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Augmented Reality in E-Commerce: A Comprehensive Systematic Literature Review and Future Directions

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ABSTRACT
Augmented reality is a technology that is now being widely adopted by the e-commerce sector. Research that comprehensively discusses the trends and impact of augmented reality on e-commerce is still not widely available. Therefore, the aim of this research is to overcome these limitations by providing an in-depth understanding of the trends and impact of augmented reality in e-commerce. Another aim is to provide gaps and contribute to opening up future research opportunities, as well as providing recommendations regarding the application and optimization of augmented reality technology in e-commerce business strategies. This research used the Systematic Literature Review method with the selected articles totaling 36 out of 592 articles. Of the 36 selected articles, the author presents findings which show that the current trend of augmented reality used in e-commerce is virtual try-on, preview placement and social media filters, as well as presenting the impact of using augmented reality as seen from user experience, satisfaction and consumer behavior. This research also presents gaps, future research and recommendations that are useful for the e-commerce sector.

Keywords—augmented reality, e-commerce, user experiences, satisfaction, consumer behavior

INTRODUCTION

The development of digital technology, which continues to experience change and progress, plays an increasingly important role in everyday life. E-commerce is one of the most striking components of this progress. [1]. Over the past several years, sales of global e-commerce have increased significantly. According to statistical data, global retail e-commerce sales are expected to exceed $5.717 trillion in 2022, up from $5.221 trillion in 2021 [2]. The use of technology is very important to increase a pleasant shopping experience in an e-commerce business that continues to grow and becomes increasingly competitive. One trend that many e-commerce businesses are following is adopting augmented reality technology.

Augmented reality is a technological advancement in e-commerce that combines virtual objects with real environments. [3]. Augmented reality can address the issue of customers not comprehending the size and details of products sold via e-commerce. This technology allows customers to “see” and “try on” products virtually by involving real-world and digital elements. [4]. For example, augmented reality can virtually display shoes on a customer's feet, a watch on their wrist, the color of lipstick on their lips, and realistically display virtual clothing on the user's body [5]. Apart from that, augmented reality has the potential to bridge the perceived divide between offline shopping and online shopping experiences [6]. Shopping using augmented reality is even more engaging and iterative than at traditional brick-and-mortar establishments.

Augmented reality in e-commerce has the potential to improve user experience [7]. By using augmented reality, customers can experience a pleasant shopping experience [8], and make customers carry out purchase retention [9], because augmented reality can make it easier for users to understand and use products online.

There is still not much research that comprehensively discusses the trends and impact of augmented reality in e-commerce. Therefore, this research was carried out to overcome these limitations and get a more profound comprehension of the trends and impact of augmented reality in e-commerce. So this research question is: What are the current trends and applications of augmented reality in the e-commerce landscape, as identified in the existing literature? How does augmented reality impact user experience, satisfaction and consumer behavior, in the context of e-commerce, according to the findings of previous

studies? What gaps emerge from the systematic literature review, and what recommendations can be proposed for future research and practical implementation of augmented reality in the e-commerce sector?

This research will help the e-commerce industry understand the augmented reality trend and the many impacts of using this technology. It will also offer practical implementations of augmented reality in the industry based on current research findings. This research also provides benefits for future researchers to find out various gaps and recommendations proposed from existing literature regarding augmented reality in e-commerce. This research consists of several sections including: section 1 introduction, section 2 theoretical background, section 3 contains a methodological overview, section 4 contains results and discussion, and is followed by section 5, namely conclusions.

I. THEORETICAL BACKGROUND

Technology known as "augmented reality," or "AR," overlays real-time virtual images captured by computers onto the outside world. This makes it possible to place virtual object behind real-world objects and observed and interacted with in real time [10]. Throughout the 1960s, System AR's development was overseen by Ivan Sutherland [10].

Augmented reality in e-commerce continues to develop, making many researchers conduct research related to augmented reality in e-commerce. In e-commerce virtual try-ons and AR social media filters are widely used according to [11] virtual try-on is a technology that allows consumers to try on different clothes without physically wearing them. AR social media filter according to [12] is a type of interaction where AR elements are applied to the user's face or environment on SNS. The use of augmented reality in e-commerce has a positive impact on user experience [13], where according to [14] customers can feel the appearance of products online, augmented reality also influences customer satisfaction [15], where the appearance of virtual products and the pleasure they feel make customers satisfied. Other researchers have conducted research on consumer behavior, where the use of augmented reality in e-commerce can make users make repeat purchases [16].

II. REVIEW METHODOLOGY

The Systematic Literature Review (SLR) approach was applied in this research to determine and assess trends, the impact of using augmented reality, as well as recommendations for future research and e-commerce that have been carried out in previous studies. SLR was used with the PRISMA method [17] and guidelines proposed by [18]. The research consists of three stages as shown in Figure 1.

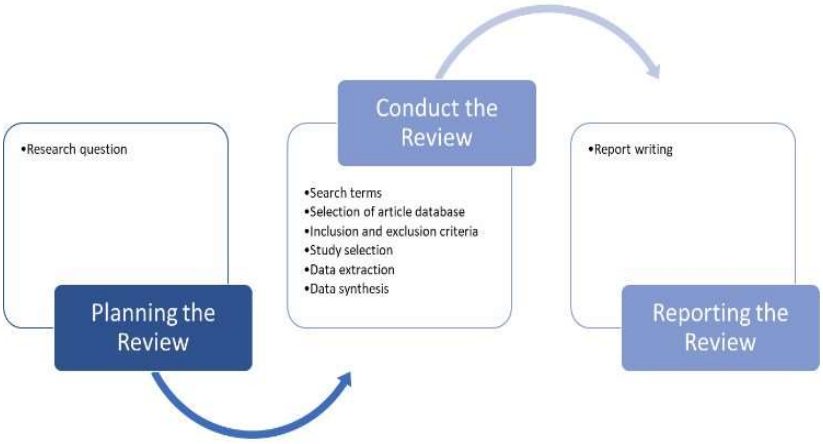

Fig. 1. Stage of SLR

A. Planning the Revuew

This stage is the initial stage in the SLR which consists of a research question

1) Research Question

Research questions are created to help researchers determine the scope of the problem to be solved in this research. The research questions of this research are as follows:

- RQ1: What are the current trends and applications of augmented reality in the e-commerce landscape, as identified in the existing literature?
- RQ2: How does augmented reality impact on user experience, satisfaction and consumer behavior, in the context of e-commerce, according to the findings of previous studies?
- RQ3: What gaps emerge from the systematic literature review, and what recommendations can be proposed for future research and practical implementation of augmented reality in the e-commerce sector?

B. Conduct the Review

This stage is the implementation stage of SLR which consists of search terms, selection of article databases, inclusion and exclusion criteria, study selection, data extraction, and data synthesis.

1) Search Terms

A keyword search is conducted to find articles that are appropriate to answer the research question. Certain keywords and Boolean operators are used to create search queries. The search string for this research is (Augmented reality AND E-commerce) AND (User OR Consumer) AND (Experience OR Behavior)

2) Selection of Article Database

Scopus, Google Scholar, Taylor & Francis, Springer, emerald.com, and ScienceDirect were the databases selected for this research. Queries for Taylor & Francis, Springer, emerald.com, and ScienceDirect were exported manually using the official export function, while queries for Scopus and Google Scholar were automated with Publish or Perish [19].

3) Inclusion and Exclusion

Selection criteria are used to reduce the possibility of bias in research [18], criteria consist of inclusion and exclusion criteria. Inclusion and exclusion criteria are explained table 1.

TABLE I. INCLUSION AND EXCLUSION

Inclusion Criteria	*Exclusion Criteria*
Publish article between 2019- 2023	Publish article under 2019
Article written in English	Article written not in English
Augmented reality and e-commerce related	Not related to augmented reality and e-commerce
Based on the title and abstract, the research offers potential solutions to the research question	Based on the title and abstract, research that does not offer potential solutions to the research question
Possibility of full text open access	Not available for full text access

4) Study Selection

At this stage, the prism method is used, as shown in Figure 2.

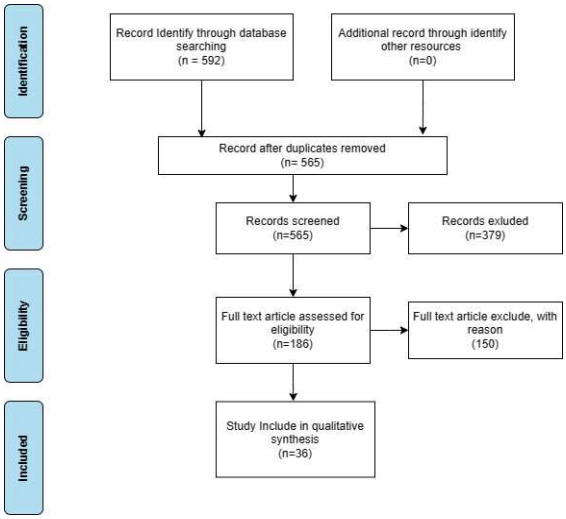

Fig. 2. Study selection

An initial search of the selected databases with the search string yielded 592 articles. The first step was to filter out duplicates, resulting in 27 articles being excluded, leaving 565 articles. The next stage of screening was title and abstract screening, resulting in 379 articles being excluded and leaving 186 articles. After that, 150 article were subsequently removed

due to their failure to satisfy inclusion and exclusion criteria in table 1, which ultimately resulted in a qualitative synthetic consisting of 36 articles.

5) Data Extraction

The process of data extraction is utilized to gather all the information required to respond to the review question [18]. The data extraction is important information in the article such as title, author, year, publisher, main findings.

6) Data Synthesis

Data synthesis involves collating and summarizing key study findings [18]. Results and discussion of the RQ data can be found in Section 4.

III. RESULT AND DISCUSSION

A. Trend and applications of augmented reality in the e-commerce landscape, as identified in the existing literature

Virtual try-on, placement preview, and social media filters are augmented reality trends in the e-commerce sector that the author discovered based on existing literature (see Figure 3). Virtual try-on is the ability to attach an object to someone realistically (P01) and can provide an interesting experience related to reality during the purchasing process (P02). In virtual try-on, a camera is needed to identify or capture images containing data that will be displayed on the user's screen in real time (P03). The next trend is social media filters, this trend is a special interaction where Augmented reality elements are applied to the user's face or environment on SNS, especially Instagram (P04). This social media filter is used by brands as a marketing communication channel (P05). According to (P04), this trend can increase customer satisfaction in using it and can encourage behavioral intentions towards the brand and also towards social networks. Then another trend is preview placement. This trend lets users to insert virtual object in actual environments, such as furniture (P06), then this trend can realize interactivity with virtual objects. For example, with placement applications such as IKEA Place, customers may organize, alter, and change virtual furniture pieces to fit diverse actual locations.

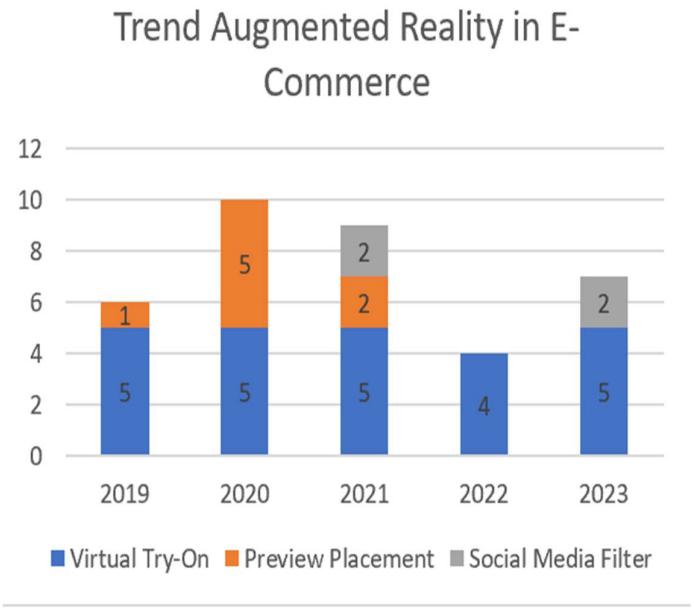

Fig. 3. Trend augmented reality in e-commerce

In order to improve the shopping experience, augmented reality has been applied extensively in e-commerce across a number of product categories (see table 2). Starting from the furniture category with IKEA Place (P06);(P07);(P08) and (P09), cosmetics with Sephora Virtual Artist (P10), as well as the YouCam Makeup application (P11);(P12);(P13) and (P14), sunglass with the Ray-Ban (P15) and Warby Parker (P16) applications, watch the Formex application (P01), Jawerly the LoLozem application (P17), clothes the Zalando application (P18), Zekit (P19), Zugara (P20), and Zara application (P21), as well as the sneaker category with the Wanna Kicks application (P22) and (P23).

TABLE II. APPLICATION IN AUGMENTED REALITY

Category Product	*Papers*
Furniture	P06;P07;P08;P09
Cosmetic	P10;P11;P12; P13; P14
Sunglasses	P15;P16
Watch	P01

Category Product	*Papers*
Jawerly	P17
Clothing	P18;P19;P20;P21
Sneaker	P22;P23

B. Augmented reality impact on user experience, satisfaction and consumer behavior, in the context of e-commerce, according to the findings of previous studies

At this stage the researcher conducted a literature review regarding user experience, satisfaction and consumer behavior based on existing findings.

1) User Experiences

Augmented reality in e-commerce has an impact on user experience, which is influenced by factors such as spatial presence, mental intangible novelty, perceived ease of use, and perceived enjoyment (See table 3).

a) Spatial Presence

Spatial presence (P24) refers to how real objects or virtual environments can look or feel. Based on the literature review, spatial presence allows customers to feel the look and feel of a product, and this spatial presence is more prominent in furniture applications compared to makeup (P25)

b) Mental intangibility

Virtual objects that appear in the real world have mental intangibility because they do not exist physically. With augmented reality, mental abilities can be reduced by involving multisensory (P26) such as visual, sound and touch to create a multisensory experience and improve the user experience.

c) Novelty

Novelty plays an important role in enhancing user experience. Research (P06), shows that virtual try-on features in today's e-commerce are designed to make users feel like they see themselves in a new, personalized light. By using this innovation, customers can have a more interesting, unique and personalized online shopping experience which in turn improves the user experience in augmented reality applications.

d) Perceived Ease of Use

The term "perceived ease of use" describes how quickly and easily users may assess how much effort and time it will take to get familiar with the system. According to (P27), shows that customers believe that using the system can increase effectiveness because it offers various quality features that are easy to use, and based on (P09), demonstrates how users are more likely to make a purchase when AR applications are easy to use. The ease of using augmented reality applications can improve the user experience because users have no difficulty interacting using augmented reality.

e) Perceived Enjoyment

Perceived enjoyment reflects consumers' perceptions of the pleasure experienced in the shopping experience when using augmented reality, not from the completion of the shopping activity. The pleasure felt not only makes the user experience better but can also encourage the influence of positive attitudes. According to (P28), perceived enjoyment felt turns out to have an influence on satisfaction and purchase intention, then according to (P10) the impact of online product display on brand views is favorably mediated by perceived enjoyment, and according to (P15) perceived enjoyment controls the influence of perceived informativeness on attitudes and usage intentions.

TABLE III. USER EXPERIENCES

User Experiences	*Papers*
Spatial presence	P24;P25
Mental intangibility	P26
Novelty	P06
Perceived ease to use	P09;P27
Perceived enjoyment	P10;P15;P28

2) Satisfaction

Customer satisfaction is a psychological and evaluative response to the experience of using augmented reality apps. Satisfaction is related to user experience, where everything that creates value from virtual products has a significant influence

on customer satisfaction (P27). Just as perceived enjoyment felt by customers can influence customer satisfaction (P28), then novelty also influences customer satisfaction (P29).

3) Consumer Behavior

Based on the literature review, it has been found that positive user experiences and satisfaction in using augmented reality in the e-commerce sector have an impact on consumer behavior as seen from purchase intention, reuse intention, and patronage intention (see table 4)

a) Purchase Intention

Purchase intention is the term used to describe consumers' potential willingness to make purchases of products. The use of AR which involves virtual objects then attractive AR information (P30) and (P31) the use of augmented reality which makes it easier to visualize products online has a positive impact on customer decisions to buy products.

b) Reuse Intention

The term "reuse intention" describes the user's desire to make use of the augmented reality application again. According to the literature (P32), shows that an immersive consumer experience results from increased sensory perception. This sense of immersion will make people feel the presence of the product even more. Consequently, customers who sense a product's existence view their experience as being more like what would often occur in a real-world buying setting. Therefore, consumers perceive product inspection as "real" because of the feeling of product presence. Consumers have a more favorable perception of AR-based apps due to the authenticity and presence of the supported product. This results in the application being used more frequently. Then according to the literature (P08), AR reuse intention is influenced by the product informativeness, quality of the interactivity system, and reality suitability.

c) Patronage Intention

Patronage intention refers to the willingness of customers to interact, buy and reuse AR applications. According to literature review (P33), the presence of AR in online stores increases attractiveness because it reduces the perception of purchase risk and in turn increases patronage intention.

TABLE IV. CONSUMER BEHAVIOR

Consumer Behavior	***Papers***
Purchase intention	P30;P31
Reuse intention	P08;P32
Patronage intention	P33

C. Gaps emerge from the systematic literature review, and recommendations can be proposed for future research and practical implementation of augmented reality in the e-commerce sector

The literature review reveals certain gaps, including in the representation of age and generation. For example, in reviews (P07); (P08); (P10);(P15);(P26);(P27), and (P32), researchers studied respondents who were potential AR users and had an average age of 17 to 30 years. These respondents are presumably younger and more tech-savvy than older generations, which limits the generalizability of the findings in the literature. As a result, there is a research gap in the augmented reality literature in the e-commerce sector because there is a limited elderly sample. Future research should therefore take this into account and examine a more diverse population comprising both younger and older generations, so that discrepancies in findings can be observed later on. Another gap is the gap in gender where the literature review is from (P24) and (P32), while this study only included female respondents, and there is a gap among men, further research could examine the role of gender in narrowing the use and success of augmented reality applications in e-commerce. The next gap is that most researchers only explore the positive impact of using augmented reality in e-commerce and rarely discuss its negative impacts, such as samples (P07); (P10) and(P35), therefore to provide a more complete picture of the impact of using augmented reality, future research must consider the negative impact of using augmented reality such as privacy risks or information risks.

From various literature reviews that were the research sample, the author found various practical recommendations that could be useful for the e-commerce sector. These practical recommendations are recommendation to implement and optimizing augmented reality technology into e-commerce business strategies. In implementing or optimizing augmented reality, companies must get benefits from implementing augmented reality in the long term, not just the short term. Therefore, companies must provide augmented reality applications that are interactive, informative, and novel. Interactivity by including additional options to organize, change, and rotate displayed products. Additionally, they must continue to improve the quality and power of their AR tools and ensure that their cameras match virtual and real-world objects, even in harsh light conditions (P08). Informative means the company must provide customers with all the information they need to make better purchasing decisions. Examples of this information include high-quality virtual images of the product, the ability to virtually try it in an augmented reality setting, enhanced product appearance through the integration of the virtual and physical worlds, and simple

access to product online stores. (P22). Novelty refers to presenting new, adaptable stimuli to customers via augmented reality that are dependent on their choices and behaviors. It offers a distinctive digital media experience for personal spaces by fusing the real and virtual worlds in a novel way (P06).

Additionally, to maintain a balance between innovation and user convenience, they should also provide non-AR options for customers who may not be interested in augmented reality features (P24). Companies can also use a "Playgrounds" approach to encourage customer creativity and enhance the customer experience in a variety of ways with AR. Providing a social effect through opportunities for customers to engage socially and expressively while shopping, as Nike and Gucci do with AR functionality to try on different shoe designs, perhaps consider including social features on their new sneakers to get feedback from experts and peers work (P07).

Subsequently, the e-commerce industry may also leverage AR Filters on social media to market their products, emphasizing engaging and enjoyable aspects. The diversity of filters will be continually added to prevent user fatigue and enhance the overall interaction. Apart from that, you can also increase the aesthetics of the filter (P04). Then companies can also increase community engagement by encouraging sharing of experiences using AR filters through competitions and challenges (P36). As well as companies are also advised to create AR advertising experiences that are more realistic in order to uphold moral marketing principles and take greater responsibility for the health of consumers (P34).

IV. CONCLUSION

A. Conclusion

The Systematic Literature Review (SLR) used in this research has provided an in-depth understanding of Augmented reality in the e-commerce sector. This research found various trends that emerged in this period, including virtual try-on, preview placement, and social media filters. Virtual try-on are the most frequently found trend in the literature in this research, followed by preview placement and also social media filters. Apart from that, this research also found the impact of using augmented reality in the e-commerce sector as seen from user experience, satisfaction and consumer behavior. Augmented reality in e-commerce has an impact on user experience, which is influenced by factors such as spatial presence, mental intangible, novelty, perceived ease of use, and perceived enjoyment. Satisfaction is related to user experience, where everything that creates value from a virtual product has a significant influence on customer satisfaction. Positive user experiences and satisfaction in using augmented reality in the e-commerce sector have an impact on consumer behavior as seen from purchase intention, reuse intention, and patronage intention. This research also provides recommendations for implementing or optimizing augmented reality. Where companies must provide augmented reality applications that are informative, interactive and novel.

B. Future Research

There is still little research that discusses the trend of social media filters in augmented reality in e-commerce. Therefore, for future researchers, the author hopes to overcome these limitations by conducting research on social media filters in augmented reality in e-commerce. Apart from that, this research focuses more on the positive impact of using augmented reality in e-commerce, therefore researchers also hope that future research can discuss the positive and negative impacts of augmented reality users.

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Appendix Literature Sample (n=36)

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