|  |
| --- |
|  |
| Non-Tesla EV Supercharger Pilot |
| Course Section: CS605.641.82  Spring 2023 |
| Prepared by |
| **Coby Rem** |
| **04/19/2023** |

Logo

Description automatically generated

|  |
| --- |
| Database Design Project Document |

**Table of Contents**

[1. Introduction 4](#_Toc516748910)

[1.1. Scope and Purpose of Document 4](#_Toc516748911)

[1.2. Project Objective 4](#_Toc516748912)

[2. System Requirements 4](#_Toc516748913)

[2.1 Hardware Requirements 4](#_Toc516748914)

[2.2 Software Requirements 4](#_Toc516748915)

[2.3 Functional Requirements 4](#_Toc516748916)

[2.4 Database Requirements 4](#_Toc516748917)

[3. Database Design Description 4](#_Toc516748918)

[3.1 Design Rationale 4](#_Toc516748919)

[3.2 E/R Model 4](#_Toc516748920)

[3.2.1 Entities 5](#_Toc516748921)

[3.2.2 Relationships 5](#_Toc516748922)

[3.2.3 E/R Diagram 5](#_Toc516748923)

[3.3 Relational Model 5](#_Toc516748924)

[3.3.1 Data Dictionary 5](#_Toc516748925)

[3.3.2 Integrity Rules 5](#_Toc516748926)

[3.3.3 Operational Rules 5](#_Toc516748927)

[3.3.4 Operations 5](#_Toc516748928)

[3.4 Security 5](#_Toc516748929)

[3.5 Database Backup and Recovery 5](#_Toc516748930)

[3.6 Using Database Design or CASE Tool 6](#_Toc516748931)

[3.7 Other Possible E/R Relationships 6](#_Toc516748932)

[4. Implementation Description 6](#_Toc516748933)

[4.1 Data Dictionary 6](#_Toc516748934)

[4.2 Advanced Features 6](#_Toc516748935)

[4.3 Queries 6](#_Toc516748936)

[4.3.1 Customer Bills 6](#_Toc516748937)

[4.3.2 Customer Rental History 6](#_Toc516748938)

[4.3.3 Movie Rental History 6](#_Toc516748939)

[4.3.4 List all videos by movie category 6](#_Toc516748940)

[4.3.5 List video usage by movie category 6](#_Toc516748941)

[4.3.6 List videos by format (Laser Disc or VHS) 6](#_Toc516748942)

[4.3.7 List defective videos 7](#_Toc516748943)

[4.3.8 List twenty popular videos by category for customers’ recommendations 7](#_Toc516748944)

[5. CRUD Matrix 7](#_Toc516748945)

[5.1 List of Entity Types 7](#_Toc516748946)

[5.2 List of Functions 7](#_Toc516748947)

[6. Concluding Remarks 7](#_Toc516748948)

[Appendices 8](#_Toc516748949)

[References 8](#_Toc516748950)

(Note: Please provide some inputs for the sections in your DB design document template even though some of them may not be suitable for your project. The purpose for all different sections is to ask you to think about different perspectives of a database project. If a section does not apply to your project, you should make something up. Please do not skip them.

For instance, Database Backup and Recovery is commonly implemented in a real database project. Even if you do not implement it, most RDBMSs may have incorporated backup and recovery tools into their interfaces and infrastructure. Give a short description of your RDBMS solution to demonstrate your thought process.)

# Introduction

Explain your database project at high-level and/or why you choose this database topic.

In March 2023, Tesla announced that non-Tesla electric vehicles (EVs) can charge at over 7,500 Tesla branded chargers across the United States by the end of 2023. Not all vehicles are supported, not all charging locations will be retrofitted with “Magic Dock” adapters so non-Tesla can only charge at participating locations, and charging a non-Tesla EV will incur higher costs for charging.

All these factors need to be tracked to allow non-Tesla electric vehicle owners to utilize the newly expanded network of electric vehicle charging stations properly and efficiently. If an electric vehicle is running low on battery and arrives at a Tesla charger that does not have a Magic Dock adapter, then the electric vehicle will need to be towed to a compatible charger, causing a major inconvenience and large cost for the vehicle owners and damaged brand reputation for Tesla.

A database can be used to track compatible chargers in the United States, electric vehicles and charging abilities, and pricing for all EVs at Tesla chargers. The information in the database can be used by navigation systems to direct EVs to Tesla chargers and by EV owners to start charging their EVs on Tesla’s charger network.

This database topic was chosen as it can solve a complex real business issue. With the expansion of the EV market in the coming decade, charger compatibility is crucial in mass adaptation of EVs. I am also interested in the EV industry from an engineering perspective and as a potential consumer, so I chose an EV related project.

## Scope and Purpose of Document

Your document discusses the requirements, design, and implementation of your database. You can elaborate each section in your document that will be covered. Or you can describe the scope of your database project. The purpose of this document serves as a written record to demonstrate the thinking process regarding the conceptual design, logical design, and implementation of the database, and to summarize the features implemented by you. (Note, this document is a part of the requirements of the term project; the template helps you to go through documenting pieces of database design project.)

## Project Objective

Describe project objective. For instance, your project involves designing and implementing a database, using a relational DBMS that captures all informational aspects of the operations you plan to do for an organization or business entity.

# System Requirements

General System requirements

## Hardware Requirements

Min. requirements for memory, CPU etc.

## Software Requirements

Min. OS requirements/Any particular software that is required to run this application (e.g. MS Access) or, for web-based application, any particular browser version?

## Functional Requirements

Functionality the application supports

## Database Requirements

What database was used in this project? What version?

# Database Design Description

General database design descriptions

## Design Rationale

Why did you choose a particular ER design? Think about how your database design may be challenged and how you can defend your design. For example, did you use artificial primary keys and why? Why did you choose non-identifying relationship for two entities when it could be modeled as identifying relationship? Why?

## E/R Model

General E/R model descriptions

### Entities

Detailed descriptions of the entities

### Relationships

Detailed descriptions of the relationships

### E/R Diagram

E/R diagram (Not Enhanced ERD)

## Relational Model

### Data Dictionary

Detailed descriptions of the metadata for the model. For example:

| Column Name | Description | Data Type | Size | Constraint Type | Not Null? | Valid Values |
| --- | --- | --- | --- | --- | --- | --- |
| SSN | Social Security Number | Varchar | 9 | Primary Key | Y | 9 numeric digits |

### Integrity Rules

How did you handle the mandatory fields, data formatting/conversion, and valid values for the data? How are the referential integrity constraints established? For example, which table references which other table(s)?

### Operational Rules

What are the constraints for some operations? For example, will the users be able to delete a patron’s information if he/she has outstanding videos? Can a patron be associated multiple records of checked-out videos? Will the application allow the users to enter a patron if the patron has the same first name and last name as an existing patron in the system?

### Operations

Describe what operations are involved for a particular use case. For example, does checking out videos involve insert/delete/update/retrieve?

## Security

Any security requirements and how are they addressed in the application (e.g., user access controls, protecting sensitive data in the database, SQL injection, and so on)?

## Database Backup and Recovery

Explain any database backup and recovery you may implement. Most RDBMSs may have incorporated backup and recovery tools into their interfaces and infrastructure. You may give a short description of.

## Using Database Design or CASE Tool

Software engineering tools provide automated or semiautomatic support for software development. A CASE (Computer-Aided Software Engineering) tool sometimes is more important than hardware for achieving good quality and productivity. Describe the tools you used to produce the artifacts for your project (e.g., a database design tool, a diagramming or graphical tool, and so on.)

## Other Possible E/R Relationships

What were the other alternatives you considered when you designed your database?

# Implementation Description

General implementation requirements

## Data Dictionary

Data dictionary after you have your database set up. This dictionary is less detailed than the one in the previous section. Usually, a “DESCRIBE” operation in your database will provide the information needed for this section. If your RDBMS has a tool to show data dictionary; it is also fine too.

## Advanced Features

Describe any triggers, stored procedures, functions, or others used in the project to implement business rules specified in your database project. Normally, you need to create 3 triggers, 3 stored procedures, and 3 functions to demonstrate your familiarity with SQL Persistent Stored Modules. (For extended features, you may include graphical user interfaces with screen shots if you have implemented a database application. You may include any special work such as reporting or data visualization tools you have done for your project that are not covered in this database design template.)

## Queries

General query information. Normally, you need to create 8-10 queries as the major functions supported by your database project. (Your specific database queries or reports)

### Customer Bills

How did you query customer bills? Provide SQL statements.

### Customer Rental History

Same as above.

### Movie Rental History

Same as above.

### List all videos by movie category

Same as above.

### List video usage by movie category

Same as above

### List videos by format (Laser Disc or VHS)

Same as above.

### List defective videos

Same as above

### List twenty popular videos by category for customers’ recommendations

Same as above

# CRUD Matrix

CRUD matrix as described in one presentation by Dr. Kung under “Module 13: Database Project > Database Project Milestone 8.

## List of Entity Types

## List of Functions

# Concluding Remarks

Lessons learned, strengths and weaknesses, what you may add to the database project if you have more time, how this project helps to apply what you have learned from the course to database design and implementation, and so on.

Appendices

Additional information, such as known defects

Appendix A - DDL, INSERT, SELECT Statements

CREATE statements for creating database objects; INSERT statements to populate test data into the database; SELECT statements to display the test data

Appendix B - Data Dictionary Index

Index to the data dictionary (e.g., column\_name in alphabetical order, table\_name))

References

Reference material