

CSE408 Software Engineering

Lab Activity 5 Design Phase

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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
- 3rd Party Service Integration Module

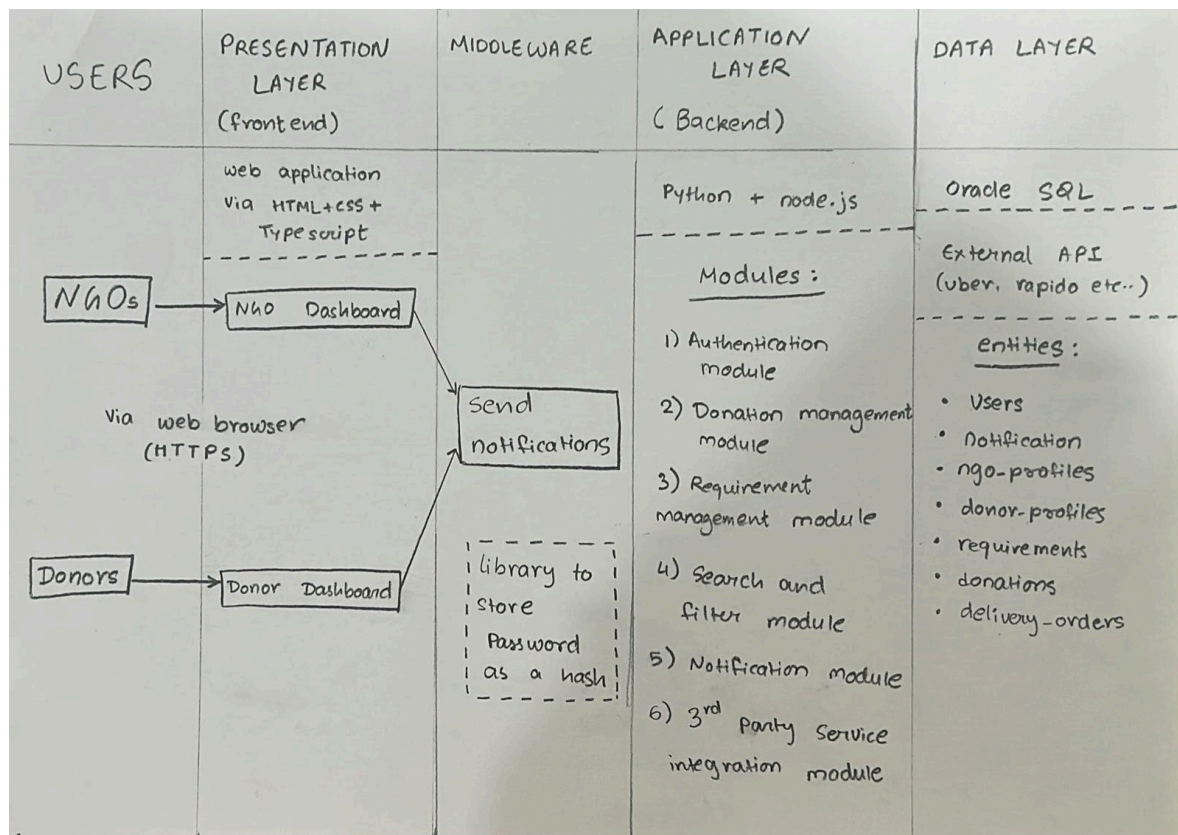
Step 2: Draw System Architecture Diagram

- 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
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Task 2: Data Design – Database Schema

Step 4: Identify Entities

(Note: Followings 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 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 (Requirements.Reuirement_ID)
Donor_ID	NUMBER(5)	Foreign Key (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 (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

3rd Party Service Integration Module - Delivery_order table