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# Mapping the Research Landscape of 360-degree Visual Integrated Virtual Guides: A Bibliometric Review

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**Abstrak:**

Integrating 360-degree images into a building's virtual guide or receptionist is an emerging multidisciplinary study area that needs more focus. The first bibliometric analysis of recent research on the connection between virtual guides/receptionists and 360-degree visuals is presented in this paper. Scopus examined publications from 2019 to 2024 to determine subjects, productivity, impact, and collaboration. The findings indicate a rise in yearly production, with over 62 publications released in 2023 attesting to heightened research activity. Additionally, more recent papers have a larger citation effect, demonstrating their relevance today. Most prolific writers are from the US, the UK, and China. However, developing nations like Indonesia, Denmark, and Iran are among the top authoring nations, suggesting an increasing internationalisation. The West is the focal point of international cooperation. However, alliances with China are growing. This quantitative intelligence is a standard for upcoming research in this enormously promising field. Monitoring by bibliographers ought to go on as the conversation develops. The field of dental health, which is extensively utilised in the dental surgery process, surprisingly dominates the production of studies on this issue; this does not preclude the possibility of using 360-degree visual integration in diverse sectors. More involvement from marginalised stakeholders is required to responsibly develop 360-degree visual integration in virtual receptionists and guides.

**Kata kunci:** bibliometric analysis; virtual guide; virtual receptionist; visual 360-degree

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## Introduction

A knowledgeable guide or receptionist can tremendously impact a building's visitor service. The best tour guides and receptionists engage visitors in conversation and impart knowledge, which can result in superior service from the establishment. (Swartout et al. 2010). In addition, a guide/receptionist will direct and assist guests' needs when visiting a building. Unfortunately, human guides/receptionists are often limited due to personnel efficiency. Numerous studies have demonstrated that people's reactions to virtual people are identical to those of real people (Gratch et al. 2007; Krämer, Tietz, and Bente 2003).

In this digital era, technology continues to develop rapidly and presents various innovations in various fields, including in terms of exploring a building (Bosch and Deckert 2023). Virtual guide/receptionist, an innovation that utilizes technology in displaying virtual reality (Maulik et al. 2022; Shila Jawale et al. 2022), is now here to offer a new immersive experience for building visitors. With the virtual guide/receptionist, visitors can virtually explore the building as if they were there in person. This technology allows visitors to see every corner of the building in incredible detail, even exploring rooms that are not physically accessible. In addition, the virtual guide/receptionist can also be equipped with interactive information that is educational and useful. (Petrič and Žlajpah 2020) like a substitute for a receptionist in a building, such as

the location of the official or staff room, the job description of each personnel in the building and some other important information that is needed and can be accessed publicly. This will make it easier to direct visitors with various needs when visiting the building. The virtual guide/receptionist is a personal assistant for present visitors and helps provide the information and navigation needed.

A virtual guide/receptionist offers visitors and building managers many benefits. For visitors, virtual guides provide convenience and flexibility in exploring the building without having to be bound by time and physical limitations (Flotynski et al. 2019). Visitors can explore the building whenever and wherever they are, simply by using a mobile device or computer. For building managers, virtual guides such as tour guides and brochures can improve operational efficiency and reduce operational costs. Virtual guides/receptionists can also help attract more visitors and improve the building's image.

The application of virtual guides in Indonesia is still relatively new, but the potential is huge. As technology and digital infrastructure continue to develop, virtual guides/receptionists are predicted to become the new standard in exploring buildings and tourist attractions. We have a platform to experiment with and demonstrate various strategies for various fields thanks to the Virtual Guide (Hofs, Theune, and op den Akker 2010). Most of the components have a common design, which is reinforced by the architecture's usage in other applications, such as virtual instructors (Evers and Nijholt 2000).

## Literature Study

Nowadays, virtual guides/receptionists are becoming an increasingly essential tool for building managers to help visitors navigate and explore buildings easily and conveniently. However, conventional digital guides with static maps and text descriptions are sometimes not enough to provide users a truly immersive and informative experience. To provide an immersive experience, 360-degree visual integration comes as an innovative solution to optimize digital guides (Azevedo et al. 2020; Ly et al. 2022). This technology allows users to see a complete panorama of a space, providing a deeper understanding of the layout, atmosphere and other important details. Users can feel as if they are actually inside the space, even before they step inside. Visual 360-degree not only delivers a stunning visual experience but also opens up a wide range of opportunities to enhance the functionality and added value of digital guides (Cha et al. 2020). Interactive virtual tours can be created, allowing users to explore the building at their own pace and get more information about different rooms and areas. More intuitive and easy-to-understand directions can be added, helping users find their way around more easily. Furthermore, 360-degree visuals can be combined with various multimedia elements such as text, audio and video to create a richer and more informative experience. Users can access historical information, architecture, or other interesting building features more engagingly and interactively. 360-degree visual integration also offers benefits to users with physical limitations (Zhou and Nahrstedt 2022). Wheelchair users, for example, can view a panoramic view of a room to understand its layout before they enter it, allowing them to navigate more safely and comfortably. Integrating 360-degree visuals is a significant step forward in developing digital building guides. By providing a more immersive experience, greater functionality, and better accessibility, 360-degree visuals can help building managers improve visitor satisfaction and add significant value to building operations.

Studies conducted within a specific time frame can be analysed using bibliometric analysis. This falls under the message that (Muhammad et al. 2022) conveys. The bibliometric analysis is one technique that may be used to examine publications on a specific topic. According to Zyoud et al. (2017), bibliometric analysis is an examination that makes use of both qualitative and quantitative indices, including publication year, nation, citation, and usage of common keywords. Numerous studies in the field of education have employed

bibliometric analysis (Muhammad et al. 2023; Ramadhaniyati et al. 2023). The Scopus database was utilised for this study. Alviz-Meza et al. (2022) claim that the Scopus database is the most popular.

Muhammad et al. (2023) conducted research related to this. However, this study only discusses mathematics education at all levels of education, and the data taken has not used the Scopus database. For this reason, researchers conducted a bibliometric analysis related to integrating 360-degree virtual-based virtual guide/receptionist with the Scopus database. This research aims to ascertain research focusses, publication trends, and citation patterns concerning 360-degree virtual-based virtual guide/receptionist integration from 2019 to 2024.

## **Methodology**

Bibliometric analysis is the methodology employed in this study; Rstudio software is utilized in this case with the aim of bibliometric mapping analysis, analysis of research development, country distribution, journal distribution, affiliation distribution, and author distribution in research discussing 360-degree virtual receptionist. Using scientific mapping tools, this quantitative approach examines bibliographic databases (Donthu et al. 2021). This approach was developed to give a clear and comprehensive field overview (Zupic and Čater 2014). Compared to other approaches like meta-analysis and systematic literature review, this method can analyse many publications. Because there is no requirement to eliminate publications during the sampling procedure, bibliometric analysis lessens subjectivity bias in contrast to systematic literature reviews and meta-analyses (Fauzi, Nguyễn, and Malik 2023).

### *Search strategy*

The bibliometric analysis was carried out using the Scopus database. Because Scopus covers more scientific publications than other databases like Web of Science or PubMed, it yields more thorough results for transdisciplinary themes like virtual receptions, digital guides, and 360-degree cameras. This is why Scopus was selected. The relevant articles were located using the following search string: ( ALL ( "digital guide" ) OR ALL ( "virtual receptionist" ) OR TITLE ( "360 camera" ) ) AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND ( LIMIT-TO ( DOCTYPE, "ar" ) OR LIMIT-TO ( DOCTYPE, "cp" ) ) AND ( LIMIT-TO ( LANGUAGE, "English" ) ).

### *Inclusion and Exclusion Criteria*

The analysis of recent emergent trends considered only publications released between 2014 and 2024. Additionally, the findings were narrowed down to include only English-language journal publications. Materials excluded included books, editorials, letters, notes, and brief surveys.

### *Inclusion and Exclusion Criteria*

A Scopus search produced 265 documents. After duplicates and irrelevant articles were eliminated following the inclusion/exclusion criteria, these articles were assessed for relevancy based on their titles, keywords, and abstracts.

## **Results**

### *Annual Scientific Production*

The findings of yearly scientific publications on 360-degree virtual-based virtual receptionists and guides indicate a general upward trend from 2019 to 2024, with a subsequent decline in 2021 (Figure 1). In particular, 20 articles on this subject were released in 2019. In 2020, there were 30 articles, a minor increase

of 50% from the previous year. On the other hand, there were 29 articles in 2021, which is 3.3% fewer than the year before. With 40 papers, or a 33% increase over 2021, the research trend on this topic resumed in 2022. There was a significant increase in 2023—62 documents were published, which is 50% more than in 2022. This still suggests that there is a lot of research being done on this subject.

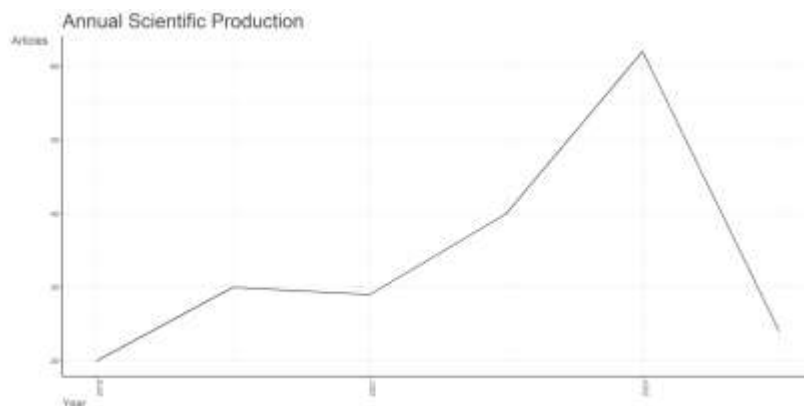


Fig 1. Annual Scientific Production

*Average Citations Per Year*

Figure 2 illustrates the trend of the average citations per article (MeanTCperArt), which increases from 2019 (5.30) to 2020 (20.77) and then declines till 2024 (1.33). However, the average citations per year (MeanTCperYear) displays a different pattern when the number of citation years is considered. There was a gain from 0.88 in 2019 to 4.15 in 2020; then 2021, there was a 1.27 decline. After that, MeanTCperYear rose to 2.47 in 2022, declined by 0.75 in 2023, and then increased by 1.33 in 2024. The rise in adjusted yearly citations between 2019 and 2020 suggests that publications published in the latter half of 2019 received more citations overall. However, after 2020, the decline in MeanTCperYear shows that citations for papers published in 2022 and 2023 that are more recent are still coming in. The corrected metric shows that publications from 2019 to 2020 have a larger yearly citation effect than older papers from 2023 and 2022, which have less time to gather citations, even though the unadjusted citation count favours older works. This points to increased research activity and the impact of current literature on virtual guides/receptionists based on 360-degree virtual environments.

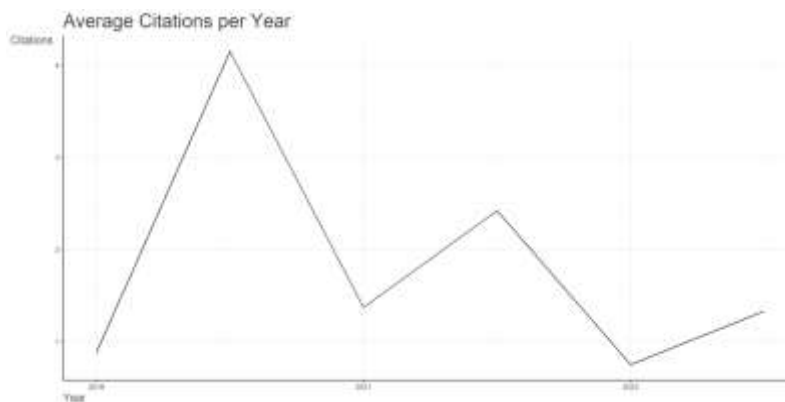


Fig 2. Average Citations Per Year

### *Most Relevant Authors*

More information about the top writers and the sources and phrases connected to them can be gleaned from the visualisation in Figure 3. As the top author, Wang L is represented by the largest node. He publishes in journals including the Journal of Oral and Maxillofacial Surgery, Drones, Journal of Dental Sciences, and Technology and Health Care: Official Journal of the European Society for Engineering and Medicine. The second-largest node features Liu Y, who publishes in several journals, including Oral and Maxillofacial Surgery, International Journal of Medical Robotics and Computer-Assisted Surgery, Drones, Journal of Aesthetic and Restorative Dentistry, Journal of Stomatology, and Frontiers in Bioengineering and Biotechnology. In addition to making substantial contributions to prestigious publications in these fields of study, other lead writers, including Chen Y, Peng L, and Li X, also frequently utilise trending keywords. Generally, prolific writers publish in journals about 360-degree virtual-based virtual guides/receptionists applied to diverse sectors in both social humanities and healthcare, and they are generally associated with Chinese institutions. As evidenced by shared keywords and joint authorship, the interconnected landscape demonstrates how these prominent writers build upon one another's work to progress this study topic cumulatively. This analysis identifies key authors who have influenced publications and the direction of research in the 360-degree virtual-based virtual guide/receptionist field.

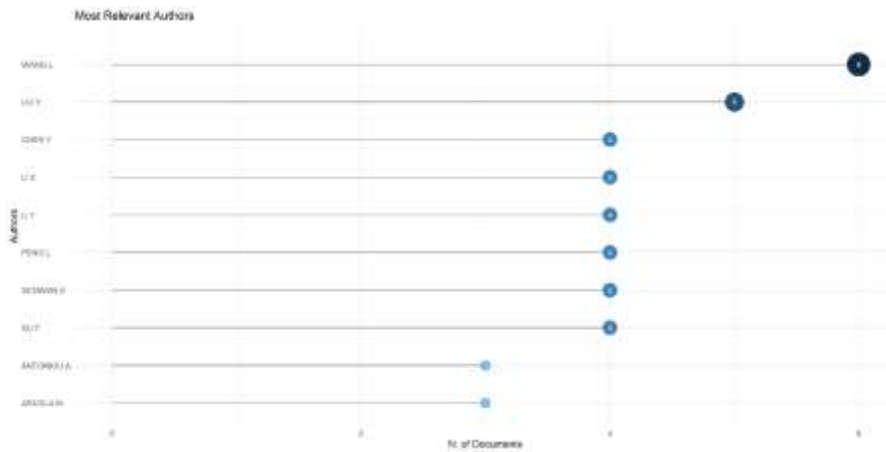


Fig 3. Most Relevant Authors

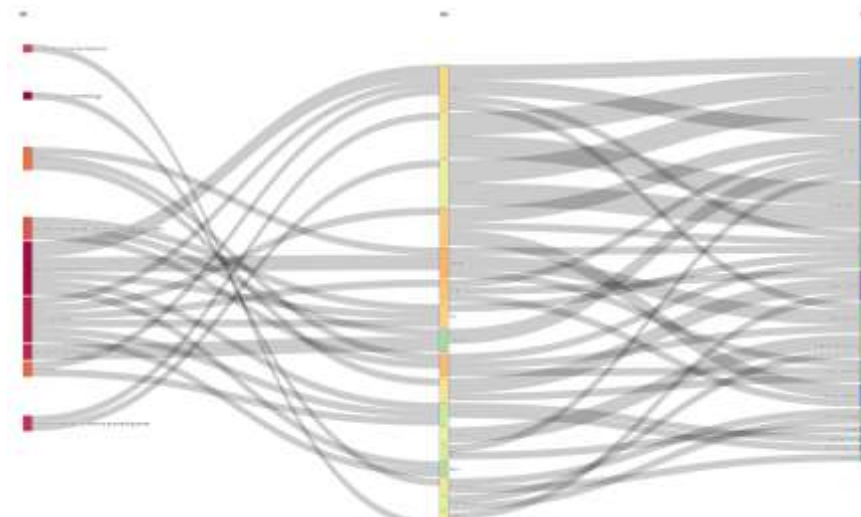




Fig 4. Three fields plot

*Affiliations Production Over Time*

According to Figure 5, the leading 360-degree virtual-based virtual guide/receptionist publishing institutions generally increase their annual research production between 2019 and 2024. China's Sichuan University, which increased from 2 articles in 2022 to 8 in 2024, demonstrated the fastest development rate. Additionally, Wuhan University's productivity increased steadily, from one article in 202 to five in 2024. Peking University School experienced similar steady growth, going from only 3 articles in 2021 to 5 in 2024. Southern Medical University continued to publish many articles, five in 2023 and five in 2024. Last but not least, Universidad de Sevilla began publishing in 2023 with one item and quickly grew to five articles in 2024. .. The number of publications has been steadily increasing, which indicates that these colleges' scholarship in this new topic is getting stronger. Due to their early contributions and continued expansion, they have become recognised as academic hubs for advancing 360-degree visual integration in virtual receptionists and guides. The increasing number of findings shows how top universities worldwide are giving this area more funding and priority. Focused cooperation amongst these active affiliates has the potential to spur even bigger advancements in this young and quickly expanding field of study.

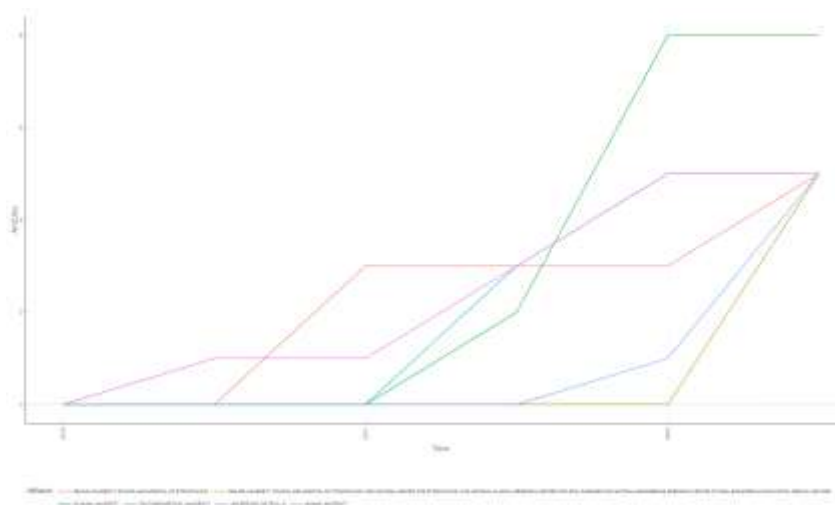


Fig 5. Affiliations Production Over Time

*Corresponding Author Countries*

China has the most authorship, with 51 pieces and a 24.9% proportion (Figure 6). With 10 articles and a 4.9% share, the United States came second. Following closely behind with 9 items and a 4.4% share was the United Kingdom. Nearly half of all authorship is accounted for by the top three countries. With shares ranging from 2.0% to 2.9%, Australia, Italy, Korea, Spain, and Japan were the next countries. The Western world is home to eight of the top ten countries, indicating the dominance of this region in research on 360-degree virtual-based virtual guides and receptionists. However, among the top author countries are developing nations like Indonesia, Denmark, and Iran, suggesting an increasing internationalisation. China leads the world in single-country publications about collaboration with 47, followed by the United States with 9 and the United Kingdom with 6. When accounting for output size, Denmark, with an MCP ratio of 100, has the greatest number of multi-country collaborations, followed by Italy, Portugal, Romania, and Iran, all of which have MCP ratios 50. This demonstrates that although China leads in volume, more

international joint work is published by other nations. The bibliometric mapping of the associated author quantifies international collaborations and worldwide research activity in this area.

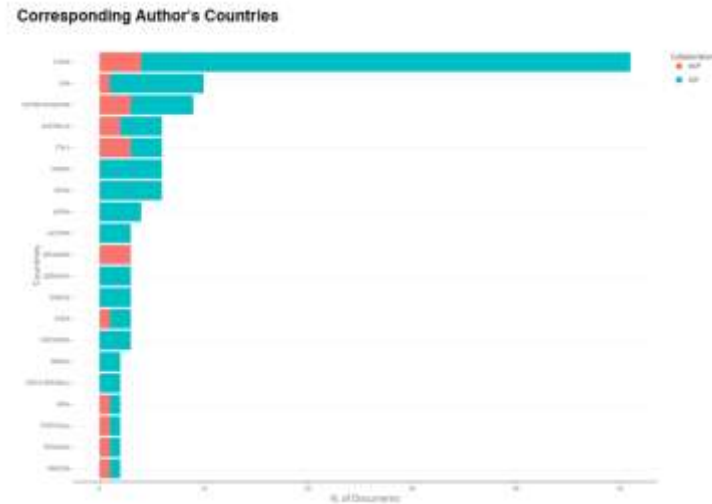


Fig 6. Corresponding Author Countries

### Country Scientific Production

With 135 documents, China produced the most publications overall, followed by the US with 49 documents (Figure 7). With 26 articles, the United Kingdom came in third place. These three nations' notoriety corresponds with the amount of writing they have contributed. The United Kingdom tops all European nations with 26 articles, followed by Germany (13), Spain (22), Italy (19), Greece (15), and Italy (19). China led the Asia Pacific region with 135 articles, followed by Australia with 22, Japan with 18, South Korea with 13, and Indonesia with 6. The regional analysis reveals the significant research domination of Asia Pacific in the field of 360-degree virtual-based virtual guide/receptionist research, with Australia and China leading the way. The fact that the US is one of the top 5 publishing nations further demonstrates its strong publishing on this subject. The next contributors are European nations, headed by Western nations like the UK. Although Western nations have historically dominated this field of study, the growing involvement of China and other nations suggests a change in the dynamics of the global economy.



Fig 7. Country Scientific Production





Expanded collaborations across South America, Africa, and the Middle East are necessary to promote global integration and mitigate research disparities in this vitally significant field.

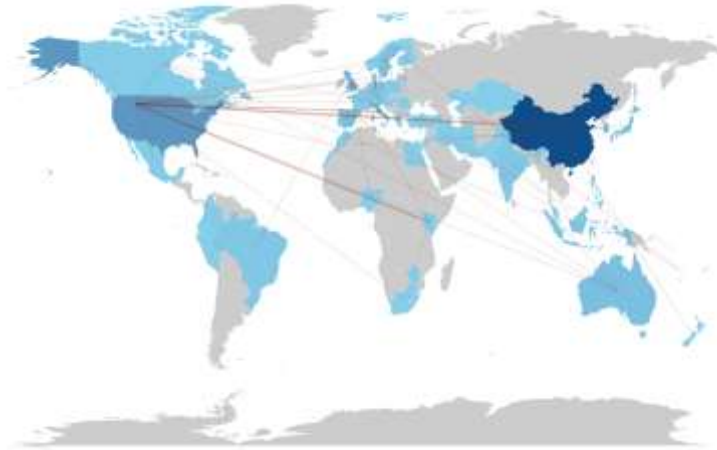


Fig 9. Collaboration World Map

## Discussion

From 2019 to 2024, this bibliometric analysis offers insightful information about the growing trends and influences in 360-degree virtual-based virtual guides and receptionists. Publications on integrating 360-degree visual virtual receptionists and guides showed consistent growth from 2019 to 2020, then a dip in 2021 and a more rapid increase until 2023. In particular, were 20 articles published in 2019, 30 in 2019, 29 in 2021, and a minor decrease to 29 in 2022. In 2022, there was a 37.9% increase to 40 publications. There were 50% more articles in 2023 than in 2022 due to the strong increase. In contrast to 2023, there had been a 61% decline in publications by the middle of 2024. The expanding global interest in using 360-degree virtual-based virtual guides/receptionists in numerous areas is reflected in the increasing trend of early publishing. As these industries realise the possibilities of implementing 360-degree virtual-based virtual guides/receptionists for faster access to information, available anywhere and anytime, and manpower savings, research efforts are rising significantly in 2021–2023. Offices and tourism are generally late adopters. Nevertheless, the declining trend in 2023 can result from insufficient indexing of current papers in Scopus when the data was taken out. On the other hand, it might point to a brief saturation following years of peak activity and enthusiasm. After 2023 publications are fully indexed, more studies should investigate whether this decline persists or reverses.

Growth is anticipated to continue as digital technology advances and is applied in more sectors. Older publications with higher citations are given preference in unadjusted citation counts. Nevertheless, newer works released in 2019–2020 exhibit a larger annual effect than earlier publications when adjusted for acceptable years. The rise in average annual citations between 2018 and 2020 suggests that new material is getting more attention as this specialised sector becomes more integrated. However, the fact that adjusted annual citations fell after 2021 indicates that referrals to recently published works are still coming in. Then, although not as much as in 2020, it grew once more in 2022. In contrast to earlier years, 2023 saw the last drop. Consequently, the adjusted analysis demonstrates a stronger contemporary influence as a basis for integrating 360-degree virtual-based virtual guide/receptionist, even though the unadjusted metrics make current publications appear less impactful. This implies that as we build on one another's work to progress in the area, research activity will intensify, and the effect of new literature will increase. The majority of

the prolific writers are from China, indicating the strength of that nation's study in this field. The top writers' overlapping rankings for total and fractional outputs demonstrate their substantial individual contributions. .. Furthermore, many citations suggest that these prolific writers also authored important fundamental works. Their co-authorship and linked keyword networks demonstrate how they developed common concepts and together influenced the discipline. This analysis, which counts important contributors, identifies subject-matter specialists whose work is likely to further the integration of 360-degree virtual-based virtual guides and receptionists.

The main sources are mostly dentistry-focused journals, which utilize this for retained root removal and simultaneous implant placement. (Lin et al. 2022) and dental surgery (Liu et al. 2024; Mon et al. 2024; Wang et al. 2024). However, relevant articles also appeared in environmental protection and ecology journals related to tourism management (Chang 2019), ecotourism interpretation services (Zhu and Lu 2021) and visual communication for neighbourhood guide maps (Hao, Lei, and Yuqin 2021) In addition, a journal of communication in computer and information science integrates 360-degree virtual-based virtual guides/receptionists in the museum. (Chen and Chen 2022; Manoudakis, Pentazou, and Bakatsaki 2023). This shows the widespread recognition of the value of 360-degree virtual-based virtual guides in this discipline beyond just the computer science field. More articles in prestigious multidisciplinary journals may boost distribution and draw in a larger readership. The regional analysis quantifies how dominant Chinese-led major Asian research is. Furthermore, with 47 publications, China leads the world in single-country publications, followed by the USA (9 articles) and the UK (6 articles). However, when output size is considered, Denmark has the greatest level of multi-country collaboration (MCP ratio: 100), followed by Portugal, Italy, Iran, and Romania. However, as this specialised profession grows, the growing engagement from other nations points to a change in global dynamics. Increased collaborations with marginalised areas could increase involvement and viewpoints. The initial exercises centred on presenting and defending the value of 360-degree virtual guides. The growth that followed focused on deploying 360-degree virtual guides in broader industries outside of travel.

## Conclusion

The most current publication trends about 360-degree virtual-based guides are in 2023, with 62 publications, according to the results and discussion above. 2020 articles had the highest trend of citations, with a MeaTCperART of 20.77. China, the United States, and the United Kingdom are three nations that have significantly influenced the study of this subject. The study is divided into three sections: 1) tourism, 2) dentistry, and 3) communication and information systems. Three-dimensional computer graphics and human-computer interaction are new themes in this field. Three-dimensional computer graphics and human-computer interaction are two more new topic keywords that have not been directly linked to the term digital guide or 360-degree camera. Future researchers who wish to take up subjects related to this field might refer to the study focus covered in this paper as a guide. The correlation between these terms may serve as a unique study avenue for integrating 360-degree virtual guides that are helpful for future investigations. Additionally, data can be found by researchers using sources from other databases like WOS, Google Scholar, and others. The study's data was collected on April 10, 2024. There might be a few minor variations because this analysis has not covered the research findings released after that date.

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