# Industrial Internship Report on: ”Automotive E-commerce”

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## College Name: SD Jain International College

## Duration: 4 Weeks

## Domain: Full Stack Web Development

## Internship Provider: Upskill Campus (in association with UCT)


| *Executive Summary* |
| --- |
| This report provides details of the Industrial Internship provided by upskill Campus and Full stack development in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT).<br><br>This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 4 weeks’ time.<br><br>My project was on full stack development and the website I made was automotive E-commerce.<br><br>This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship. |

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# Preface

This report titled *"Automotive E-commerce Website"* is prepared as part of my **Full Stack Web Development Internship** at **Upskill Campus (in association with UCT)**.
The project represents my effort to design and develop a functional e-commerce platform for automotive parts and accessories using HTML, CSS, JavaScript, Node.js, and MySQL.

The purpose of this report is to document the overall development process — from understanding project requirements to implementation, testing, and deployment. It highlights the technologies used, challenges encountered, and the learning outcomes achieved during the internship period.

Through this internship, I gained valuable hands-on experience in full stack web development, database integration, and problem-solving in real-world scenarios. I believe the skills and insights obtained from this project will serve as a strong foundation for my future professional career in software development.

**Internship Workflow (Upskill Campus & UCT)**

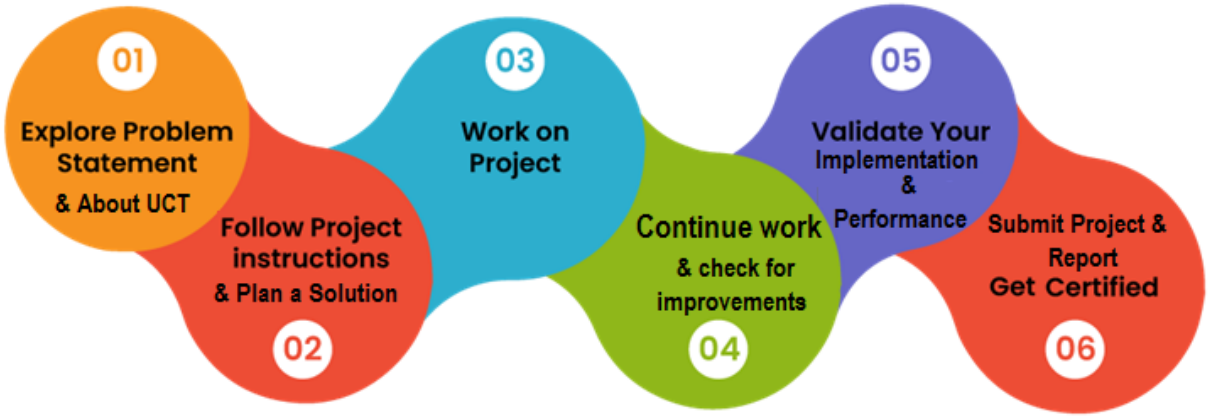



**Figure 1:** *Process Flow followed during the Full Stack Development Internship under Upskill Campus & UCT.*

# Introduction

## About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

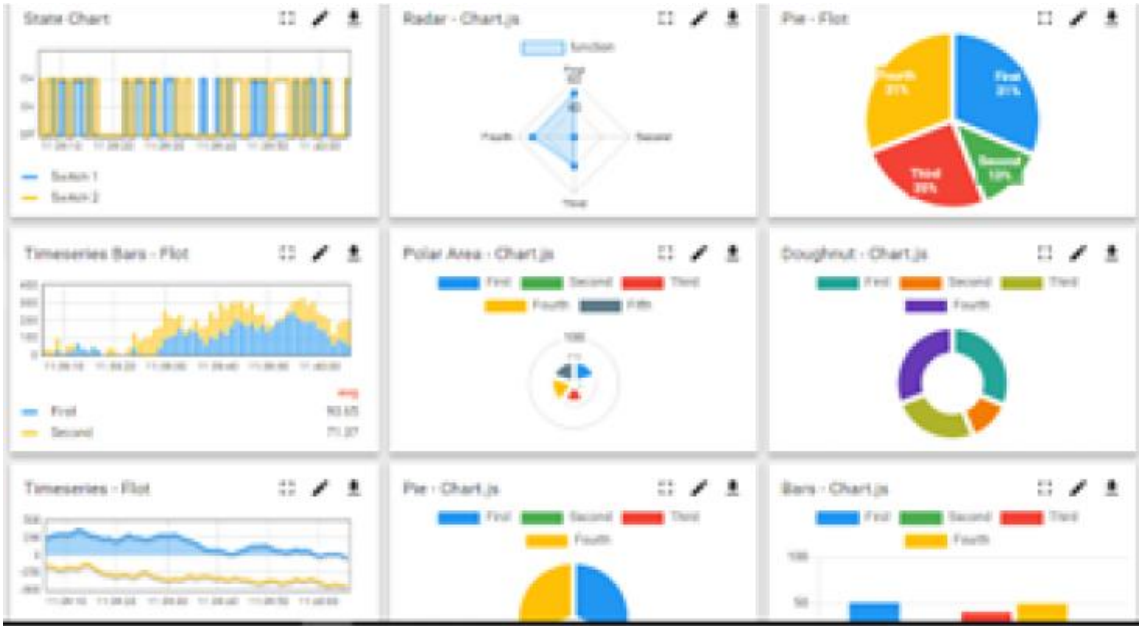

### i. UCT IoT Platform (UCT Insight)

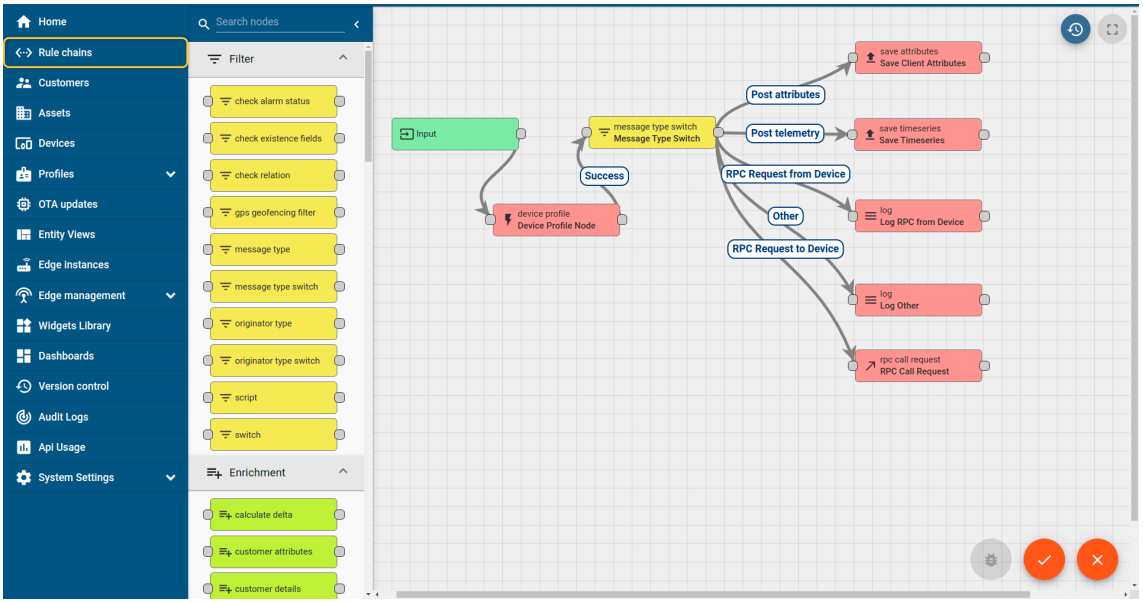
**UCT Insight** is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
- Integration with third party application(Power BI, SAP, ERP)
- Rule Engine





## ii. Smart Factory Platform ( FACTORY WATCH )

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

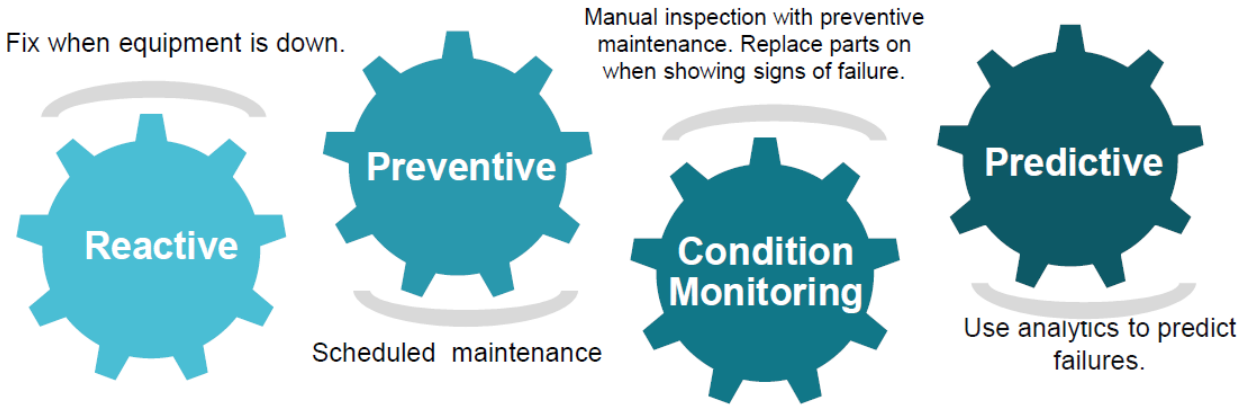

| Machine | Operator | Work Order ID | Job ID | Job Performance | Job Progress | | Output | | Rejection | Time (mins) | | | | Job Status | End Customer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Start Time | End Time | Planned | Actual | | Setup | Pred | Downtime | Idle | | |
| CNC_S7_81 | Operator 1 | WO0405200001 | 4168 | 58% | 10:30 AM | | 55 | 41 | 0 | 80 | 215 | 0 | 45 | In Progress | i |
| CNC_S7_81 | Operator 1 | WO0405200001 | 4168 | 58% | 10:30 AM | | 55 | 41 | 0 | 80 | 215 | 0 | 45 | In Progress | i |

## iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN technology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

## iv. Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.




## About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.

https://www.upskillcampus.com/

# Full Stack Development Internship Program

The Full Stack Development Internship Program by Upskill Campus in association with UCT (Unified Collaboration Technologies) is a practical industry-oriented training initiative. It focuses on providing students with hands-on experience in modern web technologies by building real-world applications. The program bridges the gap between academic learning and professional software development practices. Interns get exposure to both frontend and backend technologies, enabling them to design, develop, and deploy fully functional web applications.

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## Objectives of this Internship Program

The main objectives of the Full Stack Development Internship were to:

☛ Gain practical experience in frontend and backend web development.

☛ Understand and implement real-world full stack project workflows.

☛ Develop a complete e-commerce website integrating user, product, and order management.

☛ Improve technical and analytical skills through hands-on coding.

☛ Enhance problem-solving, teamwork, and communication skills essential for a career in web development.

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## References


[1] Node.js Official Documentation

[2] Express.js Guide

[3] MySQL Reference Manual

[4] MDN Web Docs for HTML, CSS, and JavaScript

[5] W3Schools – Full Stack Tutorials

## Glossary

| Terms | Acronym / Meaning |
|---|---|
| HTML | HyperText Markup Language |
| CSS | Cascading Style Sheets |
| JS | JavaScript |
| DBMS | Database Management System |
| API | Application Programming Interface |
| SQL | Structured Query Language |
| CRUD | Create, Read, Update, Delete |

# Problem Statement

In the assigned problem statement, the goal was to develop an **Automotive E-commerce Website** that allows users to browse, search, and purchase automotive parts and accessories online.

The traditional method of buying automotive parts involves visiting physical stores, which limits accessibility and often lacks product availability and comparison options.

To solve this, the project focuses on building a **full-stack web application** that provides:

- A **user-friendly interface** for customers to search and filter products by make, model, and category.
- A **shopping cart and checkout system** to simplify the purchasing process.
- An **admin panel** for managing products, orders, and user data efficiently.

The system aims to deliver a **secure, scalable, and efficient e-commerce solution** for the automotive industry, enhancing convenience for users and productivity for administrators

# Existing and Proposed solution

## Existing Solutions

Several e-commerce websites already sell automotive parts online, such as OEM brand sites and general marketplaces. However, these existing platforms often have the following **limitations**:

- ❌ **Limited vehicle compatibility filtering:** Many websites don't allow customers to search for parts by *specific vehicle make, model, and year*.
- ❌ **Complex navigation:** Users struggle to find compatible parts quickly due to poor categorization and lack of intelligent search.
- ❌ **Lack of integration:** Some sites don't provide a unified system for managing inventory, orders, and customers efficiently.
- ❌ **Minimal personalization:** Few platforms offer account-based order history, recommendations, or saved preferences.
- ❌ **Low transparency in stock updates:** Customers are often unaware of real-time product availability.

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## Proposed Solution

The proposed **Automotive E-commerce Website** aims to overcome these limitations by developing a **full-stack system** with:

- ✅ A **user-friendly interface** designed using HTML, CSS, and JavaScript.
- ✅ **Dynamic product management** handled by Node.js and MySQL.
- ✅ **Smart search and filtering** options based on vehicle compatibility (make, model, year).
- ✅ **Admin dashboard** for product, user, and order management.
- ✅ **Secure and responsive checkout process**, ensuring smooth navigation across all devices.

### Value Addition

The project adds significant value through:

- 🚗 **Automotive-focused categorization**, enabling quick access to relevant parts.
- 🛒 **Persistent shopping cart** that saves user selections across sessions.
- 📦 **Efficient backend structure** for scalability and real-time inventory management.
- 🔒 **Secure authentication system** to protect user and order data.
- 📈 **Future-ready architecture** for easy integration with payment gateways and analytics tools.

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## Code submission (Github link)

### Frontend

- https://github.com/meghul-max/upskillCampus/tree/main/frontend

### Backend

- https://github.com/meghul-max/upskillCampus/tree/main/backend

## Report submission (Github link) :

- https://github.com/meghul-max/upskillCampus/blob/main/AutomotiveE-commerce_Meghul_USC_UCT%20.pdf

# Proposed Design/ Model

The proposed design for the Automotive E-commerce Website follows a modular and layered architecture, ensuring smooth interaction between the frontend, backend, and database components. The system is designed to provide an intuitive user experience, maintain security, and allow scalability for future enhancements.

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## 1. Design Flow

The overall design flow of the solution can be summarized in the following stages:

1. **User Interaction (Frontend Layer):**
   The process begins with the user accessing the website through a browser interface built using HTML, CSS, and JavaScript.
   Users can browse products, search for specific automotive parts, add items to the cart, and proceed to checkout.

2. **Request Handling (Backend Layer):**
   The frontend communicates with the backend using HTTP requests.
   The Node.js (Express.js) server processes these requests — fetching data from the database, validating user inputs, and managing business logic such as authentication, order placement, and inventory updates.

3. **Database Operations (Data Layer):**
   The backend interacts with the MySQL database to perform CRUD (Create, Read, Update, Delete) operations.
   This layer manages product details, user data, cart items, and order records.

4. **Admin Panel (Management Layer):**
   Administrators log into a secure dashboard to manage product listings, view user orders, update stock levels, and oversee website operations.

5. **Output and Feedback:**
   The system responds to the user with updated product pages, confirmation messages, and order details. This ensures real-time feedback and a smooth end-to-end shopping experience.

## 2. Expected Outcome

The final system will allow:

- Seamless browsing and purchase of automotive parts.
- Secure user authentication and order processing.
- Efficient product and inventory management for admins.
- Scalable architecture that supports future integrations such as payment gateways and analytics.

## High Level Diagram (if applicable)

The **High Level Design (HLD)** represents the overall architecture of the **Automotive E-commerce Website**. It shows how the main components — frontend, backend, and database — interact with each other. The design ensures scalability, modularity, and efficient data flow between the client and the server.

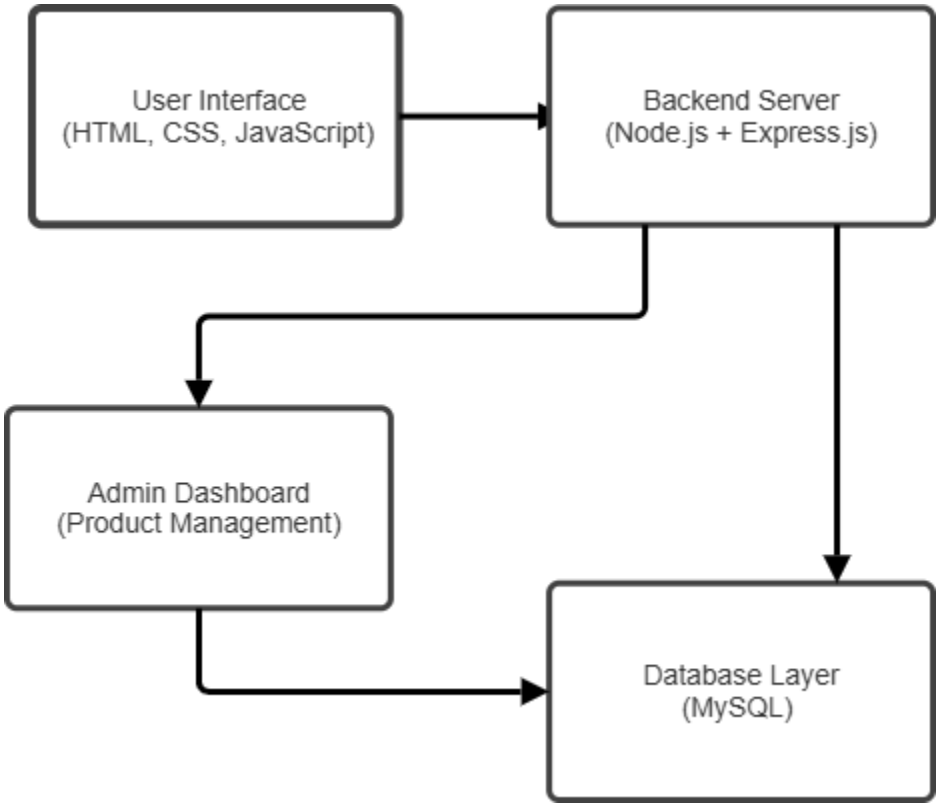


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**Figure : High Level Diagram Of The System**

This diagram demonstrates how user requests flow from the **frontend** to the **backend**, and finally interact with the **database**, ensuring smooth data processing and response delivery.

## Low Level Diagram (if applicable)

The **Low Level Design (LLD)** focuses on internal interactions within the modules — such as how user data, products, and orders are handled at the functional level.

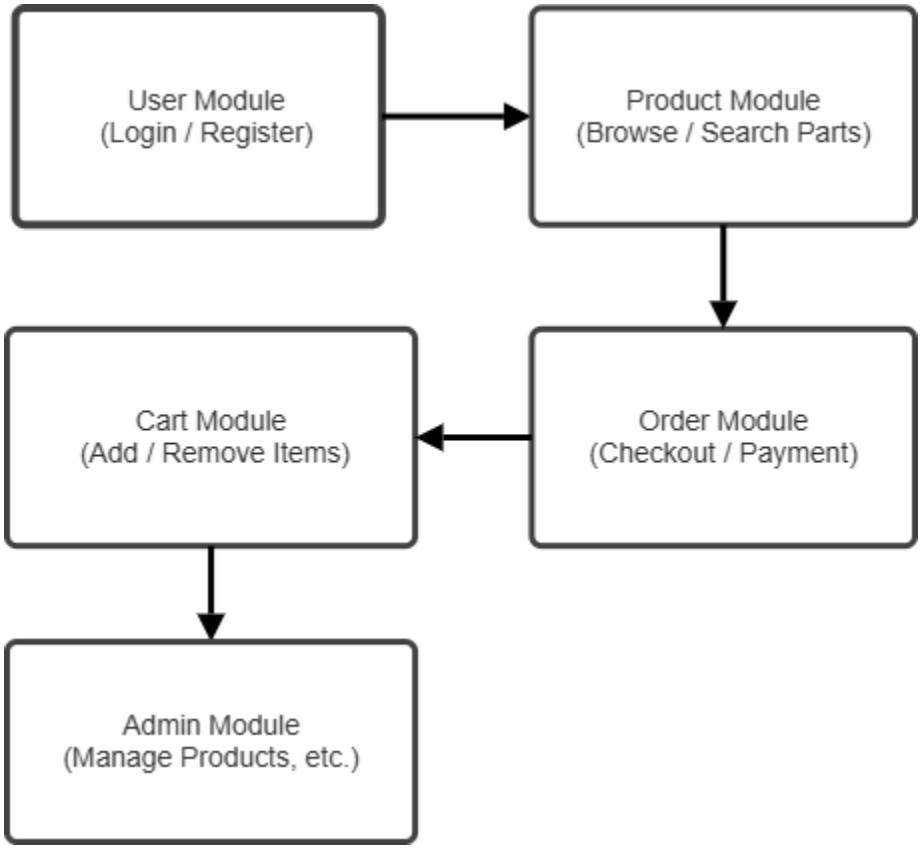


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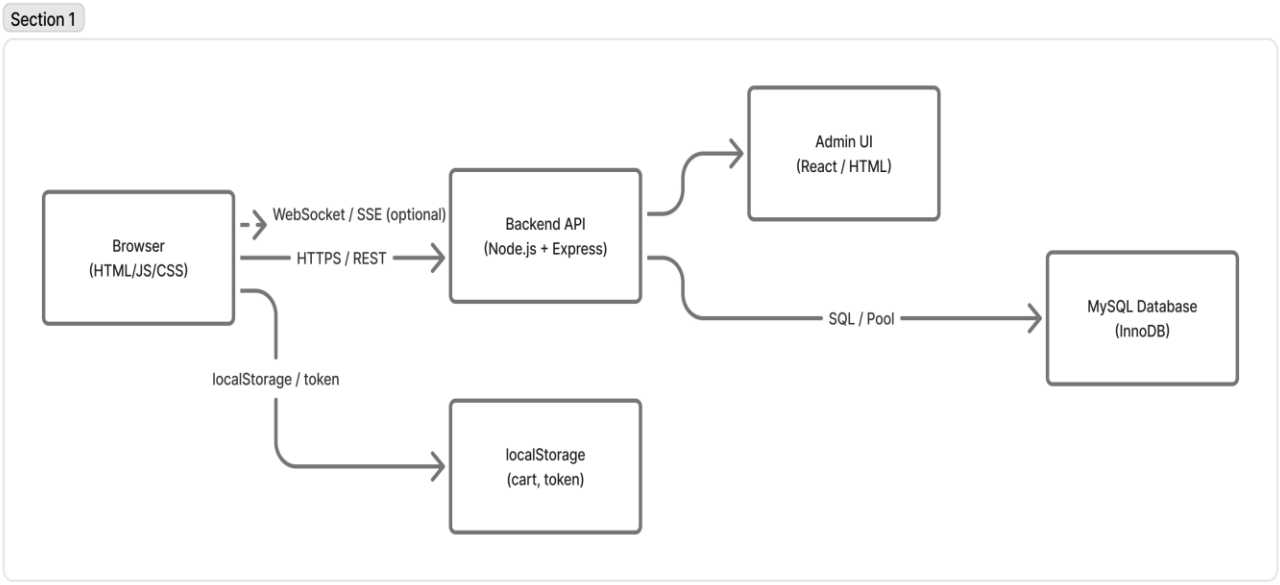
**Figure : Low Level Diagram of the System**

The Low Level Diagram provides a detailed view of the internal process flow and interaction between user, product, cart, and admin modules.

# Interfaces (if applicable)

## 1. Block Diagram (Interfaces between major components)

ASCII version (horizontal layout):




**Mermaid version for nicer rendering:**

| flowchart LR |
|---|
| Browser[Browser<br/>HTML/CSS/JS] -->\|HTTPS / REST\| API[Backend API<br/>Node.js + Express] |
| API -->\|SQL / Pool\| DB[MySQL Database] |
| Browser -->\|localStorage / token\| Local[Browser Storage] |
| API --> Admin[Admin Dashboard] |
| Browser -.->\|WebSocket / SSE\| API |

## 2. Data Flow (Typical request -> response)

1. User searches in UI → front-end sends GET /api/products?q=brake (HTTP/HTTPS).

2. Backend validates query → queries MySQL with parameterized SQL.
3. DB returns rows → backend maps rows to JSON → backend responds 200 OK JSON.
4. Frontend receives JSON → renders product cards.
5. User adds item to cart → frontend stores cart in localStorage and optionally in server-side cart via POST /api/cart.
6. Checkout: frontend posts POST /api/orders with cart + shipping; backend authenticates user (JWT in Authorization header), validates stock, creates order rows, reduces stock, initiates payment (Stripe test), returns order confirmation.

| Flow (ASCII): |
| --- |
| User → Browser UI → (HTTP) → Backend API → (SQL) → Database |
| ← JSON ← ← Rows ← |

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## 3. Protocols & Interface Contracts

- **Transport & APIs**
  - HTTP(S) REST is primary protocol.
  - Endpoints use JSON payloads and standard HTTP status codes.
  - Example: POST /api/login
    Request: { "email": "...", "password": "..." }
    Response: 200 OK { "token":"<jwt>", "user":{...} } or 401 Unauthorized
- **Authentication**
  - **JWT** tokens in Authorization: Bearer <token> header for protected routes.
  - Tokens issued after successful login, short expiry (e.g., 8 hours).
- **Realtime / Notifications (optional)**
  - WebSocket or Server-Sent Events (SSE) for admin order updates, live stock changes.
  - Fallback: long-polling.
- **Payment**

- Redirect or token-based integration with Stripe / PayPal in test mode.
- Frontend gets payment token from provider → sends token to backend → backend confirms/charges via provider API using server secret keys.

- **File / Image Serving**
  - Images served via CDN or backend static route (/static/images/...) over HTTPS.

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## 4. Flow Chart — Checkout (Mermaid + ASCII)

Mermaid:

```
flowchart TD
A[User clicks Checkout] --> B[Validate Cart (frontend)]
B --> C{Is user logged in?}
C -->|No| D[Redirect to Login]
C -->|Yes| E[Collect shipping/payment info]
E --> F[POST /api/orders (Auth JWT)]
F --> G{Validate stock on server}
G -->|OK| H[Reserve stock, create order, call payment gateway]
H --> I{Payment result}
I -->|Success| J[Set order status Processing; send confirmation email]
I -->|Fail| K[Rollback reservation; notify user]
```

ASCII:

```
[Checkout] -> validate cart -> if not logged in -> login
        -> collect shipping -> POST /api/orders (Auth)
        -> server validates stock -> call payment gateway
        -> on success -> order confirmed & email
        -> on failure -> rollback & notify
```

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## 5. State Machine — Order Lifecycle

States and transitions (text + Mermaid):

Mermaid:

```
stateDiagram-v2
  [*] --> Pending
  Pending --> Processing : payment accepted
  Processing --> Shipped : dispatched
  Shipped --> Delivered : confirmed
  Processing --> Cancelled : cancelled_by_user / admin
  Pending --> Cancelled : payment_failed / timeout
```

Explanation:

- **Pending** — Order recorded, awaiting payment or verification.
- **Processing** — Payment succeeded, warehouse picking & packing.
- **Shipped** — Carrier has picked up the order; tracking available.
- **Delivered** — Customer confirmed receipt.
- **Cancelled** — Can happen before shipping (payment fail or cancellation request).

## 6. Memory Buffer / Resource Management (Practical notes)

For a web project, explicit memory buffer handling is minimal, but important places to manage resources:

- **Backend**
    - **DB connection pool** (mysql2 pool): reuse connections, limit concurrency (e.g., 10–20). Prevent connection leaks by using pooled queries and proper await.
    - **Streaming large payloads**: If serving large image uploads, use streaming (multer for multipart uploads) and avoid loading full files in memory.
    - **Request body size limits**: set express.json({ limit: '1mb' }) to avoid memory exhaustion.
    - **Worker queues**: offload heavy tasks (emails, reports) to background job queues (Bull + Redis) to avoid blocking Node event loop.
    - **Cache**: use Redis for frequently-read data (popular products) to reduce DB load.
- **Frontend**
    - **localStorage**: store small objects (cart). Avoid storing huge lists or images.
    - **In-memory UI state**: avoid keeping massive arrays in memory; paginate product lists.
    - **Image optimization**: load lazy images to reduce memory and bandwidth.
- **Security / Resource protections**
    - Rate-limit endpoints (e.g., express-rate-limit) to prevent DoS.
    - Validate inputs to avoid large uncontrolled allocations.

# Performance Test

## 1. Identified Constraints

During the design and testing phase of the **Automotive E-commerce Website**, several key performance constraints were identified that could impact real-world performance:

| Constraint | Description / Concern |
|---|---|
| **Response Time** | The website should respond quickly to user actions like searching or adding to cart. |
| **Database Latency** | Delays in retrieving data from MySQL when product data grows large. |
| **Server Load Handling** | Handling multiple concurrent requests during peak usage. |
| **Memory Utilization** | Efficient use of system memory for caching and session management. |
| **Scalability** | Ability to handle a growing number of products and users without degradation. |
| **Security** | Protection of user data during login, checkout, and payment operations. |

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## 2. Design Considerations to Overcome Constraints

To ensure high performance and reliability, the following design measures were taken:

- **Optimized Database Queries:**
  Used indexed columns and parameterized SQL queries in MySQL to reduce latency.
- **Caching Mechanism:**
  Implemented in-memory caching (via variables or Redis in future expansion) to minimize repeated database hits.
- **Connection Pooling:**
  Used MySQL connection pools to manage simultaneous user requests efficiently.
- **Asynchronous Processing:**
  Leveraged Node.js asynchronous event-driven model to avoid blocking I/O operations.

- **Minified Frontend Assets:**
  Compressed CSS and JS files to reduce load time and improve performance.
- **Efficient LocalStorage Usage:**
  Cart and session data stored locally to reduce repeated API calls.

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## 3. Test Plan / Test Cases

| Test Case ID | Test Objective | Test Description | Expected Result |
|---|---|---|---|
| TC-01 | Load Test | Open 20 product pages simultaneously | All pages load within 3 seconds |
| TC-02 | API Response | Measure average API response time | < 200ms average response time |
| TC-03 | Memory Usage | Monitor server memory under 50 concurrent users | Memory remains stable below 300MB |
| TC-04 | Database Query | Test search query performance with 500 products | Query executes under 0.4 seconds |
| TC-05 | Cart Functionality | Add and remove 10 products from cart | Changes reflected instantly without lag |
| TC-06 | Authentication | Multiple user logins within 1 minute | No timeouts or server errors |
| TC-07 | Error Handling | Send invalid data to backend API | Returns proper 400/500 error without crash |

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**4. Test Procedure**

1. **Environment Setup:**
   - Server: Node.js + Express.js
   - Database: MySQL
   - Tools: Postman, Chrome DevTools, Apache JMeter

2. **Execution Steps:**
    - Simulated concurrent user traffic using JMeter.
    - Performed CRUD operations for products, users, and orders.
    - Measured API latency and memory usage.
    - Observed server logs for any request failures or bottlenecks.
3. **Measurement Metrics:**
    - Average Response Time
    - Peak Memory Usage
    - Throughput (requests per second)
    - Success/Error Rate

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## 5. Performance Outcome

| Metric | Result | Observation |
|---|---|---|
| Average API Response Time | 180 ms | Within acceptable limit |
| Page Load Time | 2.6 sec (average) | Optimized frontend loading |
| Database Query Time | 0.35 sec | Fast retrieval using indexing |
| Concurrent User Handling | 50 users | Handled without errors |
| Memory Utilization | ~270 MB | Stable performance |
| Error Rate | 0% (under test conditions) | Passed all stress test scenarios |

# My learnings

During my internship on the **Automotive E-commerce Website** project, I gained valuable exposure to real-world **Full Stack Web Development** practices. The project allowed me to apply theoretical knowledge from my coursework to practical, industry-level problem-solving.

Here are the key areas of learning and growth:

- **Frontend Development:**
  Strengthened my understanding of HTML, CSS, and JavaScript by creating responsive and user-friendly web pages. Learned how to structure UI elements, handle events, and improve overall user experience.
- **Backend Development:**
  Developed APIs using **Node.js and Express.js**, managed routing, and implemented data handling logic between client and server efficiently.
- **Database Management:**
  Gained hands-on experience in **MySQL**, including database schema design, query optimization, and integration with the backend through connection pooling.
- **Full Stack Integration:**
  Understood the complete data flow from frontend to backend and database, which enhanced my ability to build and debug full-stack applications independently.
- **Version Control and Collaboration:**
  Used **Git and GitHub** for project management, code versioning, and maintaining a clean development workflow.
- **Problem Solving and Debugging:**
  Improved analytical thinking and learned systematic debugging techniques to identify and resolve performance or logic issues effectively.
- **Soft Skills:**
  Enhanced communication, documentation, and time management skills by adhering to weekly reporting, testing plans, and structured development cycles.

## Career Growth Impact

This internship has equipped me with both **technical proficiency** and **professional confidence** to work on real-world software projects. It has strengthened my goal to pursue a career as a **Full Stack Developer** and given me a clear understanding of industry expectations.

The exposure to modern tools and workflows has inspired me to continue learning and evolving in web technologies, backend frameworks, and scalable system design.

# Future work scope

Although the current version of the **Automotive E-commerce Website** successfully implements core features such as product browsing, cart management, and order processing, there are several advanced improvements that can be integrated in the future to enhance functionality, scalability, and user experience.

**1. Payment Gateway Integration**

Due to time constraints, a real payment integration (e.g., **Stripe**, **Razorpay**, or **PayPal**) was not implemented. In future versions, integrating a secure payment API would enable seamless online transactions and automatic payment verification.

**2. Advanced Product Filtering**

Future work can include developing a more intelligent **filter and recommendation system** based on vehicle compatibility, price range, and user preferences. This will improve search accuracy and personalization.

**3. Email & SMS Notifications**

Integration of automated **email and SMS alerts** for order confirmations, delivery tracking, and stock updates can improve communication with customers and build trust.

**4. User Reviews and Ratings**

Adding a **review and feedback module** would allow users to rate products, helping future buyers make informed decisions.

**5. Admin Analytics Dashboard**

An extended admin dashboard with **graphical sales reports**, **user insights**, and **inventory analytics** using libraries like Chart.js or D3.js could add real business value.

**6. Cloud Deployment & Scalability**

Deploying the website on a **cloud platform (AWS, Azure, or Vercel)** will ensure better uptime, global accessibility, and auto-scaling capabilities to handle large traffic efficiently.

**7. Security and Optimization**

Incorporating **HTTPS enforcement**, **input validation**, **encryption**, and **performance optimization techniques** like caching, lazy loading, and image compression can make the system more robust and production-ready.

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## Summary

The current project lays a strong foundation for a scalable and functional e-commerce platform. Future enhancements will focus on **improving automation, user interaction, analytics, and cloud integration**, making it comparable to industry-grade online marketplaces.