Mehran University of Engineering &Technology

Jamshoro Sindh, Pakistan

WE-CEP Report

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Submitted to: Engr.Zaib ul Nisa

DEPARTMENT OF COMPUTER SYSTEMS ENGINEERING

Department of Computer Systems Engineering
Mehran University of Engineering and Technology, Jamshoro

Course: Web Engineering (CS-373)			
Instructor	Engr. Zaib Ul Nisa	**Assignment Type**	Complex Engineering Problem
Semester	5th	**Year**	3rd
Submission Deadline	10-04-2025	**Assessment Score**	

The semester project is designed to enable students to solve complex engineering problems using Web Engineering Concepts. The following characteristics of complex engineering problems are targeted in this semester's project on WE.

Complex Engineering Problem – Characteristics		
1	Depth of knowledge Required	☑
2	Range of Conflicting Requirements	☑
3	Depth of Analysis Required	☑
4	Infrequently Encountered Issues Involved	☐
5	Beyond codes/standards of practice	☑
6	Diverse groups of stakeholders with widely varying needs involved	☐
7	Interdependence (high-level problems including many component parts/sub-problems)	☐
8	Have significant consequences in a range of contexts	☐
9	Judgment (Require judgment in decision-making)	☐

Project Objectives:

Front-End Development: Design and develop a responsive, intuitive, and user-friendly front-end interface using HTML, CSS, and JavaScript. Ensure cross-browser compatibility and mobile-first design principles.

Back-End Development: Implement a robust server-side architecture using
Server-side language like PHP frameworks like Node.js, Django, or others. Ensure smooth handling of client requests, database connections, and application logic.

Database Design: Develop a scalable and efficient database schema using SQL Optimize data retrieval and storage with normalized structures and indexing.

User Authentication and Authorization: Implement secure user authentication mechanisms, such as OAuth or JWT, and establish role-based access control to protect user data and application resources.

Form Handling and Validation: Develop and implement efficient form handling systems with client-side and server-side validation to ensure data accuracy, security, and usability.

Security and Data Protection: Integrate security measures like HTTPS, data encryption, CSRF protection, and secure cookies to protect user data and ensure secure interactions between clients and servers.

Responsive and Adaptive Design: Ensure that the website adapts to various screen sizes and devices by implementing responsive design patterns and media queries.

Performance Optimization: Apply optimization techniques, such as lazy loading, minification, caching, and CDN integration, to reduce load times and improve the overall user experience.

Error Handling and Logging: Design a system for proper error handling and logging, capturing potential issues in both client-side and server-side components to ensure smooth debugging and maintenance.

Performance Optimization: Apply optimization techniques to enhance the Website's performance, responsiveness, and energy efficiency.

Project Deliverables:

Technical Report: A comprehensive technical report detailing the Website design, architecture, and implementation, including documentation of key algorithms and methodologies.
Source Code: Complete source code of the Web Engineering Project, well-organized and thoroughly commented for ease of understanding.
User Documentation: User guides and manuals explaining the system's functionalities, installation, and usage instructions.

Students would try to apply in-depth **engineering knowledge (WP1)**to complete each project. During the initial study and formulation of the proposed solution, they would focus on the detailed **requirements (WP2), and realtime constraints (WP2), and** performed **in-depth analysis (WP3).**

Introduction:

The ElectroMart project is a secure and responsive eCommerce platform developed to solve real-world challenges in online shopping systems. Built as part of the Web Engineering course, this platform enables users to register, log in, browse electronic products, and place orders seamlessly. The system is secured using JWT-based authentication and developed using modern web development practices including PHP, MySQL, JavaScript, and HTML/CSS. This report outlines the planning, execution, and delivery of the ElectroMart backend system while showcasing its ability to fulfill the requirements of a complex engineering problem (CEP).

Problem/Requirement Identification:

In today's digital landscape, eCommerce platforms are essential for both customers and businesses. The challenge was to design a scalable, user-friendly eCommerce website for a fictional brand named ElectroMart, which sells electronic products. The website must offer user authentication, secure ordering, product browsing, and responsive design. This project addresses multiple engineering challenges, including secure login systems, efficient data flow between frontend and backend, database normalization, and token-based authentication.

Project Objectives

- To design and develop a secure and scalable eCommerce backend system.

- To implement user authentication using JSON Web Tokens (JWT).

- To manage product data and user orders using MySQL and PHP.

- To create RESTful APIs for front-end-backend communication.

- To ensure code modularity, security, and performance optimization.

- To validate system f   unctionality through structured testing using Postman.

- To adhere to real-world software engineering standards and web development practices.

Implementation:

Frontend Technologies:

- HTML5, CSS3 (responsive layouts, Flexbox/Grid, animations)

- JavaScript (form validation, dynamic product rendering)

Backend Technologies:

- PHP (server-side scripting and API creation)

- SQL (database design and queries)

- JWT (secure token-based authentication)

- Postman (API testing)

- SafePay (Payment API)

Development Tools:

- XAMPP (Local Server)

- VS Code (Development IDE)

- Composer (Dependency Management)

- Git (Version Control)

File Structure Overview:

Final project

```
├──index.html          # Homepage for the storefront

├── login.html          # Login interface for users

├── register.html        # User registration form

├── products.html         # Product listing UI

├── cart.html          # Cart overview and actions

├── checkout.html         # Checkout and payment interface

├── categories.html        # Product category listing page

├── script.js          # Main frontend logic (fetch APIs, DOM control)

├── styles.css          # Global styling for layout and colors

├── stylesp.css          # Product-specific styling (cards, hover, etc.)

├── generateToken.php      # PHP script to generate JWT manually (testing only)

├── /electromart-backend

│   ├── index.php        # Backend health-check and API listing

│   ├── .htaccess        # URL routing and security headers

│   ├── /api
```

```
|   |    ├──── login.php           # Login API: verifies user and issues JWT

|   |    ├──── register.php         # Register API: creates new user account

|   |    ├──── products.php         # Returns all products for frontend

|   |    ├──── create_checkout.php  # Initiates mock checkout process

|   |    ├──── payment.php          # Processes mock payment

|   |    └──── charge.php           # Simulates payment gateway charge

|   ├──── /cart

|   |    ├──── addtocart.php        # Adds product to user cart

|   |    ├──── getcart.php          # Retrieves current user's cart items

|   |    └──── removeFromCart.php   # Removes specific product from cart
```

Flow Chart:
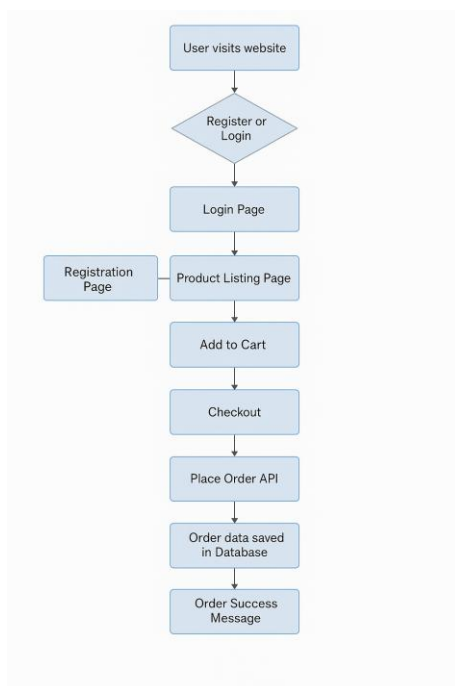
ER Diagram:
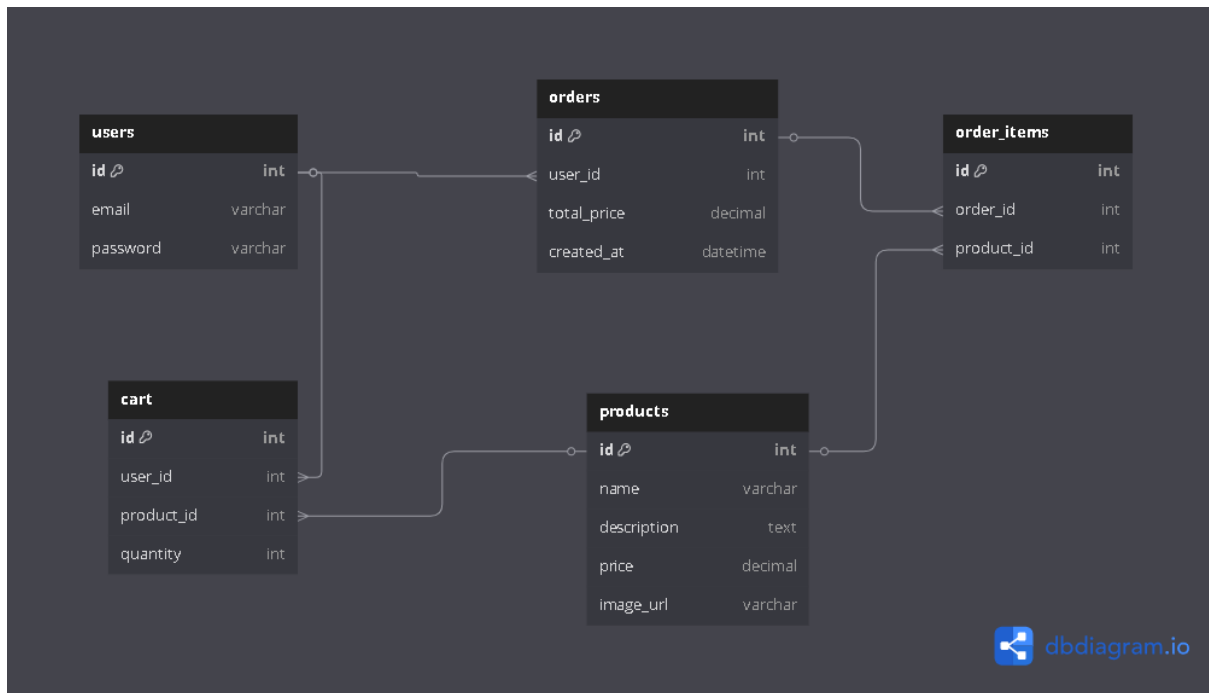
Testing and Validation

- Postman used to test all API endpoints

- Manual and automated form validation

- Token expiration testing and invalid token detection

- Tested on multiple screen sizes and browsers

Registration Page:

Register ✕

Name:

Enter your name

Email:

Enter your email

Password:

Enter your password

Register

Already have an account? Login here

Login Page:

Login ✕

Email:

khet@gmail.com

Password:

••••••••••••

Login

Don't have an account? Register here

Home page:

ElectroMart   Home   Products   Categories   Cart 2   Checkout

Welcome to ElectroMart

Your one-stop shop for the latest gadgets

Shop Now

Chat with us! —

Type your message...   Send

Home page _ Featured Product:

Featured Products

Featured Product 1
Amazing gadget with state-of-the-art features.
$299

Add to Cart | Buy Now
Add to Wishlist

Featured Product 2
Innovative design meets functionality.
$399

Add to Cart | Buy Now
Add to Wishlist

Featured Product 3
High performance gadget for everyday use.
$249

Add to Cart | Buy Now
Add to Wishlist

Featured Product 4
Experience quality and style in one package.
$349

Add to Cart | Buy Now
Add to Wishlist

Product_categories:

Shop by Categories

Smartphones & Accessories
Discover the latest smartphones, chargers, and phone accessories.
Shop Now

Laptops & Computers
Explore high-performance laptops and essential computing devices.
Shop Now

Smartwatches & Wearables
Stay connected with our range of smartwatches and fitness trackers.
Shop Now

Headphones & Speakers
Experience premium sound quality with our headphones and speakers.
Shop Now

Cameras & Accessories
Capture every moment with our range of DSLR and action cameras.
Shop Now

Our Product:

Our Products

Smartphones & Accessories

Smartphones   Chargers & Cables   Phone Cases

Laptops & Computers

Laptops   Keyboards & Mice   External Hard Drives

Smartwatches & Wearables

Fitness Trackers   Smartwatches   Bands & Straps

Headphones & Speakers

Wireless Headphones   Bluetooth Speakers   Noise-Canceling Headphones

Cameras & Accessories

DSLR Cameras   Action Cameras   Camera Lenses

Show All

Product Listing:

Smartphone Model 1	**Fast Charger 1**	**Stylish Phone Case**	**UltraBook Laptop**
A high performance smartphone with cutting-edge features.	Efficient charger for fast charging your devices.	Protect your smartphone in style with this durable case.	Lightweight and powerful for your daily tasks.
$499	$29	$19	$999
★★★★☆ (10 reviews)	★★★☆☆ (5 reviews)	★★★★☆ (8 reviews)	★★★★★ (15 reviews)
Add to Cart Buy Now	Add to Cart Buy Now	Add to Cart Buy Now	Add to Cart Buy Now
Add to Wishlist	Add to Wishlist	Add to Wishlist	Add to Wishlist

Mechanical Keyboard	**External Hard Drive**	**Fitness Tracker**	**Smartwatch Pro**
Responsive keyboard designed for gaming and typing.	Portable 1TB storage solution for your files.	Monitor your health and activity with ease.	Advanced smartwatch with fitness tracking and notifications.
$89	$59	$49	$199
★★★★★ (12 reviews)	★★★☆☆ (6 reviews)	★★★★★ (9 reviews)	★★★★★ (20 reviews)
Add to Cart Buy Now	Add to Cart Buy Now	Add to Cart Buy Now	Add to Cart Buy Now

Fast Charger 1

This is a detailed description of the product with more features and specifications.

$29

★★★☆☆ (5 reviews)

Share This Product

[Facebook] [Twitter] [LinkedIn]

Comments

Write your comment here...

[Post Comment]

Add to Cart:

This page says

Fast Charger 1 added to cart.

[OK]

Cart:

Your Shopping Cart

Product	Name	Price	Quantity	Total	Remove
	Fast Charger 1	$29.00	1	$29.00	✕
	Stylish Phone Case	$19.00	1	$19.00	✕

Cart Summary

Subtotal: **$48.00**

Shipping: **$50.00**

Total: **$98.00**

[Proceed to Checkout]

Checkout_Customer Details:

Customer Details

Name:

khet

Email:

khetvaswani@gmail.com

Phone:

00000000000

Address:

Mithi Tharparkar Sindh

Payment Method:

Visa   ○

MasterCard   ○

American Express   ○

easypaisa   ●

Account Details

Account Number:

03318096987

Account Name:

KHIT

[Confirm Order]

Order Summary

Fast Charger 1 x 1	$29.00
Stylish Phone Case x 3	$57.00

Subtotal: **$86.00**

Shipping: **$50.00**

Total: **$136.00**

Order_Confrimed

This page says

Order confirmed!
Customer: khet
Email: khetvaswani@gmail.com
Phone: 00000000000
Address: Mithi Tharparkar Sindh
Thank you for your purchase!

[OK]

Footer:

We Accept

VISA · MasterCard · · PayPal

About Us

ElectroMart is your one-stop destination for the latest electronic gadgets. We pride ourselves on quality, innovation, and customer satisfaction. Our mission is to provide a seamless shopping experience with a wide range of products and top-notch customer service.

Contact Us

Email: khetvaswani@gmail.com

Phone: 0331-8096987

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Developers

Khet Maheshwari

Vias Kohli

Bilal qazi

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Projects would be evaluated on the following criteria: -

Rubrics				CEP characteristics	Marks distribution
	Unacceptable 2	**Acceptable 7**	**Proficient 10**		
R1: Idea/Initial Study	☐	☐	☐	WP2	10%
R2: Project Proposal	☐	☐	☐	WP1, WP3	10%
R3: Project Progress	☐	☐	☐	WP3, WP2,WP5	30%
R4: Final Demo	☐	☐	☐	WP3, WP2,WP5	40%
R5: Final Report	☐	☐	☐	WP3, WP1	10%

RUBRICS

	Unacceptable	Poor	Acceptable	Adequate	Proficient	Score
R1 Problem/Requirement Identification	Problem not identified	Problem poorly identified	Problem is identified	Problem is defined adequately.	Problem is identified and analyzed in a well-defined manner.	
R2 Engineering knowledge (standards)	Can not apply engineering knowledge to the solution.	Has difficulty applying mathematics to the solution of complex engineering problems	Correctly applies basic sciences to the solution of complex engineering problems	Correctly applies engineering fundamentals to the solution of complex engineering problems	Correctly applies engineering specialization to the solution of complex engineering problems.	
R3 Efficiency of the solution	Solution does not meet requirements.	A difficult and inefficient solution.	A logical solution that is easy to follow but it is not the most efficient.	Solution is adequately efficient.	Solution is efficient, easy to understand, and maintain.	
R4 Technical Writing	The report is submitted but lacks solutions to major requirements.	The report submitted but not according to the requirements.	The requirements of report writing are not properly addressed.	Reports meets all prescribed requirements.	Reports meets all requirements, and it is prepared in original and correction way to engage readers.	
					Total	
					Normalized Score = (Total /40)*05	