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Technology Trends and Augmented Reality: A Systematics Literature Review

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ABSTRACT

The real environment is combined with artificial virtual things to create a dynamic, context-based and interactive augmented reality. Therefore, with the latest advances in augmented reality technology and using diverse displays in mobile computing system, augmented reality is affordable for the public. However, its use, as well as the variety of concepts have not yet been fully explored. Therefore, on this page, we describe the variety of industries that have used augmented reality in a variety of uses as well as a variety of displays. Therefore, in order to find relevant data about various industries using augmented reality, a review study involving filtering information from two databases was done. The results of the analysis found a total of 2,929 primary research articles that had been published between 2020 and 2024. While the literature review found that the authors paid attention to the sample size, methodology, devices used, field and results. We conclude that augmented reality design technology is able to thrive by incorporating more fields and capabilities.

1. Introduction

A new technology called augmented reality allows users to superimpose photos, text, videos, and audio components over real-world scenes. This is due to the potential for augmented reality software, hardware, and smart glasses to enhance practically every sector of the economy, from retail to manufacturing. The main forces driving the tech industry are already apparent in augmented reality, as is its potential to address some of the biggest issues, are taken from the previous studies [2,13].

In contrast to virtual reality, augmented reality allows users to encounter virtual items that actually appear in the real environment and interact with them as well, research by Hawkinson, E., [7]. According to [13], the real environment and virtual environments are found at the two ends of the reality-virtual continuum, the position of augmented reality on the continuum is between the real world and its centre. The library now offers a wide variety of multimedia and online materials,

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however assessments of research on the topic of augmented reality technology are less well-examined. This paper's goal is to identify the fields of research that use augmented reality technology with various concepts and devices to see the trends and development of the technology. More specifically, what field, and what equipment are suited is the main research question (RQ).

2. Systematic Literature Review Approach

The following are the most frequent justifications for doing a systematic literature review:

i. To summarise the available evidence.
ii. To pinpoint any research gaps and offer potential areas for additional study.
iii. To offer a foundation or context in order to situate new research endeavours properly.

The benefits of systematic literature reviews include the following:

i. While publication bias in primary studies is unaffected, the well-defined approach lowers the possibility of biased outcomes in the literature.
ii. They can provide specifics on a phenomenon's effects in a range of settings and empirical methods. Systematic reviews show the phenomena is really significant and transferable if the research yields reliable findings. If the investigations yield inconsistent results, it is possible to study the roots of variance.
iii. When it comes to quantitative investigations, meta-analytic methods can be used to combine data. This enhances the possibility of finding true impacts that smaller, more focused studies are less likely to find [3].

The planning stipulates the five Systematic Literature Review (SLR) processes of searching, scoping, synthesis, analysis, authoring, data extraction, and screening.

2.1 The Planning for Searching

During this stage, you can explore online scientific databases for relevant literature. Google Scholar and Science Direct were chosen as the two (2) relevant literature databases.

2.2 The Establishing the Extent

The patient problem of population, intervention, comparison or control, and outcomes (PICOC) framework underlines the necessity for outcomes to be quantified because the best proof comes from thorough studies that yield statistically significant results. Users make up the study's target group, which helps researchers formulate insightful, receptive research questions about augmented reality design. The remedy being considered is the use of augmented reality design tools for models. The application to create new augmented reality technology, models, and concepts is what the results are. For the selection procedure, inclusion and exclusion criteria have been devised.

2.3 The Searching

The search criteria used to find the relevant material in a paper's title and text are "augmented reality design," OR," Augmented Reality," because the terms "augmented reality design" and

"augmented reality" are synonymous. Additional search phrases include "augmented reality" and "specific field being searched, such as sport, science fiction, animation, etc."

2.4 The Screening

The papers are thoroughly scrutinised, and then a final selection is made of those that are crucial for resolving the research concerns. Articles that were published between 2020 and 2024 are taken into account by the search criteria. Board game design, SLR, and studies unrelated to augmented reality technologically were removed from the study pool. (Figure 1) The selection technique involved skimming the title abstract, findings, introduction, and conclusions as well as the entire text. Duplicates were eliminated, and quality as-Quality Assessment (QA) was utilised. The following are two QA standards that we created for this review to rate the calibre of each study:

QA1: How closely linked is the subject of the paper?
QA2: Did the paper's study approach match up?

Each article was given a rating using the following scale: Yes = 1 point, No = 0 point, and Partially = 0.5 point. Each study that was chosen received an overall quality grade ranging from 0 (extremely irrelevant) to 4 (very high). Finding and choosing 10 publications that were relevant to augmented reality in a field environment was the last step.

2.5 The Data Analysis

Before moving on to the screening section for the second phase, articles will be categorized into identification to be rejected, such as articles with incomplete information, articles without abstracts, unrelated titles, duplicates, and so on, after reviewing the final selected papers based on keyword augmented reality, augmented reality AND "specific field being searched such as sport, science fiction, animation, and etc.," (based on field that searching). The inclusion phase follows the third phase of eligibility, which involves a more thorough screening to ensure that the content satisfies the requirements of research and fields that are not duplicated. In order to identify the type of prospective augmented reality and field for the article from the chosen database, categorization was done using the PRISMA flowchart in (Figure 1).

PRISMA is an evidence-based minimal reporting standard for comprehensive studies and meta-analyses. PRISMA is largely focused on publishing studies that assess the results of interventions, even if it can be used as a foundation for systematic reviews that don't just want to assess interventions (such as analysing etiology, prevalence, diagnosis, or prognosis). In addition to being helpful for critically assessing published systematic reviews, the PRISMA diagram is intended to support authors by enhancing the reporting of systematic reviews and meta-analyses, are taken from the previous studies [12].

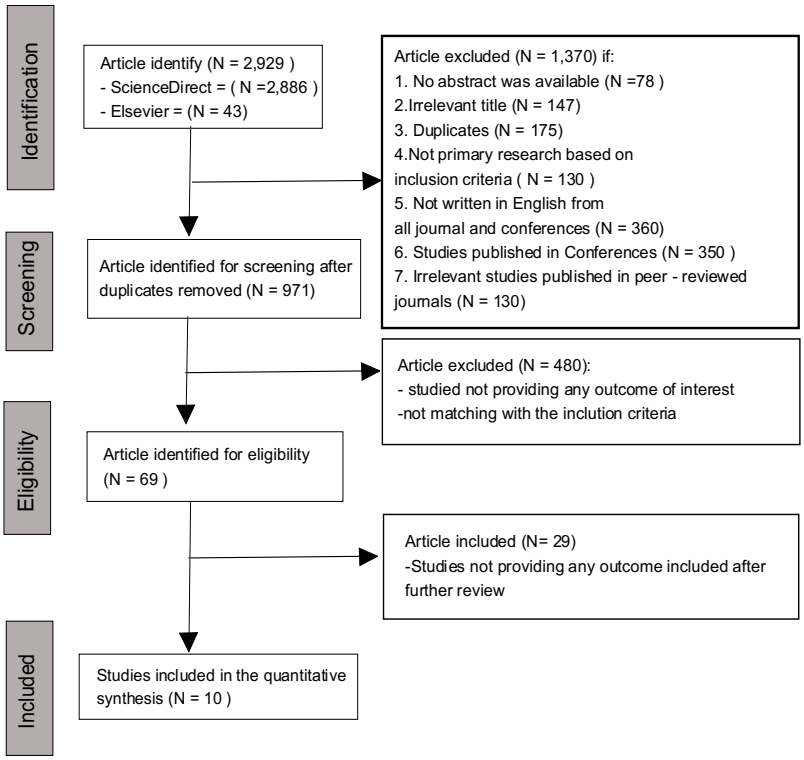

Fig. 1. PRISMA Flowchart

3. Result

There were 2,929 main studies found overall thanks to the search process. The research question developed based on the identified primary studies is summarized in the following sections. Because these databases produced papers connected to augmented reality, the majority of related articles were found there. According to this analysis, from 2020 to 2024, there will be a rise in the number of publications produced. The sharp rise could be attributed to technology advancements and growing demand for augmented reality design. The findings reveal that the following ten (10) categories include the most talked-about augmented reality design possibilities. The categories of fields discovered in the design of augmented reality educational games about are shown in (Table 1) as the findings of the SLR study.

3.1 Reading Resources

Almost anywhere can serve as the source of information. Take a look at the table below, which evaluates data from several sources.

3.2 Distinguishing Features

A textbook is a structured collection of knowledge that is useful for the academic study of a subject. A good textbook can be recognised by:

i. A discrete, well-bounded scope
ii. Use of examples and problems
iii. Internal coherence of style.
iv. An organized framework

3.3 Scholarly Journals

An academic is submitting excellent research articles to a journal that specialises in one area of study once it has undergone peer review. Academic journals offer platforms for the introduction, presentation, and criticism of current research as well as the evaluation of earlier work to serve as a reference for budding researchers. In this case, researchers search relevant journals, books, news, and magazines in addition to journal papers from conferences and other venues.

Augmented reality is the technique of superimposing digital or computer-generated content, such as images, audio, videos, haptic or tactile sensations in a live environment. All five senses can benefit from augmented reality technology, although visual applications are now the most common. Head-up displays (HUD), holographic displays, optical see-through displays fitted into smart glasses, and handheld and smartphone-based devices are the four main categories of augmented reality technology.

An earlier study discovered that users are lured to the augmented reality paradigm if they want to teach in a more engaging way. This study's primary objective was to examine model design in order to facilitate model development to meet the needs of target audiences, including tool, the edutainment gameplay genre, compassion, and efficacy. The results and recommendations in this section are based on a review and analysis of 10 papers that were written about the application of augmented reality in education and were published between 2020 and 2024. The publications were picked at random. The literature review's summary can be found in (Table 1).

Table 1
Summary of Literature Review

Reference	number of samples	methodology	Devices	Field	Result
Innovating the cultural heritage museum service model through virtual reality and augmented reality: the effects on the overall visitor experience and satisfaction [16]	A random sample of 739 visitors to the Pacis Museum in Rome participated in the "The Ara It Was" initiative.	A quantitative survey technique may involve correlation analysis, importance-performance analysis (IPA), descriptive statistics, and cluster analysis.	a 3D tracking system and a Samsung S7 smartphone are both attached to a Samsung Gear VR headset.	museum service	The study initiates the academic discussion surrounding Museum 4.0, makes theoretical advances, and has managerial implications for upcoming advancements in museum management.
Augmented Reality, a Review of a Way to Represent and Manipulate 3D Chemical Structures [6]	143 research publications were chosen for examination, and they were taken from Web of Science between 2018 and 2020.	A descriptive analysis Phase 1: Selection of the Sample of Documents. Phase 2: Content Analysis of the Documents.	Augmented reality	implemented in chemistry, both in academic settings and in research settings.	Despite the fact that the traditional 2D screen depiction is still preferred when teaching chemistry, the application of AR in early education has the potential to enhance knowledge and understanding of chemical structures. The increasing interconnection of augmented reality technology with online services and scientific networks may create new opportunities for teaching strategies.

Augmented Reality and Virtual Reality in Dentistry: Highlights from the Current Research [5]	Using particular keywords relating to Virtual reality (VR) and augmented reality (AR) many dental disciplines, a literature search was undertaken in four databases for English-language journal articles that have undergone peer review for the past ten years up until March 31, 2021. Only 68 of the 101 articles found throughout the literature search were deemed pertinent and given further examination, assisting the researchers in finding 33 full-text publications. There were 20 items left after 13 full texts were discarded from further analysis.	articles found in the literature search	Augmented reality	dentistry	It has been discovered that AR and VR are useful tools for clinical practise as well as for improving students' learning throughout their pre-clinical education and training sessions.
Augmented Reality Applications for Learning Geography in Primary Education [17].	43 fifth and sixth grade kids, six teachers, and students studying computer science were included in the study. (N = 43)	Quantitative Method	Augmented reality game based - Android mobile devices	Education	They showed that everyone had a positive opinion of augmented reality technology and was open to having it used in the classroom.
Augmented Reality, Virtual Reality, and Game Technologies in Ophthalmology Training [9].	1.The years 1995 to 2021 are covered in the articles. Identify earlier research 2. exclusion standards 3. Examine Studies Related to AR in Optical Sciences Training That Are Currently Available	Search Strategy	systematic review	Ophthalmology	The analysed Eyesi, Microvistouch, and PixEye simulations helped ophthalmology residents feel more confident about doing cataract surgery in real life.

The application of augmented reality on the anatomy of the human body to support the learning of point-by-point cupping of alternative medicine [1].	10 respondent, = 3 employees, 1 Cupping Clinic owner Bekam dan 6 patients	Manufacturing level (Assembly). Implementation Level ISO 25010 testing-Functional Suitability, usability aspects and portability aspects Usability Testing	Smartphone	Medic and education	The human body's anatomy can conduct all of its functions perfectly using cupping points in augmented reality. The usability component of this application is quite valuable, as evidenced by the overall value of 93.23% acquired from the testing of the quality of the usability aspect conducted on general respondents. The outcome of evaluating the portability aspect's quality across a number of smartphones running Android 10 as well as Lollipop, Marshmallow, and Oreo. demonstrates that the application can be set up and used on various hardware. such that the software meets the target of 100% portability quality. Suggestions The recommendations for more research on the use of Android-based augmented reality technology for understanding cupping locations on the anatomy of the human body are based on the conclusions and research findings that have been described.

Star Trek and the Metaverse: An Analysis of Foresight for Augmented Reality in Science Fiction [7].	-	- Previous study	AR Board Games and Holograms	to analyse science fiction's ability to foretell the future, with a focus on Star Trek and all of its variations, and to contrast and compare it to current developments in immersive digital media.	There were recurring themes of electronics going from our pockets to our faces and the effects of always having a digital display in our field of vision. enquiring about the long-term ramifications of consumption, including their psychological, physiological, and health impacts. Diminished reality, rather than only augmented reality, being used in a variety of ways and being linked to social status indicates a developing tendency in the digital divide. Even more of the technology featured in Star Trek is likely to become reality in the coming years, so perhaps we should keep looking at these themes from that show and other works of science fiction to identify the best practises and results while minimising the risks and potential harms as we further develop augmented reality.

Planning Virtual Application Fitting Muslim Men's Clothing Based on Augmented Reality [11].	43 respondents	The User Experience Questionnaire (UEQ) and the Black Box Testing approach are the testing techniques employed by the author. Software testing is known as "Black Box Testing." A fast evaluation can be obtained by using the user experience questionnaire. how many Google Forms questions test takers answered as part of the UEQ. The six scales on the user experience questionnaire are novelty, attractiveness, clarity, efficiency, and accuracy.	Android or iOS	fitting room	1. Using the capture feature on the scanner page, the user can view the results of the 3D objects selected in the catalogue without removing the clothing used to try on the 3D objects of the clothing. 2. This programme makes use of a marker less scanning system, a tracking object system, and a rotating 3D object functionality for clothing. 3. The programme can perform successfully based on testing utilising functional black box testing. 4. This application has been effectively produced based on the findings of clarity and efficiency with good results, outstanding outcomes for attractiveness, accuracy, and novelty stimulation.
Effect of Augmented Reality Affordance on Motor Performance: In the Sport Climbing [10].	40 primary school pupils between the ages of 8 and 10 who had never engaged in sport climbing were chosen for this study. A traditional climbing class (20 students) and a learning class (20 students) using augmented reality affordances were formed from the subjects.	By imitating the character's movements, a novice climber might use the projection-based augmented reality affordance system to scale the artificial climbing apparatus. In order to analyse the impacts on exercise performance, this study compared the performance evaluation scores before and after a class between the traditional group and the augmented reality affordance group.	Character animation system for climbing in projection-based augmented reality.	sport climbing	The results showed that using augmented reality affordance for sport climbing was just as successful as using a conventional teaching technique.

The effect of augmented reality versus traditional advertising: a comparison between neurophysiological and self-reported measures [15].	A laboratory investigation involved 60 individuals, including students and employees from a mid-sized European university (Mage = 24.6, SD = 4.8; 50% females).	The outcomes of two laboratory investigations that take into account self-reported measures of affect intensity and willingness, as well as physiological measurements of arousal (galvanic skin reaction).	iPhone 6S	advertising	These findings may have ramifications for customer segmentation and marketing strategy because switching standard commercials to augmented reality ones improves customers' physiological responses and willingness to pay.

4. Discussion

We found 43 from Elsevier and 2,886 from ScienceDirect for a total of 2,929 studies (Figure 1). 175 duplicates, 78 unavailable abstracts, 147 irrelevant titles, 130 results that were not primary research according to inclusion criteria, 360 non-English articles from all journals and conferences, 350 conference papers, and 130 irrelevant papers from peer-reviewed journals were all removed, leaving 1370 distinct results. Screening these researches yielded 971 full text reports in total after excluding 851 titles, abstracts, posters, comments, author notes, case reports, and publications written in a language other than English. Then, among these 588 different full-text reports, only those that met the cautious criteria and had any intriguing findings were kept. Only 10 studies were relevant to our systematic review and were included in the qualitative analysis out of a total of 69 studies because they did not provide any interesting results or were inconsistent with the inclusion criteria. Additionally, 29 articles did not provide any results at all. According to the screening's findings, augmented reality technology is now being used more frequently in a variety of industries, particularly those related to education, medicine, and entertainment. The study of activities including athletics, shipping, agriculture, animal husbandry, the film industry, and sewing, however, is still under-researched.

5. Conclusion

The conclusion for an earlier review article from 2020 to 2024 explains a method review study on the use of augmented reality. According to (Table 1), augmented reality has been used in a number of fields, including education, medical, advertising, services, dentistry, ophthalmology, science fiction, fitting rooms, and athletics. There are still certain limitations to this work even if it shows the diversity of the augmented reality technology sector. This limitation presents an opportunity for further investigation. First, the journal papers for this study were retrieved and selected based on our standards. As a result, we can overlook some crucial facts. For instance, we chose Science Direct and Elsevier core collections as our sources of data extraction to ensure the quality of the literature analysed in this study. By extracting literature from additional databases like Scopus, Emerald, Wiley, and Google Scholar, future studies could incorporate data from conference proceedings, research reports, working papers, theses and dissertations, books, magazines, white papers, and industry reports. Extending the investigation's scope and adding more resources are necessary for gaining new insights. The writer's expertise and experience are also drawn upon to direct the examination of the literature. The research's conclusions might not be very generalizable as a result. Future research can make more sense of the larger literature as a result of the increase in publications on AR marketing by using analytical tools like meta-analysis, bibliometric analysis, and text mining.

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