**Entity-Relationship (ER) Diagram for VehicleVerified**

**Version: 2.0**

**Date: July 14, 2025**

**1. Introduction**

**This document provides a detailed Entity-Relationship (ER) Diagram for the "VehicleVerified" application. It illustrates the main entities within the system, their attributes, and the relationships that connect them. This diagram serves as a blueprint for the Cloud Firestore database structure.**

**2. Entities and Attributes**

**Below are the main entities and their corresponding attributes.**

* **PK denotes a Primary Key.**
* **FK denotes a Foreign Key.**

**2.1 User Entity**

**Represents both Vehicle Owners and Traffic Police officials.**

**+-----------------------------------+  
|               USER                |  
+-----------------------------------+  
| PK | uid (String)                 |  
|    | name (String)                |  
|    | email (String)               |  
|    | phone (String)               |  
|    | role (String)                |  // 'owner' or 'police'  
|    | officialId (String, Optional)|  
|    | profileImageUrl (String)     |  
|    | notificationPrefs (Map)      |  
|    | language (String)            |  
|    | createdAt (Timestamp)        |  
+-----------------------------------+**

**2.2 Vehicle Entity**

**Represents a single vehicle owned by a user.**

**+-----------------------------------+  
|              VEHICLE              |  
+-----------------------------------+  
| PK | vehicleID (String)           |  
| FK | ownerID (String) -> User.uid |  
|    | make (String)                |  
|    | model (String)               |  
|    | registrationNumber (String)  |  
|    | engineNumber (String)        |  
|    | chassisNumber (String)       |  
|    | vin (String)                 |  
|    | vehicleType (String)         |  
|    | registeredDate (Timestamp)   |  
|    | image (String)               |  
|    | createdAt (Timestamp)        |  
+-----------------------------------+**

**2.3 Document Entity (Weak Entity)**

**Represents a document associated with a specific vehicle. It depends on the Vehicle entity.**

**+-----------------------------------+  
|              DOCUMENT             |  
+-----------------------------------+  
|    | documentType (String)        |  
|    | documentURL (String)         |  
|    | policyNumber (String)        |  
|    | provider (String)            |  
|    | expiryDate (Timestamp)       |  
|    | uploadedAt (Timestamp)       |  
+-----------------------------------+**

**2.4 ServiceHistory Entity (Weak Entity)**

**Represents a service record associated with a specific vehicle. It depends on the Vehicle entity.**

**+-----------------------------------+  
|           SERVICE HISTORY         |  
+-----------------------------------+  
|    | serviceType (String)         |  
|    | servicesPerformed (Array)    |  
|    | serviceDate (Timestamp)      |  
|    | cost (Number)                |  
|    | workshop (String)            |  
|    | status (String)              |  
|    | notes (String)               |  
|    | createdAt (Timestamp)        |  
+-----------------------------------+**

**3. Relationships**

**This section describes the relationships between the entities.**

**3.1 User and Vehicle Relationship (One-to-Many)**

* **One User (owner) can own many Vehicles.**
* **Each Vehicle is owned by only one User.**

**(1)               (N)  
+-------+       +------+       +---------+  
| USER  |-------| Owns |-------| VEHICLE |  
+-------+       +------+       +---------+**

**3.2 Vehicle and Document Relationship (One-to-Many)**

* **One Vehicle can have many Documents (e.g., RC, Insurance, PUC).**
* **Each Document belongs to only one Vehicle.**

**(1)               (N)  
+---------+       +-----+       +----------+  
| VEHICLE |-------| Has |-------| DOCUMENT |  
+---------+       +-----+       +----------+**

**3.3 Vehicle and ServiceHistory Relationship (One-to-Many)**

* **One Vehicle can have many ServiceHistory records.**
* **Each ServiceHistory record is associated with only one Vehicle.**

**(1)               (N)  
+---------+       +-----+       +-----------------+  
| VEHICLE |-------| Has |-------| SERVICE HISTORY |  
+---------+       +-----+       +-----------------+**

**4. Complete ER Diagram (Visual Representation)**

**This diagram combines all entities and relationships to provide a complete overview of the database schema.**

**+-------+   (1)      (N)   +---------+  
|       |                  |         |  
| USER  |----< Owns >------| VEHICLE |  
|       |                  |         |  
+-------+                  +---------+  
                              |  
                              |  
                +-------------+-------------+  
                |                           |  
               (1)                         (1)  
                |                           |  
             < Has >                     < Has >  
                |                           |  
               (N)                         (N)  
                |                           |  
      +-----------+             +-----------------+  
      |           |             |                 |  
      | DOCUMENT  |             | SERVICE HISTORY |  
      |           |             |                 |  
      +-----------+             +-----------------+**