CS631 008 - Data Management Systems Design

Woody's Automotive Online Application Project

Final Project Phase -1

Deliverable – 1

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Goal of this phase of the project:

The goal of this phase is to create a conceptual schema that describes the specifications for database design and application development for the Woody's automobile database system. The conceptual schema will provide a digital representation of the entities, relationships, and attributes in the database, including the structural constraints and key attributes.

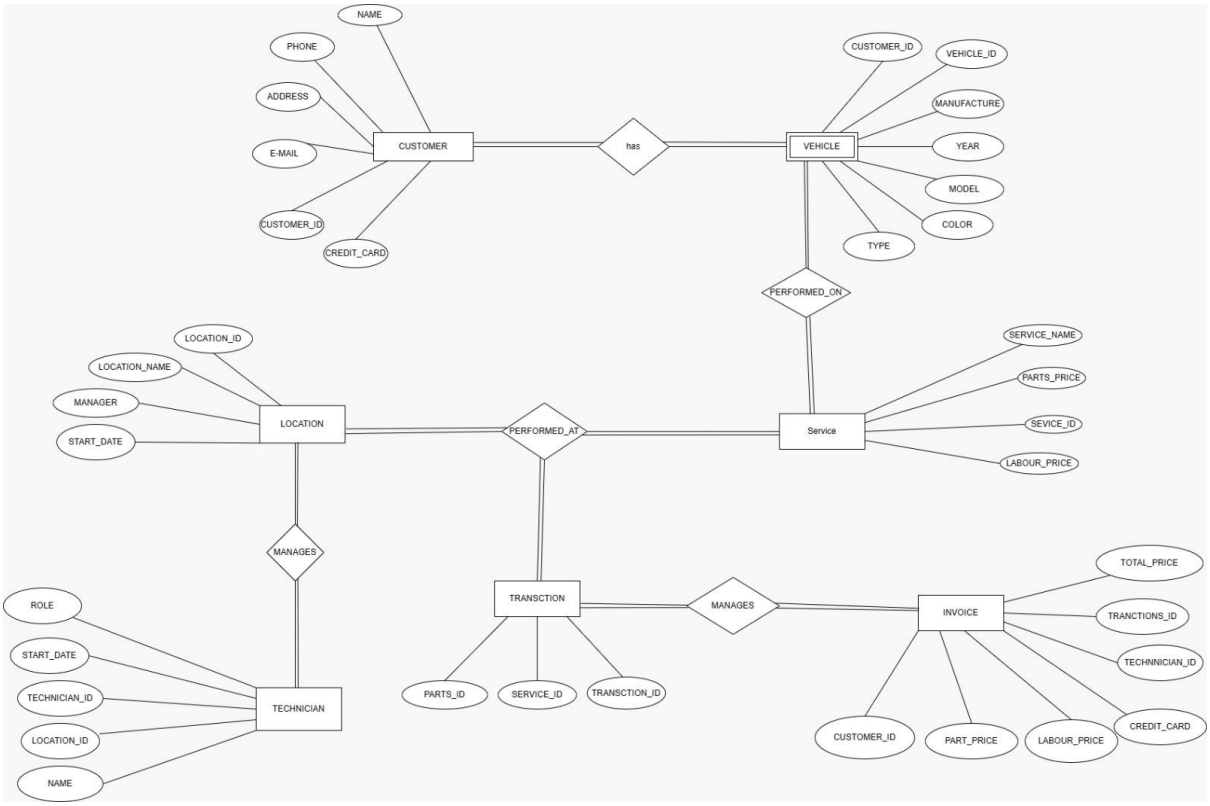
The Woody's automobile database system's extended ER diagram, which includes entity types, relationship types, attributes, and structural constraints, is supplied in this section.

Analysing of the Woody's Automotive application:

- Following a review of the problem statement and a brainstorming session with various thoughts, eight tables are created.
- Unique entities and specific properties are present in each table. We tried to connect the tables using Primary keys and foreign keys.
- As we could only discriminate between entries using three attributes technician id, vehicle id, and customer id we created a composite foreign key in the TRANSACTION table.
- When constructing these associations, we made certain assumptions to give the tables some originality. As a result, the list of them is provided.

Extended ER Diagram:

It represents the entities, relationship, and attributes for Woody's Automotive:



DETERMINING THE ENTITIES:

The initial stage in creating an ER diagram for The process of creating an ER diagram for Woody's Automotive begins with a determination of the system's entities. Eight entities have been selected based on the requirements: customer, vehicle, service, part, location, transaction, invoice, and technician. The ER diagram will be built around these items, which will be linked together by a variety of relationships and attributes.

CUSTOMER: The CUSTOMER refers to people who have scheduled service appointments with Woody's Automotive.
VEHICLE: stands for the cars that the customers own.
SERVICE: stands for the upkeep and repair solutions provided by Woody's Automotive.
PART: stands for the assortment of parts kept on hand at each location.
INVOICE: A record of the service rendered, labor and parts costs, the total price, the shop's location, the technician's name, the customer's name, the

vehicle, and the date of service are all included on the invoice that is generated after the service is complete.

TECHNICIAN: stands for the repair specialists employed at each facility.

LOCATION: stands for the location which manages of Woody's automotive

TRANSACTION: stands for the transaction details done by the customer

DETERMINING THE ATTRIBUTES TO THE ENTITIES:

Once you have discovered the entities, you need to identify the attributes for each entity. Below are the attributes for each entity based on the requirements:

1. **CUSTOMER**: CUSTOMER_ID, NAME, ADDRESS, PHONE, EMAIL, CREDIT_CARD.
2. **VEHICLE**: TYPE, MANUFACTURE, MODEL, COLOR, YEAR,
3. **SERVICE**: name(oil change, front-end alignment, brakes, tire repair/replacement, engine tune-up, vehicle computer diagnostics, state vehicle inspection)SERVICE_NAME,LABOUR_PRICE,PARTS_PRICE, SERVICE_ID.
4. **PART**: VEHICLE_ID, CUSTOMER_ID, NAME, RETAIL_PRICE.
5. **INVOICE**:TOTAL_PRICE,TRANCTION_ID,TECHNNICIAN_ID, CREDIT_CARD,LABOUR_PRICE,PARTS_PRICE,CUSTOMER_ID.
6. **TECHINICIAN**: TECHINICIN_ID, LOCATION_ID, NAME, ROLE, START_DATE, SKILLS.
7. **LOCATION**: LOCATION_ID, LOCATION_NAME, MANAGER, START_DATE.
8. **TRANSACTION**: TRANSACTION_ID, SERVICE_ID, PARTS_ID

Each entity's characteristics will be determined by its attributes, which will be linked to other entities in the ER diagram through relationships.

DETERMINING THE RELATIONSHIPS BETWEEN THE ENTITIES:

1. Customer has one or more vehicles (1:M)
2. Service has a price based on service type and vehicle type (N:1)
3. Service requires one or more parts (1:M)

4. Invoice is generated for each transaction (1:1)
5. Technician has one or more skills (1:M)
6. Location has one manager and between 4 and 6 technicians (1:M)
7. Transaction is generated for each completed service (1:1)

Here, the determined relationships between entities: (1:M - one to many, N:1 - many to one, 1:1 - one to one)

Structural Constraints:

Structural constraints are rules that regulate how the data is arranged in a database management system (DBMS). The authenticity, dependability, and importance of the data are ensured by these rules. There are numerous categories of structural constraints in DBMS, such as:

Primary key constraint: The primary keys of a table serve as a unique identifier for each row. This limitation guarantees that each table row has a distinct primary key value.

Foreign key constraint: In a single table, a foreign key is a field that refers to the primary key in another table. The primary key value in one table must match a valid foreign key value in another table, and this limitation ensures that.

Check constraint: A check constraint stipulates a requirement that must be satisfied before a row in a table can be added to or changed. This constraint ensures the accuracy of the data in the row.

Not null constraint: A not null constraint guarantees that a field in a table can never be empty. This constraint always ensures the existence and accuracy of the data in the field.

Unique constraint: A unique constraint ensures that each value in a field or group of fields in a table is unique. This constraint stops duplicate data from being present in the table. Generally, these restrictions aid in preserving data consistency, avoiding discrepancies, and guaranteeing the accuracy and relevance of the database's contents.

1. Table: CUSTOMER
    - **CUSTOMER** (CUSTOMER_ID, NAME, ADDRESS, PHONE, EMAIL, CREDIT CARD)
    - Primary Key: CUSTOMER_ID

2. Table: VEHICLE
    - **VEHICLE**(VEHICLE_ID,CUSTOMER_ID,TYPE, MANUFACTURE,MODEL,COLOR, YEAR,SERVICE_ID)
    - Primary Key: VEHICLE_ID
    - Foreign Key: CUSTOMER_ID, SERVICE_ID

3. Table: SERVICE
    - **SERVICE**(SERVICE_NAME,LABOUR_PRICE, PARTS_PRICE, SERVICE_ID)
    - Primary Key: SERVICE_ID

4. Table: PART
    - **PART**(VEHICLE_ID,CUSTOMER_ID,NAME, RETAIL_PRICE)
    - Primary Key: PART_ID
    - Foreign Key: SERVICE_ID

5. Table: INVOICE
    - **INVOICE**(TOTAL_PRICE,TRANSACTION_ID,TECHNNICIAN_ID,CREDIT_CARD,LABOUR_PRICE,PARTS_PRICE,CUSTOMER_ID.)
    - Primary Key: INVOICE_ID
    - Foreign Key: TECHNICIAN_ID, CUSTOMER_ID, VEHICLE_ID, TRANSACTION_ID.

6. Table: TECHNICIAN
    - **TECHINICIAN** (TECHINICIAN_ID, LOCATION_ID, NAME, ROLE, START_DATE, SKILLS)
    - Primary Key: TECHINICIAN_ID

7. Table: LOCATION
    - **LOCATION**(LOCATION_ID,LOCATION_NAME, MANAGER, START_DATE)
    - Primary Key: LOCATION_ID
    - Foreign Key: CUSTOMER_ID

8. Table: TRANSACTION
    - **TRANSACTION**(TRANSACTION_ID,SERVICE_ID, PARTS_ID)
    - Primary Key: TRANSACTION_ID
    - Foreign Key: TRANSACTION_ID,SERVICE_ID, CUSTOMER_ID, VEHICLE_ID, LOCATION_ID.

Assumptions:

- Each customer has a distinct NAME, ADDRESS, PHONE, EMAIL, and CREDIT_CARD.
- Each technician has a unique set of abilities.
- The manager is required to print a report of the daily services scheduled for completion.

Difficulties faced:

- Determining the structural constraints in this conceptual design work was challenging because some assumptions had to be made.
- Using attributes as external keys to link the tables.