P2: Database design and conceptual ERD

Group: 19

Healthcare Management System

1. Introduction

- The purpose is to create a database for healthcare management that manages patient information, improves operational efficiency, provides secure communication among healthcare providers such as doctors and nurses, and supports decision-making that is data driven
- The system will be used by hospitals, clinics, and healthcare organizations to handle patient records, appointment scheduling, medical treatments, and communication securely and efficiently.

2. Business Problems Addressed

The system is designed to address key healthcare challenges:.

- **Improving patient care:** quick access to records of patients and faster appointment scheduling is ensured alongside facilitating communication between healthcare providers and receivers
- **Operational Efficiency**: administrative tasks regarding billing, insurance etc are automated
- **Data Security**: Ensuring compliance with regulations like HIPAA to protect patient information.
- **Collaboration Among Providers**: secure sharing of medical records between healthcare providers is facilitated

3. Entities and Attributes

1. Patient

- **Attributes**: PatientID, Name, DOB, Gender, ContactInfo, Address, InsuranceInfo
- **Relationships**:Schedules Appointments, Receives Treatments, Assigned to a Doctor, Has Medical Records

2. AdminStaff

- **Attributes**: StaffID, Role, DepartmentID
- **Relationships**:Manages Patient Records, Schedules Appointments, Handles Billing

3 Nurse

- **Attributes**: DepartmentID,NurseID, CertificationLevel,Experience
- **Relationships**: assists in the treatments , assigned to an appointment

4. Doctor

- **Attributes**: DoctorID, Specialty, DepartmentID, Experience
- **Relationships**: Manages Appointments, Treats Patients, Prescribes Medication, Creates Medical Records , coordinates with nurses

5. Appointment

- **Attributes**: AppointmentID, Date, Time, PatientID, DoctorID, Status
- **Relationships**:Assigned to a Patient and a Doctor, Includes Treatment, Involves Billing

6. MedicalRecord

- **Attributes**: RecordID, PatientID, DoctorID, Diagnosis, TreatmentPlan, DateCreated
- **Relationships**: Belongs to a Patient, Created by a Doctor, Updated during Appointments

7. Billing

- **Attributes**: BillID, PatientID, AppointmentID, TotalAmount, PaymentStatus, InsuranceID
- **Relationships**: Linked to Appointments, Paid by Insurance or Patient

8. Insurance

- **Attributes**: InsuranceID, ProviderName, PolicyNumber, CoverageDetails
- **Relationships**:Covers Billing for Patients, Linked to Patients

9. Treatment

- **Attributes**: TreatmentID, Description, Cost, AppointmentID
- **Relationships**:Administered during Appointments, Recorded by Doctor, Involves Billing

10. Medication

- **Attributes**: MedicationID, Name, Dosage, Frequency, Cost
- **Relationships**:Prescribed by Doctors, Assigned to Patients, Includes in Medical Records

11. Department

- **Attributes**: DepartmentID, Name, HeadOfDepartment

- **Relationships**:Houses Doctors, Manages Appointments

4. Entity Relationships

1. Patient

- **Appointments**: schedules (One-to-Many)
- **MedicalRecords**: has of a patient (One-to-Many)
- **Insurance** : can have one or more insurance (One-to-Many)

2. AdminStaff

- **Appointments** for **Patients** (One-to-Many)
- **Billing :** manages billing of many patients (One-to-Many)

3.Nurse

- **Treatment** : assists in treatments (Many-to-Many with Treatments)
- **Appointments :** assigned to many appointments (One-to-Many)
- **Department :** belongs to one department(Many to one)

4. Doctor

- **Appointments :** manages many (One-to-Many)
- **MedicalRecords** : creates(One-to-Many)
- **Department** : belongs to (Many-to-One)
- **Medications** : prescribes (One-to-Many)
- **Doctor** coordinates with **Nurses** for **Treatments** (Many-to-Many)

5. Appointment

- **Patient :** belongs to one (Many-to-One)
- **Doctor :** handled by (Many-to-One)
- **Treatments :** involves many (One-to-Many)
- **Billing :** results in (One-to-One)
- **Appointment** involves **Nurses** for assistance (Many-to-Many)

6. MedicalRecord

- **Patient** : belongs to (Many-to-One)
- **MedicalRecord** is created by one **Doctor** (Many-to-One)
- **MedicalRecord** includes many **Medications** (One-to-Many)

7. Billing

- **Appointment** : belongs to one(One-to-One)
- **Insurance** : paid by one (Many-to-One)

8. Insurance

- **Patients** : covers multiple (One-to-Many)
- **Billings** : pays multiple(One-to-Many)

9. Treatment

- **Appointment** : belongs to one(Many-to-One)
- **Nurses** : involves many (Many-to-Many)

10. Medication

- **Doctor** : is prescribed by one (Many-to-One)
- **MedicalRecords** : listed in multiple (Many-to-One)

11. Department

- **Doctors** : contains multiple (One-to-Many)
- **Nurses** : contains multiple (One-to-Many)

Expanded Relationships:

- **Patient to Appointment**: A patient schedules many appointments, but each appointment is assigned to one patient.
- **Doctor to Nurse**: A doctor coordinates with multiple nurses to provide treatments, and nurses assist many doctors across treatments.
- **Doctor to Medication**: A doctor prescribes many medications, and each medication is linked to many medical records.
- **Appointment to Treatment**: Each appointment involves multiple treatments, and each treatment can involve multiple medical professionals (doctors and nurses).
- **Patient to MedicalRecord**: A patient can have many medical records, but each medical record is tied to one patient and one doctor.

5. Key Design Decisions

- **Appointment Scheduling**: The system should allow both patients and admin staff to schedule, cancel, or reschedule appointments. Each appointment is tied to both a doctor and patient.
- **Data Security**: Due to HIPAA and similar regulations, medical records must be securely stored and accessible only by authorized personnel.
- **Scalability**: The system needs to accommodate growing patient data, new medical records, and more complex treatment plans.
- **Patient Empowerment**: Patients should have controlled access to their own medical records and billing history, promoting active participation in their healthcare.

6. ER Diagram

Patient
- PatientID
- Name
- DoB
- Gender
- Contact
- Address
- Insurance Info.

Admin Staff
- StaffID
- Role
- DepartmentID

Nurse
- NurseID
- Certification Level

Appointment
- AppointmentID
- Date
- Time
- PatientID
- DoctorID
- Status

Doctor
- DoctorID
- Speciality
- DepartmentID
- Experience

Department
- DepartmentID
- Name
- HeadOfDepartment

Medical Record
- RecordID
- PatientID
- DoctorID
- Diagnosis
- Date
- TreatmentPlan

Insurance
- InsuranceID
- ProviderName
- PolicyNumber
- Coverage

Billing
- BillID
- PatientID
- AppointmentID
- TotalAmount
- Payment Status

Treatment
- TreatmentID
- Description
- Cost
- AppointmentID

Medication
- MedicationID
- Name
- Dosage
- Frequency
- Cost