DATABASE DESIGN FOR DENTAL OFFICE

Smile Dental Clinic

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REVISION HISTORY

Version	Date	Changes Made	Author
0	10/6/19	High level diagram with in-scope and out-scope items	Gauri Verma
1	10/31/9	Adding detailed diagram with explanation for all attributes	Adwait Sathe
2	11/2/19	Added business rules	Vivek Kulkarni
3	11/5/19	Added cluster diagrams by breaking down the detailed diagram	Shwetank Rokade
4	11/10/19	Defined entities that have distinct existence and objective	Adwait Sathe
4.1	11/13/19	Added detailed toad model	Vivek Kulkarni
4.2	11/14/19	Verified data types of all the attributes	Gauri Verma
4.3	11/15/19	Polishing of document	Shwetank Rokade
4.4	11/24/19	Improvisations and modifications	Gauri Verma
5	11/27/19	Verifying tables and comparing it with the toad model	Vivek Kulkarni
5.1	12/1/19	Images added to beautify the document	Gauri Verma
5.2	12/4/19	Changes as per review and feedback by professor	Shwetank Rokade
6	12/8/19	Changes in model as per implementation in frontend	Vivek Kulkarni
6.1	12/11/19	Modifying tables as per model	Shwetank Rokade
6.2	12/12/19	Adding icons for definitions	Adwait Sathe

OVERVIEW

A dental clinic is a healthcare center to aid to the dental problems of patients. A dental clinic is accustomed in maintaining their patient records and handle appointments for which the system is designed.

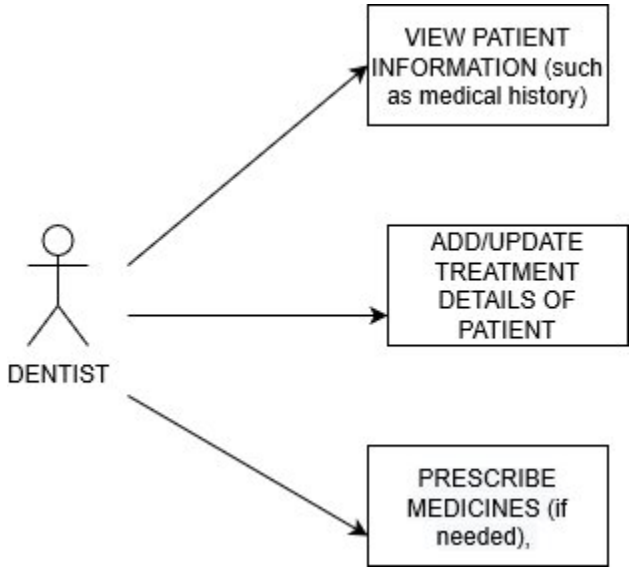
The database is created to manage and address the appointments at a multi-location dental clinic. It will cater and support the following:

- Scheduling appointments for patients
- Storing information regarding their visit(s)
- Managing diagnosis, treatment, and prescription related information
- Managing invoice
- Tracking information for the visits of the patients
- Storing and managing medical details of the patient
- Handling equipment and supplies information

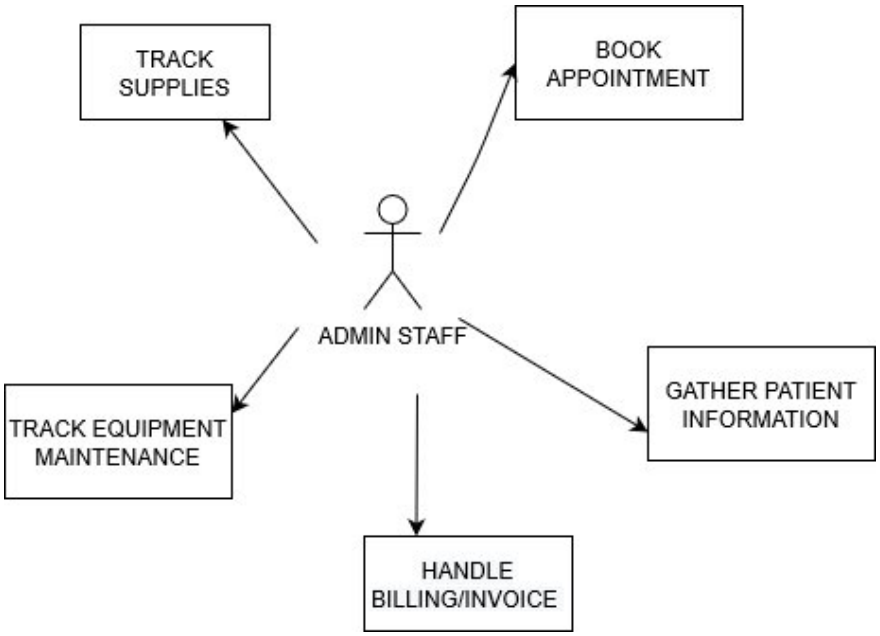
AUDIENCE

The data model is designed for the dental clinic to be able to handle patient appointments and details. The audience/actors of the system will be:

- Dentist: Dentist will be able to view and add/update/delete patient treatment information, prescriptions. Etc.

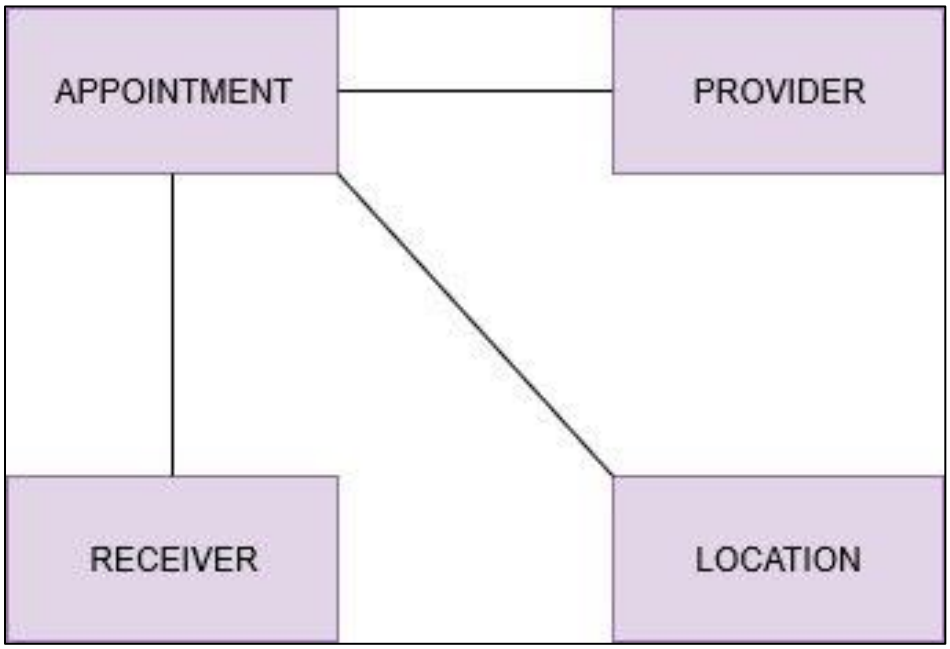


- Admin at Dental Clinic: The admin at dental clinic is responsible for booking appointments of patients and handling patient demographic details and medical history, payments. Etc.



HIGH- LEVEL DIAGRAM

The following is a high – level model of the dental clinic database design. It depicts the cumulative database design.



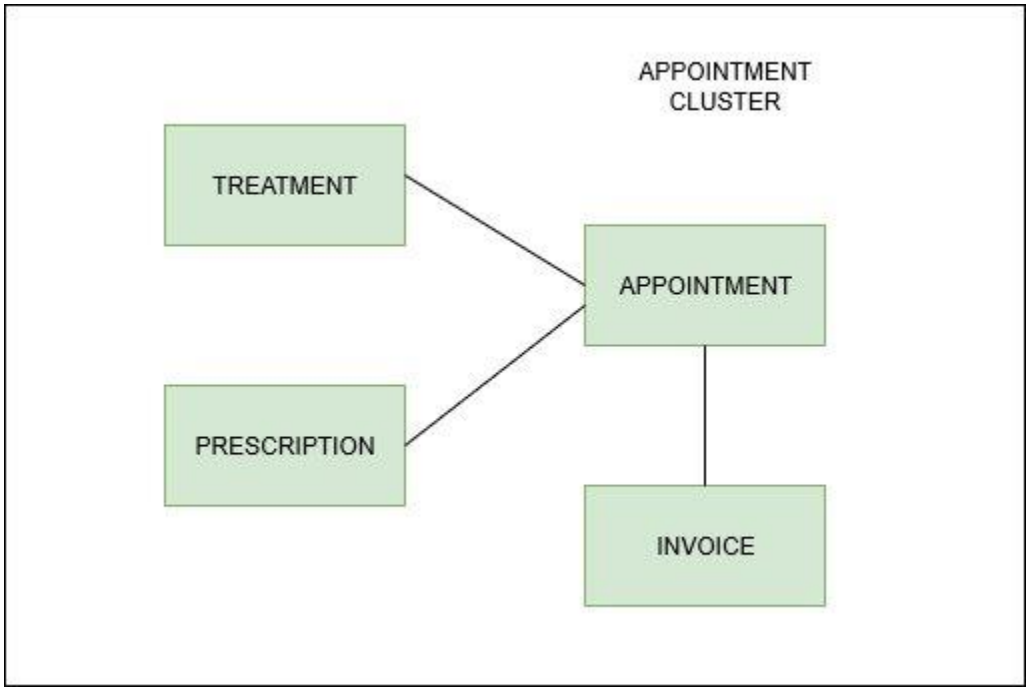
- The receiver books and appointment
- The appointment is supported by a provider
- The event of an appointment is held at a location.

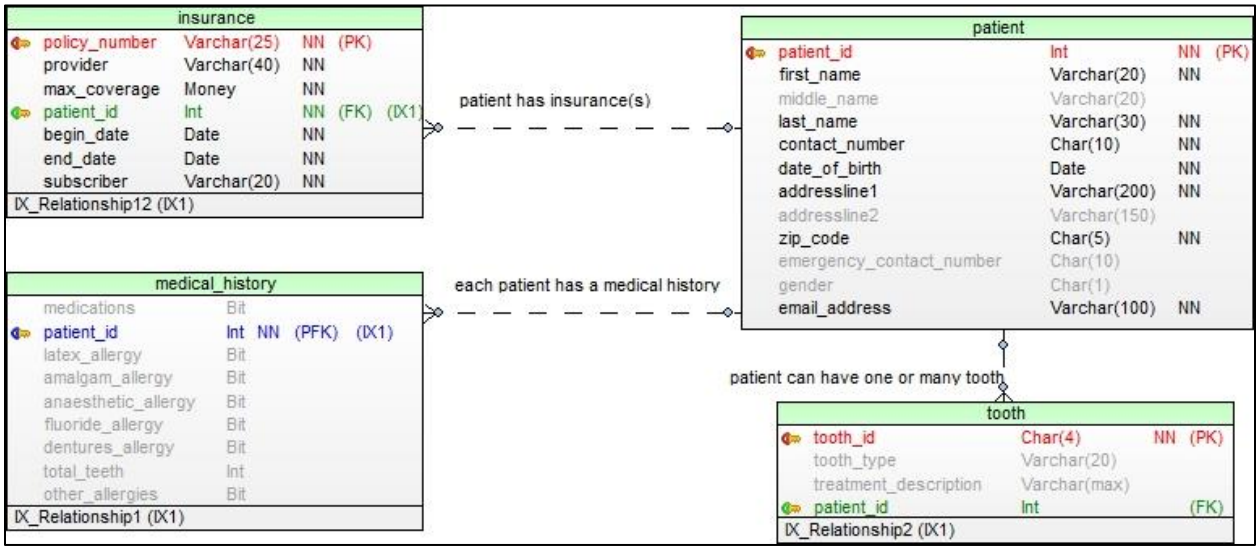
SUBJECT AREAS/CLUSTERS

Subject areas are defined as the broader descriptions of various related entities. Each cluster defined below consists of a nested structure and various observations are nested within each cluster.

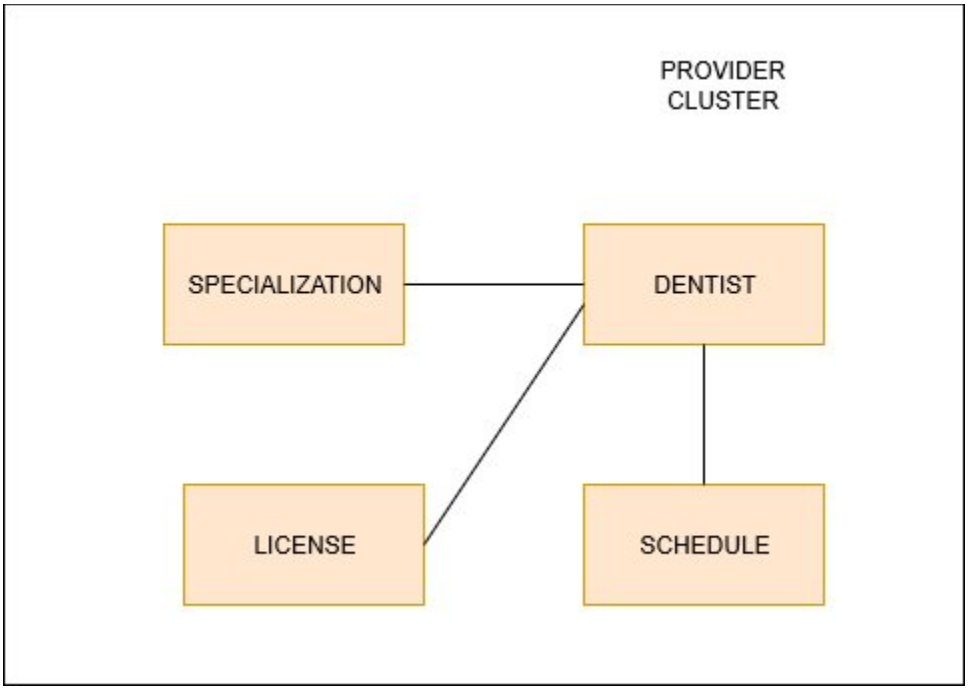
The main clusters for the same are defined below.

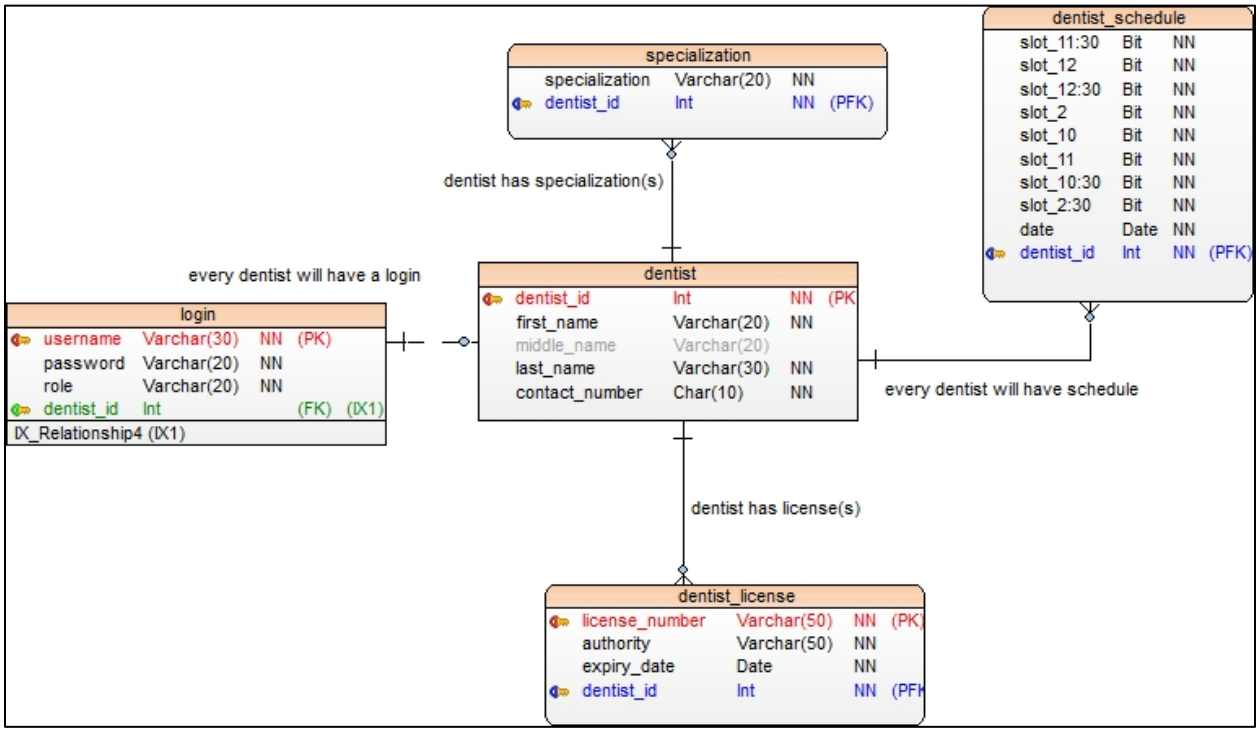
1. **APPOINTMENT**: Appointment defines the action of setting up a meeting between the patient and the dentist for dental reasons and for treatment regarding the same.



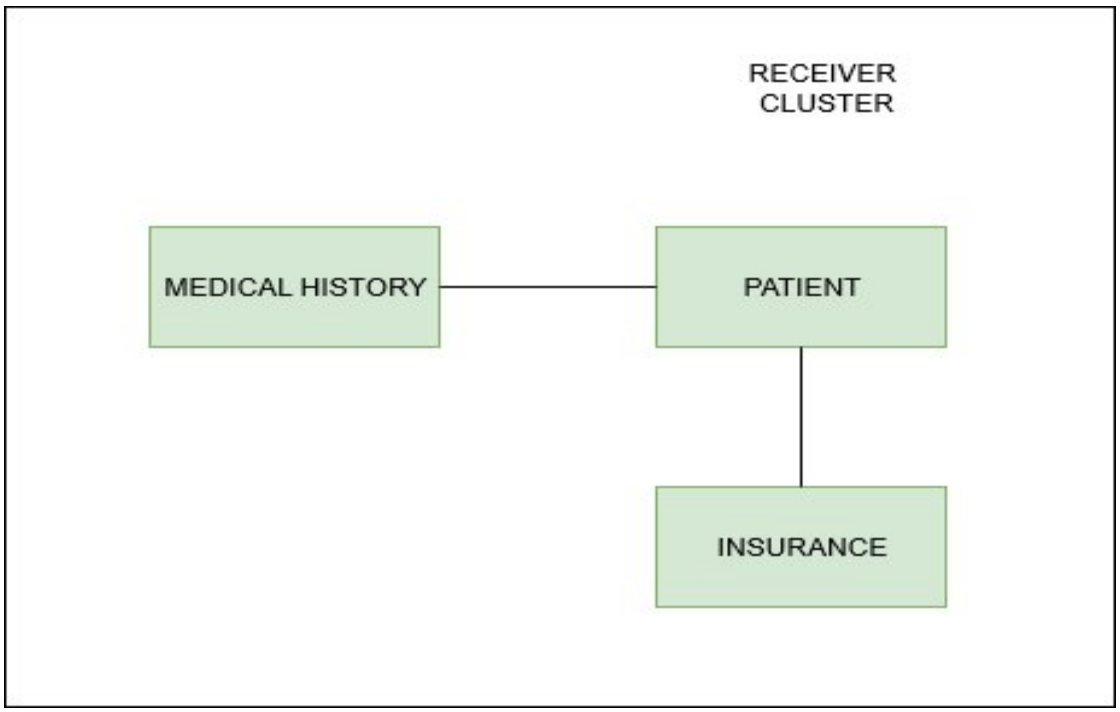


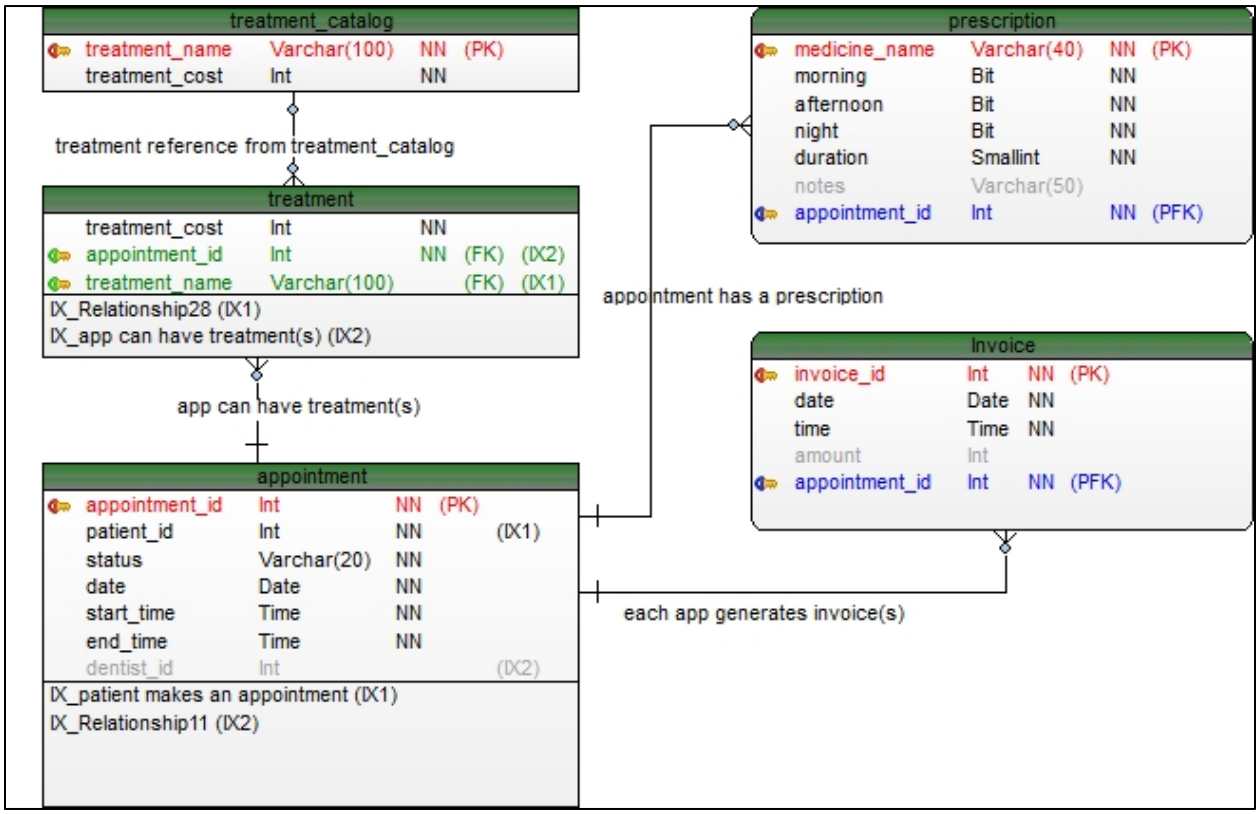
2. **PROVIDER**: A provider is one who assists the patient for his/her dental treatment(s).It includes the license details of the provider and the specializations of the provider as well.



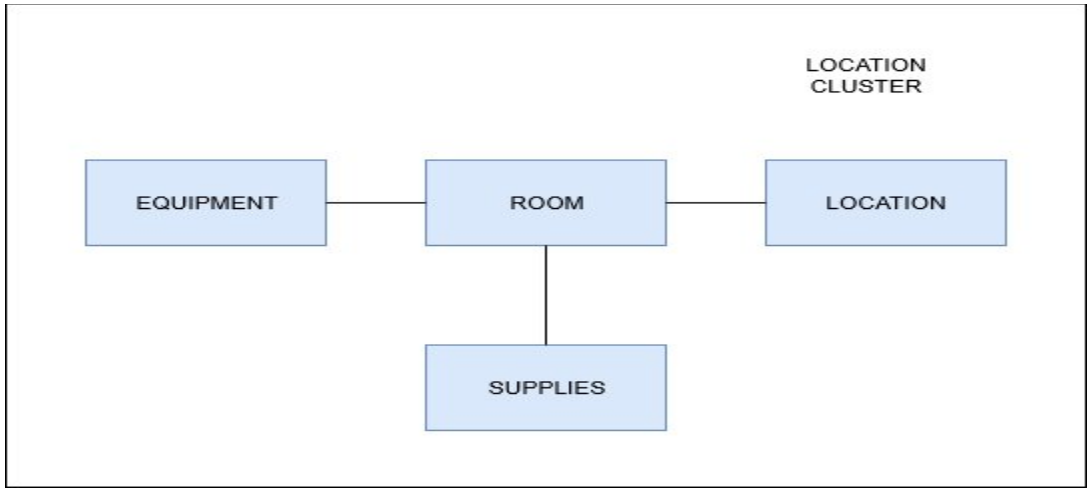


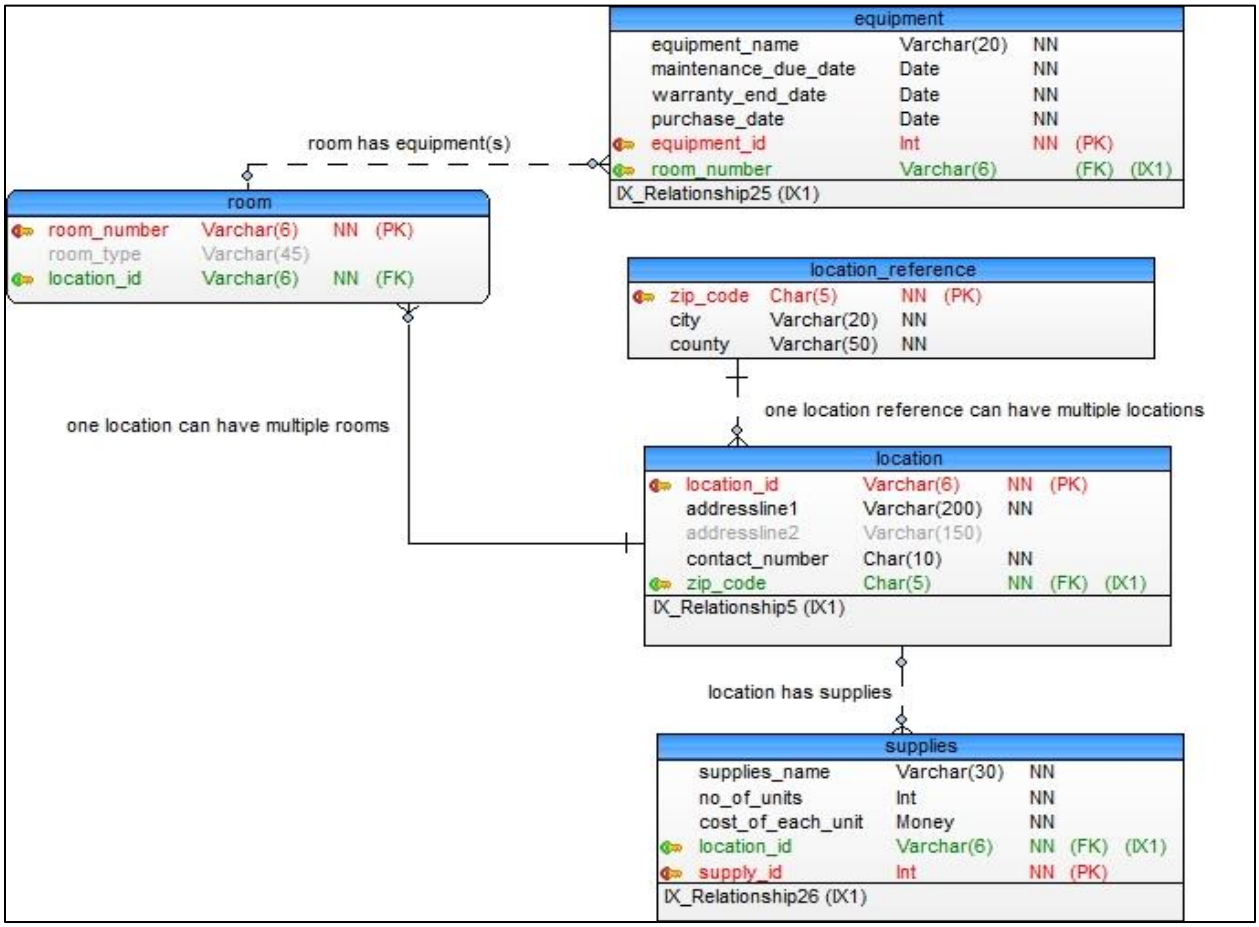
3. **RECEIVER**: This cluster includes those who receive treatment from the provider. Each receiver has a medical history associated with them and their insurance details, if any.





4. **LOCATION**: It defines the geographical location of the dental clinic. Each location will have various rooms associated with it where the appointments will be help. Each room will have various supplies and equipments associated with it.





BUSINESS RULES

Business rules defines or constrains aspects of business and resolves to either true or false. For the same, the in-scope and out-of-scope items are defined as follows:

IN SCOPE ITEMS

- The following describes what is being delivered to the customer as part of the system.
- The subject areas mentioned will be delivered as a result of the proposal.

Serial No.	Description	Related entities
IS1.	Capture patient details such a name, address, contact number. Etc.	Patient
IS2.	Patient can book more than one appointment	Patient
IS3.	Patient can have more than 1 insurance	Patient
IS4.	Emergency contact details of the patient must be captured	Patient
IS5.	Patient can have appointments with multiple dentist's in the same day	Patient
IS6.	A dentist can have more than 1 licenses	Dentist License
IS7.	A patient cannot have multiple appointments at the same time	Appointment
IS8.	Track the appointment status for each appointment	Appointment
IS9.	Capture the appointments details (such a time, location, dentist) of patients	Appointment
IS10.	License needs to be captured for the provider, can be more than 1	Dentist
IS11.	A dentist can practice at more than 1 location	Dentist
IS12.	Dentist can have more than 1 specialization	Dentist
IS13.	Capture information of the dentist such as name, contact number, license details. etc.	Dentist
IS14.	Track the validity of the dentist's license	Dentist
IS15.	There can be more than 1 location for the dentist clinic	Location
IS16.	Capture medical history of the patient	Medical History
IS17.	Generate bills for the patient(s) and the insurance company(s).	Invoice
IS18.	A treatment catalog is designed which contains all the available treatments at the clinic	Treatment Catalog
IS19.	Capture and record treatment details	Treatment
IS20.	Patient can have more than 1 treatments in a single appointment	Treatment

IS21.	A treatment can be completed in multiple appointments	Treatment
IS22.	An invoice must be generated for each appointment	Invoice
IS23.	One appointment can have multiple prescriptions associated with it	Prescription
IS24.	Each room can be associated with multiple appointments	Room
IS25.	Medical equipment can be bought from multiple vendors	Equipment
IS26.	A patient can undergo more than 1 treatment	Treatment
IS27.	There can be only 1 appointment in a room at a given time	Appointment
IS28.	A schedule of dentist is maintained	Dentist Schedule

OUT OF SCOPE ITEMS

- The activities that fall outside the boundaries of the designed model and are not planned for are listed below.
- Addition of any of the following will incur extra time and cost as per the requirements.

Serial No.	Description
O1.	Payroll and Human Resource Information
O2.	People who work in the office but do not take care of the patient
O3.	Electronic appointment reminders
O4.	Electronic booking of appointments by patient
O5.	Work schedule of other staff apart from the dentist/provider
O6.	Track of equipment like fax machine, telephone, etc.
O7.	Drug inventory/drug supply
O8.	Finances of the clinic
09.	Parking facilities
010.	Feedback of dentists by patients
011.	Payment from dental office to the suppliers
012.	Feedback of dentists given by patients
013.	Login facilities to the customer to book the appointment
014.	Maintenance and leasing cost of the building
015.	Clinic utilities like electricity bills, phone bills.etc
016.	Salaries of dentists
017.	Status of prescription
018.	Billing of equipment
019.	Payment via cheques
020.	Home treatment of patient

ENTITIES WITH DEFINITIONS AND EXAMPLES

C11 – Patient *(Cluster-1-Entity-1)

This entity would hold the demographic details of the Patient. It would contain information regarding name, address etc. There won't be any information related to medical conditions.

Attribute Name	Data Type	Constraints	Definition and example
patient_id	Integer	PK, NN	Unique ID given to patient once they register with the Dental Office Eg. 12345
first_name	Varchar (20)	NN	First name of Patient. Eg. Adwait
middle_name	Varchar (20)		Middle name of Patient. Eg. Arun
last_name	Varchar (30)	NN	Last Name of Patient. Eg. Sathe
contact_number	Char (10)	NN	Contact number of patients Eg. 7816007874
date_of_birth	Date	NN	Birth date of patient. Eg 13/11/1993
emergency_contact_ number	Char (10)		Emergency number to contact for a patient. Eg. 8577636493
addressline1	Varchar (200)	NN	Residential address of patient Eg. 1126 boylston Street
addressline2	Varchar (150)		Residential address of Patient. Eg. Near Synphony mart
zip_code	Char (5)	NN	Zip code of location of patient's address. Eg 02215
gender	Char(1)		Gender of patient. Eg. Male
email_address	Varchar(100)	NN	Email address of patient. Eg. gauri@gmail.com

C12 -Insurance

This entity would house for if patient is having any insurance, the name of the insurer, policy details of insurer and every other information related to patient's insurance.

Attribute Name	Data Type	Constraints	Definition and example
policy_number	Varchar (25)	PK, NN	Policy number of the insurance. Example PR6548833
provider	Varchar (40)	NN	Name of insurance provider. Example Blue cross blue shield.
max_coverage	Money	NN	Maximum amount a patient can cover. Eg. $3000
patient_id	Integer	FK, NN	Reference from patient table
begin_date	Date	NN	Start date of the insurance. Eg. 10/10/2012
end_date	Date	NN	End date of the insurance. Eg. 10/10/2022
subscriber	Varchar(20)	NN	Subscriber of the insurance. Eg. Tom

C13-Medical History

This entity will hold the medical history of the patient. It should be inserted when first visiting the Dental Office. It can also be updated on request of the patient.

Attribute Name	Data Type	Constraints	Definition and example
medications	Bit		1 if patient is taking medications, 0 otherwise
patient_id	Integer	PFK, NN	Reference from patient entity.
latex_allergy	Bit		1 if patient has latex allergy, 0 otherwise
amalgam_allergy	Bit		1 if patient has amalgam allergy, 0 otherwise
anaesthetic_allergy	Bit		1 if patient has anaesthetic allergy, 0 otherwise
fluoride_allergy	Bit		1 if patient has fluoride allergy, 0 otherwise
dentures_allergy	Bit		1 if patient has dentures allergy, 0 otherwise
total_teeth	Integer		Total number of teeth of patient. Eg. 30
other_allergies	Bit		1 if patient has any other allergy, 0 otherwise

C14- Tooth

This entity holds the information about the tooth/teeth of the patient on which the treatment is performed, or the one dentist needs to keep a track of

Attribute Name	Data Type	Constraints	Definition and example
tooth_id	Char(4)	PK, NN	Unique ID given to each tooth. Eg UL01
tooth_type	Varchar (20)		Type of tooth. Eg. Canine
treatment_description	Varchar (max)		Description of treatment done on the tooth. Eg. filling
patient_id	Integer	FK	Reference from patient table

C21 – Dentist

Dentist is an entity which would hold demographic information about the Dentist like the name, personal address, contact number. Etc

Attribute Name	Data Type	Constraints	Definition and example
dentist_id	Integer	PK, NN	Unique ID given to Dentist once they register with the Dental Office. Eg 12345
last_name	Varchar (30)	NN	Last name of Dentist. Eg. Dalwai
first_name	Varchar (20)	NN	First name of Dentist. Eg. Mark
middle_name	Varchar (20)		Middle Name of Dentist. Eg. Sham
contact_number	Char (10)	NN	Contact number of Dentist. Eg. 7816007874
dentist_photo	Varbinary(max)		Profile picture of dentist

C22-Specialization

This entity will hold the specialization of each doctor in a dental office.

Attribute Name	Data Type	Constraints	Definition and example
dentist_id	Integer	PFK	Reference from dentist table
specialization	Varchar (20)	NN	Specialization of doctor.Eg. Oral surgery

C23-Dentist Licenses

Dentists have special license (or certificate) to be able to legally practice

Attribute Name	Data Type	Constraints	Definition and example
license_number	Varchar (50)	PK, NN	License number of the doctor. Eg. 1234 5679 34
authority	Varchar (50)	NN	Party giving the license to the doctor.Eg Blue Cross
expiry_date	Date	NN	Expiry date of the license. Eg. 12/12/2024
dentist_id	Integer	PFK	Reference from dentist entity

C24-Login

The login entity holds the login credentials needed to access the system

Attribute Name	Data Type	Constraints	Definition and example
username	Varchar (30)	PK, NN	Login username. Eg. Tom_hardy
password	Varchar (20)	NN	Password for authentication. Eg. somepassword
role	Varchar(20)	NN	Role of the person logging in. Eg. Dentist
dentist_id	Integer	PFK	Reference from dentist entity

C25-Dentist Schedule

The schedule for each dentist, i.e, the slots that are available or unavailable is stored in this table

Attribute Name	Data Type	Constraints	Definition and example
slot1	Bit	NN	1 if slot if booked, 0 otherwise
slot2	Bit	NN	1 if slot if booked, 0 otherwise
slot3	Bit	NN	1 if slot if booked, 0 otherwise
slot4	Bit	NN	1 if slot if booked, 0 otherwise
slot5	Bit	NN	1 if slot if booked, 0 otherwise
slot6	Bit	NN	1 if slot if booked, 0 otherwise
slot7	Bit	NN	1 if slot if booked, 0 otherwise
slot8	Bit	NN	1 if slot if booked, 0 otherwise
dentist_id	Integer	PFK	Reference from dentist entity

date	Date	NN	Date for which the slots are there. Eg. 12/17/2019

C31-Appointment

This entity would hold information related to booking of appointments. It would have attributes like the location of appointment, date, time. Etc.

Attribute Name	Data Type	Constraints	**Definition** and example
appointment_id	Integer	PK, NN	Unique ID given to every appointment when a patient schedules an appointment. Eg 12345
patient_id	Integer	FK, NN	Foreign key from Patient Entity.
status	Varchar(20)	NN	Status of the appointment. Eg. booked
date	Date	NN	Date of appointment. Eg. 2019-12-12
start_time	Time	NN	Start Time of appointment. Eg. 02:02:02
end_time	Time		End time of appointment. Eg. 03:02:02
dentist_id	Integer	FK	Reference from dentist entity.
room_number	Varchar(6)	FK	Reference from room entity

C32-Treatment

Information related to the treatment by the provider to the patient would be captured in this entity. It would list the medical problem the patient has and the actions taken for the same. It would also hold information regarding previous treatments.

Attribute Name	Data Type	Constraints	**Definition** and example
treatment_name	Varchar (100)	FK	Name of treatment performed on the patient. Eg. Root canal
treatment_cost	Integer	NN	Cost of each treatment. Eg. $300.
appointment_id	Integer	FK, NN	Reference from appointment entity

C33 -Treatment Catalogue

This entity will hold all the treatment which the dental office can provide. This is a reference table.

Attribute Name	Data Type	Constraint	**Definition** and example
treatment_name	Varchar (100)	PK, NN	Name of the treatment. Eg. Root Canal
treatment_cost	Integer	NN	Cost of Each treatment. Eg. 79.

C34 -Prescription

This entity would hold the list of medicines prescribed by the doctor to the patient.

Attribute Name	Data Type	Constraints	Definition and example
medicine_name	Varchar (40)	PK, NN	Name of the medicine to be taken. Eg. Advil
duration	Integer	NN	Days for which medicine needs to be taken Eg. 4
morning	bit	NN	Is the medicine to be taken in Morning. It's a flag.
afternoon	bit	NN	Is the medicine to be taken in Evening. It's a flag.
night	bit	NN	Is the medicine to be taken in Night. It's a flag.
appointment_id	Integer	PFK, NN	Reference from appointment table.
notes	Varchar (50)		Any special instructions to patient. Eg. After food

C35 -Invoice

This entity would hold the billing statement's information with respect to a particular appointment. It would say how much is the total amount that the patient has to pay, invoice number etc.

Attribute Name	Data Type	Constraints	Definition and example
invoice_id	Integer	PK, NN	Invoice number for every appointment. Eg. 1234
amount	Decimal		Total amount to be paid by patient. Eg. $400
date	Date	NN	Date at which invoice is generated. Eg. 12/12/2019
time	Time	NN	Time at which invoice is generated. Eg. 13:30
appointment_id	Integer	PFK, NN	Reference from appointment entity

C41-Location

This entity will hold information regarding the geographical location of the dentist office. It would be the address of office, city, state, zip code, and country.

Attribute Name	Data Type	Constraints	Definition and example
location_id	Varchar(6)	PK, NN	Unique location ID given to every Location. Eg.12345
addressline1	Varchar (200)	NN	Main address of location. Eg. 1126 boylston Street
addressline2	Varchar (150)		Address of docation. Eg. Near Synphony mart

contact_number	Char (10)	NN	Contact number of the dental office. Eg. 7816007874
zip_code	Char (5)	NN	Zip in which the location is. Eg. 02215

C42-Room

This entity will hold information related to each room where a particular appointment would be held. It would describe the room number and the type of room.

Attribute Name	Data Type	Constraints	Definition and example
room_number	Integer	PK, NN	Room number. Eg. 305
room_type	Varchar (45)	NN	Type of room. Eg. Surgical Room
location_id	Varchar(6)	FK, NN	Reference from Location Entity

C43-Equipments

There would be several equipment used in dental care. This entity will hold information about those equipment(s). Information about the maintenance of equipment and which room or place the equipment is located in will also be held here.

Attribute Name	Data Type	Constraints	Definition and example
equipment_name	Varchar (20)	NN	Name of the equipment. Eg. X-ray machine
maintaiance_due_date	Date	NN	Due date of next maintenance of equipment. Eg. 10/10/2020
warranty_end_date	Date	NN	Expiry date of warranty ofequipment. Eg. 12/12/2022
purchase_date	Date	NN	Purchase date of equipment Eg. 10/10/2019
equipment_id	Integer	PK, NN	Unique number of the equipment Eg. 1234
room_number	Varchar(6)	FK	Reference from Room Entity

C44-Supplies

All the materials that are used for giving care to the patient would be in this entity such as gloves, needles, paper napkins. Etc

Attribute Name	Data Type	Constraints	Definition and example
supplies_name	Varchar (30)	NN	Name of the item. Eg. Gloves.
no_of_units	Integer	NN	Number of units of the item. Eg. 2
cost_of_each_unit	Money	NN	Cost of each item. Eg. $50
location_id	Varchar(6)	FK	Reference to location entity
supply_id	Integer	NN, PK	Unique ID given to every supply. Eg. 1234

C45 -Location Reference

This entity would be a reference entity. It would hold information of all zip code, city and county in MA area.

Attribute Name	**Data Type**	**Constraint**	**Definition** and example
zip_code	Char (5)	PK, NN	Zip code of area. Eg. 02215
city	Varchar (20)	NN	City in MA state. Eg. Boston
county	Varchar(50)	NN	Name of county for the zip code. Eg. Hampshire

DEFINITIONS

1- Definitions

Following are the descriptions for the main entities that are managed in the dental database model. It contains the statement of the meaning of each entity defined in the dentist system and conveys its precise meaning and actions.

DENTIST

This entity houses the demographic details of a provider in the dental system. This person must be licensed by the state they are operating in to perform general dentistry. Dental assistants and other office staff are not represented here. Each dentist is identified by a dentist ID which is unique.

SPECIALIZATION

It includes the details of the specialization(s) of each dentist practicing in the clinic.

LOCATION

This entity defines the geographical location of the dentist's clinic, primarily the address. A dentist can have multiple clinics at multiple locations.

PATIENT

This entity describes whoever needs dental assistance. A dental service or procedure will be proposed and/or resolved after diagnosis by a dentist on a patient to help maintain a patient's oral health.

ROOM

A enclosed area with proper equipment that provides patient comfort and is ideal for the course of treatment being followed. Each room must have a room number associated with it to identify it.

APPOINTMENT

This entity represents the act of the patient meeting the dentist at the given time and place for his/her medical diagnosis and/or treatment. Each appointment has an appointment ID associated with it and defines the appointment for a patient at a given

TREATMENT

This entity describes the course of treatment the patient is undergoing, such as a root canal, for which multiple visits need to be scheduled or a tooth filling. All dental procedures that the patient has gone through or is currently under are recorded under this entity.

TREATMENT CATALOG

This entity contains the list of treatments and their respective prices that are available at a particular clinic.

MEDICAL HISTORY

Each patient will have to declare their medical history before visiting the dentist. It can include medications being taken, allergies, medical problems such as diabetes, previous dental consultations. Etc.

SUPPLIES

The supplies entity includes all the medical supplies that have been used for each appointment by the dentist. It can include materials such as local anesthesia, fillers, impression materials, prevention materials, gloves. Etc.

PRESCRIPTION

A list of medications prescribed by the dentist to the patient.

EQUIPMENT

A set of instruments that are used by the dentist for any treatment. Eg Xray Machine.

INSURANCE
This contains all the information of the insurances of each patient.

INVOICE
An invoice entity can include the multiple bills that have been generated, i.e., 1 for the insurance company and 1 that the patient is charged for. It can keep a track of the payments made by both and the pending payments as well.

TOOTH
This contains the information of each tooth on which the treatment is performed, or which the dentist needs to store some information about.

ABBREVIATIONS

- NN: Not Null
- PK: Primary Key
- FK: Foreign Key
- PFK: Primary Foreign Key
- Naming convention for tables:
    - Cxy: Cluster x Entity y

DETAILED E-R DIAGRAM: