VI Міжнародна науково-практична конференція
«АКТУАЛЬНІ ПРОБЛЕМИ СУЧАСНОГО ДИЗАЙНУ»
Київ, КНУТД, 25 квітня 2024 р.

УДК 7.012-035.63/.64:[004.4'236:005.21

INTEGRATING VISUAL INFORMATION TECHNOLOGY INTO PRODUCT DESIGN: STRATEGIES AND TRENDS

BULHAKOVA Tetiana[1], LU Qianyu[1,2]

[1]Kyiv National University of Technologies and Design, Kyiv, Ukraine
[2]Kyiv Institute at Qilu University of Technology, Jinan, People's Republic of China
bulgakova.tv@knutd.com.ua, 1213162963@qq.com

This paper explores the integration of visual information technology and product design, emphasizing the importance of cognitive guidance, aesthetic balance, and fault tolerance in user-centered design. By examining case studies, the research highlights emerging trends such as biomimetic design, inclusive experiences, and sustainable visual languages. These directions contribute to advancing intelligent, human-centered, and ecologically responsible product design, where physical form and visual expression seamlessly integrate with technology to enhance user experiences.

Key words: *visual information technology, product design, aesthetic balance, cognitive design, biomimetic forms.*

INTRODUCTION

Visualization information technology is a theory, method and technology that uses computer graphics and image processing techniques to convert data into graphics or images for display on the screen and then conduct interactive processing [2]. For designers, it facilitates conceptualization and presentation, while for users, it introduces intuitive and intelligent functionalities that improve usability and accessibility. However, while visual information technology offers numerous opportunities, its integration requires a thoughtful approach to ensure harmony between digital and physical elements in product design.
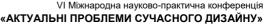
PURPOSE

This study investigates how visual information technology can be embedded into product design beyond traditional human-computer interaction. The aim is to explore methods that enhance physical design through material innovation, ensuring that visual information is seamlessly integrated within the aesthetic and functional framework of modern products.

RESULTS AND DISCUSSION

To effectively incorporate visual information technology, designers must address several key aspects:

Cognitive guidance in product interfaces: Users often experience "information anxiety" when interacting with complex product functions. Effective product design should transform abstract data into spatially logical visual narratives.

VI Міжнародна науково-практична конференція
«АКТУАЛЬНІ ПРОБЛЕМИ СУЧАСНОГО ДИЗАЙНУ»
Київ, КНУТД, 25 квітня 2024 р.

For instance, Tesla's digital interface replaces traditional buttons with a streamlined control panel, simplifying interaction and improving accessibility (Fig. 1).

Aesthetic balance and material integration: The inclusion of digital elements should enhance, rather than overshadow, the essential value of a product. Designers must move beyond conventional black, white, and gray color schemes, exploring richer material and color palettes suited to different use scenarios. For example, the B&O Beoplay A9 speaker incorporates dynamic grating in its fabric mesh cover, transforming sound waves into visible patterns, seamlessly blending technology with material aesthetics.

Enhancing fault tolerance in interaction design: Many technology-driven products prioritize convenience but often compromise on operational flexibility. Product design should provide multiple interaction options, including physical and digital controls, to accommodate different user preferences and ensure reliability. Features such as Tesla's automated window closure during rainfall exemplify fault-tolerant design, ensuring continued functionality even in unpredictable conditions.

Fig.1. Tesla Car Central Control

Looking ahead, the evolution of visual information technology in product design will be shaped by several key trends:

Biomimetic design for enhanced interaction - Future designs will draw inspiration from natural structures to improve functionality and user engagement. The Porsche Taycan's curved dashboard mimics the avian retinal structure, optimizing visual perception and reducing cognitive load. Similarly, Panasonic's bread fermentation display adopts a biomorphic approach, visualizing biochemical processes through translucent silicone expansion.

Inclusive and accessible experiences - Future product design will increasingly prioritize accessibility for diverse user groups. Voice interaction technology enhances usability for the visually impaired, while automated environmental adjustments in smart home systems ensure comfort without manual input. Technologies such as biometric authentication reduce cognitive effort and improve security.

VI Міжнародна науково-практична конференція
«АКТУАЛЬНІ ПРОБЛЕМИ СУЧАСНОГО ДИЗАЙНУ»
Київ, КНУТД, 25 квітня 2024 р.

Sustainable visual language - Environmental considerations are driving the integration of sustainability into product aesthetics. Designs that incorporate recycled materials and modular structures reduce ecological impact while maintaining aesthetic and functional value. Fairphone, for example, embeds circuit layouts into decorative elements on its transparent back panel, merging technical efficiency with design aesthetics.

CONCLUSIONS

This study identifies fundamental strategies for integrating visual information technology into product design, emphasizing cognitive guidance, aesthetic balance, and fault-tolerant functionality. Additionally, key trends in biomimetic design, inclusive experiences, and sustainable visual language demonstrate the evolving role of technology in shaping intelligent and user-centered product design. Future research should further explore the intersection of design innovation and emerging digital technologies to enhance usability, accessibility, and environmental sustainability in product development.

REFERENCES

2. Patel A., Baxter W., Porat T. Toward Guidelines for Designing Holistic Integrated Information Visualizations for Time-Critical Contexts: Systematic Review. *J Med Internet Res.* 2024. №26. e58088. DOI: 10.2196/58088. URL: https://www.jmir.org/2024/1/e58088 (дата звернення: 03.03.2025).

3. Singh P. C., Rajesh A., Kumar R. C. та ін. Information Visualization for Intelligent Systems. John Wiley & Sons, Inc., 2025. 320 с. DOI: 10.1002/9781394305810.

4. Zhang T. Design Strategy and Application of Headwear with National Characteristics Based on Information Visualization Technology. *International Journal of Advanced Computer Science and Applications (IJACSA)*. 2023. Т. 14, № 8. С. 846–856.

БУЛГАКОВА Т., ЛУ Цяньюй
ІНТЕГРАЦІЯ ВІЗУАЛЬНИХ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ У ДИЗАЙН ПРОДУКТІВ: СТРАТЕГІЇ ТА ТЕНДЕНЦІЇ

Цей документ досліджує інтеграцію візуальних інформаційних технологій та дизайну продуктів, підкреслюючи важливість когнітивних орієнтирів, естетичного балансу та відмовостійкості в дизайні, орієнтованому на користувача. Вивчаючи конкретні приклади, дослідження висвітлює нові тенденції, такі як біоміметичний дизайн, інклюзивний досвід та стійкі візуальні мови. Ці напрямки сприяють розвитку інтелектуального, орієнтованого на людину та екологічно відповідального дизайну продуктів, де фізична форма та візуальна виразність плавно інтегруються з технологіями для покращення користувацького досвіду.

Ключові слова: *візуальні інформаційні технології, дизайн продуктів, естетичний баланс, когнітивний дизайн, біоміметичні форми.*