ENHANCING COMPUTER EQUIPMENT PROCUREMENT THROUGH THE INTEGRATION OF 3D COMPUTER HARDWARE MODELS WITH ONLINE PLATFORM

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ABSTRACT

Nowadays, the online market has seen substantial growth. Thus, enhancing efficiency in online platform becomes importance. Specifically, the sale of computer equipment has shifted predominantly to online platforms, necessitating a method that allows buyers to select and purchase computer equipment effectively. Consequently, this research involved developing a 3D model in conjunction with an online trading platform. The objectives of this research are to create 3D models resembling computer equipment to aid in decision-making during product purchases and to develop web application systems for the online selling of computer equipment. The objectives of this research are to create 3D models resembling computer equipment to aid in decision-making during product purchases and to develop web application systems for the online selling of computer equipment. Researchers conducted a thorough analysis of consumer needs, followed by the design and development of 3D computer equipment models. This included establishing an online selling platform as a web application and assessing the efficiency of the system based on feedback from actual users. The findings revealed high levels of user satisfaction, demonstrating that incorporating 3D models into online selling platforms can enhance consumer satisfaction with their purchases. This is particularly true in terms of providing detailed information and product characteristics before a purchase decision is made. This approach serves as an innovative method for presenting products online and fosters a positive online shopping experience.

Keywords: 3D Model, Online Platform Integration, E-Commerce Innovation

INTRODUCTION

Currently, the pattern of purchasing products has changed to an online platform. Including the purchase of computer equipment, electronic equipment and other products related to computers via online system. When compared to purchasing traditional products was found that consumers have a desire for convenience and want to reduce the cost of traveling to buy products. This situation has been further accelerated by the COVID-19 pandemic. That makes consumers turn to ordering products online and choosing to deliver products to the destination recipient. However, purchasing products online still has limitations, such as presenting product information, and platform is not user friendly. Such limitations need to be improved according to user needs. The system must be easy to use and have a modern design. In addition, the application of 3D models in conjunction with product sales platforms is an important innovation. That adds a new dimension to viewing and choosing products online, with 3D models allowing buyers to view products from every angle. In addition, the application of 3D models combined with a sales platform is an important innovation. That adds a new dimension to viewing and choosing products online, with 3D models allowing buyers to view products

from every angle. It gives an experience that is close to seeing the real product. Users can zoom in and out to help inspect product details. This creates confidence and satisfaction among customers. In addition, products present with the 3 Dimensions model not only reduce hesitation, but the system also helps buyers to get accurate information about the product such as the actual size, color, and shape of the product which affects purchasing decisions in a positive way. This research is enhancing computer equipment procurement through the integration of 3D computer hardware models with online platform, aims to increase the efficiency of product selection. A system has been developed in website platform to enhance the convenience of purchasing computer and electronic products. Utilizing 3D models, this system provides users with the ability to examine products in a comprehensive 360-degree view, including detailed displays of product content. Such functionality affords consumers a more convenient and realistic viewing experience, thereby increasing the likelihood of purchase decisions.

OBJECTIVE

1. To develop 3D models of computer equipment to support the decision to purchase products.
2. To develop web application for selling computer equipment with an online platform.

RELATED WORK

Numerous studies and research have been conducted on the topic of developing websites for e-commerce with a focus on enhancing the efficiency of product selection. Theerapong Malivalaya developed a web application system for e-commerce to study the operational processes of these systems [1]. In a similar vein, Sirikanya Pilabutr and Sita Tupmongkol developed an e-commerce web application aimed at analyzing, designing, and developing applications [2]. Chinawat Prayurat investigated website design methods for digital learning in a 3D virtual reality environment and assessed the quality of user interfaces [3]. Patharaporn Maummee and Jariya Kongkaew conducted a study on the factors affecting online product purchasing in e-commerce, exploring various elements that influence consumer purchasing behavior [4], including demographic factors and online marketing mix elements that affect the online accommodation decisions of Thai tourists. The research findings indicated that gender plays a significant role in the decision-making process for selecting accommodations [5].

Moreover, Manirat applied blockchain technology to enhance transaction security in e-commerce systems [6]. This research focuses on how blockchain technology can help prevent fraud and increase trust among users. Finally, Piyapong Sukchai employed artificial intelligence for analyzing consumer behavior on websites to help entrepreneurs for better products and services [7],[8].

METHODOLOGY

The research methodology is shown in Fig 1. User steps need to be a member of the system if user want to purchase products. The methodology involved a process that consisted of designing and developing a database, creating and designing 3D models, web development and developing a trading platform for the sale of computer equipment. The details are as follows:

Figure 1

Framework for computer equipment procurement through the integration of 3D computer hardware models
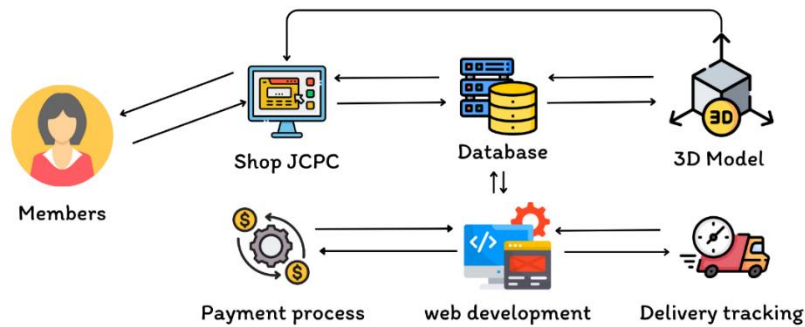
Designing and developing a database

Designing and developing a database involved conducting design in ER-model and Context Diagram. This process enables the recording of details of the ordering system, user data, and administrator data. Operation proceeds by processing information from user purchase orders, sending this data to the system, and then relaying the data back to the database and returning information to the user. The UML was show in Figure 2.
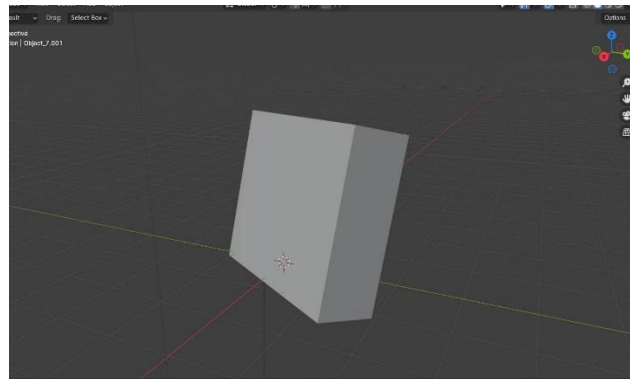
Figure 2
UML of System
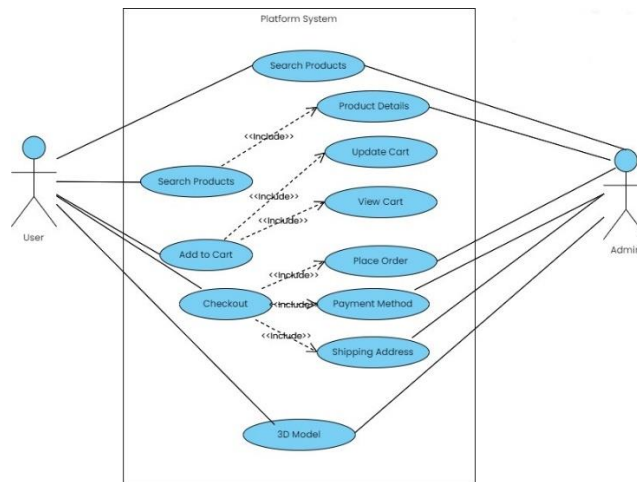
Designing 3D models

3D model development consists of 3D model design, 3D model development, and the preparation of files for the platform with the following details:

1) Designing 3D models for computer equipment

The design process involved the researcher gathering information about computer equipment, technical details, shapes, materials, and various components of the equipment. Preliminary drafts of the model were created using 3D design software, Blender, to outline the shape and structure of the equipment. From Figure 3, the design of the 3D model is displayed in preparation for model creation.

Figure 3
Example of 3D Computer Hardware Model

Figure 4
Example of Image Texture for 3D Computer Hardware Model
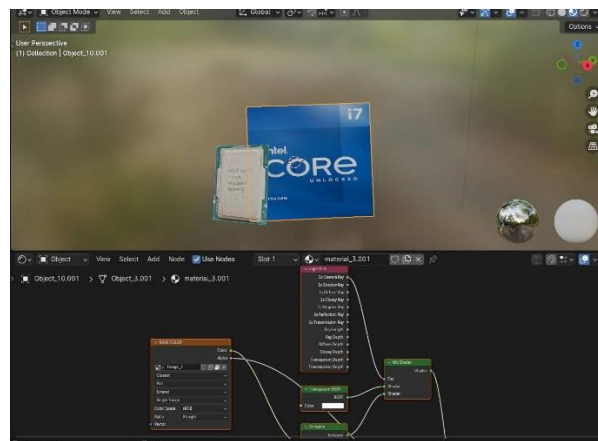
2) development 3D Model for computer equipment

The development of the 3D model was carried out according to the design that had been planned. Subsequently, the 3D model was created by adding details, surfaces, colors, and textures, as well as optimizing the 3D model for rapid processing for real-time web rendering. From Figure 4, an image of the 3D model is shown with image textures applied to the model.

3) Preparation of 3D Model files for the platform

This step involves converting the model files to formats that can be used on online platforms, by transforming model into .glb or .gltf file types, which are suitable for web application displays. The files are prepared for the platform in the Glb format to facilitate the use of objects on the web, by exporting them as glTF 2.0 (.glb / .gltf).

Web development

The development of the web platform consists of the following steps:

1) Designing platform

The design of the web application platform framework aims to manage and segment operations. Designing a Sitemap helps understand the structure of the website by defining the functions of various pages, such as the homepage, product listings, product details, 3D model display, and shopping cart page.

2) System development

This step involves starting to code the program according to the web application platform framework that has been designed. This research has been developed using JavaScript and NodeJS, including the use of frameworks and libraries.

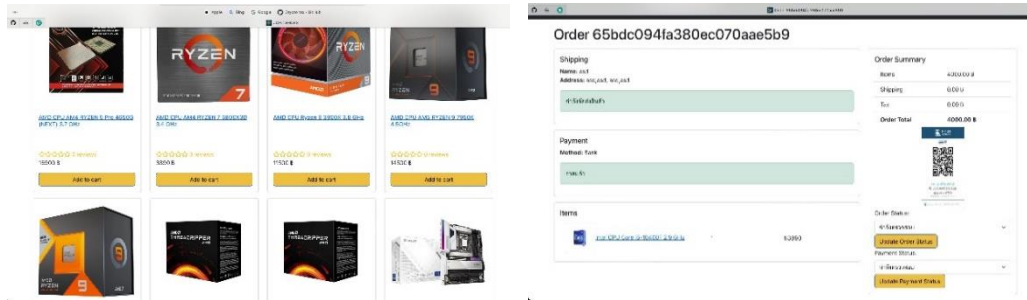**Figure 5**
Example of System Interface

Figure 5 illustrates the interface of the developed platform, showcasing product listings in the store, shopping cart, product details, product reviews, prices, about us, contact information, payment methods, and the option to view 3D models of each product item. Users are required to register before placing orders. For purchasing, buyers can make payments either by scanning a QR code or through the PayPal system.

3) Algorithm for connection 3D model

This process involves the integration of 3 D models with the developed platform for trading computer equipment, allowing users to view the details of computer products thoroughly before making a purchase decision. The algorithm is show in Figure 6.

Figure 6
Algorithm for React Image Upload Handler

Algorithm for React Image Upload Handler

    Input: User selects a file (e), flag indicating if the upload is for images (forImages)

    Output: Successful upload with update to UI or an error message

Step 1: Initialize file upload
- Extract the first file from the event target (**e.target.files[0]**) and assign it to variable **file**.
- Create a new instance of **FormData**.
- Append the **file** to the **FormData** instance with key 'file'.

Step 2: Send upload request
- Dispatch an action **UPLOAD_REQUEST** to indicate the start of an upload process.
- Use **axios.post** to send a POST request to **/api/upload** endpoint with the **FormData** instance and headers:
  - 'Content-Type': 'multipart/form-data'
  - 'Authorization': **Bearer ${userInfo.token}**

Step 3: Handle response
- On successful upload:
- Extract the **data** from the response.
- Dispatch an action **UPLOAD_SUCCESS**.
- If **forImages** is true:
  - Update the images state array by adding the new image's secure URL (**data.secure_url**).
- Else:
  - Update the image state with the new image's secure URL (**data.secure_url**).
- Display a success message to the user.

Step 4: Error handling
- If the upload fails (catch block is executed):
- Display an error message with details of the error.
- Dispatch an action **UPLOAD_FAIL** with the error details.

Step 5: Form UI for Image Upload
- Display a form group for image file upload with:
- A label indicating "Image File".
- An input control for the user to select a file, linked to the **image** state variable.
- The input control should trigger the **setImage** function on change to update the state with the new file's value and should be marked as required.

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    4) System Testing

    This research conducted a system testing in the form of user trial testing, evaluated by three experts and 50 users. The quality assessment was structured using a 5-point rating scale, where level 5 indicates very high quality, level 4 indicates high quality, level 3 indicates medium quality, level 2 indicates fair quality, and level 1 indicates a need for improvement. The analysis of the research results was conducted by calculating the mean value ($\bar{x}$) and standard deviation (S.D.), using interpretation criteria to categorize the average scores [9] following ranges:

    An average score of 4.50 – 5.00 indicates the highest level of satisfaction.
    An average score of 3.50 – 4.49 indicates a high level of satisfaction.
   An average score of 2.51 – 3.49 indicates a moderate level of satisfaction.
    An average score of 1.50 – 2.49 indicates a low level of satisfaction.
    An average score of 1.00 – 1.49 indicates the lowest level of satisfaction.

RESULTS

The evaluation results from 3 experts and a group of 50 users found that the overall average was high ($\bar{x} = 3.71$ and SD = 0.81), indicating that the development of the web application platform incorporating 3D models has a positive impact on product selection, making the website higher in quality and more appealing. Furthermore, it is noted that the satisfaction with processing performance scored the highest, with the satisfaction level being high ($\bar{x} = 4.2$ and SD = 0.63). The detail of evaluation result show in Figure 7.

Figure 7
Evaluation result of user satisfaction
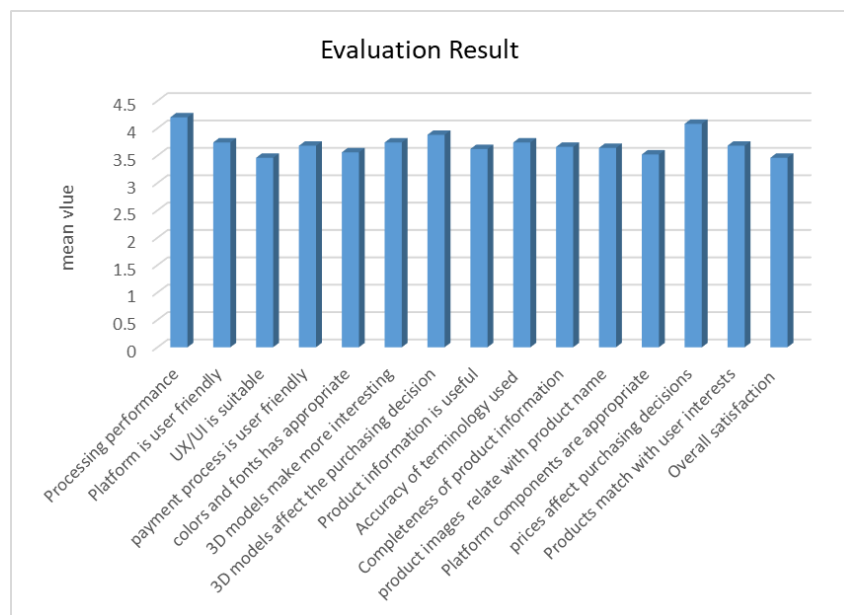
CONCLUSION AND FUTURE WORK

The development of an online platform for enhancing procurement of computer equipment through the integration of 3D computer hardware models supports the decision-making process for purchasing by evolving into a web application system. This system enables users to perceive products in a realistic 3D format. Satisfaction assessments from 50 users revealed a high average satisfaction level. Key findings include that the influence of 3D models on purchasing decisions is markedly positive. The introduction of 3D models considerably elevates product interest levels and platform components receive high marks for appropriateness.

The results suggest that the integration of 3D models and the developed system substantially improve the product selection process, with users reporting high levels of satisfaction. This enhancement is particularly evident in facilitating detailed product examination and selection before making a purchase, thereby elevating user satisfaction and potentially boosting sales for retailers. Future research will explore extending the 3D model development approach to other types of online product sales.

ACKNOWLEDGEMENTS

REFERENCES

[1] Malivalaya, T. (2020), Development of a web application system for e-commerce. Department of Computer Technology, *Faculty of Information Science, Nakhonratchasima College*, Pp. 4-5.

[2] Malivalaya, T., Pilabutr, S. and Tupmongkol, S. (2020), Development of a web application system for e-commerce, *The 7th National Conference Nakhonratchasima College Journal*, pp. 984-990.

[3] Prayurat, C. (2018), Design of a 3D virtual reality digital learning website, Sripathum University Chonburi, *Journal of Interdisciplinary Studies*, 4(3), pp. 25–35.

[4] Maummeesri, P., Kongkaew, J. and Chaiyasivamongkol, W. (2017), Factors affecting e-commerce product purchasing, retrieved on October 3, 2019, from http://sc2.kku.ac.th/stat/statweb/images/Eventpic/60/Seminar/01_4_Ecommerce.pdf.

[5] Pandey, P., Suwunniponth, W., Techarattanased, N. and Klaysung, C. (2023), Online marketing mix factors affecting the online accommodation decisions of Thai tourists, *International Academic Multidisciplines Research Conference*. Fukuoka, pp. 229-238.Suan Sunandha Rajabhat University.

[6] Wongthep, M. (2019), Application of blockchain technology in e-commerce systems to enhance transaction security. *Information Technology Journal*, 15(3), pp. 45-60.

[7] Sukchai, P. (2021), Use of artificial intelligence in analyzing consumer behavior on e-commerce websites,*Research and Development Journal*, 18(2), Pp. 112-127.

[8] Potjanajaruwit, P. and Klaysung, S. (2024), business partnerships, personnel competency, and marketing strategies influencing the success of tourism business operations in Thailand. *Geojournal of Tourism and Geosites,* 52(1), pp.203 –211. Suan Sunandha Rajabhat University.

[9] Silpcharu, T. (2014), Research and Statistical Data Analysis with SPSS, (6th ed.). *Business R&D*.