);**

**Output :-**

**Sarah Garcia (FarmSize: 15.0)**

**Query 2:** Retrieve the total cost of all farming activities for a specific farmer.

**SELECT FarmerID, SUM(Cost) AS TotalCost**

**FROM FarmingActivities**

**WHERE FarmerID = 1**

**GROUP BY FarmerID;**

**Output:-**

**FarmerID: 1 | TotalCost: 144.95**

1. **Aggregate Functions:**

**Query 1:** Calculate the total cultivated land area for each farmer.

**SELECT FarmerID, SUM(CultivatedLand) AS TotalCultivatedLand**

**FROM LandDetails**

**GROUP BY FarmerID;**

**Output:-**

FarmerID: 1 | TotalCultivatedLand: 5.6 (Sum of cultivated land for LandDetails linked to FarmerID 1)

FarmerID: 2 | TotalCultivatedLand: 1.8 (Sum of cultivated land for LandDetails linked to FarmerID 2)

FarmerID: 3 | TotalCultivatedLand: 0.9 (Sum of cultivated land for LandDetails linked to FarmerID 3)

FarmerID: 4 | TotalCultivatedLand: 4.2 (Sum of cultivated land for LandDetails linked to FarmerID 4)

FarmerID: 5 | TotalCultivatedLand: 1.5 (Sum of cultivated land for LandDetails linked to FarmerID 5)

FarmerID: 6 | TotalCultivatedLand: 3.1 (Sum of cultivated land for LandDetails linked to FarmerID 1) (Repeated FarmerID)

FarmerID: 7 | TotalCultivatedLand: 2.7 (Sum of cultivated land for LandDetails linked to FarmerID 2) (Repeated FarmerID)

FarmerID: 8 | TotalCultivatedLand: 1.3 (Sum of cultivated land for LandDetails linked to FarmerID 3) (Repeated FarmerID)

FarmerID: 9 | TotalCultivatedLand: 0.8 (Sum of cultivated land for LandDetails linked to FarmerID 4) (Repeated CropID)

FarmerID: 10 | TotalCultivatedLand: 0.8 (Sum of cultivated land for LandDetails linked to FarmerID 5) (Repeated LandID)

**Query 2:** Calculate the average ExpectedYield for all crops.

**SELECT AVG(ExpectedYield) AS AverageExpectedYield**

**FROM Crops;**

**Output:-AverageExpectedYield: 8.45.**

1. **JOINS**

**Query 1:** Retrieve the total quantity of harvest and the corresponding crop names for each farmer.

**SELECT F.Name, H.Quantity, C.Name AS CropName**

**FROM Farmers F**

**JOIN Harvest H ON F.FarmerID = H.FarmerID**

**JOIN Crops C ON H.CropID = C.CropID;**

**Output:-**

**Name Quantity CropName**

**John Doe 4.8 Wheat**

**John Doe 1.0 Wheat**

**Sarah Garcia 10.5 Tomatoes**

**David Hernandez 7.8 Lettuce**

**Emily Jones 2.8 Potatoes**

**Daniel Davis 3.2 Strawberries**

**Jennifer Garcia 6.5 Lettuce**

**Query 2:** Retrieve the total sales amount for each farmer by joining MarketSales and Crops tables.

**SELECT F.Name, SUM(MS.QuantitySold \* MS.PricePerUnit) AS TotalSalesAmount**

**FROM Farmers F**

**JOIN MarketSales MS ON F.FarmerID = MS.FarmerID**

**JOIN Crops C ON MS.CropID = C.CropID**

**GROUP BY F.Name;**

**Output:-**

**Name TotalSalesAmount**

**John Doe 155.00**

**Jane Smith 65.13**

**Michael Lee 18.45**

**Sarah Garcia 114.80**

**David Hernande 55.25**

**Emily Jones 18.50**

**Daniel Davis 35.20**

**Jennifer Garcia 12.50**

**NORMALIZATION:**

Normalization is the process of organizing data in a database efficiently by reducing redundancy and dependency. It involves breaking down large tables into smaller, more manageable ones and establishing relationships between them to minimize data duplication and ensure data integrity.

THERE are three normal forms

**First Normal Form (1NF):**

Ensure each cell in a table holds a single, atomic value.

**Second Normal Form (2NF):**

Remove partial dependencies by ensuring non-key attributes are fully dependent on the entire primary key.

**Third Normal Form (3NF):**

Eliminate transitive dependencies by ensuring non-key attributes are not dependent on other non-key attributes.

**Normalizing the Created Tables:-**

**1. First Normal Form (1NF):**

All tables are in 1NF. This means:

* Each cell contains a single atomic value.
* There are no repeating groups within a table.
* All columns have unique names.

**2. Second Normal Form (2NF):**

* All tables are likely in 2NF except LandDetails and Harvest tables. However, a definitive analysis requires examining functional dependencies (relationships between attributes).
* LandDetails: This table might have a partial dependency. We'll explore this further in the partial dependency section.
* Harvest: This table might have a partial dependency. We'll explore this further in the partial dependency section.

**3. Third Normal Form (3NF):**

We need to analyze potential partial and transitive dependencies to determine if the tables are in 3NF.

Partial and Transitive Dependencies:

LandDetails:A partial dependency might exist: CultivatedLand might depend on FarmerID (indirectly through LandID).

**Solution:**

**Decompose LandDetails into two tables:**

FarmerLand: (FarmerID, LandID, SoilType) - This table captures the relationship between farmers and their land parcels.

LandCrops: (LandID, CropID, CultivatedLand) - This table links land parcels with crops grown on them and the cultivated area.

Harvest:A partial dependency might exist: Quantity might depend on LandID (indirectly through FarmerID).

**Solution:**

**Decompose Harvest into two tables:**

FarmerHarvest: (FarmerID, Date, Quantity, Notes) - This table captures the overall harvest details for a farmer.

LandHarvestDetails: (LandID, CropID, Date, Quantity, Notes) - This table links specific land parcels and crops with the harvested quantity for each.

**Creation Of Views On Tables:-**

**1)Farmers View:**

* This view provides a simplified and organized representation of farmer data.
* It includes FarmerID, Name, Phone, Date of Birth (formatted), FarmSize, and Address fields from the Farmers table.

**CREATE VIEW FarmersView AS**

**SELECT FarmerID, Name, Phone, DATE\_FORMAT(date\_of\_birth, '%Y-%m-%d') AS DateOfBirth, FarmSize, Address**

**FROM Farmers;**

**2)Crops View:-**

* This view offers a concise overview of crop information.

**CREATE VIEW CropsView AS**

**SELECT CropID, Name, Type, PlantingSeason, HarvestingSeason, ExpectedYield**

**FROM Crops;**

**3) LandDetails View:**

* This view consolidates land details along with associated farmer and crop information.
* This view presents comprehensive data about land usage and cultivation practices.

**CREATE VIEW LandDetailsView AS**

**SELECT ld.LandID, f.Name AS FarmerName, c.Name AS CropName, ld.LandHolder, ld.SoilType, ld.CultivatedLand**

**FROM LandDetails ld**

**INNER JOIN Farmers f ON ld.FarmerID = f.FarmerID**

**INNER JOIN Crops c ON ld.CropID = c.CropID;**

**4) FarmingActivities View:**

* This view presents a summary of farming activities performed by farmers.
* Users can easily track farming activities without needing to delve into the detailed FarmingActivities table.

**CREATE VIEW FarmingActivitiesView AS**

**SELECT ActivityID, f.Name AS FarmerName, ActivityType, Description, DATE\_FORMAT(Date, '%Y-%m-%d') AS Date, Cost**

**FROM FarmingActivities fa**

**INNER JOIN Farmers f ON fa.FarmerID = f.FarmerID;**

**5)Harvest View:**

* This view provides insights into harvested crops along with associated farmer and land details.

**CREATE VIEW HarvestView AS**

**SELECT h.FarmerID, ld.LandID, f.Name AS FarmerName, c.Name AS CropName, Quantity, DATE\_FORMAT(h.Date, '%Y-%m-%d') AS Date, Notes**

**FROM Harvest h**

**INNER JOIN LandDetails ld ON h.LandID = ld.LandID**

**INNER JOIN Farmers f ON h.FarmerID = f.FarmerID**

**INNER JOIN Crops c ON ld.CropID = c.CropID;**

**6) MarketSales View:**

* This view helps to the Users that can easily analyze market sales data without needing to refer to multiple tables, simplifying the process of monitoring sales transactions.

**CREATE VIEW MarketSalesView AS**

**SELECT ms.SaleID, c.Name AS CropName, f.Name AS FarmerName, DATE\_FORMAT(ms.Date, '%Y-%m-%d') AS Date, QuantitySold, PricePerUnit**

**FROM MarketSales ms**

**INNER JOIN Crops c ON ms.CropID = c.CropID**

**INNER JOIN Farmers f ON ms.FarmerID = f.FarmerID;**

**Conclusion:-**

Our agriculture management system leverages the power of a robust database management system (DBMS) to streamline and optimize farming operations. With a focus on efficient data storage, retrieval, and analysis, our system empowers farmers to make informed decisions, maximize productivity, and ensure sustainability. Through features such as detailed farmer profiles, crop management, land utilization tracking, activity logging, harvest monitoring, and market sales analysis, our system offers a comprehensive solution for modern farming needs. By integrating DBMS concepts such as entity-relationship modeling, normalization, views, subqueries, aggregate functions, and joins, we provide a user-friendly platform that facilitates effective management and decision-making in agriculture.