CS631-Data Management systems design
Woody's automotive online application project
Deliverable-1

Team-09

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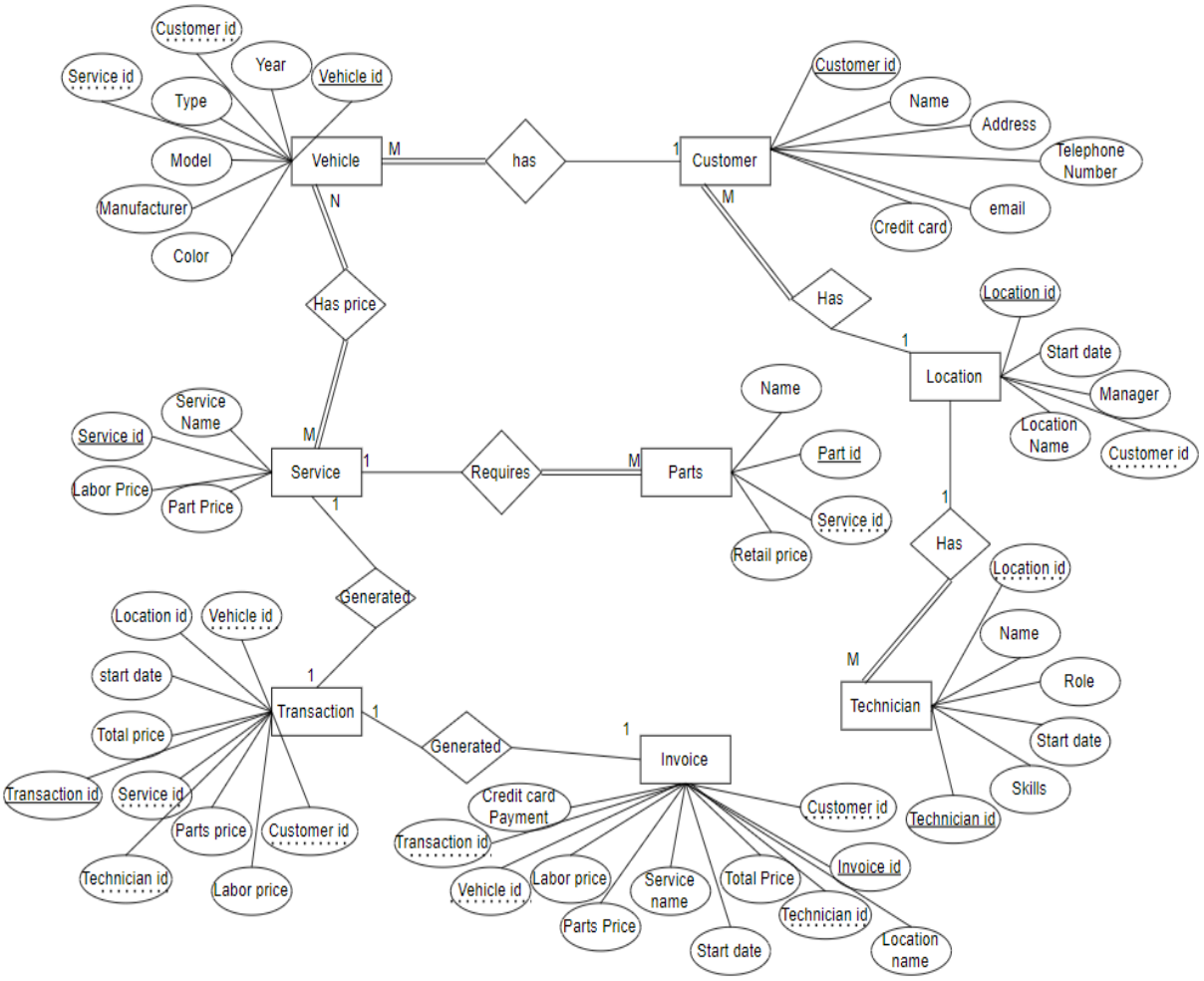
Goals of this project:
The goal of this phase is to create a detailed conceptual schema for the Woody's Automotive database system, which specifies the requirements for database design and application development. The conceptual schema will give a graphic representation of the database's entities, connections, and characteristics, along with any structural limitations and essential attributes.

Analysis of intended database system:
- Many tables were constructed after looking over the problem statement and brainstorming several ideas. Each table has distinct entities and characteristics. Using primary keys and foreign key references, we attempted to construct a link between the tables.
- We made certain assumptions in establishing these associations in order to add distinctiveness to the tables. They are mentioned below in the appropriate order.
- The extended ER diagram for the Woody's Automotive database system is shown below, which includes entity types, relationship types, attributes, and structural restrictions.

Extended ER diagram for the Woody's Automotive database system:



Entities and its Attributes:

- Customer: ID, name, home address, telephone number, email address, credit card.
- Vehicle: type (sedan, SUV, sports car, truck), manufacturer, model, color, year.
- Service: name, labor price, parts price.
- Parts: name, retail price.
- Location: name, manager, start date.
- Invoice: service provided, labor charge, parts charge, total charge, shop location, technician id, customer id, vehicle id, date of service, credit card payment.
- Transaction:service provided, labor charge, parts charge, total charge, shop location, technician id, customer id, vehicle id, date of service
- Technician: name, role, start date, skills.

Attribute Types:

Simple attributes:

customer id, name(Customer), address(Customer), phone, email(Customer), credit card(Customer), type (of Vehicle), manufacturer,model,color, Year, service id, service name, labor price, parts price, part id, part name, retail price, location id, location name, manager, start date, labor price, parts price, total price, technician id, name(technician), Role, Start Date, Skills, Transaction id, Invoice id

Composite Attributes:

None

Multivalued Attributes:

skills (since a technician can have multiple skills)

Derived Attributes:

None

Relationship Types:

The following are the determined relationships between entities: (1:M means one to many, N:1 means many to one, and 1:1 means one to one).

- Customer has one or more vehicles – (1:M)
- Service requires one or more parts – (1:M)
- Service has a price based on service type and vehicle type – (M:N)
- Location has one manager and between 4 and 6 technicians – (1:M)
- Technician has one or more skills – (1:M)
- Transaction is generated for each completed service – (1:1)
- Invoice is generated for each transaction – (1:1)

Preliminary Database Design:

Customer Table:

Customer(customer id, name, address, phone, email, credit card)

- Primary Key : customer id

Vehicle Table:

Vehicle(vehicle id, customer id, type, manufacturer, model, color, year, service id)

- Primary Key: vehicle id
- Foreign Key : customer id, service id

Service Table:

Service(service id,service name, labor price, parts price)

- Primary Key : service id

Part Table:

Part(part id, service id, name, retail price)

- Primary Key : part id

- Foreign Key : service id

Location Table:

Location(location id, location name, manager, start date, customer id)

- Primary Key : location id
- Foreign Key : customer id

Technician Table:

Technician(technician id, location id, name, role, start date, skills)

- Primary Key : technician id
- Foreign Key : location id

Transaction Table:

Transaction(transaction id, service id, labor price, parts price, total price, location id, technician id, customer id, vehicle id, start date)

- Primary Key : transaction id
- Foreign Key : service id, technician id, customer id, vehicle id

Invoice Table:

Invoice(invoice id, service name, labor price, parts price, total price, location id, technician id, customer id, vehicle id, start date, credit card, transaction id)

- Primary Key : invoice id
- Foreign Key : technician id, customer id, vehicle id, transaction id

Structural Constraints:

Structural constraints refer to the rules and restrictions placed on the database structure to ensure the data is consistent and accurate. Here are some examples of structural constraints that could be applied to the database design for Woody's Automotive:

- **Primary key constraint:** Each table should have a primary key, which uniquely identifies each record in the table. For example, the Customer table could have a primary key of CustomerID, while the Service table could have a primary key of ServiceID.
- **Foreign key constraint:** Tables with relationships should use foreign keys to enforce referential integrity. For example, the Vehicle table could have a foreign key to link it to the Customer table, ensuring that each vehicle belongs to a valid customer.
- **Check constraints:** Check constraints allow you to specify rules that the data must follow. For example, you could add a check constraint to the Service table to ensure that the labor cost is greater than zero.
- **Not null constraint:** A not null constraint ensures that a field in a table cannot be left blank. This constraint ensures that the data in the field is always present and valid.

- **Unique constraint**: A unique constraint ensures that the values in a field or set of fields in a table are unique. This constraint ensures that duplicate data is not added to the table.

By applying these structural constraints, the database design for Woody's Automotive will ensure data consistency and accuracy, making it easier to manage the growing company.

Constraints:

- Each customer has one or more vehicles.
- A vehicle is owned by a single customer.
- One or more vehicles can be serviced at the same time.
- One or more services can be performed on a vehicle.
- A service may consist of one or more parts.
- A part can be applied to one or more services.
- There is only one manager for each location.
- Each manager is in charge of a single location
- Each location has 4 to 6 technicians.
- Each technician is assigned to a specific location.
- Each technician possesses one or more skills.
- Each service appointment is scheduled by a single customer at a single location.
- Each service appointment is reserved for a single vehicle.
- Each service appointment is handled by a single technician.
- Each service appointment may have multiple statuses.
- Each service appointment results in a single invoice.

Assumptions:

- Each customer has a distinct name, home address, phone number, email address, and credit card.
- A report of the daily services scheduled for completion must be printed by the manager.
- Each technician has a unique set of skills.

Difficulties faced:

- One of the main difficulties encountered during the conceptual design phase was determining the appropriate relationships between entities.
- Mapping invoice with other entities.