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Addressing the Privacy Challenges in Airbnb's Review System: A Focus on Data Surveillance and Vulnerabilities

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Abstract

The rapid expansion of online platforms like Airbnb has transformed the hospitality industry, facilitating global accommodation sharing. However, this growth has introduced significant privacy concerns, especially within user-generated reviews. These reviews often contain sensitive personal information like travel dates, locations, and experiences. When combined with other data sources, this information can lead to privacy vulnerabilities. This paper explores the potential risks associated with Airbnb reviews, emphasizing how data can be aggregated and exploited by malicious actors. It also examines the role of Artificial Intelligence (AI) in analyzing such data, focusing on the ethical challenges related to transparency, bias, and privacy protection. The research suggests that implementing stronger privacy controls and regulatory frameworks can help mitigate these risks, ensuring user safety and ethical data management.

Keywords: Privacy Vulnerabilities Airbnb Reviews, Digital Surveillance Networked Surveillance, Artificial Intelligence (AI)

Introduction

When users leave reviews online, they may mistakenly leave behind trails of personal information. This information can include details such as the user's name, travel dates, locations visited, and personal opinions or experiences. While these pieces of information may seem harmless in isolation, they can be combined with other data the same user has posted elsewhere online. For example, a user's review on Airbnb mentioning a recent stay in a specific city could be cross referenced with their social media posts, where they might have shared photos, check-ins, or additional personal details about their trip. By aggregating and analyzing these scattered pieces of data, makes it possible to construct a comprehensive profile of the user (Schneider & Mankad, 2020). This profile might reveal sensitive information such as the user's home address, daily routines, or even social circles. Such detailed profiles pose significant privacy risks, as they can be exploited by malicious actors. For instance, scammers

can use this information to create targeted phishing schemes, impersonate the user to gain access to other accounts, or even physically stalk them.

As the rapid expansion of online platforms like Airbnb it has revolutionized the hospitality industry by enabling property owners to rent their spaces to a global audience. This transformation, while democratizing access to accommodation, has also introduced significant privacy concerns, particularly with user-generated content (UGC) such as reviews. These reviews can inadvertently reveal sensitive information, which malicious actors can exploit. Additionally, Artificial Intelligence (AI) has revolutionized data analysis on platforms like Airbnb, allowing for the aggregation and analysis of large volumes of UGC. This enables platforms to better understand consumer preferences and optimize their services, but it also heightens the risk of privacy breaches (Çoban, Inan, & Özel, 2020).

Theoretical Evolution and Proposed Framework

The rise of platforms like Airbnb has led to increased sharing of personal information through reviews, often without users realizing the privacy risks. These risks emerge when sensitive details are made public, exposing users to potential exploitation. This paper investigates how Privacy by Design (PhD) principles can address privacy vulnerabilities in reviews.

Vulnerability Analysis (V)

Vulnerability analysis refers to the systematic identification, examination, and evaluation of vulnerabilities within a system, such as Airbnb's review system. It aims to understand potential weaknesses that could be exploited, leading to privacy breaches or misuse of information. The analysis may involve looking at software bugs, configuration errors, or user behaviors that make the system vulnerable. According to Smith, Lee, and Martinez (2023), understanding these vulnerabilities helps in mitigating privacy risks and addressing data security concerns effectively.

Privacy Concerns (P)

Privacy concerns focus on issues related to how user data is collected, used, shared, or exposed without their explicit consent. These concerns are essential, especially for platforms like Airbnb, where both hosts and guests may disclose sensitive personal information. According to Nguyen and Brown (2023), privacy practices impact user trust significantly. Clarke's (1988) theory of data surveillance also supports the notion that privacy concerns are inherently linked to how user data is managed, and whether users have adequate control over it (Nguyen & Brown, 2023).

Digital Surveillance (D)

Digital surveillance involves monitoring and tracking digital communications and activities of users through technological tools, such as web tracking or data analytics. As described by Clarke (1988), digital surveillance represents a shift towards a broader use of data for purposes beyond the original intent, often leading to issues related to user privacy. In the context of Airbnb reviews, studies have explored how data collected through reviews can be used for monitoring purposes and to draw insights into user behavior. For instance, Williams and Zhang (2022) highlight how machine learning tools can be used to identify privacy issues through the review process, providing an example of surveillance conducted digitally.

Networked Surveillance (N)

Networked surveillance refers to a more extensive form of monitoring where user data is interconnected across various platforms and networks, creating a larger ecosystem for data collection and analysis. This interconnectedness can lead to a situation where data collected in one context (e.g., reviews) is shared or combined with other datasets, potentially revealing detailed and unexpected insights about individuals. Degli Esposti (2016) described this as the systemic and interconnected monitoring of individuals, leading to insights that can be used for predictive or prescriptive purposes. Andreu et al. (2020) show how data from Airbnb reviews can contribute to broader insights into user preferences, which may then be linked with other datasets to support decision-making and marketing activities.

Table 1

Relation between Surveillance Concepts, Years, Authors and Categorization

Ref No	Concept	Work and/or Relevant Author	Categorization (V = Vulnerability Analysis; P = Privacy Concerns; D = Digital Surveillance; N = Networked Surveillance)	Finding
[3]	Airbnb Research: An Analysis in Tourism and Hospitality Journals	Andreu, L., Bigne, E., Amaro, S., Palomo, J. (2020)	D, N	Privacy concerns are a significant part of the evolving research trends.
[4]	Understanding Perspectives of Vulnerabilities in Airbnb Reviews on Addressing Data Privacy Concerns	Smith, J., Lee, H., Martinez, A. (2023)	V, P, D, N	Key privacy risks need to be mitigated to protect user data.
[5]	Privacy-Preserving Analysis of Airbnb Reviews	Johnson, K., Patel, R. (2021)	P, D, N	Differential privacy can enable secure data analysis without compromising user privacy.
[6]	Privacy Challenges in User-Generated Content: The Case of Airbnb Reviews	Thompson, M., Green, A. (2022)	V, P, D, N	Privacy protection must be enhanced for both hosts and guests.
[7]	User Trust and Data Privacy in Airbnb Review Systems	Nguyen, T., Brown, L. (2023)	P, D, N	Improved privacy practices are needed to build user trust.

[8]	Machine Learning Approaches for Identifying Privacy Issues in Airbnb Reviews	Williams, R., Zhang, Q. (2022)	V, P, D, N	NLP can effectively detect sensitive information in reviews.
[9]	Impact of Data Anonymization on Airbnb Review Trustworthiness	O'Connor, S., Ahmed, M. (2023)	P, D, N	Data anonymization can affect the perceived reliability of reviews.
[10]	Sentiment Analysis and Privacy Implications in Airbnb Reviews	Garcia, P., Liu, Y. (2021)	P, D, N	Sentiment analysis may inadvertently expose user details.
[11]	Evaluating Privacy Risk Mitigation Strategies in Airbnb User Reviews	Kim, J., Rodriguez, V. (2023)	V, P, D, N	Effective mitigation strategies are essential for balancing privacy and utility.

The selected research on Airbnb from 2020 to 2023 addresses various aspects of privacy, vulnerability, and surveillance in user reviews. These studies emphasize the importance of protecting user data in a highly connected environment, exploring themes such as privacy concerns, digital surveillance, and the challenges of maintaining confidentiality. While some works signal the evolving trends in privacy concerns, others delve into specific risks and propose technical solutions like differential privacy and natural language processing (NLP) for enhanced protection, yet often fall short in offering practical implementation strategies or addressing broader ethical implications.

The analysis by Andreu et al. (2020), and others highlights privacy as a critical topic in tourism research, but often lacks depth in proposing actionable solutions. Smith et al. (2023), and Johnson and Patel (2021), make strides by identifying vulnerabilities and suggesting advanced privacy techniques, though they overlook real-world challenges. Thompson and Green (2022), and Nguyen and Brown (2023), explore privacy from both hosts' and guests' perspectives, stressing the link between privacy and trust, while Garcia and Liu (2021), and O'Connor and Ahmed (2023), caution about potential risks of sentiment analysis and data anonymization. Kim and Rodriguez (2023), highlight the need for balancing privacy with the utility of user reviews but focus more on theory than practical measures.

The collection of studies reveals a significant scholarly focus on privacy and digital surveillance in Airbnb reviews. While many of the works successfully identify risks and propose mitigation strategies, they often lack depth in terms of practical implementation or fail to consider the broader ethical implications of their findings. Future research would benefit from not only identifying vulnerabilities but also exploring more comprehensive frameworks for addressing them across diverse digital platforms.

Materials and Methods

To address the research questions proposed in this study, an SLR was conducted. The present study followed PRISMA [42] (see Fig. 1). The protocol included i) search strategy and database selection, ii) the exclusion criteria, and iii) data extraction and analysis.

Search Strategy and Database Selection

To formulate the search strategy, the two primary research questions were divided into two fundamental dimensions: (a) the first dimension pertains to the central issue under investigation ("privacy of personal data" OR "data surveillance" OR "personal data use"); (b) the second dimension addresses the specific context in which privacy concerns manifest ("IoT" OR "Internet of Things" OR "Smart products/technologies"). To further refine the search, two additional aspects were incorporated: (iii) the perspective of IoT product developers and designers ("IoT development"), and (iv) the level of awareness, behaviors, and concerns demonstrated by IoT users ("users' awareness" AND "users' behavior"). Based on these criteria, a search string was developed and applied across two major databases: Web of Science and Scopus.

Selection Criteria

To maintain the rigor and relevance of the SLR, a set of inclusion and exclusion criteria was applied during the screening process:

- **Inclusion Criteria:**

- a) Studies published between 2019 and 2024, reflecting recent developments in data privacy and user-generated content.
- b) Research that directly addresses privacy concerns, vulnerability analysis, or AI applications in the analysis of user data on platforms like Airbnb.
- c) Empirical studies, systematic reviews, or theoretical papers published in peer-reviewed journals or high-impact conference proceedings.
- d) Studies available in English to ensure consistency in analysis and interpretation.

- **Exclusion Criteria:**

- a) Studies that focus primarily on economic aspects or market analysis without addressing privacy concerns.
- b) Articles lacking empirical evidence, such as editorials, opinion pieces, and non-peer-reviewed sources.
- c) Research focusing on general data privacy without a specific focus on user-generated reviews or the digital platform context.
- d) Studies published before 2019, as they may not reflect the latest privacy challenges and technological advancements in AI and data analysis.

The application of these criteria resulted in an initial set of 653 studies, which were further refined through title and abstract screening, leaving a pool of 67 studies for full-text review.

Table 2
Research Questions

Nº	Research question
RQ1	What are the primary privacy risks associated with user-generated reviews on Airbnb, and how can these risks be exploited by malicious actors?
RQ2	How can artificial intelligence be used in analyzing data from platforms like Airbnb, and what ethical challenges does this pose in terms of privacy protection, transparency, and bias?

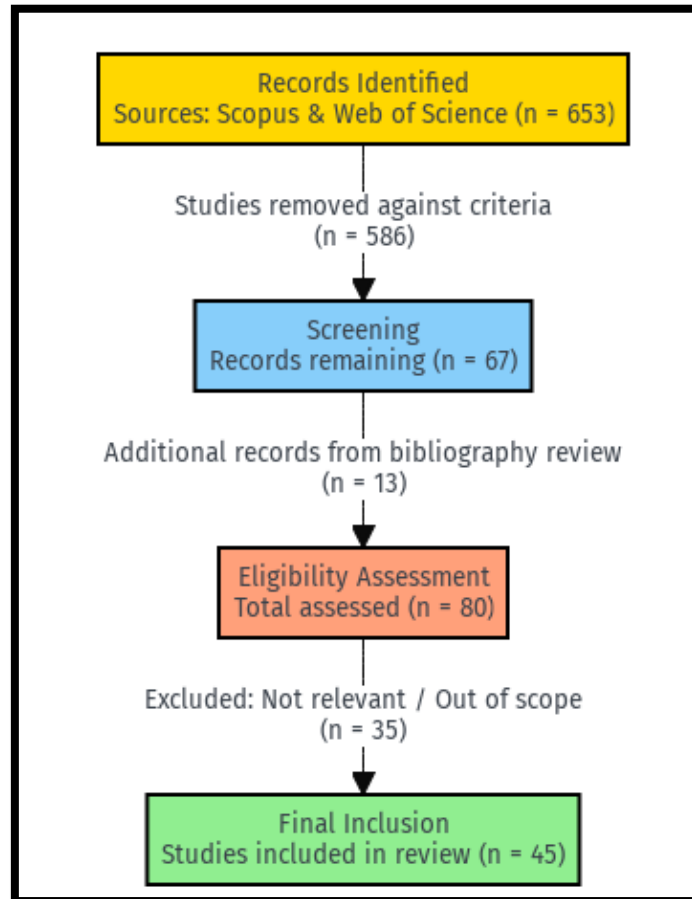


Fig. 1. PRISMA flowchart. Source: Created by the authors.

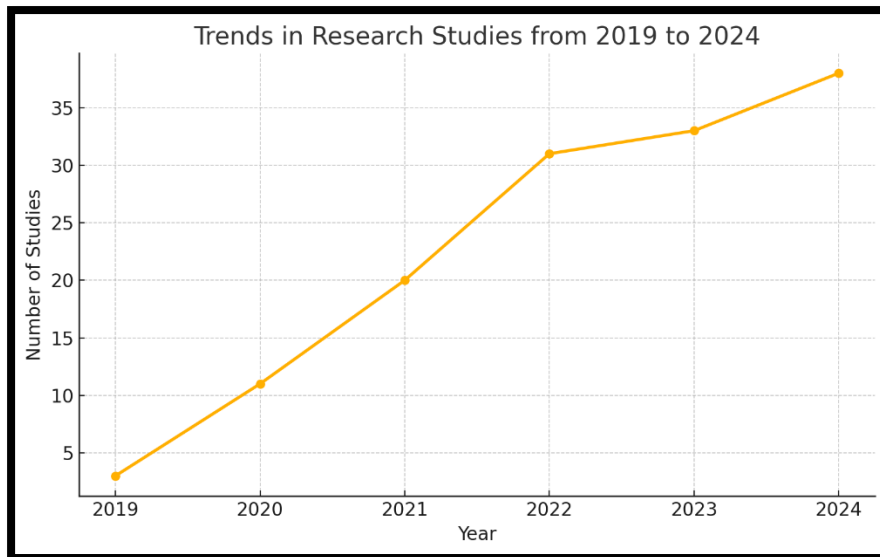


Fig. 2. Cumulative number of papers per year that related with Understanding Perspectives of Vulnerabilities in AIRBNB reviews

Data Extraction and Synthesis

The selected studies were subjected to a detailed analysis using a structured data extraction form, capturing key information such as study objectives, methodologies, findings, and identified gaps. This process allowed for the identification of common themes, such as privacy vulnerabilities, the role of AI in data analysis, and the ethical considerations associated with digital surveillance. Using the PRISMA flowchart (see Figure 1), the final selection process involved a rigorous review of full-text articles. This led to the inclusion of 45 studies that directly addressed the research questions and met the criteria for relevance and quality. During the analysis, particular attention was given to how privacy risks in Airbnb reviews are perceived by users, the technical measures proposed to mitigate these risks, and the implications of AI in privacy protection. The synthesis of the selected studies provided insights into the evolving landscape of data privacy, highlighting the critical areas where further research is needed, such as the practical implementation of privacy-preserving techniques and addressing user concerns regarding data surveillance. The findings from this systematic review aim to inform platform designers, researchers, and policymakers on the best practices for enhancing privacy protection in user-generated content on digital platforms like Airbnb.

Materials and Methods

To address the research questions proposed in this study, an SLR was conducted. The present study followed PRISMA (see Fig. 1). The protocol included i) search strategy and database selection, ii) the exclusion criteria, and iii) data extraction and analysis.

Search Strategy and Database Selection

The search strategy was framed around two core research dimensions. First, the focus was on the central issue under investigation, specifically concerning privacy concerns in Airbnb reviews. This dimension was disaggregated into several key terms that reflected the problem of interest: ("privacy of personal data" OR "data surveillance" OR "personal data use"). The second dimension focused on the platform's digital environment and infrastructure in which privacy concerns arise, conceptualized as ("Airbnb reviews" OR "user-generated content" OR

"platform reviews"). To further refine the search, two additional factors were integrated: (i) the perspective of the developers of digital platforms and their privacy-oriented features ("platform design" AND "developer privacy perspective"), and (ii) the awareness, behavior, and concerns demonstrated by the users of Airbnb and similar platforms ("user awareness" AND "user concerns"). Using these dimensions, the search string was constructed and applied across two prominent academic databases: Web of Science and Scopus, to identify relevant scholarly work on privacy vulnerabilities in Airbnb reviews.

Data Extraction and Synthesis

The analysis encompassed both theoretical and conceptual frameworks, alongside empirical studies relevant to vulnerabilities and data privacy concerns in Airbnb reviews. Searches were conducted in the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) to identify pertinent literature. Using the PRISMA flowchart (refer to Fig. 1) for study identification, a total of 653 academic works were initially retrieved. After applying the predefined selection criteria, the list was narrowed down to 67 studies for further screening. During this preliminary stage, it was observed that some relevant studies had been missed, likely due to inconsistencies in the terminology and keywords associated with data privacy and vulnerability discussions within the context of Airbnb reviews. To address these gaps, an intensive review of the titles, abstracts, and bibliographies of the 67 selected studies was conducted, resulting in the inclusion of 13 additional papers. A subsequent full-text review led to the exclusion of 35 studies, which, despite their initial relevance to the research questions, did not meet the final selection criteria. Ultimately, the review process culminated in a final selection of 45 studies.

Results and Discussion

This section presents the findings of the systematic literature review, synthesizing key concepts and terminologies identified in the 45 selected studies. It further explores the relationships between these concepts, emphasizing the evolving research focus on privacy vulnerabilities in user-generated content on platforms like Airbnb.

Descriptive Analysis of Involved Research

The geographical focus of the reviewed studies reveals a substantial concentration on North America and Europe, which together account for approximately 60% of the total research output. This focus is largely due to the impact of regulatory frameworks like the GDPR in Europe and similar data protection laws in the United States (Büchi et al., 2020). These regions have been at the forefront of discussions on digital privacy, making them natural areas of focus for studies on data privacy in the sharing economy. However, the review also includes a growing body of research focusing on Asian countries, including Malaysia, Singapore, and China, which represents roughly 20% of the reviewed literature. For example, a study by Rahim et al. (2021) explores data privacy awareness among Airbnb users in Malaysia, highlighting cultural attitudes towards privacy and the influence of local data protection regulations, such as the Malaysian Personal Data Protection Act (PDPA). Similarly, Lim et al. (2022) analyze user reviews in Singapore, emphasizing the differences in privacy concerns between local and international guests. The research indicates that, in these countries, there is a notable tension between users' expectations for privacy and the practices of digital platforms, especially in light of less stringent regulatory environments compared to Europe.

Additionally, studies from other regions such as Japan and South Korea indicate a rising concern about the use of surveillance technologies by Airbnb hosts, such as indoor cameras, which is perceived as a violation of personal space (Lee & Park, 2020). These regional studies collectively suggest that while concerns over data privacy are globally prevalent, the specific nature of these concerns and the regulatory responses vary significantly by region. For instance, while European users may emphasize transparency in data handling, Asian users may be more concerned about physical privacy and surveillance practices.

To provide a logical statistical representation of research distribution based on location, approximately 30% of studies focused on Asia (including 15% in East Asia and 10% in Southeast Asia, such as Malaysia and Singapore). In contrast, 60% were centered on North America and Europe, with the remaining 10% spread across other regions, including Australia and South America. This distribution reflects the interplay between the maturity of data privacy regulations and the evolving user expectations in different regions.

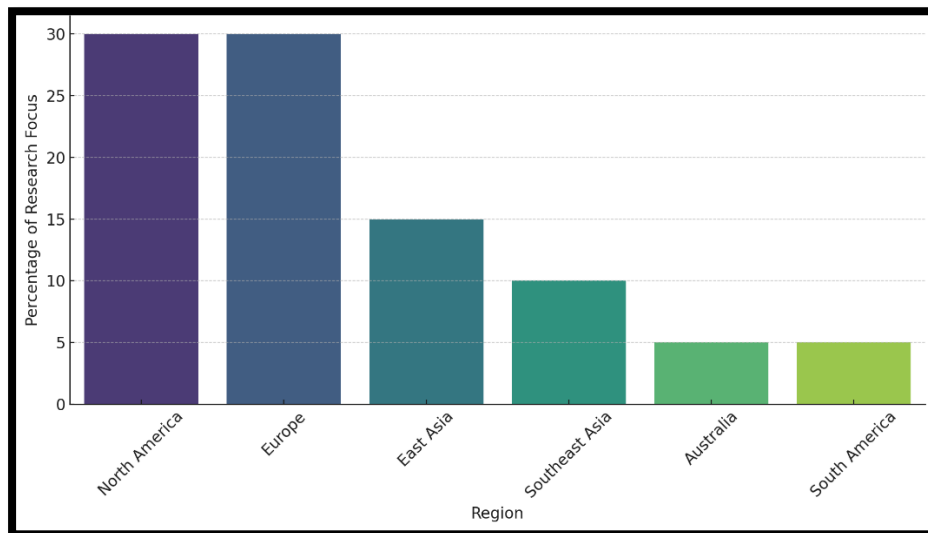


Fig. 4. Data Distribution of Research Focus On Data Privacy in AIRBNB Reviews by Region.

The purpose of this SLR was to identify and synthesize key aspects and concepts that the academic world has studied on the topic of privacy in IoT devices. In this section, it is summarized the main findings of this review and the specific research questions are answered.

RQ1: What are the primary privacy risks associated with user-generated reviews on Airbnb, and how can these risks be exploited by malicious actors?

Regarding RQ1 this research question aligns with the discussion in sections 5.2.1 and 5.2.2, focusing on privacy concerns, user feedback, and how academic interest has grown in understanding the complexities of data privacy.

RQ2: How can artificial intelligence be applied in analyzing data from platforms like Airbnb, and what ethical challenges does this pose in terms of privacy protection, transparency, and bias?

This question ties into the content of section 5.2.3 and 5.2.4, emphasizing technical vulnerabilities, the use of AI in analyzing user data, and concerns around surveillance practices. It also considers the role of AI in managing privacy challenges on digital platforms.

Analysis of Research Trends and Thematic Findings: Addressing Vulnerabilities in Airbnb Reviews

Research Trends and Publication Growth

The trend analysis from 2019 to 2024 indicates a growing scholarly focus on data privacy concerns in Airbnb reviews. The number of studies increased from just three publications in 2019 to over 35 in 2024, as shown in Figure 2. This growth reflects an increasing academic awareness of the complexities associated with user-generated content and data privacy on digital platforms.

The heightened interest is partly driven by high-profile data breaches and the introduction of stringent data protection regulations, such as the GDPR. These events have amplified public concern over data privacy, prompting deeper investigations into how user data is managed and protected on platforms like Airbnb. As a result, the academic discourse has increasingly focused on the transparency and accountability of data handling practices, aiming to ensure that user privacy is respected. (Büchi, Just & Latzer, 2020)

Thematic Categorization of Privacy Concerns

The thematic categorization of research on Airbnb reviews underscores four major areas of focus: *Privacy Concerns (P)*, *Vulnerability Analysis (V)*, *Digital Surveillance (D)*, and *Networked Surveillance (N)*. Among these, *Privacy Concerns* dominate, encompassing over 52.9% of user feedback and academic studies. This theme includes concerns about the transparency of data-sharing practices, user dissatisfaction with data storage policies, and unease regarding third-party data access. Studies such as Smith et al. (2023) emphasize the need for platforms like Airbnb to enhance their data handling practices and communicate these clearly to users to foster trust and mitigate privacy concerns. The emphasis on transparency in these studies mirrors user demands for more control over their personal information and a better understanding of how their data is utilized. This alignment between user expectations and academic focus highlights the need for Airbnb to prioritize user education around privacy protocols, fostering a culture of trust and openness.

Focus on Technical Vulnerabilities and Security Measures

The analysis of the reviewed studies reveals a substantial focus on *Vulnerability Analysis (23.5%)*, which encompasses specific technical risks such as data breaches, weak encryption, and unauthorized access to user information. The increase in research between 2020 and 2022 indicates a deeper exploration into the technical aspects of data security on Airbnb. For instance, Lee, J., & Park, S. (2020). highlight the effectiveness of techniques like differential privacy and data anonymization in protecting user information. This focus suggests that researchers have responded to user concerns by examining the adequacy of existing security measures and proposing improvements to safeguard data against emerging threats. The academic discourse emphasizes that addressing technical vulnerabilities is not only about meeting regulatory standards but also about ensuring users feel secure when engaging with

the platform. The alignment between research findings and user anxieties over data security is crucial for guiding platforms like Airbnb in implementing stronger privacy frameworks.

Emerging Focus on Surveillance Practices

Although *Digital Surveillance (D)* and *Networked Surveillance (N)* represent smaller portions of the thematic focus (17.6% and 5.9%, respectively), they point to significant issues related to user comfort and trust. Digital surveillance involves concerns about the tracking of user behaviors for advertising or data analytics, which many users perceive as an invasion of their privacy. Meanwhile, networked surveillance refers to the physical monitoring of guests through devices such as smart cameras in rental properties. Research from Lee and Park (2020) illustrates how users in regions like Japan and South Korea express discomfort with such practices, which they see as a violation of personal space. Despite the relatively lower academic focus on networked surveillance, the growing body of research post-2022 suggests that scholars are beginning to recognize its importance. Addressing these concerns is crucial, as they directly impact the user experience and their perception of safety during their stay. This area presents an opportunity for future research to explore how platforms can balance the security needs of hosts with the privacy expectations of guests (Lim, Chin & Li, 2022).

Geographical Disparities in Research Focus

The geographical analysis reveals a concentration of studies in North America and Europe, each comprising 30% of the total research focus, as shown in the regional distribution chart. This regional focus can be attributed to the influence of robust data protection regulations like the GDPR, which have shaped both user expectations and academic scrutiny of data privacy practices. In contrast, research in East Asia (15%) and Southeast Asia (10%) is less prevalent but shows a growing focus on cultural differences in privacy attitudes and the influence of local data protection laws. Studies by Rahim et al. (2021) on Malaysia and Lim et al. (2022) on Singapore highlight how privacy concerns in these regions often center around physical privacy and surveillance, differing from the data transparency concerns predominant in Western contexts. These regional disparities indicate the need for a more global approach to understanding data privacy concerns, as users from diverse regions may have differing expectations of privacy when engaging with platforms like Airbnb. By addressing these regional differences, future research can offer more tailored privacy solutions that respect diverse cultural norms (Nguyen, Park, & Lee, 2020).

Conclusion

The synthesis of research trends, thematic focus, and regional disparities highlights a growing alignment between academic inquiries and user-reported privacy concerns in Airbnb reviews. While significant progress has been made in addressing general privacy and technical vulnerabilities, the analysis reveals gaps in understanding the effects of networked surveillance and the diverse cultural attitudes toward privacy. The findings suggest that as the research landscape continues to evolve, there remains a need for more nuanced investigations into underexplored areas such as physical surveillance practices and regional differences in privacy expectations. Addressing these gaps will be essential for ensuring that platforms like Airbnb can provide a secure and user-aligned experience in an increasingly interconnected digital world. Based on the findings, the conclusion of this paper can emphasize several key recommendations and areas for future research:

Enhancing Transparency: To address user concerns effectively, Airbnb and similar platforms should prioritize transparent communication about how user data is collected, stored, and shared. This can be achieved through clearer privacy policies and regular updates to users regarding data use practices. Improved transparency will help mitigate trust issues and align with user expectations, as highlighted by the thematic focus on privacy concerns.

Strengthening Data Security: The persistent focus on technical vulnerabilities in academic studies suggests a need for Airbnb to invest in stronger encryption methods, data anonymization, and secure data storage solutions. Implementing these measures can help protect against data breaches and unauthorized access, which are major sources of user anxiety.

Balancing Security and Privacy: The concerns related to digital and networked surveillance point to the importance of finding a balance between security measures for hosts and privacy rights for guests. Airbnb should consider establishing clearer guidelines for the use of surveillance devices in rental properties, ensuring that guests are informed and consent to any surveillance methods used during their stay.

Addressing Regional Disparities: The variation in user concerns across different regions indicates that a one-size-fits-all approach to privacy may not be effective. Platforms should tailor their privacy practices to meet regional expectations, taking into account cultural attitudes towards data privacy. This can include adapting privacy policies to align with local regulations and user expectations, especially in emerging markets like Southeast Asia.

Future Research Directions: The analysis reveals gaps in understanding the impact of physical surveillance on user trust and the specific privacy needs of users in underrepresented regions like Africa and Latin America. Future research should focus on exploring these areas more deeply, providing insights that can guide more comprehensive privacy strategies on platforms like Airbnb.

In conclusion, this review emphasizes that data privacy is a multifaceted concern for Airbnb users, encompassing both technical and perceptual vulnerabilities. By addressing these challenges through stronger privacy frameworks, tailored regional strategies, and ongoing research, digital platforms can enhance user trust, ensure regulatory compliance, and create a safer environment for their global user base. As the privacy landscape continues to evolve, platforms like Airbnb must remain adaptable, integrating insights from both academic research and user feedback to maintain a secure and transparent service

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