ÓBUDA UNIVERSITY

REJTŐ SÁNDOR FACULTY OF LIGHT INDUSTRY AND ENVIRONMENTAL ENGINEERING

A MAGYAR TUDOMÁNY ÜNNEPE

Az MTA programsorozata

IJCELIT 2023

BOOK OF PROCEEDINGS

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Book of Proceedings of the 9th International Joint Conference on Environmental and Light Industry Technologies [PDF]

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IMPRESSUM

It is a Book of Proceedings of the 9th International Joint Conference on Environmental and Light Industry Technologies held online on 10 November 2023. IJCELIT aims to bring together researchers, engineers, and creative artists from basic research to industry applications working on light industry areas. IJCELIT 2023 comprised three simultaneous events, the Workshop on Graphic Communications Technology (GCTW), the International Symposium on Design and Innovative Technologies (ISDIT) and Workshop on Environmental Sciences and Engineering (WESE). Each event showcased selected scientific papers highlighting emerging technologies. The joint plenary session highlighted the latest technology trends in the field of the TCLF industry. The conference was organised in the framework of the Hungarian Scientific Season.

This publication, carried out by the Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, is available on the conference website: https://rkk.uni-obuda.hu/ijcelit-2023/

The papers appearing in this book compose the technical conference proceedings cited on this volume's cover and title page. Papers were selected by the organising committee to be presented in oral or poster format and were subject to review by the programme committee.

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FULL PAPERS

EVALUATING OF THE EFFECTIVENESS OF DIGITAL CLOTHING IN ONLINE CUSTOMIZATION SYSTEMS

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Abstract

Internet customization of clothes involves the active participation of the consumer in the creation of individual clothes for the purpose of their manufacture and use. Existing models of customization do not fully satisfy consumers in the case of production of ready-made products without fitting. The paper proves the feasibility and effectiveness of implementing blocks of digital clothing in the model of customization systems. The developed model resolves the contradiction between the modern possibilities of digital clothing and the difficulties of its implementation by means of digitization of the image, real display online or in virtual fitting rooms. The model of with application of virtual fitting rooms is proposed. An analysis of the conformity of the real product to its three-dimensional image and individual image in the virtual fitting room was made. A survey of potential customers of customization using digital clothing systems and interviews with manufacturers and organizers of online clothing stores were conducted. A comparison of the consumer and material efficiency of online digital clothing and digital clothing in virtual fitting rooms demonstrates the feasibility of implementing processes related to digital clothing into online customization systems.

Keywords: *Digital clothing, customization, fitting room, feedback loop*

1. INTRODUCTION

Internet trade is developing rapidly all over the world. For items of clothing, the processes are complicated by two main factors. The first factor consists in the fact that each customer wants to have personalized clothes that correspond to his preferences and, if possible, are individual. The second factor determines the difficulty in determining the actual appearance of the ordered clothes on a person.

The solution of these problems in a number of cases is associated with Internet customization systems [1]. These systems use a number of modern inventions, such as virtual reality devices and artificial intelligence programs. Blockchain technologies are adopted by many fashion brands [2].

The implementation of such systems requires the use of modern means of creating digital clothing and virtual prototyping technologies [3]. At the same time, one of the problems remains the lack of trust in the virtual matching of clothes.

The general problem consists in the construction of such a model, in which the wishes of the consumer were satisfied to the greatest extent without his real presence, but with the obligatory consideration of feedback.

2. STUDY OF THE STATE OF THE QUESTION, SELECTION OF UNSETTLED PARTS OF THE PROBLEM

The significant growth of online trade is determined by modern challenges and opportunities of the Internet. Research [4] proves the need for as deep knowledge as possible about the clothing sector when organizing online trade. Aspects identified as important by clients. The proposed system only partially solves the problem of customer feedback. Article [5] defines the main factors of consumers' attitude towards the online trade of clothes. The continuation of this trend is observed in the study [6], where it is determined that one of the important factors is the agreement of the actual product with the expectation. Article [7] proves the importance of individual design, reliability of manufacturing according to requirements.

Based on these publications, it is possible to draw a conclusion about the shortcomings of modern Internet trading systems related to a number of factors. One of the most important issues is data security threats. This fact can include theft of users' personal information, data leaks, and attacks on e-commerce sites that can compromise customers' confidential data. Online shopping runs the risk of not providing the buyer with a realistic picture of the quality of the goods. Photos and descriptions may be misleading, and the reality may be different from expectations. This applies not only to the quality of the goods but also to delivery. Returning or exchanging an item can be a complicated process due to poor-quality goods, erroneous orders, or customer dissatisfaction. Delays in delivery, flaws in tracking systems, or unforeseen circumstances such as natural disasters can lead to missed delivery deadlines and customer dissatisfaction.

Digital clothing solves many of the problems associated with the quality of information about the appearance of clothing and its fit on the individual consumer's figure. Despite the increasing development of digital clothing systems, they are not used enough in practical activities. The introduction of digital clothing has the potential to reshape the fashion industry radically. One key factor is trying on clothes virtually before buying them.

The technology that brought digital clothing to life is based on various approaches. One of the most common methods is 3D modeling, where virtual garments are created that can then be worn in augmented or virtual reality. Using special algorithms and simulations, these digital clothing are realistically animated to mimic the way fabric moves and behaves. Advanced image recognition technologies also make it possible to combine digital clothing with real images or videos, offering huge potential for e-commerce. Shoppers can try on different clothes and styles in a virtual environment for a personalized and interactive shopping experience. This fact gives retailers new opportunities to showcase their products and influence customers' purchasing decisions.

The authors [8] describe the possibilities of individual selection of clothes according to individual taste, but determine the need for a certain qualification of the consumer. Research [9] proves the possibility of building a structure based on three-dimensional measurements, which best corresponds to the individual physique.

Based on the analysis of literary sources, it is possible to note the main contradictions of the existing models of Internet customization (Figure 1).

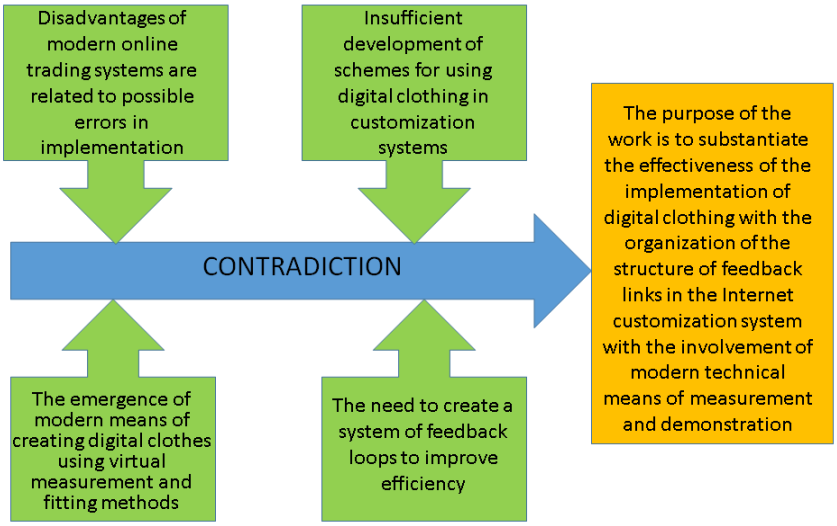

Figure 1: Contradictions of existing customization models

The purpose of the work is to substantiate the model of Internet customization with a network of service centers for the creation of avatars and virtual fitting rooms.

3. THEORETICAL RESULTS. IMPROVEMENT OF THE INTERNET CUSTOMIZATION MODEL USING DIGITAL CLOTHING SYSTEMS

The traditional model of an online customization system (Figure 2) includes the possibility of online communication with the consumer to satisfy their wishes. The general problem consists in the construction of such a model, in which the wishes of the consumer were satisfied to the greatest extent without his real presence, but with mandatory consideration of feedback.

Research proves the feasibility and effectiveness of implementing blocks of digital clothing in the model of customization systems. The developed model resolves the contradiction between the modern possibilities of digital clothing and the difficulties of its implementation employing digitization of the image, real display online, or in virtual fitting rooms.

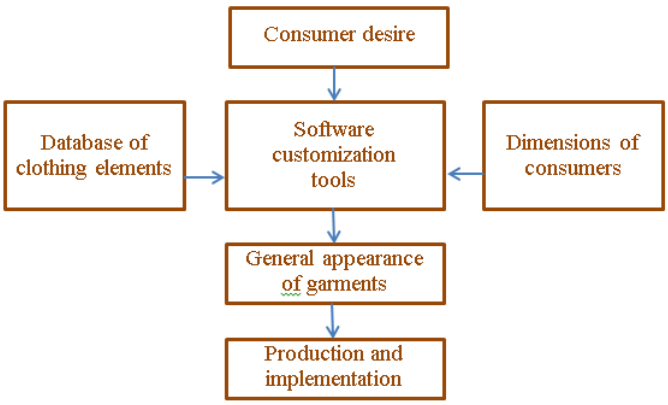

Figure 2: Existing customization scheme

The proposed model (Figure 3) uses several modern inventions, such as virtual reality devices and artificial intelligence programs. Blockchain technologies can be adopted by many fashion brands. Providing a feedback system increases trust and, accordingly, the effectiveness of customization.

The proposed model takes into account the latest achievements in the field of digital clothing and digital technologies and also provides for the creation of several feedback loops.

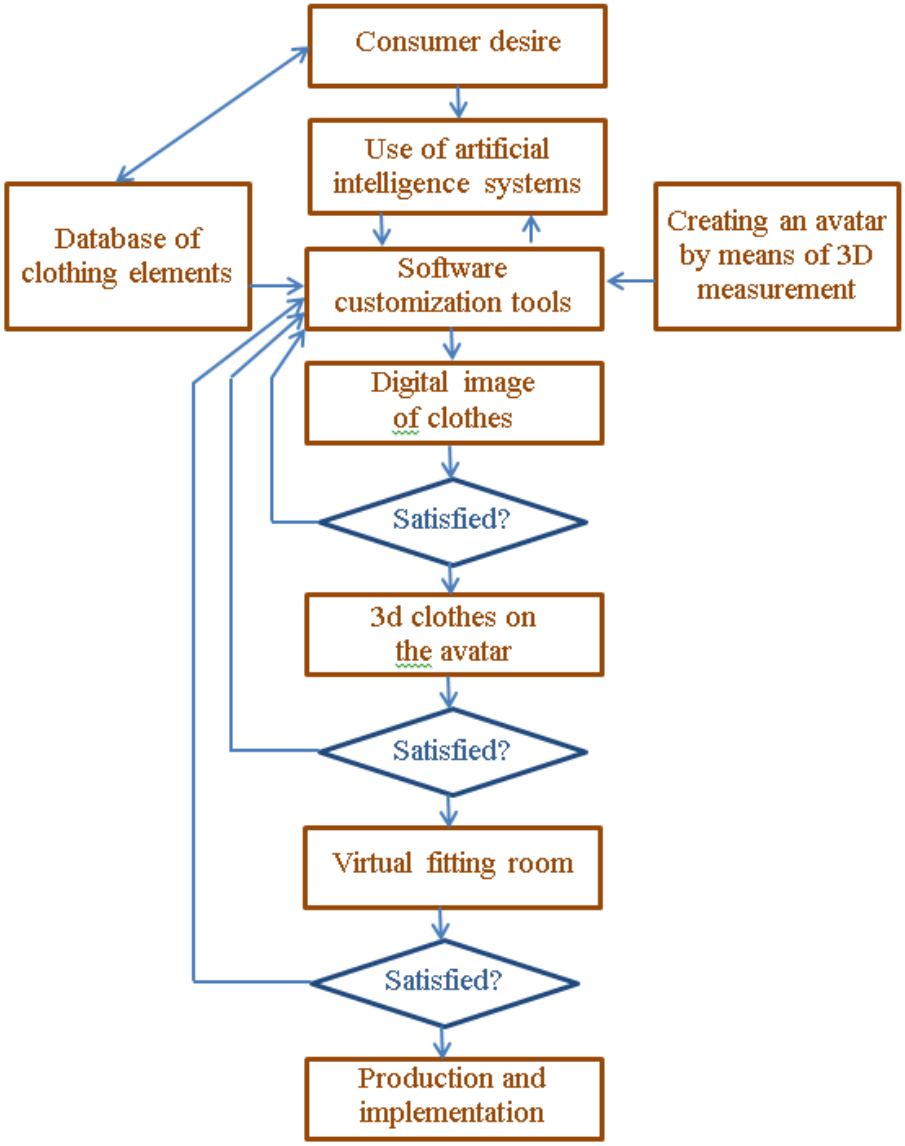

Figure 3: Customization scheme with the use of digital clothing

In particular, new blocks are proposed that take into account the use of artificial intelligence systems, software customization tools, digital images of clothes, 3D clothes on the avatar, use of virtual fitting rooms. These blocks are combined into one algorithm. The feedback system ensures constant contact with the individual consumer and increases the overall efficiency of clothing customization systems.

New business models based on this algorithm are customer-centric, which completely determines their structure: from the value proposition aimed at satisfying the customer's needs, timely delivery and to revenue streams.

2. EXPERIMENT. RECOGNITION OF THE EFFECTIVENESS OF THE PROPOSED MODEL

Interviews and surveys of possible consumers were organized. Consumers were divided into two age groups. Predictably, the younger age group showed a much greater willingness to use digital technologies in the process of designing, manufacturing, and selling clothes. The survey data are shown in Table 1.

Table 1: Questionnaire of potential consumers

Online customization options	Consumers aged 18-30	Consumers aged 31-60
Readiness to perceive the creation of clothes by methods of artificial intelligence	Middle level	Low level
Readiness to create and use 3D avatars	High level	Very low level
Readiness to use virtual fitting rooms	Very high level	Middle level
Willingness to participate in the customization process within existing limits	Middle level	Low level
Willingness to participate in the customization process in the conditions of using digital clothing	Very high level	Middle level

A very high level of readiness to use virtual fitting rooms, as well as willingness to participate in the customization process in the conditions of using digital clothing, was demonstrated. A high level is demonstrated in the field of readiness to create and use 3D avatars.

Representatives of the older age group demonstrated a rather low level of readiness to create and use 3D avatars, which is in contradiction with the survey of representatives of the younger age group. Meanwhile, general trends demonstrate very real prospects, the possibility, and expediency of implementing the proposed scheme with the introduction of digital clothing systems, 3D avatars, and virtual fitting rooms.

Cronbach's Alpha coefficient was calculated to assess the reliability of the survey and to select the most complete set of criteria for the effectiveness of the adjustment. The weighting coefficients of possible directions for the introduction of digital clothing were determined (Table 2). The level of significance was determined on a five-point scale. All the proposed blocks have a fairly high level of significance.

Table 2: Significance of customization model based on the use of digital clothing

Parameter	Relevance	Cronbach's alpha
Digital image	4.14	0.8742
3D clothes	3.55	0.8432
Virtual fitting room	3.67	0.8163
Artificial intelligence	3.72	0.7885
Software customization	4.19	0.9214

High levels of values Cronbach's alpha indicators demonstrate sufficient completeness of the proposed model and the absence of the need to exclude the main blocks, elements, and feedback.

3. DISCUSSION

Digital clothing allows complete freedom of expression for both consumers and designers. The advantage of digital clothing is that there is no need to purchase real clothing online with the risk of not getting what you want. For these purposes, you can create a digital thing. The most real-life application of this technology is digital prototyping. With such images, you can see how the item will fit on different body types, and, based on the results, decide on launching a clothing line or purchasing it.

The transformation of traditional fashion into its correspondence with the so-called meta-fashion is happening very actively, supporting general changes in the world. Consumers become avatars for themselves not only in social networks but also in digital production systems, digital fashion, and online commerce.

The transition of digital clothing into the real sphere requires, on the one hand, certain financial and intellectual investments, and on the other hand, it can potentially significantly increase the efficiency of the online fashion trade. Research shows that potential consumers, especially in the younger age segment, are ready for the practical implementation of digital means in their diversity.

CONCLUSIONS

The model of Internet customization using digital clothing systems and artificial intelligence is proposed. Directions for using 3D measurements, 3D avatars, and virtual fitting rooms are shown.

The conducted surveys confirmed the readiness of the modern consumer to participate in the use of digital clothing, sufficient completeness of the proposed model, and a potential increase in the effectiveness of online clothing customization systems.

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