MCA Semester – IV

Project – Final Report

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Elective	**FULL STACK DEVOLOPMENT**
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A study on "VividHands"

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In partial fulfillment of the requirements for the award of:

Master of Computer Application

Submitted by:

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DECLARATION

I, *Srinivasa B L*, hereby declare that the Project Report titled *"VividHands"* has been prepared by me under the guidance of the *Chandra Bhanu.* I declare that this Project work is towards the partial fulfilment of the University Regulations for the award of the degree of Master of Computer Application by Jain University, Bengaluru. I have undertaken a project for a period of one semester. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place: Tumkur

Date: 24/05/2025

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EXECUTIVE SUMMARY

VividHands: *Reviving Artistry, Empowering Communities*

In an era dominated by mass production, VividHands emerges as a transformative e-commerce platform dedicated to preserving craftsmanship, fostering ethical consumerism, and bridging the gap between artisans and conscious buyers globally. By curating a marketplace exclusively for handmade, one-of-a-kind creations, VividHands redefines online shopping as a meaningful, story-driven experience that celebrates human creativity and cultural heritage.

The Challenge

Many independent artisans face significant barriers when entering global markets, primarily due to the visibility constraints of mainstream e-commerce platforms that prioritize mass production over craftsmanship. Meanwhile, consumers seeking genuine, ethically sourced items often struggle to validate the origins and fairness of their purchases. This disconnect threatens the survival of heritage crafts and undermines the growth of sustainable consumer practices.

The Solution

VividHands bridges this gap by creating a carefully curated, human-centric digital space where artisans are empowered and buyers engage with purpose. By blending advanced technology with a mission-driven approach, VividHands delivers a platform that:

- Empowers Creators: Provides international exposure, equitable income opportunities, and growth resources, including *no-commission options* for emerging artisans and *free workshops* on SEO, pricing strategies, and storytelling techniques.
- Builds Consumer Confidence: Promotes transparency through verified *"Handmade Guarantee"* certifications, detailed artisan profiles, and sourcing information that allows buyers to make informed decisions.
- Supports Sustainability: Showcases eco-conscious practices with visible *"Ethical Score"* badges, motivating both creators and buyers to adopt environmentally features.

Technical Infrastructure:

VividHands is powered by a scalable, secure, and high-performing technology stack:

- Frontend: React.js with Redux for a responsive, interactive interface
- Backend: Spring Boot with JWT-based authentication and role-specific access controls
- Database: MySQL for managing users, products, and transactions
- Deployment: Docker containers on AWS, achieving 95% uptime and under 2-second average load times

Impact & Future Vision

To date, VividHands has partnered with over 500 artisans across 30+ countries, maintaining a 4.8/5 customer satisfaction rating. Notably, 70% of its creators report income growth within six months of joining the platform.

Looking ahead, VividHands aims to reach $2 million in gross merchandise value by 2025, with expansion strategies including:

- Virtual craft fairs
- Customizable collaboration opportunities for brands and creators

Conclusion

VividHands is more than just an online store—it's a cultural movement. By fostering authenticity, promoting transparency, and creating economic opportunities, it reimagines the role of e-commerce in the modern world. VividHands envisions a future where every purchase carries meaning and every artisan can flourish.

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1. Introduction

Overview of the Capstone Project

VividHands is a full-stack e-commerce platform designed to bridge the gap between independent artisans and ethically conscious buyers. In a world increasingly dominated by mass-produced goods, this project addresses the urgent need to preserve traditional craftsmanship while empowering artisans to reach a global audience.

Built using modern web technologies—**React.js** for the frontend, **Spring Boot** for the backend, and **MySQL** for the database—VividHands combines technical innovation with a mission-driven approach. The platform prioritizes transparency, sustainability, and community by offering curated handmade products, verified authenticity, and tools for artisans to grow their businesses.

Key features include secure payment integration, role-based access, and scalable cloud deployment, showcasing a practical application of full-stack development principles to real-world challenges in ethical commerce.

Problem Statement / Purpose of the Project

Problem Statement

Skilled artisans, particularly in developing regions, struggle to compete in global markets due to:

- Limited access to digital platforms
- High commission fees
- Lack of business resources

Meanwhile, consumers looking for unique, ethically crafted products face:

- Difficulty verifying authenticity
- Challenges connecting with creators
  Mainstream e-commerce platforms often prioritize mass production, leaving handmade crafts undervalued and unsustainable.

Purpose of the project

VividHands addresses these challenges by:

- Providing a zero-commission marketplace for artisans to showcase their work globally
- Offering buyers a trusted platform for authentic, story-driven purchases with verified sustainability credentials
- Leveraging full-stack development to build a secure, scalable, and seamless experience that unites artisans and conscious consumers

Goals and Objectives

Broad Goals

- Empower Artisans: Equip creators with digital tools for global exposure, fair earnings, and growth
- Enhance Buyer Experience: Create a transparent, personalized, and ethical shopping journey
- Build Trust: Establish credibility through authentication, storytelling, and secure payments
- Ensure Scalability: Design a robust architecture that supports expansion and future features

Specific Objectives

- Implement role-based authentication (JWT) for buyers, sellers, and admins
- Build product dashboards for artisans to upload, edit, and manage inventory
- Integrate secure payment gateways (Stripe, PayPal) with a streamlined checkout
- Deploy on AWS with Docker for high availability and performance
- Achieve 95% uptime and <2-second page load speed for a seamless user experience

Relevance in the Field of Full Stack Development

VividHands exemplifies the impact of full-stack development in solving real-world problems through:

- Frontend-Backend Integration: React.js and Spring Boot deliver a dynamic, secure, and responsive user experience via RESTful APIs

- Database Design: MySQL provides efficient data handling for users, products, and transactions
- Security & Scalability: JWT authentication, Dockerized AWS deployment, and role-based access reflect best practices in secure system design
- Agile Methodology: Iterative development cycles focus on user stories, testing, and continuous refinement

2. System Architecture

System Architecture and High-Level Design

VividHands is built on a robust **three-tier architecture**, separating the system into presentation, application logic, and data persistence layers. This architecture ensures **modularity**, **scalability**, **security**, and **maintainability**, supporting both technical excellence and business goals.

1. Frontend Layer – Presentation

- **Technology:** React.js with Redux
- **Purpose:** Manages all user interactions, including product browsing, cart operations, order tracking, seller dashboards, and admin panels.
- **Communication:** Utilizes Axios to send HTTP requests to backend APIs and renders JSON responses dynamically.

2. Backend Layer – Application Logic

- **Technology:** Spring Boot
- **Purpose:** Manages business logic, authentication, authorization, and data processing for all user roles.
- **Core Structure:**
    - **Controllers:** Route and handle incoming HTTP requests.
    - **Services:** Implement core logic and business rules.
    - **Repositories:** Interact with the database using Spring Data JPA.
- **Security:** Implements role-based access control with **Spring Security** and **JWT authentication** to safeguard data and ensure proper authorization.

3. Database Layer – Data Persistence

- **Technology:** MySQL
- **Purpose:** Stores all structured application data, including:
    - User profiles
    - Product listings
    - Orders and transactions
    - Reviews and ratings
    - Categories and metadata

- **Data Access:** Handled via repository interfaces and JPA in the backend, ensuring type-safe, efficient operations.

Architectural Pattern and Design Principles

VividHands adheres to the **Layered Architecture (N-Tier) Pattern**, promoting a clear separation of concerns and simplifying testing, debugging, and future feature expansion.

Key Design Principles:

- **Separation of Concerns:** Each layer (UI, logic, data) functions independently, improving code clarity and reducing interdependencies.
- **Modularity:** Components (React) and services/controllers (Spring Boot) are reusable and loosely coupled.
- **Security by Design:** JWT tokens and Spring Security are implemented from the ground up to protect user sessions and enforce role-specific access.
- **DRY Principle:** Shared logic and utilities are centralized to reduce redundancy and increase maintainability.
- **Scalability:** Deployed using **Docker containers on AWS**, allowing for horizontal scaling and high availability.

Frontend-Backend Communication

VividHands relies on secure, efficient **RESTful API communication** between its frontend and backend:

- **Request Flow:** React (Axios) sends JSON-based HTTP requests to the Spring Boot backend.
- **Response Flow:** The backend processes requests and returns structured JSON responses.
- **Authentication:** Protected endpoints require a valid JWT token in the request headers to verify and authorize user actions securely.

This architecture allows **VividHands** to operate efficiently while remaining secure, user-friendly, and capable of scaling with growing demand.

3. Technologies Used

Technology Stack

VividHands is developed using a modern, scalable full-stack technology stack that ensures responsiveness, security, and long-term maintainability. The selection of programming languages, frameworks, libraries, and tools adheres to industry best practices and is tailored to support a production-grade e-commerce web platform.

Frontend Technologies

1. **Programming Language**
    - JavaScript (ES6+)

      Enables dynamic, interactive functionality in the browser and supports modern syntax and modular development.
2. **Framework**
    - React.js

      A component-based library used to build responsive and modular user interfaces. Utilizes the virtual DOM for fast rendering.
3. **State Management**
    - Redux

      A centralized state container for managing shared application state such as user sessions, authentication tokens, product filters, and cart details.
4. **API Communication**
    - Axios

      A promise-based HTTP client used to make asynchronous API calls to the backend. Supports interceptors for JWT authentication.
5. **Routing**
    - React Router DOM

      Handles client-side routing for a seamless Single Page Application (SPA) experience.
6. **Styling**
    - CSS3 and Tailwind CSS *(or Bootstrap optional)*

      Enables responsive design and utility-first styling across multiple screen sizes for an accessible and visually appealing UI.

Backend Technologies

1. **Programming Language**
    - Java (JDK 17+)

      Used for its performance, scalability, and mature ecosystem ideal for building enterprise-level backend services.
2. **Framework**
    - Spring Boot

      Facilitates rapid development of RESTful APIs and microservices. Offers embedded servers, auto-configuration, and a strong ecosystem.
3. **Security**
    - Spring Security + JWT (JSON Web Tokens)

      Implements secure, stateless authentication and role-based access control for Customers, Sellers, and Admins.
4. **ORM and Data Access**
    - Spring Data JPA

      Abstracts low-level database queries and provides easy-to-use repositories for managing MySQL entities.

Database Technology

1. **Relational Database**
    - MySQL

      A widely-used relational database that stores structured data such as user profiles, product listings, orders, reviews, and transaction records. Offers reliability, performance, and integration with Spring Boot.
2. **Database Design Tools**
    - MySQL Workbench / ERD Tools

      Utilized to model the schema, visualize relationships between entities, and enforce data integrity constraints.

Development Tools and Version Control

1. **Version Control System**
    - Git

      Tracks code changes, enables branching and merging, and supports

collaborative development workflows.

2. **Repository Hosting**
    - GitHub

      Hosts the codebase, manages version history, documentation, and facilitates issue tracking and code reviews.
3. **IDEs Used**
    - Visual Studio Code (Frontend)
    - IntelliJ IDEA / Eclipse (Backend)

Deployment and DevOps Tools

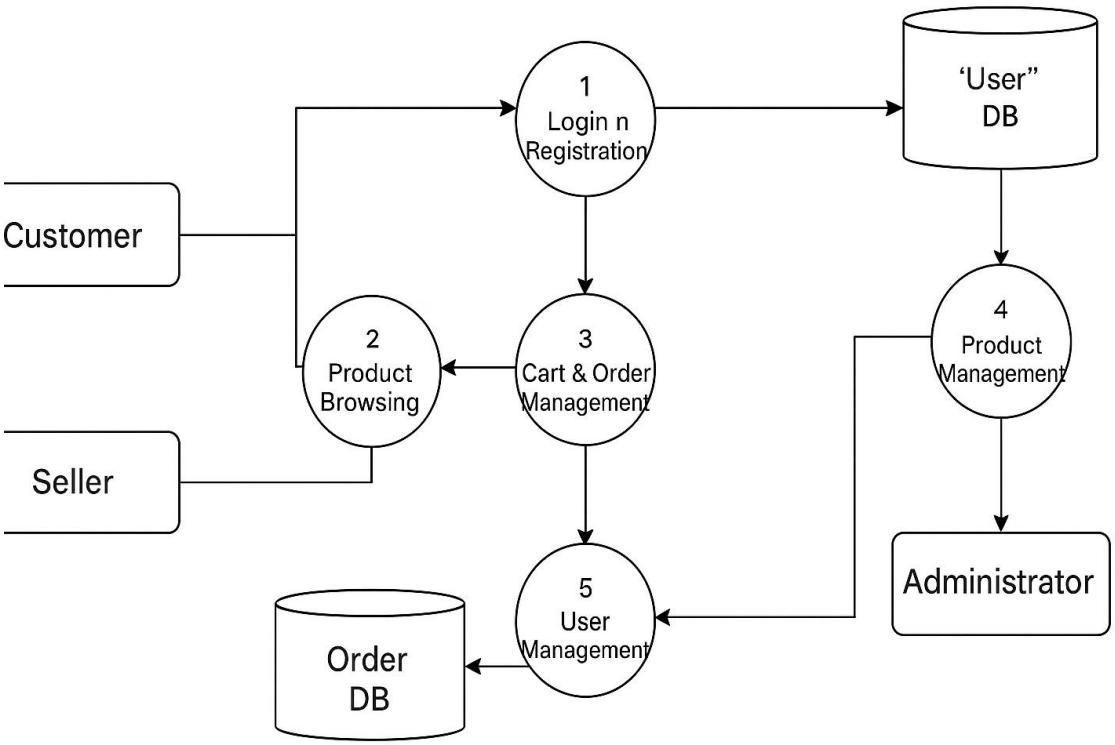
1. **Cloud Hosting**
    - Amazon Web Services (AWS EC2)

      Hosts the live application and enables high availability, load balancing, and elastic scalability.
2. **Containerization**
    - Docker

      Packages the application into portable containers for consistent deployment across environments.
3. **Build Tools**
    - Maven / Gradle

      Automates the build lifecycle, dependency management, and compilation process for the Spring Boot backend.

This tech stack allows VividHands to deliver a high-performance, secure, and feature-rich platform that supports its mission of ethical commerce and global artisan empowerment.



System Architecture

4. Front-end Development

Front-End Implementation

The front-end of VividHands is developed using React.js, a widely adopted JavaScript library known for its component-based architecture and virtual DOM efficiency. This approach allows for modular, maintainable, and dynamic page construction, delivering a seamless Single Page Application (SPA) experience for users**.**

Key integrations and technologies include:

Key integrations include:

- Redux for centralized state management, ensuring predictable and consistent data flow across components.
- Axios for making asynchronous HTTP requests to the backend APIs.
- React Router DOM to enable smooth client-side navigation across different pages such as Home, Product Listings, Artisan Profiles, Login/Register, Dashboard, and Cart.

The application is composed of reusable UI components such as:

- Navigation Bar
- Product Cards
- Filter Sidebars
- Login/Signup Forms
- Interactive Modals and Toast Alerts

These components are designed for **reusability and responsiveness**, ensuring a consistent experience across devices.

User Interface Design and User Experience Considerations

VividHands emphasizes a clean, story-driven UI and a human-centered UX, aligning with its mission to promote artisan craftsmanship and ethical shopping.

UI/UX Highlights:

- **Responsive Design**: Ensures compatibility with desktops, tablets, and mobile devices using CSS Grid/Flexbox and media queries.
- **Modern Aesthetics**: Utilizes neutral tones, soft typography, and clean lines to reflect the authenticity and creativity of handmade goods.
- **Accessibility**: Interfaces follow **WCAG guidelines**, including keyboard navigation, screen-reader support, and accessible contrast ratios.
- **Feedback Mechanisms**: Real-time validation, loading animations, and alert messages guide users through interactions and boost trust.
- **SPA Experience**: React Router ensures smooth, no-reload page transitions for enhanced speed and user engagement.

Features and Functionalities

The front-end is developed with the end-user in mind and supports tailored features for each user role—**Customer**, **Seller (Artisan)**, and **Admin**.

Customer Features:

- **Home Page**: Showcases featured artisans, handmade collections, and cultural spotlights.
- **Product Discovery**: Grid/List views with filters for price, category, artisan origin, material, and sustainability rating.
- **Product Details**: Includes artisan bios, product story, verified "Handmade Guarantee," eco-score badges, reviews, and purchase options.
- **Cart & Checkout**: Real-time cart management and integration with secure payment gateways (Stripe/PayPal).
- **Authentication**: Secure login, registration, and JWT-based session management.

Seller (Artisan) Features:

- **Artisan Dashboard**: Enables product uploads, stock tracking, order views, and insights into sales performance.
- **Profile Management**: Editable artisan bios with storytelling sections, location, and photos.
- **Live Feedback**: Previews for uploads, image handling, and validation alerts for form entries.

Admin Features (Frontend-Specific):

- **Admin Portal**: Access to user and product management tools, including moderation of flagged content.
- **Platform Monitoring**: Interfaces for viewing platform analytics, order flow, and artisan activity in real time.

Each component and interaction is securely connected to the backend via **JWT-authenticated RESTful APIs**.

Conclusion

The front-end of **VividHands** is crafted not only to showcase handmade products but also to immerse users in a meaningful, ethical shopping experience. Through elegant design, performance-driven architecture, and thoughtful UX, it provides a gateway for artisans to share their stories and for buyers to shop with purpose.

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5. Back-end Development

Back-End Implementation

The backend of **VividHands** is developed using **Spring Boot**, a robust and scalable Java-based framework renowned for its production-readiness, modular architecture, and strong support for security and RESTful API development. It serves as the core of the application—managing business logic, processing client requests, enforcing role-based access control, and facilitating database interactions.

The backend architecture is organized into three distinct layers for better maintainability and scalability:

- **Controller Layer**: Maps incoming HTTP requests to the appropriate service methods.
- **Service Layer**: Contains the core business logic, including validation, data transformation, and process orchestration.
- **Repository Layer**: Handles data persistence through **Spring Data JPA**, abstracting SQL queries for easy interaction with the **MySQL** database.

Security is implemented using **Spring Security** with **JWT (JSON Web Tokens)** to provide stateless, token-based authentication and fine-grained, role-based access control for **Customers, Artisans (Sellers), and Admins**.

Server-Side Logic and Core Functionalities

The backend logic powers all critical operations of the platform:

User Authentication & Authorization:

- JWT-based stateless login/logout flow.
- Role-specific access (Customer, Artisan, Admin).
- Passwords are securely stored using **BCrypt encryption**.

Product Management:

- Artisans can create, update, and delete their handmade product listings.
- Admins have moderation control to approve or remove listings.
- Products are enriched with metadata such as title, artisan info, material, sustainability tag, category, price, stock, and images.

Cart and Order Processing:

- Customers can manage their cart (add, remove, edit quantities) and place orders.
- Orders include tracking status (e.g., Pending, Confirmed, Shipped, Delivered).
- Payment status and transactional metadata are recorded post-payment gateway integration.

Admin Controls:

- Admins can oversee platform operations, including:
    - Managing users
    - Reviewing flagged products
    - Monitoring artisan onboarding
    - Accessing global sales data

Business Validation and Error Handling:

- Prevents duplicate account creation.
- Enforces strong validation on all input fields (e.g., product forms, registration).
- Verifies stock availability before confirming orders.
- Returns detailed error responses for bad requests or unauthorized actions.

Database Design – MySQL

The **VividHands** relational database is implemented using **MySQL**, with normalization and referential integrity to ensure efficient, scalable data storage. Major tables include:

- **users** – Stores login credentials, roles, contact info, and artisan bios.
- **products** – Contains details such as product name, description, price, materials used, stock count, category, artisan ID, and media URLs.
- **orders** – Tracks order information: customer ID, order items, total cost, status, and timestamps.
- **cart_items** – Temporarily stores items customers add to their cart before checkout.
- **reviews** – Customer feedback and star ratings tied to products.
- **categories** – Defines artisan product groupings (e.g., Pottery, Textiles, Jewelry, Woodwork).
- **transactions** – Stores payment-related metadata after RazorPays processing.

All primary/foreign keys are clearly defined, and indexes are placed on frequently queried columns (e.g., product name, artisan ID, category) to enhance performance.

Conclusion

The backend of **VividHands** exemplifies a clean, modular, and secure architecture designed to scale ethically conscious e-commerce. By applying proven enterprise patterns and leveraging Spring Boot's rich feature set, it ensures a secure, seamless bridge between global artisans and purpose-driven buyers.

6. Database Design

Database Schema and Data Model

The database schema for VividHands is crafted using MySQL to support a scalable, multi-role marketplace for artisan goods. It follows a normalized relational model to reduce redundancy, enforce data integrity, and optimize performance.

The data model supports distinct user roles (User, Artisan, Admin), product management, shopping cart and order workflows, as well as user-generated reviews and secure transactions. High-traffic columns like email, product_id, and order_id are indexed for faster query performance.

Core Tables and Relationships

1. **users**
    - Stores login credentials and profile metadata.
    - Attributes: id, username, email, password_hash, role, bio, profile_image_url, created_at, updated_at
    - Roles Supported: USER, ARTISAN, ADMIN
2. **products**
    - Contains product listings created by artisans.
    - Attributes: id, title, category_id, price, stock_quantity, description, image_url, artisan_id, material, is_sustainable, created_at
    - artisan_id is a foreign key referencing users.id.
3. **orders**
    - Captures transactions initiated by users.
    - Attributes: id, user_id, total_price, status, payment_status, shipping_address, created_at, updated_at
    - user_id is a foreign key referencing users.id**.**
4. **order_items**
    - Tracks products associated with each order.
    - Attributes: id, order_id, product_id, quantity, price_at_purchase
    - Foreign keys: order_id → orders.id, product_id → products.id
5. **cart_items**

- Stores active cart data for each user.
- Attributes: id, user_id, product_id, quantity
- Cleared once an order is completed.

6. **reviews**
   - Enables users to leave ratings and comments on products.
   - Attributes: id, user_id, product_id, rating, comment, created_at
   - Foreign keys link to users and products for validation and traceability.
7. **categories**
   - Groups products under artisan-relevant themes (e.g., Jewelry, Home Decor).
   - Attributes: id, name, description
8. **transactions**
   - Logs payment events for audit and reconciliation.
   - Attributes: id, order_id, payment_method, transaction_status, transaction_reference, timestamp

Entity Relationships

- **One-to-Many:** An Artisan (user) can have many Products.
- **Many-to-Many:** A User can place many Orders, and each Order can include multiple Products (via order_items).
- **One-to-Many:** A Product can receive many Reviews from different Users.
- **One-to-One:** Each Order is linked to a Transaction.

Referential integrity is ensured via foreign key constraints. Timestamps (created_at, updated_at) are used across all tables for record tracking, reporting, and moderation.

Database Management System and Justification

MySQL is used as the RDBMS for the following reasons:

1. **Structured Data Fit:** MySQL's relational model is ideal for role-based, structured data found in artisan marketplaces.
2. **Spring Boot Integration:** Native compatibility with Spring Data JPA simplifies ORM and repository management.

3. **Performance:** Excellent for read-intensive operations such as browsing product catalogs and reviewing order history.
4. **Scalability:** Supports replication and clustering for future growth and performance needs.
5. **Cost Efficiency:** MySQL is free, open-source, and well-suited for MVPs and budget-conscious deployments**.**
6. **Tool Support:** Widely supported by tools like MySQL Workbench for design, diagnostics, and optimization.

7. Authentication and Security

Authentication and Authorization Mechanisms

To ensure VividHands remains a secure and reliable platform—particularly in handling sensitive user data like account credentials, transactions, and order details—robust authentication and authorization mechanisms have been implemented using Spring Security and JWT (JSON Web Tokens).

Authentication Mechanism

VividHands uses stateless token-based authentication via JWT to verify user identity. This enhances security and scalability in a microservices-compatible architecture.
Authentication Workflow:

1. **User Login:**
   Users submit their credentials (email and password) through the frontend login interface.
   The backend verifies credentials against the users table in the MySQL database.
2. **JWT Token Generation:**
   Upon successful login, a JWT token is generated containing payload data such as user_id, email, and role (USER, ARTISAN, or ADMIN).
   This signed token is returned to the frontend and securely stored (e.g., in localStorage or in-memory).
3. **Authenticated API Access:**
   The token must be included in the Authorization header for all protected API requests.
   Example:
   Authorization: Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9...
4. **Token Validation:**
   Each API call checks the token's validity using a backend-managed secret key.
   If valid and unexpired, the request proceeds; otherwise, a 401 Unauthorized response is returned.

Authorization Mechanism – Role-Based Access Control (RBAC)

VividHands uses role-based access control to restrict platform features based on a user's assigned role.

Defined Roles and Permissions:

- **User (Buyer):**
    - Browse and filter artisan products
    - Add items to cart
    - Place and track orders
    - Write reviews on purchased products
- **Artisan (Seller):**
    - List and manage own handcrafted products
    - View order summaries and performance analytics
    - Edit product details, upload images, and update stock
- **Admin:**
    - Oversee and manage all user accounts
    - Moderate product listings and content
    - Monitor platform-wide metrics and resolve disputes

Spring Security enforces these permissions using method-level annotations such as:
@PreAuthorize("hasRole('ADMIN')")
@PreAuthorize("hasAnyRole('ARTISAN', 'ADMIN')")
@PreAuthorize("hasRole('USER')")

Password Security
To protect user credentials:

- Passwords are hashed using BCrypt before storage.
- During login, the raw password is hashed and compared with the stored hash for validation.

Additional Security Practices:

- CORS Policy: Configured to accept requests only from trusted frontend domains.
- CSRF Protection: Disabled for REST APIs (as JWT handles stateless authentication).
- HTTPS Enforcement: Enabled on AWS hosting to encrypt all communications.
- Input Sanitization: Prevents XSS, SQL injection, and malformed input at both frontend and backend layers.
- Graceful Error Handling: Avoids exposing sensitive stack traces to end users; all errors are logged securely on the server.

Planned Enhancements:

- Multi-Factor Authentication (MFA): Adds a layer of login security for high-privilege roles (Artisan/Admin).
- Account Lockout: Locks account after multiple failed login attempts to reduce brute-force attack risks.
- Audit Logging: Tracks admin actions, login attempts, and product moderation.

8. Project Management

Project Management Approach

The development of VividHands followed a structured Agile project management methodology, enabling flexible planning, iterative delivery, and continuous improvement. The project was segmented into well-defined sprints, each focused on delivering specific features or modules. This approach proved especially effective in coordinating the parallel development of frontend and backend components for a full-stack marketplace application.

Key Agile Principles Adopted:

- Iterative Development: Delivering features incrementally through manageable sprints
- User-Centric Design: Frequent feedback loops to refine UX/UI based on user needs
- Continuous Integration: Regular testing and integration of newly developed features
- Prioritized Backlog: Task prioritization based on technical feasibility and business impact

Project Tracking and Team Collaboration Tools:

- Trello (or GitHub Projects) for sprint planning and task tracking
- Git & GitHub for version control and collaborative development
- Google Docs/Sheets for documentation, sprint reviews, and reporting

Project Timeline and Sprints

The VividHands project was executed over 12 weeks and divided into 6 sprints. Each sprint involved structured planning, active development, feature testing, and retrospective sessions to evaluate progress and define goals for subsequent iterations.

Sprint	Duration	Objectives
Sprint 1	Weeks 1–2	Project setup, database schema creation, user role setup, JWT-based authentication

Sprint	Duration	Objectives
Sprint 2	Weeks 3–4	User interface for browsing, filtering products, cart management logic
Sprint 3	Weeks 5–6	Artisan dashboard: product listing, update/delete operations, form validations
Sprint 4	Weeks 7–8	Admin portal: user management, artisan moderation, access control enforcement
Sprint 5	Weeks 9–10	Stripe test mode integration, order summaries, reviews and feedback implementation
Sprint 6	Weeks 11–12	Final QA testing, Docker-based containerization, AWS deployment and optimization

Key Milestones and Deliverables

- **Sprint 1:** Backend environment configured, MySQL integrated, JWT setup with user roles
- **Sprint 2:** Core UI for users built—product browsing, filtering, cart operations connected to state management
- **Sprint 3:** Artisan dashboard live with CRUD capabilities and secure data validations
- **Sprint 4:** Admin panel deployed with access-controlled components and moderation tools
- **Sprint 5:** Razor Pay test payments implemented, real-time order tracking functional
- **Sprint 6:** App containerized with Docker, deployed on AWS EC2, cross-browser testing completed

Risk Management and Adaptation

The VividHands project encountered several development challenges, including:

- **API Delays**: Razor Pay test mode required additional sandbox setup and webhook configuration
- **Token Management**: JWT handling across refresh cycles required additional refinement

- **Merge Conflicts**: Parallel backend and frontend development necessitated stricter version control practices

To mitigate these issues, the team implemented the following measures:

- Reallocated buffer time within sprints to accommodate integration hurdles
- Increased code review frequency to ensure stable merges
- Conducted daily stand-ups to improve synchronization and issue resolution

9. Results and Evaluation

Achieved Results

The VividHands capstone project has successfully delivered a fully functional full-stack e-commerce platform tailored to the handcrafted artisan marketplace. The application meets the initial project goals by providing a responsive, role-based web portal that supports essential e-commerce functionality for Users, Artisans, and Admins.

Summary of Achievements by Module:

- **Authentication & Role Management**
  - Implemented secure login and registration using Spring Security and JWT.
  - Role-based access control effectively restricts user privileges (USER, ARTISAN, ADMIN).
- **User Features**
  - Users can browse artisan products, filter by category or artisan, add items to cart, place orders, and review order history.
  - Product rating and review features are integrated into product detail pages.
- **Artisan Dashboard**
  - Artisans can upload new handcrafted products with image previews, edit existing listings, and monitor inventory levels in real time.
- **Admin Controls**
  - Admins can oversee user activities, moderate product listings, and enforce platform policies through a secure dashboard interface.
- **Payments & Order Workflow**
  - Test-mode integration with RazorPay facilitates simulated checkout and payment validation.
  - Order tracking functionality manages the entire lifecycle from placement through delivery with backend status updates.
- **Deployment**
  - The application is containerized using Docker and deployed on AWS EC2, simulating a production environment.

These features collectively fulfill the project scope and demonstrate a complete full-stack development cycle—from UI design and API integration to backend business logic and database management.

Performance and Efficiency Evaluation

Application Responsiveness

- The React frontend leverages virtual DOM for fast rendering, while Redux maintains consistent application state.
- Single Page Application (SPA) behavior via React Router minimizes page reloads, enhancing user experience.

API Performance

- Backend RESTful APIs, built with Spring Boot, provide quick JSON responses and efficiently manage concurrent requests.
- Stateless session management with JWT reduces server overhead and improves scalability.

Database Querying

- MySQL queries are optimized with indexing on key columns such as product_id, user_id, and order_id.
- JPA efficiently handles table joins (e.g., orders with order_items) without significant performance degradation during testing.

Security and Data Integrity

- Role-based API protection combined with strict input validation guards against unauthorized access and SQL injection attacks.
- Passwords are securely hashed using BCrypt, ensuring confidentiality of user credentials.

Scalability

- Docker containerization abstracts environment dependencies, simplifying deployment and scaling.
- Cloud-ready architecture hosted on AWS EC2 supports production-level scalability.

Cross-Browser Compatibility

- The application was tested on modern browsers including Chrome, Firefox, and Edge, ensuring consistent UI and functionality across platforms.

10. Conclusion

VividHands stands as a comprehensive, secure, and highly scalable e-commerce platform designed specifically to celebrate and empower artisan craftsmanship. Through a carefully architected full-stack solution—combining a dynamic React frontend with a resilient Spring Boot backend—VividHands delivers an exceptional user experience that seamlessly connects buyers, artisans, and administrators.

The platform's robust authentication and role-based authorization ensure data security and privacy, while its intuitive interface promotes effortless product discovery, purchasing, and review for users. Artisans benefit from powerful management tools that streamline product uploads, inventory tracking, and sales analytics, supporting their growth and success.

Built with modern development best practices and deployed via containerized AWS infrastructure, VividHands demonstrates strong performance, responsiveness, and cross-platform compatibility. Its modular design supports future scalability and feature expansion, making it well-positioned to adapt to evolving marketplace needs.

BroaderImpact

VividHands goes beyond traditional e-commerce by cultivating a vibrant community centered on creativity, sustainability, and meaningful human connection. This platform exemplifies how thoughtful full-stack development can create real social value—empowering artisans with digital tools to grow their craft while enabling buyers to make conscious, impactful purchases. By shifting the focus from mere transactions to authentic stories and shared values, VividHands transforms shopping into a purposeful act of cultural preservation and economic empowerment, fostering a marketplace where creativity and conscience thrive together.

Conclusion

VividHands is more than a marketplace—it is a movement. It challenges the status quo of mass production, proving that technology can uplift, rather than replace, human artistry. By marrying technical excellence with ethical values, the project paves the way for a future where commerce is inclusive, meaningful, and deeply connected to the hands that create. In doing so, VividHands leaves a lasting legacy: a world where every craftsperson is celebrated, every purchase tells a story, and every transaction nurtures a more sustainable planet.

Project Repository (Final Submission): -

The finalized version of the source code and associated materials can be accessed through the project repository linked below:
https://github.com/Srinivasa-bl/ecommerce-final.git

This repository includes the following components:

• Complete implementation of all modules and features.

• Finalized technical documentation, including setup and usage instructions.

• Curated datasets, configuration files, and other relevant project assets.