

Design and Implementation of a Secure Online Marketplace for Babcock University

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Abstract:

E-commerce's explosive rise has drastically changed how people buy and sell goods around the world; however, within university environments, majority of student transactions are conducted through informal social media platforms, leading to issues such as poor organization, limited product visibility, trouble confirming reliable vendors and increased risk of fraud. This study presents the design and implementation of a secure, web-based, campus-based online marketplace system tailored specifically for Babcock University students. The system was developed using the Software Development Life Cycle (SDLC) with the incremental approach model, implementing a React-based frontend, a Spring Boot backend, and a PostgreSQL database. A crucial feature of the platform is institutional email verification, which enhances user trust and ensures that only registered students can access the system.

The platform provides functionalities including user authentication, product listing and management, search and filtering, order processing, real-time communication, reporting system and a review and rating system. The evaluation was conducted using performance, accessibility, best practices and search engine optimization (SEO) metrics, with the findings indicating improved system efficiency, usability and transaction organization. The proposed system demonstrates how a structured digital marketplace can enhance transparency, trust and accessibility within a university community while promoting student entrepreneurship and secure peer-to-peer commerce.

Keywords — Online Marketplace, E-commerce Systems, Campus-Based Platforms, User Verification, Web Application.

I. INTRODUCTION

The rapid growth of electronic commerce (e-commerce) has greatly transformed the way goods and services are exchanged which enables users to trade successfully over digital platforms. Online marketplaces, which allow various independent sellers to offer products within a centralized system, have further enhanced accessibility, efficiency and scalability in electronic commerce today. E-commerce uses the internet to change traditional business methods and remove distance limits [1]. It provides convenience for consumers and helps

sellers reduce their operating expenses and increase brand visibility [2]. In Nigeria, the growth of internet, mobile technology and the evolution of safe online payment systems has increased the adoption of e-commerce with the sector valued at US\$15 billion as of 2023 and is predicted to grow to US\$33 billion by 2026 [3], [4].

Despite all the improvements, many university communities still rely on social media platforms for e-commerce activities. While these methods ensure fast communication, they are unsafe and lack a centralized platform where all products and services can be viewed easily. This may cause sellers to struggle with low visibility and buyers finding it

difficult to find trustworthy vendors. The findings from a study at Federal Polytechnic, Nekede shows that a lot of students and staff use social media platforms like Facebook and Instagram for e-commerce activities [5]. This may cause sellers to struggle with low visibility and buyers finding it difficult to find trustworthy vendors.

The existence of large platforms like Jumia, Konga, Jiji, and so on, do not cater to the university community and cannot verify student identity to track business transactions within school. General marketplaces are too broad and cannot fully accommodate the specific and localized needs of students especially in areas such as trust, user verification and accessibility [6]. Despite the rapid growth of e-commerce in Nigeria, there is still lack of a dedicated platform for most university communities. The various limitations emphasize the need for a specialized online marketplace designed to meet the unique commercial and security needs of students within a university community.

To address the gaps, the online marketplace for university students aims at creating a trusted, user-friendly, school-based platform that makes buying and selling easier for Babcock University students. This study makes the following contributions:

1. Identifying the limitations of social media-based commerce within Babcock University particularly in areas of organization and trust.
2. Design of a secure, web-based, campus-based online marketplace that addresses the lack of a dedicated platform in Babcock University.
3. Implementation of a web-based system with React, Spring Boot and PostgreSQL, in developing scalable e-commerce solutions.
4. Integration of institutional email verification as a trust mechanism to ensure that only authenticated students can access the system.
5. Evaluation of the proposed system using performance, accessibility, best practise and search engine optimization metrics which shows improvements in the study.

The rest of the paper is written as follows: Section II presents the related works, Section III describes the methodology and system design, Section IV displays the implementation, Section V discusses the results of the system evaluation and Section VI concludes the paper and recommends the directions for further study.

II. RELATED WORK

A. E-commerce and Online Marketplaces

Over the years, e-commerce and online marketplaces each have driven faster more convenient consumer access and global reach into businesses. According to [7], e-commerce platforms provide benefits such as better access to the market, availability of 24/7 purchase, customer delight, but to mention a few. They author also stated some shortcomings like fraud, lack of customer service, security issue, delivery delay and so on.

Similarly, [8] noted that e-commerce growth has positively impacted small and local companies' access to wider consumer base and collection of customer data to market products. The author noted that internet fees and delivery issues have been the major constraints that stop local businesses from taking full advantage of e-commerce systems.

The limitations reveal that although e-commerce platforms have brought significant improvement, we are still faced with the challenges of security, trust and logistics.

B. Campus-Based Marketplaces

Studies have shown that many students engage in small-scale commerce through online platforms. Chukwudum & Victor [9] recently describe a student-focused digital marketplace that caters to micro-entrepreneurs in the university system in Nigeria; this "Small Pocket Money" platform promotes institutional verification and intra-campus trade.

Similarly, a "Student-Centric E-Commerce Platform for Local Business Growth" project at the University of Port Harcourt, Nigeria, the platform introduced filters that only showed goods within a student's university with an aim to promote peer trade and local relevance of product [10].

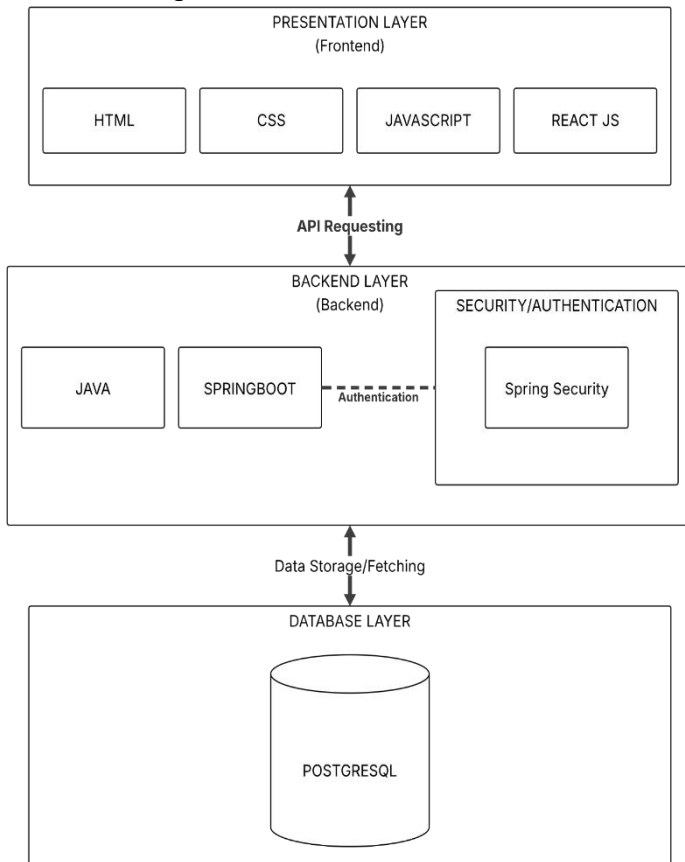
These studies demonstrate the potential for marketplace platforms focused more on students than general users. Nonetheless, little peer-reviewed literature addresses student-only marketplaces that are fully deployed, particularly within African university environments. Existing solutions, for instance, often provide listing and messaging but not integrated verification or reputation systems. This gap suggests the demand of more research on student exclusive marketplace.

C. Research Gap

From the reviewed literature, it is shown that although e-commerce and online marketplaces platforms have improved accessibility and visibility, they still face challenges relating to security and service inefficiencies. Existing campus-based marketplace solutions have the potential to support

students efficiently, however, many of these systems are not fully deployed or lack essential features like user verification.

The dependence of students on informal



platforms for trading reveals the absence of a structured and secure system tailored specifically to university communities. This indicates a gap in the availability of fully developed, student-based marketplace platforms that combine accessibility, trust and efficiency within a controlled campus setting.

III. METHODOLOGY

The study adopts the Software Development Lifecycle (SDLC) methodology in the design and implementation of the proposed online marketplace system for Babcock University students. The SDLC provides a structured framework that helps in planning, designing, implementing and testing of the project.

The incremental process model was used in the study. The model enables the gradual development of multiple features with a focus on developing and testing distinct modules before merging them together. Instead of releasing the whole system at once, it is a process in which smaller pieces are developed and delivered known as increments. Every increment adds new capabilities to the previous version until the complete system is achieved [11]. It is best suited for this system

because it enables flexible scheduling and modification to requirements are simple.

The development process began with requirement analysis where the needs of the users were gathered including features like user registration and verification, creating and browsing listing, review and reporting system, in-app chat, order processing and administrative control. System design then involves defining the system architecture and UI structure.

The implementation stage entailed developing the system with modern web technologies. The frontend was implemented using React and the backend was developed with Spring Boot. For database management, PostgreSQL was used. These technologies were selected to support the modularity of the system.

Testing was carried out during the development process to ensure that each module functions properly independently and when integrated. This verified the functionality and usability to ensure the system met specified requirements. A final evaluation was also conducted with Lighthouse to analyse the system based on performance, accessibility, best practice and search engine optimization.

Fig. 1 : System Architecture of the Online Marketplace Platform

Fig. 1 shows that the system adopts a three-tier architecture consisting of the Presentation, Backend, and Database layers. This architecture enhances modularity, scalability, and data security while ensuring smooth communication between all layers.

IV. SYSTEM IMPLEMENTATION

The implementation of the proposed system was carried out by developing each module and integrating to ensure proper system functionality. It is developed as a web-based application to enable easy access to users within Babcock University.

The system consists of three main roles which are buyers, merchants and administrators. Each role has its specific functionalities to ensure interaction within the system.

The system includes a user verification mechanism that allows students to register and log in using their institutional credentials only. Users land on the registration/login page first when accessing the system. Here, they provide their details, such as name, school email and password, to gain access to the platform's features. The setup

of the platform enhances the trust within the marketplace by restricting use to only Babcock students and reducing the risk of fraudulent activities.

The system provides a secure platform for real-time communication between the buyer and the seller. Users have the option to use this interface to make price negotiations, ask about the condition of the product, and arrange for a safe meeting on campus. By providing this interface, the system ensures the privacy of the users.

An admin module was developed to oversee the system and its users. It shows a general statistical overview of how well the marketplace is doing, monitors users, manages listings and handles reports on the system. It ensures that everything is going according to the school guidelines.

The implementation brings together these modules mentioned among others to provide a structured, centralized and user-friendly marketplace system that supports commerce within Babcock University.

V. RESULTS AND DISCUSSION

The developed online marketplace system was tested with automated and manual tests which helped to evaluate its performance, functionality, security, usability and compatibility.

Google Lighthouse was used to assess the webpage automatically with an emphasis on performance, accessibility, best practices, and SEO. The findings reveal that the system is an efficient system with high page load speed, compliant to the accessibility standards, and in conformance with the web development best practices, as well as search visibility.

TABLE I
EVALUATION OF KEY METRICS USING LIGHTHOUSE

Metrics	Babcock Marketplace
Performance	93%
Accessibility	83%
Best Practices	92%
SEO	83%

Manual testing was also carried out using predefined test cases covering key system features. Functional testing ensured that user registration, log-in, product listing, booking requests, and management of order offers were functioning as desired. Security testing indicated that user passwords have been securely hashed and access to user data by an unauthorized third party has been properly barred.

Additional testing on performance and usability also proved the fact that the system loads in reasonable time and gives users an opportunity to search and find listings within a decent amount of time. System Compatibility tests revealed that the system is compatible with major browsers like Chrome and Safari as well as being well-operating on desktop and mobile devices, optimizing better on desktops.

However, overall, the demonstration shows that the system is very reliable, secure, and effective to support structured student-based transactions as opposed to informal platforms like WhatsApp and Instagram as well as broad marketplaces like Jiji. However, limitations such as the absence of a dedicated mobile application, limited integration with existing university systems and restricted real-world deployment remain.

VI. CONCLUSIONS

The study designed and implemented an online marketplace system for Babcock University. The study was prompted by the challenges students face when buying and selling goods within the university community. Common informal trading methods used by students are unstructured, lack transparency and record management, and security; hence, issues of maximum product visibility, reachability to the target audience, transaction tracking efficiency and trust issues.

The developed system provides a centralized platform that supports structured buying and selling activities within a secure digital environment. The system had three main user roles: Students (Users), Merchants and Admins and to maintain role-based access control and system organization, each of these roles had specific functionalities. The user module enables login/registration, product browsing, search and filter, in-app chat with merchants. The vendor module allows storefront management, product listings, inventory management, order management and in-app chat with customers. The admin module ensures system oversight through user management, product monitoring, and enforcement of platform policies.

The system was designed with appropriate software development methodologies starting from conducting system analysis, requirements specification, designing the system, implementing it and then testing. Testing was performed to confirm that each module worked as specified in the requirements.

In general, the study objectives were accomplished by establishing a fixed and workable

online marketplace system for Babcock University students that demonstrates how such digital solutions can enhance accessibility, accountability and convenience during campus-based transactions.

Future Research Recommendations

Future research can extend this study by investigating how students and vendors adopt and interact with the Online Marketplace System over time. This includes analysing user behaviour, purchase trends and the drivers of trust and engagement in university based digital marketplaces.

Another important direction is to evaluate the impact of the platform on student entrepreneurship within the university. That could include exploring whether such platforms help students develop small businesses or boost their income compared to social media platforms.

Future work can also involve comparing solutions for other university marketplace systems to understand their efficacy, usability and the sustainability of the platform in augmenting campus trading activities.

In addition, Future studies can examine development and usability of a mobile application version of the marketplace system. This analysis might assess mobile access effects on usage, feasibility and general acceptance among the students.

Lastly, assessments could be done on the scalability of such a system should Babcock University decide to fully adopt the system in its present condition. This involves testing the performance of a system with large user traffic and examining the technical and operational needs required to implement on a large scale throughout the university.

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