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College-Centric Multi-Vendor E-Commerce Platform

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Abstract -
E-commerce platforms have transformed the way goods and services are exchanged online. However, most existing platforms such as Amazon and Flipkart are designed for commercial purposes and do not focus on the academic needs of students. This paper presents a college-centric e-commerce platform that enables students to buy and sell academic resources such as notes, textbooks, and study materials within a college environment.

The proposed system is developed using modern web technologies such as React/Next.js for the frontend, Node.js for backend services, and a database for managing user and product data. Core functionalities include user authentication, product listing, and cart management. The application is deployed in a cloud-based test environment for testing and demonstration. The platform aims to reduce the cost of study materials and promote peer-to-peer learning among students.

Keywords: E-Commerce, College Platform, Academic Resource Sharing, Web Application, Node.js, React

1.INTRODUCTION

E-commerce refers to the buying and selling of goods and services through online platforms using internet-based technologies. Over the past few years, digital commerce has grown rapidly due to increased internet access, smartphone usage, and improvements in web technologies. Popular commercial platforms such as Amazon and Flipkart have changed the way people shop by offering convenience, wide product availability, and reliable delivery services. These platforms use modern web-based systems to manage large numbers of users, products, and transactions efficiently.

Despite their success, most commercial e-commerce platforms are designed mainly for profit-oriented markets and large-scale usage. They do not focus on the specific and localized needs of college students. Students often require affordable study materials such as handwritten notes, textbooks, reference books, and project resources. Currently, the exchange of such academic materials is usually done through informal methods like messaging applications, social media groups, or direct personal communication. These methods are unorganized, unreliable, and limited in reach.

With the increasing adoption of digital solutions in education, there is a growing need for a dedicated platform that supports academic collaboration and resource sharing within colleges. A college-specific e-commerce system can provide a structured environment where students can easily buy and sell study-related materials. Such a system also helps in reducing costs, avoiding duplication of resources, and improving accessibility to learning materials.

The proposed college-centric e-commerce platform aims to address these challenges by providing a secure and user-friendly online marketplace for academic resource sharing. The system leverages modern web technologies to implement features such as user authentication, product listing, category-based browsing, and cart management. By focusing on student-centric requirements rather than commercial sales, the platform promotes peer-to-peer learning, encourages reuse of academic resources, and creates a collaborative academic ecosystem within the college environment.

2. PROBLEM STATEMENT

College students frequently require access to academic resources such as handwritten notes, textbooks, reference materials, and previous project work. At present, the sharing and exchange of these materials is mostly done through informal methods such as messaging applications, social media groups, or personal contacts. These methods are unstructured, time-consuming, and limited to small groups of students.

Commercial e-commerce platforms like Amazon and Flipkart mainly focus on selling new products at market prices and do not support student-to-student exchange of academic resources. As a result, students are often forced to purchase expensive new materials or struggle to find required study resources on time. There is no dedicated system within colleges that allows students to securely buy and sell academic materials in a centralized manner.

Therefore, there is a need for a college-centric e-commerce platform that provides a structured, secure, and affordable solution for academic resource sharing. Such a system should support multiple user roles, ensure easy access to study materials, and promote collaboration among students within the college environment.

3. LITERATURE REVIEW

Recent studies and projects in web application development highlight the effectiveness of full-stack technologies in building scalable and interactive systems. Many modern web-based platforms are developed using JavaScript-based stacks that separate frontend, backend, and database responsibilities to improve maintainability and performance. Among these, the PERN stack, consisting of PostgreSQL, Express.js, React, and Node.js, has gained popularity for developing data-driven web applications.

React is widely used for frontend development due to its component-based architecture, which helps in building dynamic and responsive user interfaces. Node.js, along with Express.js, is commonly used on the server side to handle client requests, manage APIs, and implement business logic efficiently. PostgreSQL is a relational database system known for its reliability and ability to handle structured data, making it suitable for applications involving users, products, and transactions.

Commercial e-commerce platforms such as Amazon and Flipkart use similar multi-layered architectures with frontend interfaces, backend services, and databases to manage large-scale operations. These platforms support features like authentication, product management, cart systems, and secure transactions. However, they are designed for commercial usage and do not focus on academic resource sharing or student-to-student marketplaces.

Some academic platforms provide digital access to learning materials but lack full e-commerce functionality such as pricing, cart management, and peer-to-peer selling. Informal solutions like social media groups are also commonly used, but they lack structure, security, and data management. Based on this review, there is a clear need for a college-centric e-commerce platform built using a full-stack approach like PERN, which combines modern web technologies with academic requirements in a secure and organized manner.

4. METHODOLOGY

The proposed college-centric e-commerce platform is developed using the PERN stack, which consists of PostgreSQL, Express.js, React, and Node.js. The system follows a layered architecture where the frontend, backend, and database are handled separately to improve performance, maintainability, and scalability.

The frontend of the application is developed using React, which provides a component-based structure for building dynamic and responsive user interfaces. React is used to display product listings, user dashboards, cart details, and forms for login and registration. It allows smooth interaction between users and the system without reloading pages.

The backend is developed using Node.js with the Express.js framework. Express.js is used to create RESTful APIs that handle client requests such as user authentication, product management, cart operations, and order processing. The backend acts as a bridge between the frontend and the database, ensuring secure and efficient data exchange.

PostgreSQL is used as the relational database to store structured data such as user information, product details, orders, and transactions. SQL queries are used to retrieve, insert, and update data based on user actions. This ensures data consistency and reliability within the system.

The system is developed using an iterative approach. Core functionalities such as user login, product listing, and cart management are implemented first. Additional features are added gradually and tested after each update. The application is deployed in a cloud-based test environment for demonstration and testing purposes.

4.1 System Architecture

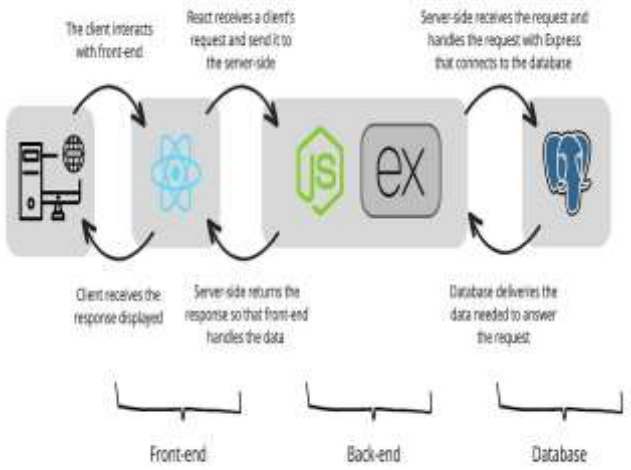


Fig -1: Technical Architecture

The system architecture of the proposed college-centric e-commerce platform follows a three-tier architecture consisting of the frontend, backend, and database layers. This separation of concerns improves system maintainability, security, and scalability.

The frontend layer is developed using React and is responsible for user interaction. It provides interfaces for users to register, log in, browse products, add items to the cart, and place orders. All user actions are captured and sent to the backend through HTTP requests.

The backend layer is developed using Node.js and Express.js. It handles business logic such as authentication, product management, cart operations, and order processing. The backend also validates user requests and ensures secure communication between the frontend and the database.

The database layer uses PostgreSQL to store structured data such as user details, product information, and order records. The backend communicates with the database to retrieve and update data based on user actions. This architecture ensures reliable data storage and smooth system operation.

4.2 Data Flow Diagram

The Data Flow Diagram (DFD) illustrates the complete flow of data within the proposed college-centric e-commerce platform, including user interaction, store creation, admin approval, product management, and order processing. The system follows a controlled workflow where users are required to create a store and obtain admin approval before selling any academic resources. The detailed data flow is described below:

a. User Interaction

The data flow begins when a user accesses the system through a web browser. The user interacts with the frontend interface developed using React. Through this interface, users can register, log in, browse academic products, create a store request, add items to the cart, and place orders.

b. User Registration and Authentication

When a new user registers, details such as name, email, and password are entered through the frontend interface. This data is sent to the backend server developed using Node.js and Express.js. The backend validates the input and stores user information securely in the PostgreSQL database.

During login, user credentials are sent to the backend, verified against database records, and an authentication response is sent back to the frontend.

c. Store Creation Request

A user who wants to sell academic materials must first create a store. The user submits store-related details such as store name and description through the frontend interface. This store creation request is sent to the backend server and stored in the database with a pending status.

d. Admin Review and Approval

The admin accesses the admin dashboard to review pending store creation requests. The backend retrieves store request details from the database and displays them to the admin. The admin can either approve or reject the request.

If the admin approves the store, the backend updates the store status in the database to approved. If rejected, the status is updated accordingly. Only after approval is the user allowed to upload and sell products on the platform.

e. Product Upload and Management

Once the store is approved, the seller can upload academic resources such as notes and books. Product details including title, category, description, and price are entered through the frontend and sent to the backend server. The backend validates and stores the product information in the PostgreSQL database, making it available for buyers to view.

f. Product Browsing and Cart Management

Buyers browse available products through the frontend interface. Product requests are sent to the backend, which retrieves relevant product data from the database and sends it back to the frontend.

When a buyer adds a product to the cart, the cart details are sent to the backend, processed, and stored in the database. Any cart updates are reflected back to the frontend.

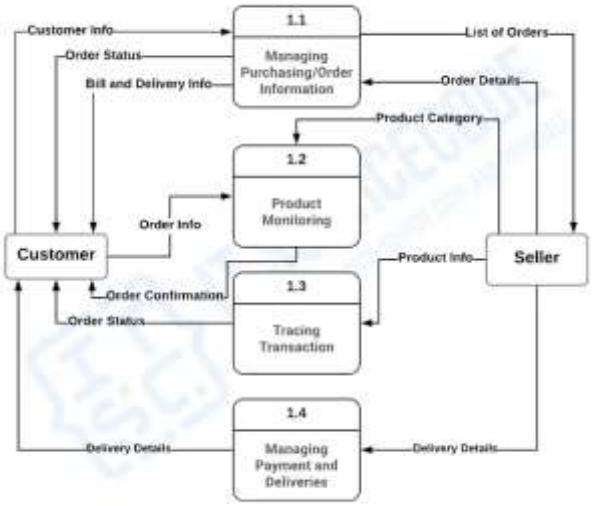
g. Order Placement and Processing

When a buyer places an order, order details such as selected products and quantities are sent to the backend server. The backend processes the order, stores order information in the database, and updates the order status. A confirmation response is then sent back to the frontend.

h. Database Storage and Response Flow

The PostgreSQL database serves as the central data repository, storing user profiles, store details, product information, cart data, and order records. For every user action, the backend communicates with the database and sends appropriate responses back to the frontend, ensuring smooth system operation and data consistency.

This controlled data flow ensures platform security, seller verification, and proper administration while maintaining efficient interaction between users, backend services, and the database.



5. FEATURES AND BENEFITS

The proposed college-centric e-commerce platform is designed to address real academic challenges faced by students by providing a controlled, secure, and purpose-driven marketplace. The system introduces several features that differentiate it from traditional commercial e-commerce platforms and informal resource-sharing methods.

a. Controlled Seller Onboarding with Admin Approval

Unlike open marketplaces, the system follows a controlled seller onboarding process. A student cannot sell any product directly after registration. The user must first create a store and submit a request to the admin. The admin reviews the request and approves or rejects it based on predefined criteria. This ensures that only verified and responsible users are allowed to sell academic resources, maintaining trust and content quality on the platform.

b. College-Specific Academic Marketplace

The platform is dedicated exclusively to academic resources such as handwritten notes, textbooks, reference materials, and study guides. By restricting the system to college-related content, the platform avoids unnecessary commercial products and ensures relevance for students.

c. Multi-Role User Management

The system supports multiple user roles including Admin, Seller, and Buyer. Each role has clearly defined permissions. The admin manages store approvals and overall system control, sellers manage their stores and products, and buyers browse products and place orders. This role-based structure improves system security and usability.

d. Structured Product Listing and Categorization

Approved sellers can upload products with detailed information such as subject, semester, category, description, and price. Products are organized systematically, allowing buyers to easily search and find required study materials. This structured approach improves accessibility compared to unorganized sharing through messaging applications.

e. Verified Student-to-Student Academic Marketplace

The platform provides a verified student-to-student marketplace where only admin-approved sellers can list academic materials. This ensures that shared resources

such as notes and study guides are relevant, reliable, and useful for other students. By combining peer-to-peer exchange with administrative control, the system maintains academic quality while encouraging knowledge sharing within the college.

f. Cart-Based Purchasing and Order Tracking

Buyers can add multiple products to a shopping cart, review selected items, and place orders in a single transaction. The system maintains order details and provides order status updates, giving users a clear view of their purchases.

g. Secure and Centralized Data Management

All system data, including user profiles, store details, product information, cart data, and order records, is securely stored in a centralized PostgreSQL database. This ensures data consistency, reliability, and secure access across the platform.

h. Practical Benefits for the College Ecosystem

The platform reduces dependency on external e-commerce websites and informal social media groups. It saves time for students, lowers the cost of academic materials, and creates a trusted digital ecosystem within the college. The admin-controlled model also allows the institution to monitor and regulate academic content effectively.

5. RESULT

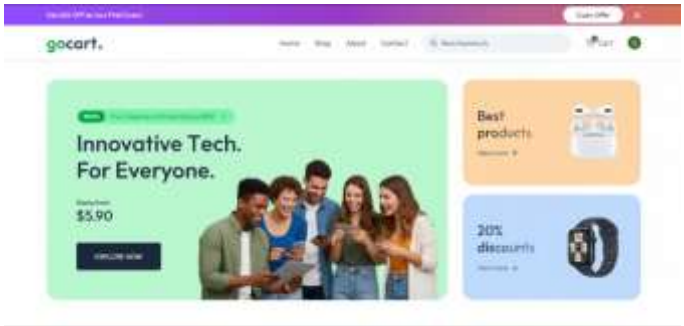


Fig -1: Home page

Fig -2: Login and sign up page

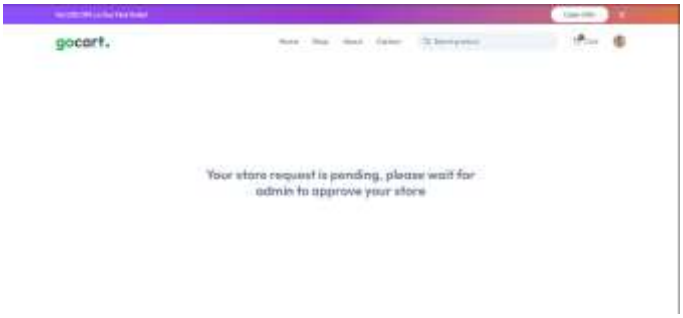


Fig -3 Store creation request page

Fig -4 Request approval/rejection page at admin dashboard

Fig – 5 Admin dashboard

6. CONCLUSION

This review paper presented the design and partial implementation of a college-centric e-commerce platform aimed at improving academic resource sharing among students. The proposed system focuses on creating a trusted and organized digital marketplace within the college environment, supported by role-based access and administrative control.

By incorporating features such as store creation with admin approval, structured product listing, and secure data handling, the platform addresses the limitations of informal sharing methods and general commercial platforms. The use of the PERN stack enabled a modular and scalable system architecture, supporting clear separation between frontend, backend, and database layers.

The results demonstrate that the core functionalities of the system are operational, while several modules are under active development and enhancement. Overall, the proposed platform provides a strong foundation for a college-focused digital marketplace and has significant potential for further improvement and real-world deployment within educational institutions.

7. FUTURE SCOPE

• Implementation of rating and review system for sellers and products

• Advanced search, filtering, and sorting options for study materials

• Recommendation engine for personalized academic resource suggestions

• Mobile application development for Android and iOS platforms

• Integration with college authentication system for verified user access

• Role-based analytics dashboard for admin monitoring and reporting

• Automated content moderation for academic material quality control

• Notification and alert system for order status and system updates

• Support for multiple product categories and academic departments

• Enhanced security features such as two-factor authentication

• Chat or messaging system between buyers and sellers

• Backup and recovery mechanisms for data protection

• Performance optimization for handling higher user load

• Integration with external academic tools or learning platforms

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