System Design Document

for

Organ Donation and Procurement Network Management System

Prepared by

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Course: Database Management Systems

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1 Purpose

The Database Design Document for the ODPNMS (Organ Donation and Procurement Network Management System) application defines the choice of the database management system to meet the software system's needs. This selection is driven by the goal of maintaining data consistency and integrity throughout the application. The Entity-Relational model, originating from the analysis of the use case diagram, is transformed into a relational schema tailored to the selected Database Management System (DBMS). This meticulous design ensures that the ODPNMS operates effectively and efficiently in managing its data

1.1 Document Objectives

The Database Design Document aims to achieve the following objectives:

1)To delineate the software design and specifications for the ODPNMS (Organ Donation and Procurement Network Management System) database. This includes defining the system's architecture and components that are accessible to both users and system developers through the Database Management System (DBMS).

2)To establish a foundational framework for implementing the database and associated software modules. This framework serves as a valuable resource for extracting essential details required during the software development phase of the application.

1.2 Intended Audience and Document Overview

This document caters to various groups of stakeholders, including:

- Technical Reviewers: Responsible for assessing and ensuring the document's quality.
- Architects: Whose architectural design must align with the requirements outlined in this document.
- Designers: Whose designs need to adhere to the document's specifications.
- Developers: Who will implement the software in accordance with the requirements presented in this document.
- Quality Assurance Personnel: Responsible for testing and validating the requirements detailed herein.

The subsequent section, "Assumptions and Constraints," provides insights into the assumptions considered and the limitations imposed during the product development process. The following section, "Database-wide Design," focuses on elucidating the system's behavior, with an emphasis on key roles and actions. It also outlines DBMS platform details, security requirements, and decisions related to performance and availability. The fourth section, "Database Administrative Functions," furnishes the Entity-Relationship Model, the relational schema derived from the ER diagram, and includes information on normalization and data formats.

1.3 Definitions,Acronyms andAbbreviations

1	ODPNMS	Organ Donation and Procurement Network Management System
2	NITC	NATIONAL INSTITUTE OF TECHNOLOGY
3	DBMS	DatabaseManagement System
4	1NF	First Normal Form
5	2NF	Second Normal Form
6	3NF	Third Normal Form

1.4 References

- http://www.sdlcforms.com/PopupForm-DatabaseDesignDocument.html
- https://creately.com/
- Fundamentals of Database Systems by Ramez Elmasri

2 Assumptions and Constraints

2.1. Assumptions

The following are the assumptions made while developing this product :

- Only user have permission to add/delete/update records.
- The data of all the organ available ,organ donated and users must be stored in a database
- The system must have storage capacity and render fast access to the database
- The system will be available at all times
- The users know English as the interface will be entirely in English
- The user are aware of the basic functioning of the system
- The database must be updated upon transaction/availability/donation
- Since the application is web-based, there is a need for an internet browser. It will be assumed that users will possess decent internet connectivity.
- It is also assumed that the user is familiar with an internet browser and handling the keyboard and mouse.

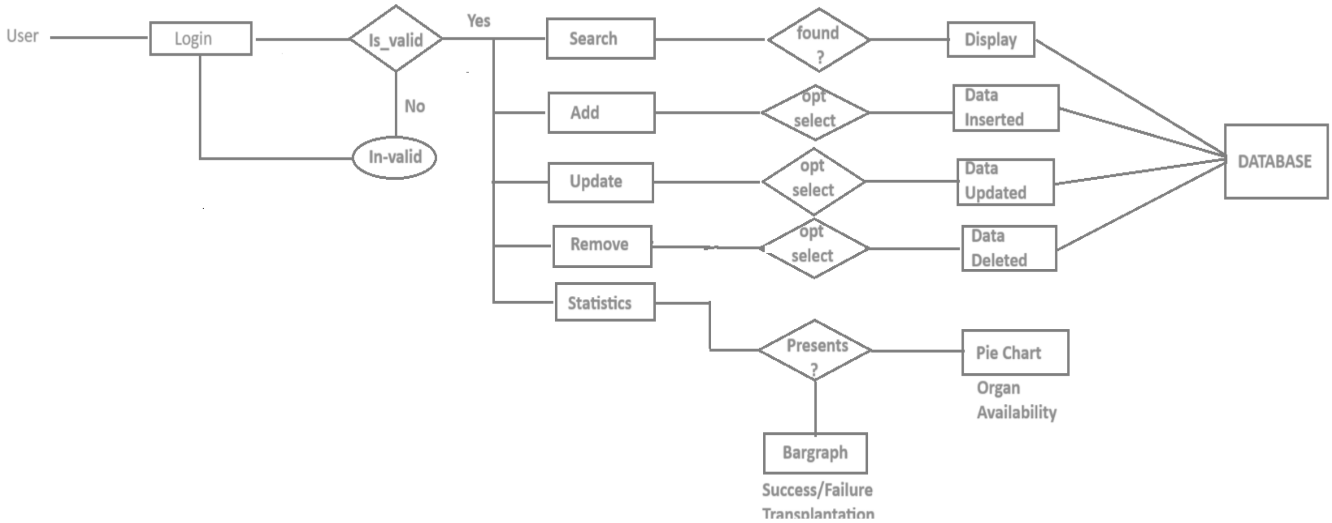
2.2 . Constraints

The following design and implementation constraints are employed in the system:

- User access is protected with exclusive credentials
- user has an individual username and password.
- User can view all the details of the web.
- The software is designed, delivered and maintained to the client by this team.

3 Database- Wide Design Decisions

3.1 Product Overview:



3.2 Behaviour

1. Login

● The user, on opening the application, are directed to a login page. The user can enter user's username and password and log in to the application. The application redirects to next page.

- **Login Page:** Users access the system via a login page.
- **User Authentication:** The system verifies login credentials and redirects to next page.

2. User

Users, after logging into the system is presented with the following options:

- User
- Search
- Add
- Update
- Remove
- Statistics

3.3 . DBMS Platform

The Database Management System (DBMS) platform in the Organ Donation and Procurement Management System (ODPNMS) project is a web-based solution that ensures a clear, interactive user experience. Accessible through web browsers, it authenticates users based on their credentials and directs them to role-specific pages with tailored functionalities. The DBMS securely manages all data, adhering to role-based access control and standard templates, facilitating efficient data retrieval, interaction, and user-friendly navigation. This platform underpins the ODPNMS, providing a robust foundation for data management, role-based functionality, and a seamless user experience.

3.4 Security Requirements

Data Security

All data is stored in a secure database, ensuring the confidentiality and integrity of sensitive information.

Access Control

The privilege to update the database is restricted to authorized users, typically administrators or super admins.

User Safety

The system is designed with user safety as a top priority, and it poses no inherent threats to its users.

Malware Protection

To safeguard against potential attacks by malware, regular database backups are strongly advised, enhancing data resilience and system continuity.

These security measures collectively establish a robust security framework for the ODPNMS, addressing data protection, access control, user safety, and proactive measures to combat potential security threats.

3.5. Performance and Availability Decisions

Real-time Data Updates: The system places a strong emphasis on real-time data updates. Search and retrieval operations are designed to instantly reflect any changes made within the system. This ensures that users have access to the most up-to-date and accurate information.

Rapid Response: The system's primary objective is to provide swift response times. It is designed to respond to user requests within a fraction of a second, guaranteeing a seamless and efficient user experience. While viewing transaction history may take slightly longer, the overall performance remains exceptionally fast and precise.

Data Handling: ODPNMS is architected to manage substantial volumes of data. It is equipped to efficiently handle large datasets. This capacity ensures that the system can meet the growing demands of both data and users while maintaining high-performance standards.

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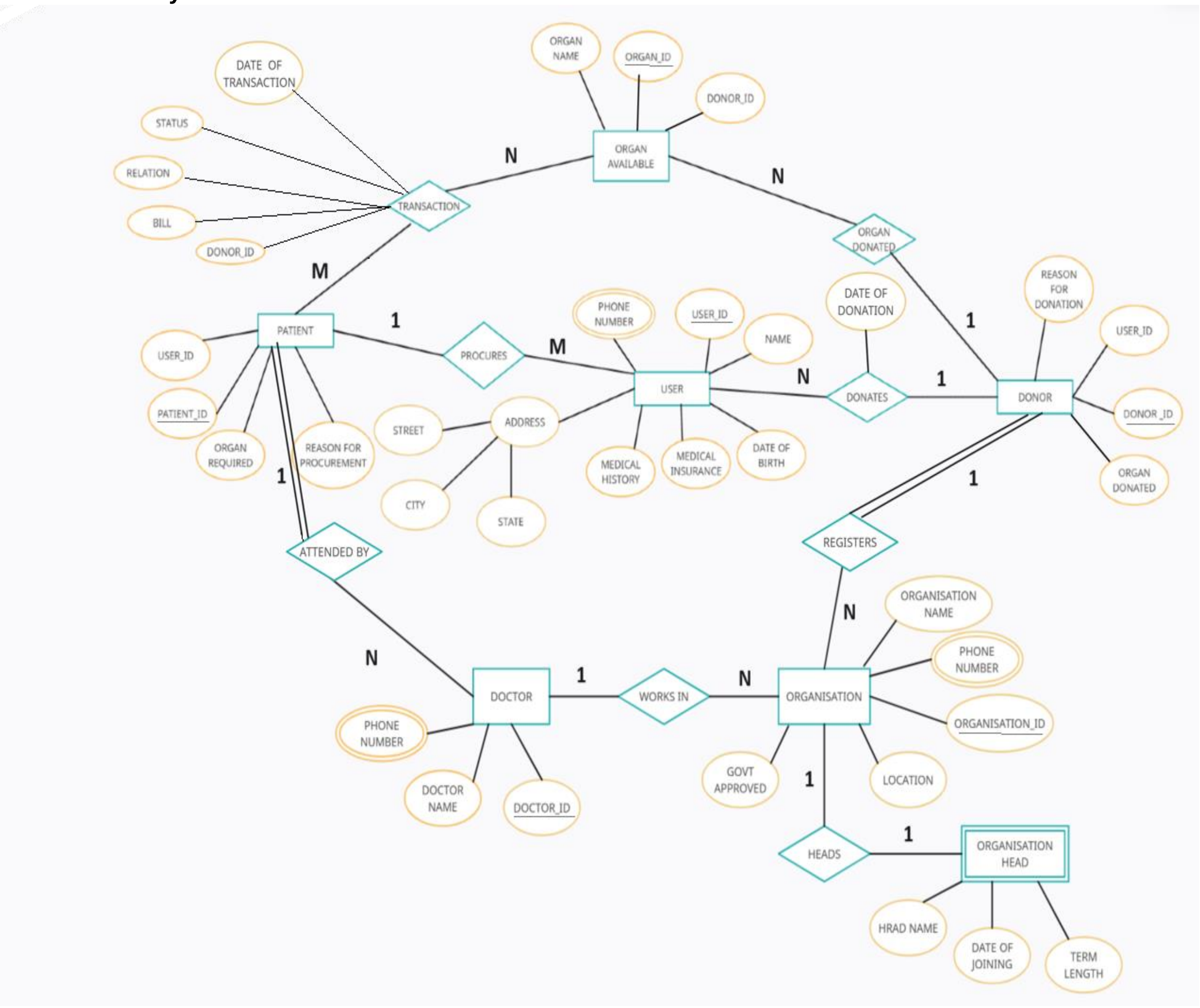
4 Database Administrative Functions

4.1 Entity-Relation Model



ER Analysis: Identifying Entity Sets and Relationship Sets:

Entity Sets:

1. User

1. User ID

2. Name

3. Date of birth

4. Phone Number (multi-valued)

5. Medical Insurance

6. Medical History

7. Address

2. Patient

1. Patient_ID

2. Organ Required

3. Reason of procurement

4. User_ID (foreign key)

3. Donor

1. Donor_ID

2. Organ Donated

3. Reason of donation

4. User_ID (foreign key)

4. Organ Available

1. Organ_ID

2. Organ Name

3. Donor_ID (foreign key)

5. Organization

1. Organization ID

2. Organization Name

3. Location

4. Government approved organization or not

5. Phone Number (multi-valued)

6. Doctor

1. Doctor ID

2. Doctor Name

3. Phone Number (multi-valued)

7. Organization Head

1. Head Name

2. Date of Joining

3. Term Length

Relationship Sets:

1. Donates – The act of donation of an organ from a donor

2. Date – Date of donation

3. Procures - The act of procuring an organ by the patient

4. Transaction

1. Date of transaction

2. Status – whether the surgery was successful or not

5. Organ Donated -The organ donated by an donor, which is then stored in Organ_available table.

6. Attended By -The transplantation performed by doctor – procuring an organ from a donor and transplanting it to the patient by surgery.

7. Registers - Donor is registered in which organization

8. Works in – The organization where the doctor works.

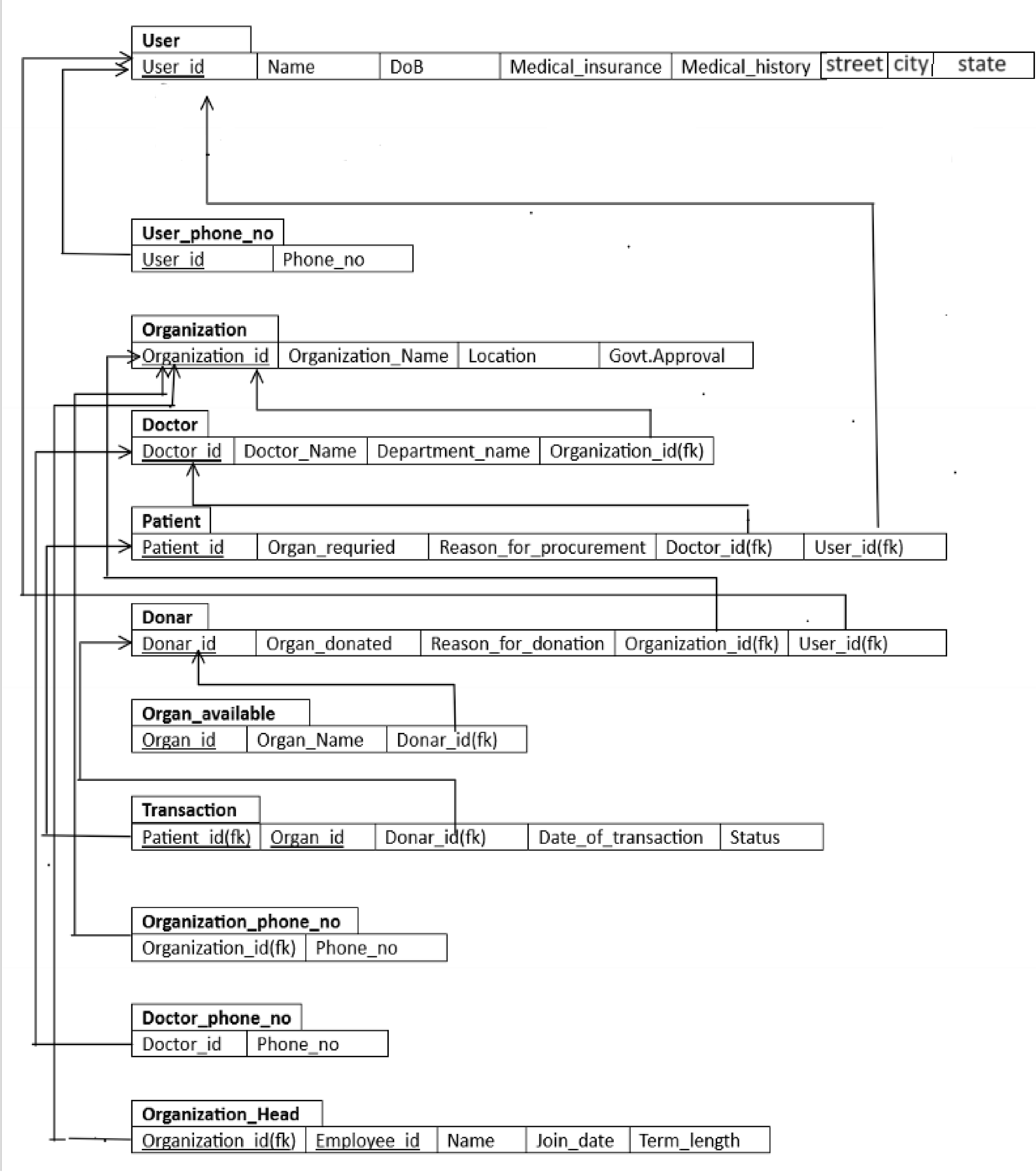
9. Headed By – The organization is headed by which person 4.2 Relational Schema

Tables and their Functional Dependencies :-

1) **User**(User_ID, Name, Date _of_birth, Medical_Insurance, Medical_History, Street, City, State)
FD={User_ID → Name, Date _of_birth, Medical Insurance, Medical History, Street, City, State}
2) **User_phone_no**(User_ID, phone_no)
FD={User_ID -> phone_no}
{User_ID} is foreign key constraint
3) **Patient**(Patient_ID, organ_req, reason_of_procurement, Doctor_ID, User_ID)
FD={Patient_ID, organ_req -> reason_of_procurement, Doctor_ID, User_ID}
{User_ID, Doctor_ID} are foreign key constraints
4) **Donor**(Donor_ID, organ_donated, reason_of_donation, Organization_ID, User_ID)
FD={Donor_ID, organ_donated -> reason_of_donation, Organization_ID, User_ID}
{User_ID, Organization_ID} are foreign key constraints
5) **Organ Available**(Organ_ID,Organ_name, Donor_ID)
FD={Organ_ID -> Organ_name,Donor_ID}
{Donor_ID} is foreign key constraint
6) **Transaction**(Patient_ID, Organ_ID, Donor_ID, Date_of_transaction,

Status)
FD={Patient_ID, Organ_ID -> Donor_ID,Date_of_transaction,
Status}
{Patient_ID, Donor_ID} are foreign key constraints
7) **Organization**(Organization_ID, Organization_name, Location,
Government_approved)
FD={Organization_ID -> Organization_name, Location,
Government_approved}
8) **Organization_phone_no**(Organization_ID, phone_no)
FD={Organization_ID -> phone_no}
{Organization_ID} are foreign key constraints
9) **Docto**r(Doctor_ID, Doctor_name, Department_name, Organization_id)
FD={Doctor_ID **->** Doctor_name, Organization_id}
{Organization_ID} is foreign key constraint
10) **Doctor_phone_no(**Doctor_ID, phone_no)
FD={Doctor_ID -> phone_no}
{Doctor_ID} is foreign key constraint
11) **Organization_head**(Organization_ID, Employee_ID, Name,
Date_of_joining, Term_length)
FD={Organization_ID, Employee_ID -> Name, Date_of_joining,
Term_length}

4.2 Relational Schema



User

User_id	Name	DoB	Medical_insurance	Medical_history	street	city	state

User_phone_no

User_id	Phone_no

Organization

Organization_id	Organization_Name	Location	Govt.Approval

Doctor

Doctor_id	Doctor_Name	Department_name	Organization_id(fk)

Patient

Patient_id	Organ_requried	Reason_for_procurement	Doctor_id(fk)	User_id(fk)

Donar

Donar_id	Organ_donated	Reason_for_donation	Organization_id(fk)	User_id(fk)

Organ_available

Organ_id	Organ_Name	Donar_id(fk)

Transaction

Patient_id(fk)	Organ_id	Donar_id(fk)	Date_of_transaction	Status

Organization_phone_no

Organization_id(fk)	Phone_no

Doctor_phone_no

Doctor_id	Phone_no

Organization_Head

Organization_id(fk)	Employee_id	Name	Join_date	Term_length

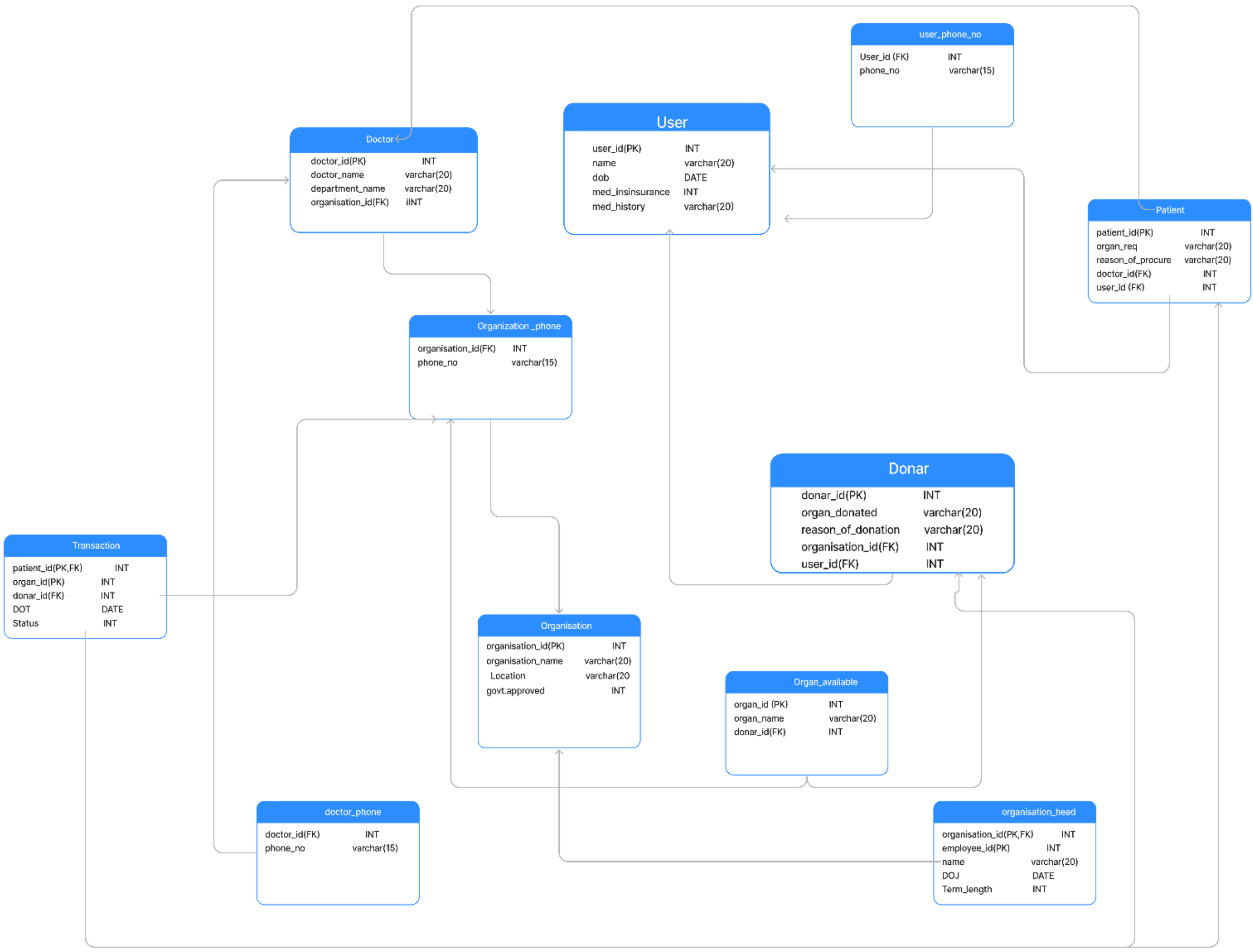
4.3 Normalization

- 1NF - The tables are in 1NF, as there are no multivalued or composite attributes. Each table cell contains atomic values, and each record is unique. Hence the database is 1NF normalized.

- 2NF - The tables are already in 1NF as proved above. There are no partial dependencies, that is, there are no non-prime keys solely dependent on only one part of a primary key in any of the tables. Hence the database is 2NF normalized.

- 3NF - The tables are already in 2NF as proved above. There are no transitive functional dependencies in the schema. There are no non-prime keys that are dependent on another non-prime key in any specific table. Hence the database is 3NF normalized.

4.4 Schema Description & Data Formats



user_phone_no	
User_id (FK)	INT
phone_no	varchar(15)

User	
user_id(PK)	INT
name	varchar(20)
dob	DATE
med_insinsurance	INT
med_history	varchar(20)

Doctor	
doctor_id(PK)	INT
doctor_name	varchar(20)
department_name	varchar(20)
organisation_id(FK)	iINT

Patient	
patient_id(PK)	INT
organ_req	varchar(20)
reason_of_procure	varchar(20)
doctor_id(FK)	INT
user_id (FK)	INT

Organization _phone	
organisation_id(FK)	INT
phone_no	varchar(15)

Donar	
donar_id(PK)	INT
organ_donated	varchar(20)
reason_of_donation	varchar(20)
organisation_id(FK)	INT
user_id(FK)	INT

Transaction	
patient_id(PK,FK)	INT
organ_id(PK)	INT
donar_id(FK)	INT
DOT	DATE
Status	INT

Organisation	
organisation_id(PK)	INT
organisation_name	varchar(20)
Location	varchar(20
govt.approved	INT

Organ_available	
organ_id (PK)	INT
organ_name	varchar(20)
donar_id(FK)	INT

doctor_phone	
doctor_id(FK)	INT
phone_no	varchar(15)

organisation_head	
organisation_id(PK,FK)	INT
employee_id(PK)	INT
name	varchar(20)
DOJ	DATE
Term_length	INT