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e-Carp: An E-Commerce Platform for Wood Furniture and Fixture in Bongabong, Oriental Mindoro

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ABSTRACT

Traditional methods used by many carpenters in Bongabong, Oriental Mindoro wood furniture sector in managing orders and tracking work are slow and error-prone. The research focuses on designing an e-commerce site that helps the carpenter promote wooden items, create a marketplace for customers, and also implements features such as a real-time chatbot, push notifications, data visualization, tracking inventory, product 3D view, and determining the perception of users by adopting the ISO/IEC standards and the UTAUT framework. The researchers presented "e-Carp," an e-commerce platform for wood furniture and fixtures to address problems carpenters have encountered. The platform was developed using the Agile model. ISO/IEC 25010 assesses the system's quality, while the UTAUT model assesses user acceptance. The results based on ISO 25010 evaluation reveal high scores in Usability (4.72), Portability (4.41), and Security (4.25), and the UTAUT framework with mean scores ranging from 3.52 to 3.91 across Behavioral Intention, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. The findings of the study were that e-Carp enhanced order processing, reduced errors in inventory, and improved customer satisfaction through a real-time chatbot while making the system more adoptable. The study concludes that e-Carp can modernize the local wood furniture industry through improving business performance, operations, and market reach. Promotional tools, better filtering, and an enhanced chatbot should be included. The recommendations include push notifications, AR features, and real-time tracking. Regular updates should be provided based on user feedback to improve it further.

INTRODUCTION

The market for wooden furniture in the Philippines is of great significance internationally in that it blends tradition and innovation, and craftsmanship. Stereotypically, people have come to appreciate stylish products, which has led to a heightened demand for eco-friendly wooden furniture. The Philippine furniture sector is estimated to expand to approximately USD 1.72 billion (Statista, 2024) by 2033. Such growth is primarily driven by strong domestic and export demand from residential and hotel markets. Despite the potential for growth, local firms, especially in Bongabong, Oriental Mindoro, are still inhibited by outdated methods of process management, workflow, inventory, and limited exposure to broader markets.

The local furniture manufacturers also face some challenges, primarily caused by reliance on conventional methods of handling orders and monitoring materials. This traditional approach is time-wasting, and numerous mistakes creep in, cutting down on efficiency and customer satisfaction. Moreover, there is no online presence, hence confining them to advertising the products in the local market only, which makes it impossible to get customers from outside. This is not desirable since foreign furniture brands that compete with local craftsmen are advantaged by superior technology and logistics (Salah & Ayyash, 2024).

The change to e-commerce has affected various industries, including the furniture industry. According to Barrera *et al.* (2022), the COVID-19 pandemic forced firms to use internet platforms and increase the use of consumer-friendly websites to ensure enhanced customer satisfaction. Also, Atnafu & Balda (2018) and Baylen (2020) indicate that effective inventory control is vital to increase business performance, decrease costs, and increase profitability. However, limited technology and inadequate training among small and medium enterprises in the Philippines hinder their effectiveness (Salah & Ayyash, 2024). Nevertheless, a competitive advantage for SMEs can be brought about with the right tools, thus allowing them to widen their global reach.

To solve these concerns, this research proposes the development of a customized e-commerce site, "e-Carp," for the wood furniture market in Bongabong. This will revolutionize order handling, monitor the stock of products on hand, and provide an online platform on which nearby enterprises can showcase and sell their products. A few of its major functionalities include a real-time chatbot, 3d visualizer, tracking orders, visualization of sales and revenues, and inventory management. These functionalities are designed to automate business processes, minimize errors, and enable local carpenters to access a wider customer.

The main purpose of this study was to establish e-Carp, a web-based e-commerce platform specifically targeting wood furniture and fixtures in Oriental Mindoro's Bongabong. This study's exact purpose was to establish a website that enables local carpenters to easily sell their

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wood products and allows consumers to find an easy-to-use online space for buying good-quality furniture. Real-time chatbots were built, based on natural language processing (NLP), to answer queries immediately, thereby automating simple customer support and enhancing communication (Adamopoulou & Moussiades, 2020). SMS and Email Notifications are included to inform customers about their orders, and Inventory Management enables carpenters to monitor stock and popular products, thus supporting smarter business decisions.

MATERIALS AND METHODS

Software Development Method

The Agile development process was used by the team to create e-Carp to facilitate an adaptive and responsive development process. Agile facilitates splitting the project into smaller, iterative phases called sprints to enable the team to deliver functional modules at regular intervals and make adjustments based on real user feedback (Beck *et al.,* 2001). This facilitated ongoing interactions with stakeholders such as carpenters, vendors, and customers,

Figure 1: Agile Methodology

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The selection of Agile was deliberate, given its adaptive nature, which is well-suited for projects that need constant tweaking and continuous improvement (Larman, 2004). During the planning phase, the team attended and conducted interviews with local carpenters to outline the scope, system features, and functions that formed their actual challenges. In the transitioning stage of design, the team created the user interface along with the system architecture. the first drafts of the UI skeletons were completed. During the development phase, the platform was built on WordPress, PHP, HTML, CSS, and JavaScript. The team used an ongoing feedback loop that allowed theme building and feature testing within assigned sprints, with regular check-in meetings to see how things were going, discuss improvements, and make adjustments based on changing feedback. The hosted system was also tested online via Hostinger, and rigorous testing was site-wide on navigation feature buttons and non-bug button-pressed system reliability and end-user usability. Finally, the system was deployed in Bongabong.

Evaluation and Testing

Evaluation of the e-Carp was performed using the ISO/IEC 25010 model. The criteria employed were system quality across functionality, performance, reliability, usability, maintainability, portability, and security (ISO/IEC 25010:2011). Stratified sampling was adopted to ensure proper representation of subgroups, as the data were collected from 100 respondents: 40 IT students, 5 IT faculty, 10 IT experts, 15 employees, and 30 consumers. The ISO 25010 is chosen to be applied due to its significance in software quality evaluation and user acceptance research. ISO 25010 was appropriate to ascribe the degree of the reliability of the platform and its general quality, which is crucial for a successful system in actual applications.

Table 1: Component of ISO/IEC 25010 Questionnaire

Criteria	Indicator
Functional Suitability	It evaluates how well the system's features align with both explicit and implicit user requirements under specified conditions.
Performance Efficiency	It examines the system's ability to deliver its functions with optimal resource utilization.
Compatibility	It ensures that the system can operate correctly across different devices, browsers, operating systems, and environments.
Reliability	It's the ability of a system, product, or component to consistently perform its designated functions under predefined conditions over a specified timeframe.
Maintainability	It refers to how easily the software can be modified, updated, or improved after deployment.

Security	It encompasses the system's capacity to protect information and data, granting access only to authorized individuals or systems in alignment with their respective authorization levels.
Portability	It indicates how well the software can adapt to various operating systems, hardware configurations, or deployment settings.
Usability	It measures the system's effectiveness, efficiency, and overall user satisfaction, ensuring it provides a user-friendly experience.

The researchers utilized a four-point Likert scale to evaluate the system, with scores ranging from 1.00 to 4.00. A score between 3.50–4.00 indicated "Strongly Agree," 2.50–3.49 signified "Agree," 1.50–2.49 represented "Disagree," and 1.00–1.49 denoted "Strongly Disagree." This scale was applied to gather structured feedback on the system's functionality, performance, and overall user experience.

RESULTS AND DISCUSSION

The system provided an online e-commerce platform for buying and selling wooden-made furniture products, offered 3D visualization of products, data visualization of reports, generated reports, online payment, a real-time chatbot, and a user-friendly interface.

the user could log in or register an account, explore featured and displayed products, and visit the store list.

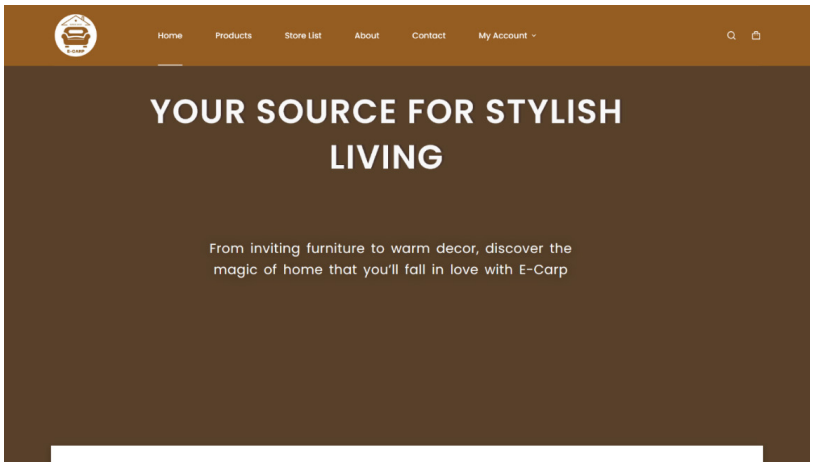

Figure 2: Landing Page

Admin Side

The following figures show the access of the admin to the e-Carp system.

Figure 3 presents a sample view of the admin dashboard. The system administrator can modify all necessary data, view and monitor vendors, consumers, and products.

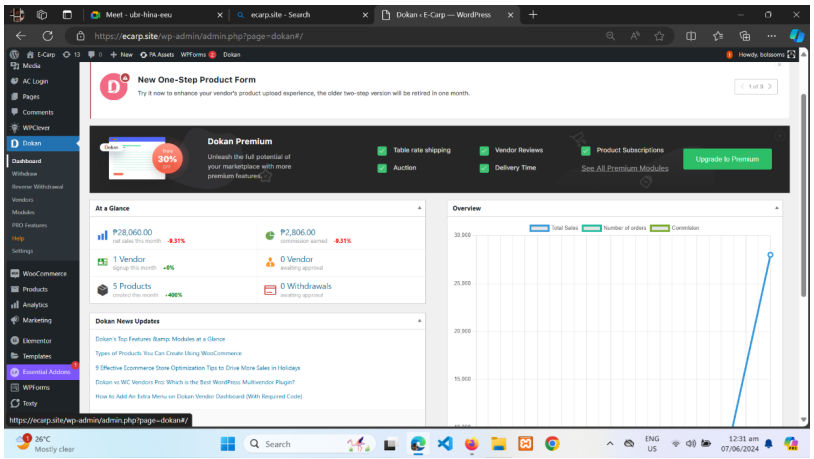

Figure 3: Admin's Dashboard

Figure 4 below presents the products uploaded by the vendors to the system where the admin will check it first before publishing the product.

Figure 5 presents the analytics of the products sold with a specific range of months, revenue, orders, variations, categories, coupons, taxes, downloads record of the product image, and stock inventory.

Figure 6 shows the form needed to complete to generate a 3d illustration of a product. Before generating a 3d model of the product admin needs to switch the image file into glTF (Graphics Library Transmission Format or GL Transmission Format) to generate the 3d model of

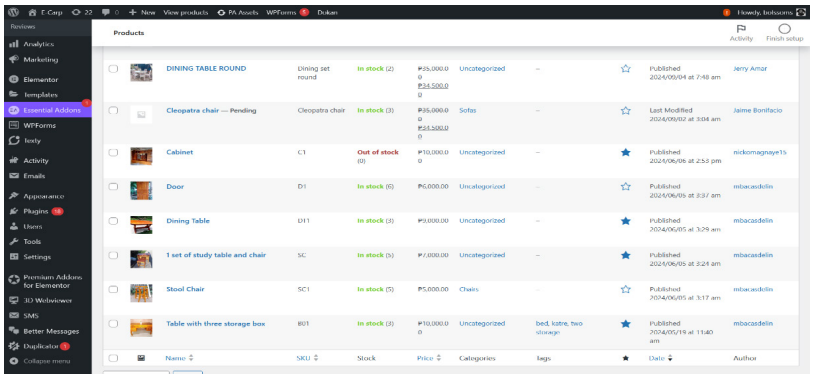

Figure 4: Product Management

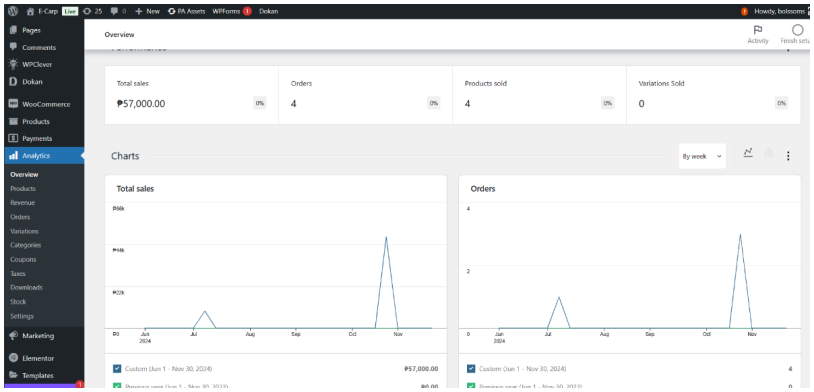

Figure 5: Analytics

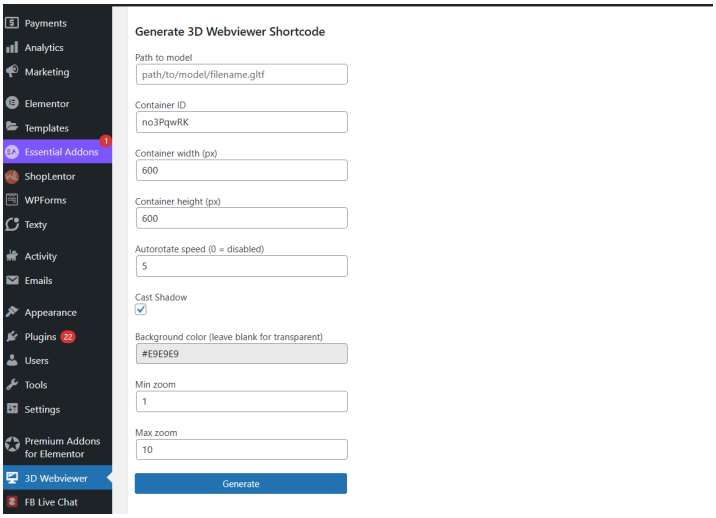

Figure 6: 3D Viewer Model

the product. Admin will just copy the generated code to the description of the product to display the 3d model on the product page.

Customer Side

The following figures illustrate the activities undertaken to provide customers with a dynamic e-commerce site for furniture.

Figure 7 below presents the product page where the customer can choose any furniture they want to buy. The page displays a list of furniture, its name and price, reviews, and the add-to-cart button.

Client Side

The following figures illustrate the activities undertaken to provide furniture shops to expand their business.

Figure 8 below shows the net sales, order status, and sales of the month. The dashboard menu has products where the seller will upload their product, orders where the list of orders can be seen, withdraw, and live chat if the customer has concerns about the product.

Figure 9 presents the live chat page where the seller can see the queries of the customers and reply.

Figure 10 below shows the registration form for customers to have access to the system and interact with

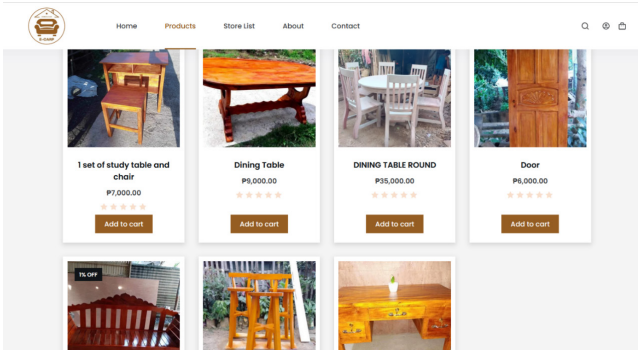

Figure 7: Product Page

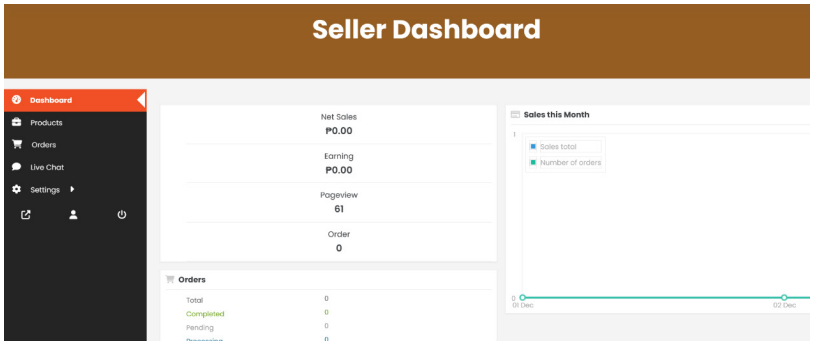

Figure 8: Seller Dashboard

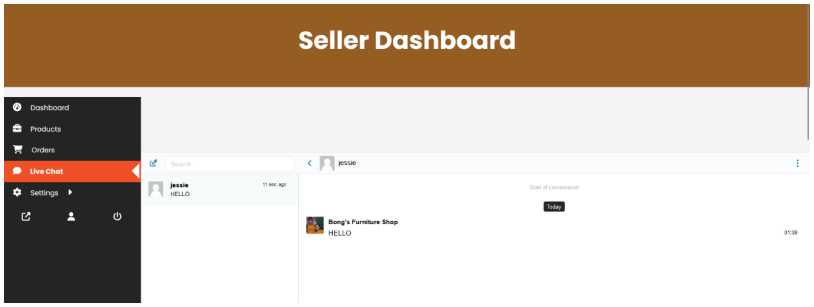

Figure 9: Live Chat

the furniture owners. The following fields in the form are needed information for the account of the customer.

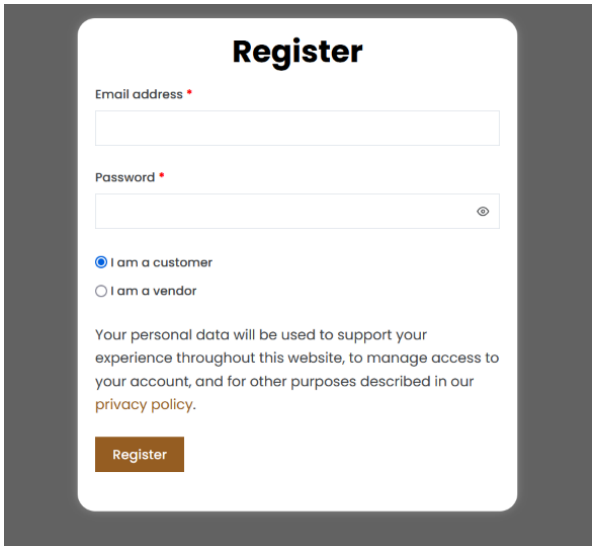

Figure 10: Registration Form

After inputting their personal information, a notification message will show to tell the user to verify their email first.

Evaluation of the System

The evaluation aimed to assess users' opinions regarding several key aspects, including Functional Suitability, Performance Efficiency, Compatibility, Reliability, Maintainability, Usability, Portability, and Security of the e-Carp system.

Table 2 shows e-Carp system evaluation on six ISO 25010 criteria, rated "Strongly Agree" with an overall mean of 3.90. Functional Suitability (3.28) is sufficient in user support, while Performance Efficiency (3.36) shows potential for improvement. Reliability (3.53) means stable, Compatibility (3.87) means it is easy to integrate, and Maintainability (3.79) means it is easy to update. Usability (4.72), Portability (4.41), and Security (4.25) received the highest scores, showcasing the system's user-friendly design, flexibility, and robust data protection.

Table 2: Summary Results of the ISO 25010 Evaluation

Category	Overall Mean	Rank	Verbal Interpretation
Functional Suitability	3.28	8	Agree
Performance Efficiency	3.36	7	Agree
Reliability	3.53	6	Strongly Agree
Compatibility	3.87	4	Strongly Agree
Maintainability	3.79	5	Strongly Agree
Usability	4.72	1	Strongly Agree
Portability	4.41	2	Strongly Agree
Security	4.25	3	Strongly Agree
Overall Mean	**3.90**		**Strongly Agree**

CONCLUSION

Conclusions from the study highlight successful development of the e-Carp platform as a user-friendly, modernized sales process for carpenters. E-Carp created an effective online marketplace through customer support via real-time access, notification systems, and highly developed tools that allow data visualization and 3D product views, which is of benefit for both customers and sellers. Positive evaluation results in usability, portability, and security have demonstrated that this platform is positively welcomed and has an even stronger potential for adoption. The recommendations include integrating promotional tools, updating the product catalog with advanced filters, and enhancing the functionality of the chatbot using machine learning and language support. Predictive analytics, automatic restock alerts, AR visualization, and real-time shipment tracking are proposed as additional features to enhance the performance and user satisfaction of the platform. Regular system reassessments and updates based on user feedback will ensure that the platform meets evolving needs.

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