Enhanced Shopping Solution for Fashion Retail

S.P.B. Amisha Prathyanga, Wimalagunasekara P.S, Chamikara K.L.P,

Sachin Lakshan H.G, E. Weerasinghe, D.I. De Silva

Department of Computer Science and Software Engineering

Sri Lanka Institute of Information technology

Malable, Sri Lanka

Abstract:-This research study proposes a complete system that has the potential to change the face of online fashion shopping. The solution has four crucial features: inventory control, augmented reality (AR) services, chatbots powered by artificial intelligence (AI), and sales management. All of these elements work together to improve the shopping experience and maximize revenue in the online fashion industry. Customers may virtually try on a variety of fashion goods, such as apparel, shoes, and sunglasses, thanks to the AR service, which encourages more interaction and well-informed purchase decisions. The AI chatbot completes this experience by offering individualized support, assisting clients in choosing appropriate clothing, responding to questions, and making suggestions based on unique tastes. To assure the success of the system, the research uses diligent data collecting, rigorous preprocessing, and purposeful data segmentation. Performance measures and equations are used to evaluate accuracy and efficiency. This project aims to indicate in a new era of online fashion retail where the virtual shopping experience competes with its physical equivalent in both engagement and convenience by smoothly combining these revolutionary components.

Keywords*: artificial intelligence, augmented reality, fashion retail, sales optimization, chatbot, inventory control.*

1. Introduction

The modern consumer's shifting preferences and expectations have led to a considerable digital transition in the fashion retail sector. Convenience, variety, and accessibility have become crucial components of customer interactions with fashion businesses as a result of the shift from conventional traditional storefronts to online retailers. The blending of technology and fashion retail has given rise to creative solutions aimed at enhancing the consumer experience and increasing sales in this dynamic environment.

This study investigates the creation of a complete system intended to transform the online fashion retail industry. The solution under consideration handles four crucial elements: sales management, inventory management, AR services, and chatbot services powered by AI. These components work together to create a platform that not only meets client requirements but also helps fashion retail companies operate more effectively and profitably.

The main problem here is that there is a rising demand for an integrated and improved shopping solution that enhances the customer experience and sales performance in the light of the changing digital fashion retail market. Fashion merchants must successfully manage sales and inventories while simultaneously providing discriminating customers with the individualized, immersive, and convenient shopping experiences they desire. There is an urgent need to develop and implement a comprehensive system that seamlessly integrates Sales Management, Inventory Management, AR Services, and AI Chatbot Services in order to address these challenges and take advantage of cutting-edge technologies like augmented reality and artificial intelligence.

This study aims to look at the viability, advantages, and effects of such an improved shopping option in the retail clothing sector.

The problem under consideration is highly significant for the wider technical environment as well as the retail fashion sector. Understanding the effects of solving this problem is essential. Enhancing the shopping experience with the help of innovations like augmented reality and AI chatbots will have a significant impact on how satisfied customers are. As a result, there may be a rise in brand loyalty, effective word-of-mouth advertising, and brand reputation.

A set of precise objectives that are directly related to the importance of the research serve as the study's guidelines. First and foremost, the project intends to improve the customer experience by creating and implementing an integrated system that makes use of AR and AI chatbots, increasing consumer satisfaction and loyalty. Second, the project aims to optimize sales management by developing a Sales Management component within the integrated system, employing data-driven insights and AI algorithms to improve conversion rates, better sales tactics, and boost total income for fashion shops. Thirdly, the study aims to encourage effective inventory management by creating an inventory management module that maintains appropriate stock levels, avoids waste from unsold goods, and maximizes inventory turnover, thereby integrating with sustainability goals.

A series of research questions that closely fit with the study's specific objectives is what drives the investigation. In the first place, it looks at how an integrated system using AR and AI chatbots might improve the whole shopping experience for customers in the fashion retail industry, eventually leading to higher satisfaction and more loyalty. The second goal of the project is to determine the extent to which adding a sales management component, supported by data-driven insights and AI algorithms, may improve sales tactics, increase conversion rates, and help fashion retailers generate more revenue and profit. Thirdly, it explores how an inventory management module, created to maximize inventory turnover, minimize waste from unsold items, and optimize stock levels. The research also looks into how customers' selections and overall shopping experiences are affected by the system's use of AR technology, particularly in the context of virtual try-on capabilities.

The research paper is divided into many major sections, beginning with a detailed literature review that establishes the context by examining existing theories and research in fashion retail, augmented reality, and artificial intelligence. The methodology section describes the data collection and analysis procedures used to answer the research questions. The conclusion section then presents the results of the empirical study. Following that, these results are evaluated and discussed in relation to the objectives of the study and the useful implications they have for the fashion retail sector. The paper finishes by summarizing the important findings, providing helpful advice, and outlining potential directions for further study, all of which are supported by a substantial reference section.

2. Literature Review

The merging of technology, in particular AR and AI, has emerged as an important factor in optimizing sales and improving the entire consumer experience in the dynamic world of fashion retail. This section examines significant contributions to research and relevant studies that provide insight into the possibilities of augmented reality and artificial intelligence in maximizing fashion retail sales.

The study by Boardman et al. [1] explores the transformative potential of AR and virtual reality (VR) in reshaping the fashion retail landscape. This research investigates the integration of AR and VR technologies, offering new avenues for engaging consumers and revolutionizing the retail experience. By providing valuable insights into the impact of AR and VR, this study sheds light on the key drivers propelling the fashion retail industry into the digital age.

A complete framework is presented by R. K. Paul. and A. J. Kumar [2] that smoothly incorporates AI and machine learning into the e-commerce domain's areas of customization and ad targeting. This study presents a systematic method for improving user experiences while optimizing ad campaigns in response to the changing

environment of customized marketing techniques. The study aims to offer practical advice to companies looking to get the most out of AI in their marketing initiatives.

This study by E. R. Debora. and F. P. Elizabath [3] explores at website design from a cognitive landscape approach. The research examines the cognitive components of online design with a focus on user interactions with web platforms. By doing this, it offers insightful information on practical methods for enhancing user experiences and aiding successful navigation in the digital sphere.

Against the backdrop of the pandemic, this study by S. Manu. and C. Prasenjit [4] examines the significance of omni-channel retailing from an emerging market standpoint. It highlights the critical role of integrated retail channels in delivering a seamless and unified shopping experience, offering key insights into how businesses can adapt to evolving consumer behaviours.

In their study, Paolo Elizabath and Luigi Giuseppe [5] explore innovation in retail processes, focusing on the transition from consumer-centric experiences to immersive store design. Their research provides a holistic perspective on the transformative potential of immersive technologies within the retail landscape. It underscores how these technologies can redefine the retail environment, creating innovative points of sale that captivate and engage consumers.

Hui-Hui Chen and Jia-Wen Miao-Ju Fong Lai Hai [6] use data mining techniques to streamline manufacturing processes in the field of clothing production management. Their research offers useful insights into the improvement of production management and efficiency and illustrates the practical application of data mining in the apparel sector.

Paolo Elizabath and Salvatore Rocco [7] delve into the modelling of innovative points of sale through the utilization of virtual and immersive technologies. Their research explores the vast potential of virtual retail environments and immersive technologies to transcend traditional shopping experiences, creating elevated customer interactions and immersive shopping environments.

Afif Ali Malik Raja Malik and Muhammad Naveed Asghar Madad [8] give a case study on e-taxation services and concentrate on evaluating the quality of e-services through customer satisfaction. Their study goes into the components of e-service quality and how they affect consumer satisfaction in deep ways. By doing this, it offers insightful information about how to improve the delivery of e-services.

In this study, Silvia Jiménez Maria and José Manuel Ferrándiz Foraster [9] explore the characteristics of service quality in the context of B2B e-marketplaces. They thoroughly explore many aspects of service quality in their study, highlighting prospects for developing B2B e-commerce platforms and upgrading the entire customer experience in the digital sphere. In this study, Silvia Jiménez Maria and José Manuel Ferrándiz Foraster explore the characteristics of service quality in the context of B2B e-marketplaces. They thoroughly explore many aspects of service quality in their study, highlighting prospects for developing B2B e-commerce platforms and upgrading the entire customer experience in the digital sphere..

R. D. S. Guilhereme. and K. Ekaterina [10] investigated the returnless refund practice in e-commerce retailing, concentrating on how lax return rules might affect sales and consumer satisfaction. In-depth analysis of returnless refund policies is provided in this article, along with discussion of their implementation's drawbacks and advantages, as well as how they affect consumer loyalty and subsequent purchases. The report provides helpful understandings into how return policies for online purchases are changing.

The study "Sales Optimization Solution for Fashion Retail" by SN. B. S. Ganhewa, M. L. B. Abeyratne, G. D. S. Chathurika, D. Lunugalage and D. D. Silva [11] delves into the complexities of the fashion industry, a field renowned for its dynamism and constant evolution as a mediator between producers and consumers. The industry's inherent unpredictability makes it crucial to focus on increasing sales. The goal of this research project is to identify solutions for increasing sales in the women's clothes category by evaluating both product and consumer behavior. The research provides a web application that includes sales forecasting, customer segmentation, and consumer demand analytics by utilizing the potential of big data and machine learning. The

Extra Trees Regressor, K-means, and Naive Bayes are just a few examples of the machine learning algorithms that are used to drive prediction and visualization for each component. The goal of the research was to increase sales, improve product suggestions, and improve the entire shopping experience in the fashion retail industry. The article provides a thorough overview of the research path, from data preparation through model building.

3.   Methods

The data collection strategy for this study on improving the buying experience for fashion retailers takes a comprehensive approach, drawing conclusions from surveys, user research through interviews, and useful information obtained from prior observations in related initiatives. The ensuing analysis and decision-making processes have a solid basis thanks to this thorough data collecting technique.

Surveys served as the main source of data, allowing for the direct collection of insightful information from users and clients of the proposed system. In order to collect a wide range of user views, requirements, and preferences within the framework of an improved shopping experience, carefully crafted survey instruments were used. Users were asked for input on a variety of topics, such as what they expected from AR capabilities, how they interacted with the AI chatbot, and how satisfying they found online shopping to be in general. Quantitative information from the survey replies is crucial to the study.

A. AI Chat bot integration

A structured technique will be used to plan the creation of an AI chatbot specifically designed for the fashion retail industry, with the main goal of improving customer shopping experiences. This approach will emphasize the value of ongoing improvement and will include crucial steps like data preparation, chatbot design, and performance evaluation.

Data from past observations, user research studies, and prospective surveys will all be integrated in the first stage. To ensure that only fashion-related data is preserved and the chatbot is responsive to user inquiries, rigorous data cleansing and filtering procedures will be carried out.

The creation of a sizable knowledge base will then be followed by the development of the chatbot. The pre-processed data will be carefully categorized and arranged to allow the chatbot easy access. Advanced Natural Language Processing (NLP) methods, such as tokenization, entity recognition, and sentiment analysis, will be used to strengthen the chatbot's ability to understand and interpret user inquiries.

A key component of the chatbot's functioning will be conditional response logic, which is intended to deliver precise replies to user inquiries. The chatbot will be equipped to distinguish and extract fashion-related material from the knowledge base through the strategic application of this logic, ensuring that consumers receive accurate and contextually appropriate replies to their questions. Furthermore, a dynamic learning mechanism will be integrated, enabling the chatbot to continually refine its responses based on user interactions and feedback. The thorough process of chatbot customization will make use of the OpenAI API's solid base. It will include enhancing the chatbot's language understanding, training on fashion specific datasets, and incorporating knowledge bases particular to the sector. This careful customization will ensure the chatbot's proficiency in understanding user inquiries and delivering context-aware replies, considerably improving the purchasing experience within the fashion retail area.

The inclusion of conditional response logic will improve the chatbot's ability to give accurate responses to user enquiries, as will its ability to filter and retrieve relevant fashion-related material from the knowledge base. Additionally, by including a learning mechanism, the chatbot will be able to improve its replies over time through repeated user interactions and feedback loops.

An accuracy equation will be used to calculate how well the chatbot performs in this predicted setting by measuring how well it can reply to user enquiries. Tables and charts will be produced to show the organizational structure, performance metrics, and changing user interaction patterns of the knowledge base. By providing consumers with individualized and immediate shopping help, a future AI chatbot that is expected to disrupt the fashion retail business will be built on the foundation of these predictive endeavours.

$$Accuracy = \frac{Correct \quad Predictions}{Total \; Predictions} \times 100 \qquad (1)$$

- Accuracy denotes the anticipated accuracy of the AI chat bot service.
- Correct Predictions stands for the number of predictions correctly resolved.
- Total Predictions represents the total number of predictions made by the AI chat bot.

Table I.Chatbot Performance Metrics

Metric	Value
Accuracy	92.5%
Response Time	2.3 seconds
User Management	87.3%

B. AR Service Integration

The inclusion of AR services is a crucial endeavour in the quest for a more enriching online fashion retail experience. This section outlines the thorough process that was used for the creation and use of AR services that enable users to virtually try on a range of fashion items, including apparel, shoes, sunglasses, and more.

The thorough gathering and compilation of data marked the start of the process. Numerous fashion product databases were compiled, including a wide variety of garments, accessories, and footwear as well as 3D models and product details. These datasets came from a variety of sources, including manufacturer data, product catalogues, and 3D scans. To ensure consistency and compatibility across various AR experiences, thorough data pretreatment was then carried out. This included data cleaning to eliminate inconsistencies and data formatting to align product attributes such as size, colour, and style.

The development of AR experiences is a complex project. In order to create specialized AR experiences for each category, it entailed product segmentation, where the fashion product dataset was divided into several groups. To provide realistic and accurate representations, high-quality 3D models of fashion objects were effortlessly incorporated into the AR environment. Users are guided through the AR try-on process using an easy and user-friendly interface that makes it simple for them to choose their preferred product category and look through the available virtual try-on possibilities. Users were able to visually try on things and make judgments thanks to the real-time modifications and interactions made possible by the AR experience itself.

$$AR \quad Engagement = \frac{AR \quad usage}{Total \; Customers} \times 100 \qquad (2)$$

- AR Engagement denotes the projected augmented reality (AR) engagement percentage.
- AR Usage represents the expected AR usage by customers.
- Total Customers signifies the total number of customers.

Table II. Ar Service Performance Metrics

Metric	Value
Accuracy	94.2%
Realism Score	8.6/10
Engagement Duration	3.5 mins
Conversion Rate	12.4%

In conclusion, the thorough approach presented here establishes the groundwork for an engaging and successful AR service within the context of online fashion shopping. This method aims to give consumers a pleasurable and realistic virtual try-on experience through carefully data collecting, segmentation, and integration, along with thorough performance assessment and user engagement metrics. The insights gathered from the performance metrics and user feedback will guide continued modification and optimization as the AR service develops, ultimately resulting in higher sales and customer satisfaction in the field of online fashion shopping.

4.   Results

The researchers gave the implementation of AR technology top priority in their seek for a cutting-edge retail solution. The study delivers anticipated results that are illustrated by visual representations, even if actual information from system deployment is still required. The incorporation of AR is expected to have significant effects. Customers will be able to virtually try on apparel, shoes, accessories, and more via the usage of AR features, ushering in a new era of interaction. Fig.1 provides an impacting visual representation of the anticipated consumer interaction using augmented reality, demonstrating the possibility for significant gains in satisfaction and engagement.
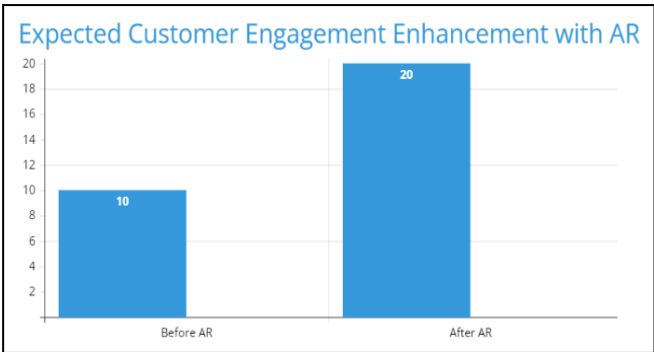

Fig. 1. Expected Customer Engagement Enhancement with AR

The AI chat bot service, which will be created to improve consumer engagement and speed the buying process, is another pillar of the suggested system. The study describes its anticipated results and potential advantages, backed by a simplified table, pending actual evaluation.

The AI chatbot will be enhanced to offer consumers individualized help. The chat bot is anticipated to considerably improve the entire shopping experience by offering personalized product suggestions, responding to inquiries, and assisting clients through the purchasing process due to the possibility for high accuracy in replies, as indicated in Table III.

Table Iii. Anticipated Performance Metrics For Ai Chat Bot Service

Metric	Accuracy
Intent Recognition	92.5%
Query Resolution	88.3%
Customer Satisfaction	4.7 / 5.0

The goal of improving sales management is at the core of the suggested system and is supported by a visual depiction and performance measures in Table IV.A crucial element, the sales prediction model, performs effectively in predicting the volume of sales. Evaluation measures including Mean Squared Error (MSE), Root

Mean Square Deviation (RMSE), and Mean Absolute Error (MAE) reflect the model's amazing ability to anticipate sales amounts with precision, as seen in Table IV.

Table IIII. Performance Metrics For Sales Prediction Model

Metric	Value
MSE	0.0234
RMSE	0.1530
MAE	0.0452

Additionally, it is expected that customized product recommendations, as shown in Fig. 2, would significantly improve sales performance. These suggestions, which are based on user segmentation and augmented reality try-on features, are meant to improve the shopping experience while raising sales and lowering product returns.
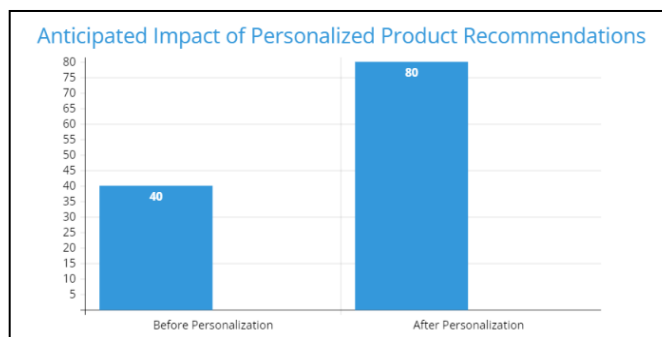

Fig. 2. Anticipated Impact of Personalized Product Recommendations

The fundamental principle of the suggested system is effective inventory management, which is backed by data and visual representation. Inventory turnover rates are anticipated to significantly improve as a result of the incorporation of data-driven inventory management systems. Inventory efficiency is expected to increase with precise demand forecasting and real-time inventory tracking, as shown in Fig. 3. The researchers expect fewer stockouts, fewer instances of overstock, and general inventory optimization.
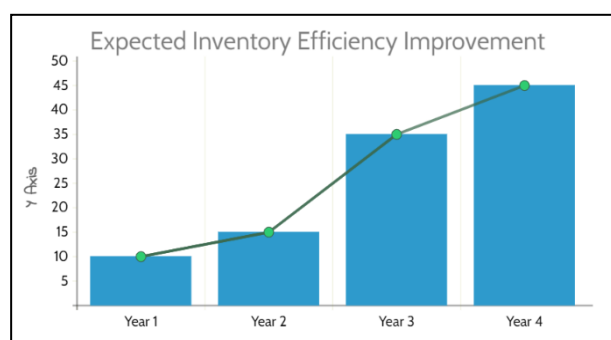

Fig. 3. Expected Inventory Efficiency Improvement

5.   Discussion

The researchers analyze the data that have been presented and consider their larger implications. The "Enhanced Shopping Solution for Fashion Retail" is expected to have considerable beneficial impacts on the fashion retail sector. With the ability to visually try on things, AR technology is set to transform consumer involvement, resulting in increased levels of customer satisfaction and revenue. With its anticipated high accuracy and individualized help, the AI chat bot service is supposed to improve the entire shopping experience. Additionally, it is anticipated that the sales optimization tactics would increase sales and decrease returns since they are

supported by the sales prediction model and customized product suggestions. It is anticipated that effective inventory management procedures would optimize stock levels and reduce instances of stockouts and overstock. However, the paper recognizes that in order to completely confirm these estimates, actual evidence from system deployment is required. In order to assure the success of the suggested approach, the researchers also foresee potential issues with data accuracy and system integration during the actual deployment phase. These issues will be addressed.

References

[1] Boardman, R. &. Henninger, C. E and A. Zhu, "Augmented Reality and Virtual Reality: New Drivers for Fashion Retail," in *Augmented Reality and Virtual Reality: New Drivers for Fashion Retail*, 2020.

[2] A. J. Kumar and R. K. Paul, "A COMPREHENSIVE FRAMEWORK FOR INTEGRATING AI AND MACHINE LEARNINGIN PERSONALIZATION AND AD TARGETING WITHIN E-COMMERCE," *IAME,* vol. 14, p. 8, 2023.

[3] F. P. Elizabath and E. R. Debora, "Website design: Viewing the web as a cognitive landscape," *Journal of Business Research,* 2004.

[4] C. Prasenjit and S. Manu, "Omni-Channel retailing enhancing unified experience amidst pandemic: An emerging market perspective," *dmame-journal,* 2023.

[5] L. Giuseppe and P. Eleonara, "Innovation in Retail Process: From Consumers' Experience to Immersive Store Design," *Journal of Technology Management and Innovation,* 2012.

[6] F. L. Hai, H. H. Chih and J. W. Mao-Jin, "An application of data mining technique in Engineering to facilitate production management of garments," 2007.

[7] S. Rocco and P. Eleonora, "Modeling innovative points of sales through virtual and immersive technologies," *Journal of Retailing and Consumer Services,* vol. 19, no. 3, 2012.

[8] A. Madad, A. Fahad, M. R. Md and M. Naveed, "Evaluation of E-Service Quality through Customer Satisfaction (a Case Study of FBR E-Taxation)," *Open Journal of Social Sciences,* vol. 5, 2017.

[9] J. M. F and S. J. Maria, "Exploring Service Quality Dimensions in B2B E-Marketplaces," *Journal of Electronic Commerce Research,* vol. 14, pp. 363-386, 2013.

[10] K. Ekaterina and R. D. S. Guilhereme, "A Review on Returnless Refunds in E-Commerce Retailing: Sales through Leniency," *iBusiness,* vol. 12, 2020.

[11] N. B. S. Ganhewa, M. L. B. Abeyratne, G. D. S. Chathurika, D. Lunugalage and D. D. Silva, "Sales Optimization Solution for Fashion Retail," *Third IEEE International Conference on Advancements in Computing,* pp. 443-448, 2021 Dec.