

# CSE408 Software Engineering

## Lab Activity 5 Design Phase

Roll No.AU2340222 Name: Dev Kansara

**Aim:** To design the **system architecture, database schema, and define data validation, integrity rules, and data storage/retrieval mechanisms** for a selected project.

**Key objectives to practice:**

- Create a **high-level system architecture diagram**
- Design an **appropriate database schema**
- Define **data validation and integrity constraints**
- Explain **data storage and retrieval mechanisms**

\*\*\*\*\*

### Task 1: Software Design – System Architecture

#### **Step 1: Identify System Components**

- User Interface Module
- Authentication Module
- Donation Management Module
- Requirements Management Module
- Search & Filter Module
- Notification Module
- 3<sup>rd</sup> Party Service Integration Module

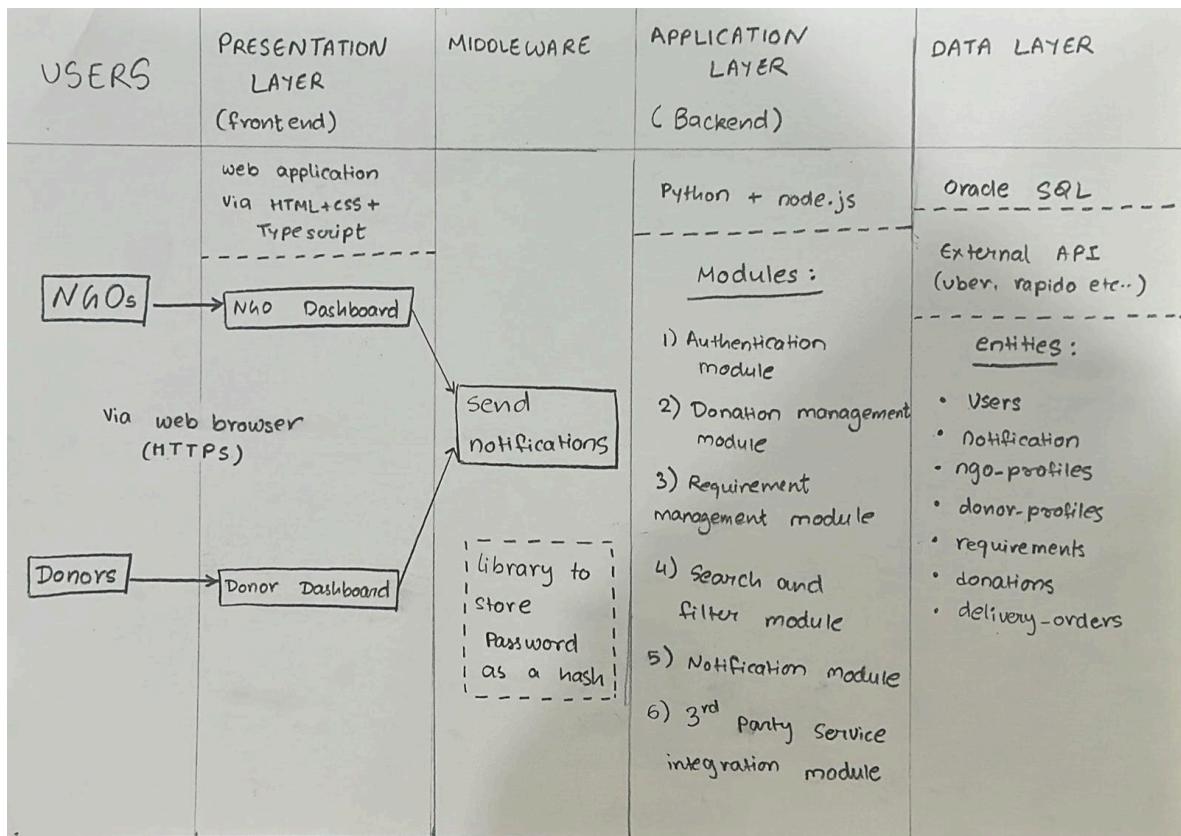
#### **Step 2: Draw System Architecture Diagram**

- Refer Sample Software Architectural Diagrams related to your project from internet

#### **Step 3: Architecture Description**

| Layer             | Description                            |
|-------------------|--|
| UI Layer          | Handles user interaction               |
| Middleware        | Notifications Handling                 |
| Application Layer | Business logic for login, issue/return |

|            |                              |
|------------|------------------------------|
| Data Layer | Stores and retrieves records |
|------------|------------------------------|



## Task 2: Data Design – Database Schema

### Step 4: Identify Entities

(Note: Following are sample entities only, you need to add all required entities related to your project)

1. User (Strong)
2. NGO (Strong)
3. Donor (Strong)
4. Requirement (Strong)
5. Donation (Strong)
6. Delivery\_Order (Weak)
7. Notifications (Weak)

### Step 5: Database Schema Design

#### 1. Users

| Field     | Type      | Constraint                |
|-----------|-----------|---------------------------|
| UserID    | NUMBER(5) | Primary Key               |
| Name      | VARCHAR2  | NOT NULL                  |
| Email     | VARCHAR2  | UNIQUE                    |
| Password  | VARCHAR2  | NOT NULL                  |
| Role      | VARCHAR2  | NOT NULL                  |
| Phone     | VARCHAR2  | -                         |
| CreatedAt | TIMESTAMP | DEFAULT<br>CURR_TIMESTAMP |

## 2. Ngo\_profiles

|                   |               |  |
|-------------------|---------------|--|
| NGO_ID            | NUMBER(5)     | Primary Key, Foreign Key(Users.UserID) |
| Organization_Name | VARCHAR(150)  | NOT NULL                               |
| Address           | VARCHAR(1000) | -                                      |
| City              | VARCHAR(100)  | -                                      |
| State             | VARCHAR(100)  | -                                      |
| Pincode           | VARCHAR(10)   | -                                      |
| Description       | VARCHAR(1000) | -                                      |

## 3. Donor\_profiles

|                   |               |   |
|-------------------|---------------|---|
| Donor_ID          | NUMBER(5)     | Primary Key, Foreign Key (Users.UserID) |
| Donor_Type        | VARCHAR(30)   | NOT NULL                                |
| Organization_Name | VARCHAR(150)  | -                                       |
| Address           | VARCHAR(1000) | -                                       |

## 4. Requirements

|                |              |                           |
|----------------|--------------|---------------------------|
| Requirement_ID | NUMBER(5)    | Primary Key               |
| NGO_ID         | NUMBER(5)    | Foreign Key (NGO, NGO_ID) |
| Title          | VARCHAR(150) | NOT NULL                  |

|             |               |                           |
|-------------|---------------|---------------------------|
| Description | VARCHAR(1000) | -                         |
| Quantity    | NUMBER(5)     | NOT NULL                  |
| Status      | VARCHAR(20)   | DEFAULT 'OPEN'            |
| CreatedAt   | TIMESTAMP     | DEFAULT CURRENT_TIMESTAMP |

### 5. Donations

|                 |             |  |
|-----------------|-------------|--|
| Donation_ID     | NUMBER(5)   | Primary Key                                  |
| Requirement_ID  | NUMBER(5)   | Foreign Key<br>(Requirements.Requirement_ID) |
| Donor_ID        | NUMBER(5)   | Foreign Key<br>(Donor.Donor_ID)              |
| Donation_Status | VARCHAR(20) | NOT NULL                                     |
| CreatedAt       | TIMESTAMP   | DEFAULT CURRENT_TIMESTAMP                    |

### 6. Delivery\_Orders

|                |               |  |
|----------------|---------------|--|
| Order_ID       | NUMBER(5)     | Primary Key                            |
| Donation_ID    | NUMBER(5)     | Foreign Key<br>(Donations.Donation_ID) |
| ProviderName   | VARCHAR(50)   | NOT NULL                               |
| EstimatedCost  | DECIMAL(10,2) | -                                      |
| TrackingLink   | VARCHAR(255)  | -                                      |
| PickupTime     | DATETIME      | -                                      |
| DeliveryStatus | VARCHAR(30)   | NOT NULL                               |
| CreatedAt      | TIMESTAMP     | DEFAULT CURRENT_TIMESTAMP              |

### Notifications:

|                  |               |                            |
|------------------|---------------|----------------------------|
| Notifications_ID | NUMBER(5)     | Primary Key                |
| UserID           | NUMBER(5)     | Foreign Key (Users.UserID) |
| Message          | VARCHAR(1000) | NOT NULL                   |

|           |           |                           |
|-----------|-----------|---------------------------|
| IsRead    | BOOLEAN   | DEFAULT FALSE             |
| CreatedAt | TIMESTAMP | DEFAULT CURRENT_TIMESTAMP |

### Task 3: Data Validation and Integrity Rules

#### **Step 7: Data Validation Rules**

- Email must follow a valid email format
- Password must contain a minimum of 8 characters (1 capital alphabet, special symbol, 1 digit, 1 small alphabet) and should be in hashed format
- Phone number must have 10 digits.
- created\_at (date of registering) must be in D-MON-yyyy format
- Pincode must be 6 digits.
- Status of requirements must be fulfilled/not fulfilled/ partially completed
- The cost of delivery must be in INR.
- Delivery\_status must be in delivered/ not delivered/ delivering
- Role must be either NGO/ Donor
- City name must be of India
- Status must be initiated/ confirmed/ in progress/ completed/ cancelled

#### **Step 8: Data Integrity Rules**

| Rule Type             | Description                                      |
|-----------------------|--|
| Entity Integrity      | Primary keys must be unique                      |
| Referential Integrity | UserID and BookID must exist                     |
| Domain Integrity      | Data type and size restrictions                  |
| Business Rule         | A donation cannot be made if requirements are 0. |

### Task 4: Data Storage and Retrieval Mechanisms

#### **Step 9: Data Storage Mechanism**

- The system will use a Relational Database Management System (RDBMS) like Oracle Sql.
- Data stored in relational tables like Donor, Donation, NGO, Delivery\_Order, etc.
- Sensitive data like password stored in hashed format.
- INSERT command used to add new users, donation entries, requirements by NGOs.
- UPDATE command used to modify requirement status, update delivery status.

## **Step 10: Data Retrieval Mechanism**

- SELECT queries used to fetch information from tables
- Filtering conditions using WHERE clause.
- Sorting using ORDER BY
- JOIN to combine multiple tables like Donor + Donation, NGO + Requirement

### **Example Retrieval:**

- Retrieve all donations made by a specific donor
- Retrieve pending requirements of an NGO.
- Retrieve delivery status of a donation
- Generate monthly donation reports

## **Task 5 : Mapping Software Design to Data Design**

Authentication Module - Users, ngo\_profile and donor\_profile tables

Donation Management Module - Donations, delivery\_order, requirements, donor\_profile table

Requirements Management Module- Requirements and ngo\_profile table

Search & Filter Module - Requirements table

Notification Module - Notification table

3<sup>rd</sup> Party Service Integration Module - Delivery\_order table