

**PROJECT TITLE:Transport fleet management**  
**GROUP MEMBERS:Vincent Mwendwa-1052108**  
**:Brenda Mwikali -1049506**  
**:Arthur Kiprotich-1049436**  
**:Cynthia Nasike-1049524**  
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## **I. INTRODUCTION**

### **overview**

This report outlines the implementation and results of SQL queries executed to manage and analyze data in a Vehicle Management System. The system encompasses modules for vehicles, drivers, maintenance, assignments, inspections, and fuel logs. These queries facilitate data retrieval, updates, and analysis to streamline operations, ensure compliance, and optimize resources.

The SQL commands were tested on a database containing records of vehicles, drivers, maintenance activities, and assignments. The report provides insights derived from the queries, their objectives, and their significance in the operational context of fleet management.

### **Rationale**

Efficient vehicle management is critical for organizations to ensure operational continuity, minimize costs, and comply with regulatory requirements. A well-structured database and effective querying mechanisms enable:

1. **Real-time Tracking:** Retrieval of current vehicle and driver information.
2. **Operational Transparency:** Comprehensive records of maintenance, inspections, and assignments.
3. **Decision-Making Support:** Identification of resource utilization patterns, cost trends, and areas for improvement.
4. **Regulatory Compliance:** Monitoring drivers' license expirations and vehicle inspection statuses.

By analyzing the stored data using SQL queries, fleet managers can ensure that the organization's resources are effectively utilized and maintained, reducing downtime and operational risks.

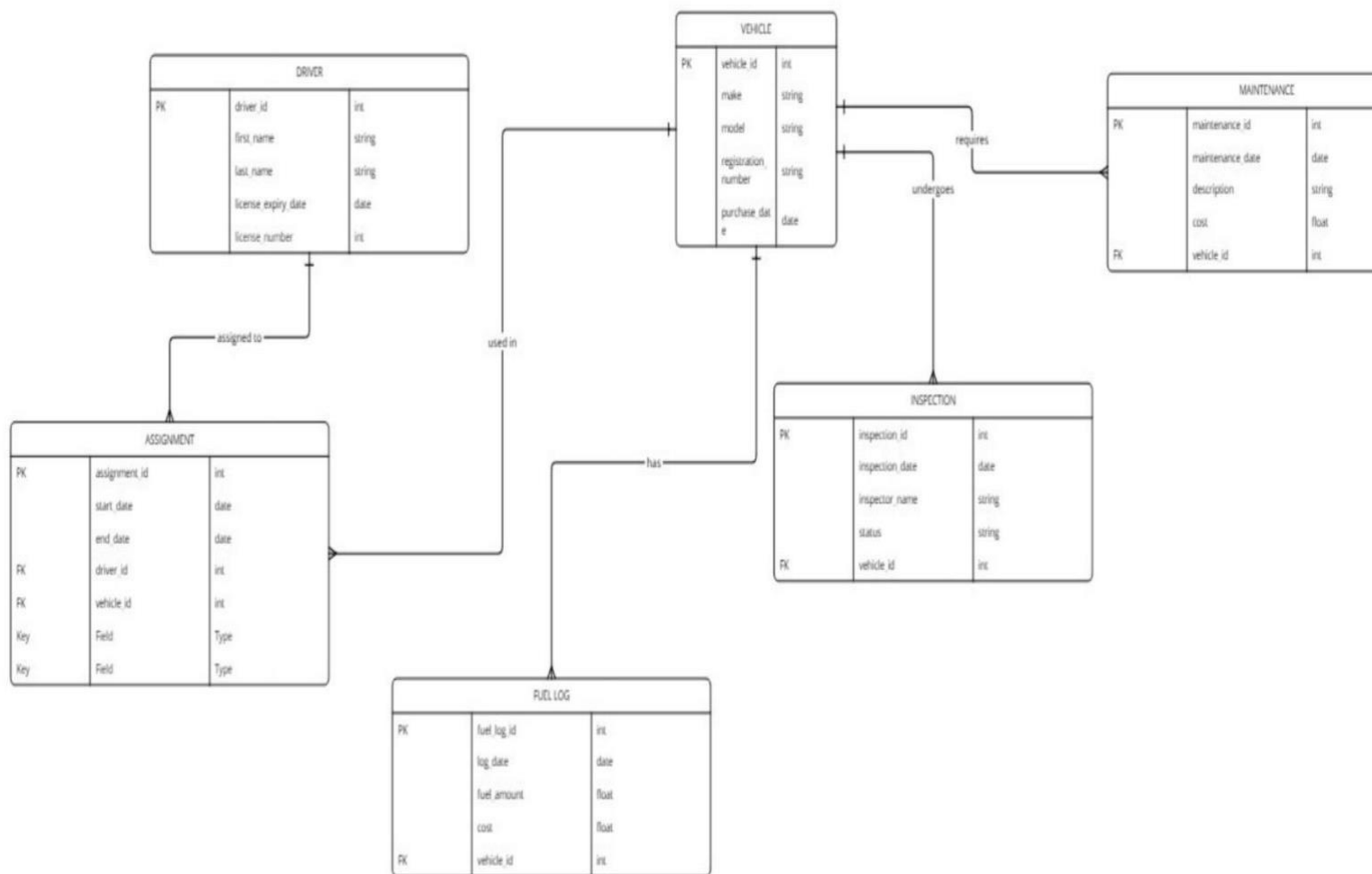
### **Objectives**

1. **Retrieve Vehicle Status:** Display all vehicles with their current operational status.
2. **Identify Valid Driver Licenses:** List drivers with licenses valid beyond 2025.
3. **Analyze Maintenance Costs:** Track maintenance expenses for specific vehicles.
4. **Monitor Assignments:** Link vehicles with drivers and track assignment details.

5. **Calculate Fuel Costs:** Determine total fuel expenditure across all vehicles.
6. **Inspection Results:** Identify vehicles that failed inspections.
7. **Driver Workload:** Review assignment history for individual drivers.

## SYSTEM DESIGN

### er diagram



The ER diagram shows the following relationships:

- One-to-many (1:M) relationships:
  - DRIVER to ASSIGNMENT: One driver can be assigned to multiple assignments. A driver record is linked to multiple assignment records.
  - VEHICLE to ASSIGNMENT: One vehicle can be involved in multiple assignments. A vehicle record is linked to many assignment records.
  - VEHICLE to MAINTENANCE: One vehicle can have multiple maintenance records.
  - VEHICLE to INSPECTION: One vehicle can have multiple inspection records.
  - VEHICLE to FUEL\_LOG: One vehicle can have multiple fuel log entries.
- For this project, we used following entities and attributes

### **1. DRIVER Entity:**

- **Attributes:**

- driver\_id (Integer, Primary Key): Unique identifier for each driver.
- first\_name (String): Driver's first name.
- last\_name (String): Driver's last name.
- license\_expiry\_date (Date): Date when the driver's license expires.
- license\_number (Integer): Driver's license number.

### **2. VEHICLE Entity:**

- **Attributes:**

- vehicle\_id (Integer, Primary Key): Unique identifier for each vehicle.
- make (String): Vehicle manufacturer (e.g., Ford, Toyota).
- model (String): Vehicle model (e.g., F-150, Camry).
- registration\_number (String): Vehicle's registration plate number.
- purchase\_date (Date): Date when the vehicle was purchased.

### **3. MAINTENANCE Entity:**

- **Attributes:**

- maintenance\_id (Integer, Primary Key): Unique identifier for each maintenance record.
- maintenance\_date (Date): Date of the maintenance.
- description (String): Description of the maintenance performed.
- cost (Float): Cost of the maintenance.
- vehicle\_id (Integer, Foreign Key): Links to the VEHICLE entity, indicating which vehicle the maintenance refers to.

#### **4. INSPECTION Entity:**

- **Attributes:**

- inspection\_id (Integer, Primary Key): Unique identifier for each inspection.
- inspection\_date (Date): Date of the inspection.
- inspector\_name (String): Name of the person who performed the inspection.
- status (String): Result of the inspection (e.g., "Passed," "Failed").
- vehicle\_id (Integer, Foreign Key): Links to the VEHICLE entity.

#### **5. FUEL\_LOG Entity:**

- **Attributes:**

- fuel\_log\_id (Integer, Primary Key): Unique identifier for each fuel log entry.
- log\_date (Date): Date when the fuel was added.
- fuel\_amount (Float): Amount of fuel added (e.g., in gallons or liters).
- cost (Float): Cost of the fuel.
- vehicle\_id (Integer, Foreign Key): Links to the VEHICLE entity.

#### **6. ASSIGNMENT Entity:**

- **Attributes:**

- assignment\_id (Integer, Primary Key): Unique identifier for each assignment.
- start\_date (Date): Start date of the assignment.
- end\_date (Date): End date of the assignment.
- driver\_id (Integer, Foreign Key): Links to the DRIVER entity.
- vehicle\_id (Integer, Foreign Key): Links to the VEHICLE entity.

#### **The codes we used**

##### **Tables:**

```
CREATE TABLE Vehicle ( vehicle_id VARCHAR(20) PRIMARY KEY, make VARCHAR(50), model VARCHAR(50), year INT, license_plate VARCHAR(20), status VARCHAR(20));
```

```
CREATE TABLE Driver ( driver_id VARCHAR(20) PRIMARY KEY, first_name VARCHAR(50), last_name VARCHAR(50), license_number VARCHAR(20), license_expiry DATE, contact_number VARCHAR(15));
```

```
CREATE TABLE Maintenance ( maintenance_id VARCHAR(20) PRIMARY KEY,
vehicle_id VARCHAR(20), maintenance_date DATE, description TEXT, cost FLOAT,
FOREIGN KEY (vehicle_id) REFERENCES Vehicle(vehicle_id));
```

```
CREATE TABLE Assignment ( assignment_id VARCHAR(20) PRIMARY KEY,
vehicle_id VARCHAR(20), driver_id VARCHAR(20), start_date DATE, end_date
DATE, route VARCHAR(100), FOREIGN KEY (vehicle_id) REFERENCES
Vehicle(vehicle_id), FOREIGN KEY (driver_id) REFERENCES Driver(driver_id));
```

```
CREATE TABLE Fuel_Log ( fuel_log_id VARCHAR(20) PRIMARY KEY, vehicle_id
VARCHAR(20), date DATE, liters FLOAT, cost FLOAT, FOREIGN KEY
(vehicle_id) REFERENCES Vehicle(vehicle_id))
```

```
CREATE TABLE Inspection ( inspection_id VARCHAR(20) PRIMARY KEY,
vehicle_id VARCHAR(20), inspection_date DATE, inspector_name VARCHAR(50),
result VARCHAR(20), FOREIGN KEY (vehicle_id) REFERENCES Vehicle(vehicle_id));
```

### **Crude operations:**

#### **Insertion:**

```
INSERT INTO Vehicle (vehicle_id, make, model, year, license_plate, status)VALUES
('V001', 'Toyota', 'Corolla', 2020, 'ABC123', 'Available'),('V002', 'Ford', 'Ranger', 2019,
'DEF456', 'Under Maintenance'),('V003', 'Honda', 'Civic', 2021, 'GHI789',
'Assigned'),('V004', 'Isuzu', 'D-Max', 2018, 'JKL012', 'Available'),('V005', 'Mercedes',
'Sprinter', 2022, 'MNO345', 'In Service');
```

```
INSERT INTO Driver (driver_id, first_name, last_name, license_number, license_expiry,
contact_number)VALUES ('D001', 'brenda','mwikali', 'L123456', '2025-12-31', '123-456-
7890'),('D002', 'cynthia', 'nasike', 'L789101', '2024-05-20', '234-567-8901'),('D003', 'vincent',
'mwendwa', 'L456789', '2026-11-15', '345-678-9012'),('D004', 'arthur', 'kiprotich', 'L112233',
'2023-07-19', '456-789-0123'),('D005', 'Michael', 'Jackson', 'L334455', '2027-03-25', '567-
890-1234');
```

```
INSERT INTO Maintenance (maintenance_id, vehicle_id, maintenance_date, description,
cost)VALUES ('M001', 'V002', '2024-12-01', 'Oil change and filter replacement',
150.00),('M002', 'V003', '2024-12-15', 'Brake pad replacement', 200.00),('M003', 'V001',
'2024-12-20', 'Engine tune-up', 300.00),('M004', 'V004', '2024-12-10', 'Tire replacement',
400.00),('M005', 'V005', '2024-12-05', 'Battery replacement', 250.00);
```

```
INSERT INTO Assignment (assignment_id, vehicle_id, driver_id, start_date, end_date,
```

```
route)VALUES ('A001', 'V003', 'D001', '2024-12-01', '2024-12-03', 'City Center to Airport'),('A002', 'V005', 'D002', '2024-12-05', '2024-12-07', 'Warehouse to Port'),('A003', 'V004', 'D003', '2024-12-20', '2024-12-22', 'Highway Patrol'),('A004', 'V001', 'D004', '2024-12-15', '2024-12-17', 'Downtown Delivery'),('A005', 'V002', 'D005', '2024-12-10', '2024-12-12', 'Suburban Route');
```

```
INSERT INTO Fuel_Log (fuel_log_id, vehicle_id, date, liters, cost)VALUES ('F001', 'V001', '2024-12-01', 50.0, 75.00),('F002', 'V002', '2024-12-15', 60.0, 90.00),('F003', 'V003', '2024-12-20', 40.0, 60.00),('F004', 'V004', '2024-12-05', 80.0, 120.00),('F005', 'V005', '2024-12-10', 100.0, 150.00);
```

```
INSERT INTO Inspection (inspection_id, vehicle_id, inspection_date, inspector_name, result)VALUES ('I001', 'V001', '2024-12-30', 'Inspector A', 'Pass'),('I002', 'V002', '2024-12-20', 'Inspector B', 'Fail'),('I003', 'V003', '2024-12-15', 'Inspector C', 'Pass'),('I004', 'V004', '2024-12-05', 'Inspector D', 'Pass'),('I005', 'V005', '2024-12-25', 'Inspector E', 'Pass');
```

```
SELECT * FROM Vehicle
```

```
mysql> SELECT * FROM Vehicle;
```

vehicle_id	make	model	year	license_plate	status
V001	Toyota	Corolla	2020	ABC123	Available
V002	Ford	Ranger	2019	DEF456	Under Maintenance
V003	Honda	Civic	2021	GHI789	Assigned
V004	Isuzu	D-Max	2018	JKL012	Available
V005	Mercedes	Sprinter	2022	MNO345	In Service

5 rows in set (0.01 sec)

```
SELECT first_name, last_name, license_number, license_expiry
FROM Driver
WHERE license_expiry > '2025-01-01';
```

```
mysql> SELECT first_name, last_name, license_number, license_expiry
> FROM Driver
> WHERE license_expiry > '2025-01-01';
```

first_name	last_name	license_number	license_expiry
brenda	mwikali	L123456	2025-12-31
vincent	mwenda	L456789	2026-11-15
Michael	Jackson	L334455	2027-03-25

3 rows in set (0.01 sec)

```
SELECT maintenance_date, description, cost
FROM Maintenance
WHERE vehicle_id = 'V002';
```



```

SELECT a.assignment_id, a.route, a.start_date, a.end_date, v.make, v.model
FROM Assignment a
JOIN Vehicle v ON a.vehicle_id = v.vehicle_id
WHERE a.driver_id = 'D001';

```

```

mysql> SELECT a.assignment_id, a.route, a.start_date, a.end_date, v.make, v.model
-> FROM Assignment a
-> JOIN Vehicle v ON a.vehicle_id = v.vehicle_id
-> WHERE a.driver_id = 'D001';
+-----+-----+-----+-----+-----+
| assignment_id | route           | start_date | end_date | make  | model |
+-----+-----+-----+-----+-----+
| A001          | City Center to Airport | 2024-12-01 | 2024-12-03 | Honda | Civic |
+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)

```

```

SELECT v.vehicle_id, v.make, v.model, m.maintenance_date, m.cost
FROM Vehicle v
JOIN Maintenance m ON v.vehicle_id = m.vehicle_id
WHERE m.cost > 200.00;

```

```

mysql> SELECT v.vehicle_id, v.make, v.model, m.maintenance_date, m.cost
-> FROM Vehicle v
-> JOIN Maintenance m ON v.vehicle_id = m.vehicle_id
-> WHERE m.cost > 200.00;
+-----+-----+-----+-----+-----+
| vehicle_id | make   | model   | maintenance_date | cost |
+-----+-----+-----+-----+-----+
| V001       | Toyota | Corolla | 2024-12-20       | 300  |
| V004       | Isuzu  | D-Max   | 2024-12-10       | 400  |
| V005       | Mercedes | Sprinter | 2024-12-05       | 250  |
+-----+-----+-----+-----+-----+

```

```

SELECT d.driver_id, d.first_name, d.last_name, COUNT(a.assignment_id) AS
total_assignments
FROM Driver d
LEFT JOIN Assignment a ON d.driver_id = a.driver_id
GROUP BY d.driver_id;

```

	driver_id	first_name	last_name	total_assignments
►	D001	Brenda	Mwikali	1
	D002	Cynthia	Nasike	1
	D003	Vincent	Mwendwa	1
	D004	Arthur	Kiprotich	1
	D005	Michael	Jackson	1

```

SELECT v.vehicle_id, v.make, v.model, COUNT(a.assignment_id) AS usage_count
FROM Vehicle v
JOIN Assignment a ON v.vehicle_id = a.vehicle_id

```



GROUP BY v.vehicle\_id  
ORDER BY usage\_count DESC  
LIMIT 1;

```
5 rows in set (0.01 sec)

mysql> SELECT v.vehicle_id, v.make, v.model, COUNT(a.assignment_id) AS usage_count
-> FROM Vehicle v
-> JOIN Assignment a ON v.vehicle_id = a.vehicle_id
-> GROUP BY v.vehicle_id
-> ORDER BY usage_count DESC
-> LIMIT 1;

+-----+-----+-----+-----+
| vehicle_id | make  | model  | usage_count |
+-----+-----+-----+-----+
| V001      | Toyota | Corolla | 1          |
+-----+-----+-----+-----+

1 row in set (0.01 sec)
```

UPDATE Vehicle  
SET status = 'Available'  
WHERE vehicle\_id = 'V002';

DELETE FROM Fuel\_Log  
WHERE date < '2024-12-10';

SELECT v.vehicle\_id, v.make, v.model, SUM(m.cost) AS total\_maintenance\_cost  
FROM Vehicle v  
JOIN Maintenance m ON v.vehicle\_id = m.vehicle\_id  
GROUP BY v.vehicle\_id;

```
mysql> SELECT v.vehicle_id, v.make, v.model, SUM(m.cost) AS total_maintenance_cost
-> FROM Vehicle v
-> JOIN Maintenance m ON v.vehicle_id = m.vehicle_id
-> GROUP BY v.vehicle_id;

+-----+-----+-----+-----+
| vehicle_id | make  | model  | total_maintenance_cost |
+-----+-----+-----+-----+
| V001      | Toyota | Corolla | 300                    |
| V002      | Ford   | Ranger  | 150                    |
| V003      | Honda  | Civic   | 200                    |
| V004      | Isuzu  | D-Max   | 400                    |
| V005      | Mercedes | Sprinter | 250                    |
+-----+-----+-----+-----+

5 rows in set (0.00 sec)

mysql> SELECT *FROM Vehicle;

+-----+-----+-----+-----+-----+-----+
| vehicle_id | make  | model  | year | license_plate | status |
+-----+-----+-----+-----+-----+-----+
| V001      | Toyota | Corolla | 2020 | ABC123        | Available |
| V002      | Ford   | Ranger  | 2019 | DEF456        | Available |
| V003      | Honda  | Civic   | 2021 | GHI789        | Assigned |
| V004      | Isuzu  | D-Max   | 2018 | JKL012        | Available |
| V005      | Mercedes | Sprinter | 2022 | MNO345        | In Service |
+-----+-----+-----+-----+-----+-----+

5 rows in set (0.00 sec)
```

## **Recommendations**

1. **Maintenance Tracking:** Implement automated alerts for scheduled maintenance to reduce vehicle downtime.
2. **Driver Monitoring:** Regularly review driver license expirations and enforce compliance.
3. **Cost Management:** Focus on vehicles with high maintenance or fuel costs to identify efficiency improvements.
4. **Assignment Optimization:** Maximize vehicle usage by assigning underutilized vehicles to active routes.
5. **Inspection Compliance:** Conduct follow-ups on failed inspections to ensure roadworthiness.

## **Conclusion**

The analysis identified gaps in vehicle utilization, maintenance tracking, driver compliance, and cost management. To address these challenges, recommendations focused on improving data integration, automating critical processes, and enhancing monitoring tools were provided. These solutions aim to reduce downtime, optimize resource allocation, and ensure regulatory compliance. Implementing these strategies will result in better operational efficiency, cost savings, and improved service delivery, aligning the fleet management system with organizational objectives.

## ***references***

- iTrack Tracking. (2023, November 16). *Fleet Management in Kenya | Control all your fleet in a single screen*. iTrack Kenya. <https://itrack.ke/fleet-management-in-kenya/>
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- Carro Tracking Solutions Kenya Ltd. (2024, March 27). *Fleet+Management+System - Carro Tracking Solutions Kenya Ltd.* [https://www.cartrackingsolutionskenya.com/fleetmanagementsystem/?srsltid=AfmBOopv8MnT4jakmqnoSCF2jns3rwLOG5E\\_NSDNbWVtynfqf8\\_kdFrW](https://www.cartrackingsolutionskenya.com/fleetmanagementsystem/?srsltid=AfmBOopv8MnT4jakmqnoSCF2jns3rwLOG5E_NSDNbWVtynfqf8_kdFrW)

Appendices

	fuel_log_id	vehide_id	date	liters	cost
▶	F001	V001	2024-12-01	50	75
	F002	V002	2024-12-15	60	90
	F003	V003	2024-12-20	40	60
	F004	V004	2024-12-05	80	120
	F005	V005	2024-12-10	100	150
*	NULL	NULL	NULL	NULL	NULL

	inspection_id	vehide_id	inspection_date	inspector_name	result
▶	I001	V001	2024-12-30	Inspector A	Pass
	I002	V002	2024-12-20	Inspector B	Fail
	I003	V003	2024-12-15	Inspector C	Pass
	I004	V004	2024-12-05	Inspector D	Pass
	I005	V005	2024-12-25	Inspector E	Pass
*	NULL	NULL	NULL	NULL	NULL

	driver_id	first_name	last_name	license_number	license_expiry	contact_number
▶	D001	Brenda	Mwikali	L123456	2025-12-31	123-456-7890
	D002	Cynthia	Nasike	L789101	2024-05-20	234-567-8901
	D003	Vincent	Mwendwa	L456789	2026-11-15	345-678-9012
	D004	Arthur	Kiprotich	L112233	2023-07-19	456-789-0123
	D005	Michael	Jackson	L334455	2027-03-25	567-890-1234
*	NULL	NULL	NULL	NULL	NULL	NULL

	assignment_id	vehide_id	driver_id	start_date	end_date	route
▶	A001	V003	D001	2024-12-01	2024-12-03	City Center to Airport
	A002	A001	D002	2024-12-05	2024-12-07	Warehouse to Port
	A003	V004	D003	2024-12-20	2024-12-22	Highway Patrol
	A004	V001	D004	2024-12-15	2024-12-17	Downtown Delivery
	A005	V002	D005	2024-12-10	2024-12-12	Suburban Route
*	NULL	NULL	NULL	NULL	NULL	NULL

	fuel_log_id	vehide_id	date	liters	cost
▶	F001	V001	2024-12-01	50	75
	F002	V002	2024-12-15	60	90
	F003	V003	2024-12-20	40	60
	F004	V004	2024-12-05	80	120
	F005	V005	2024-12-10	100	150
*	NULL	NULL	NULL	NULL	NULL

	maintenance_id	vehide_id	maintenance_date	description	cost
▶	M001	V002	2024-12-01	Oil change and filter replacement	150
	M002	V003	2024-12-15	Brake pad replacement	200
	M003	V001	2024-12-20	Engine tune-up	300
	M004	V004	2024-12-10	Tire replacement	400
	M005	V005	2024-12-05	Battery replacement	250
*	NULL	NULL	NULL	NULL	NULL