Insights Into IoT: A Bibliometric Study Revealing The Development of Smart Home Technologies in Scholarly Conversation

Fitri Syifaul Ummi[1], Lugi Sumantri[2]
[1] Informatika of Universitas Majalengka and fitrisyifa594@gmail.com
[2] Informatika of Universitas Majalengka and lugisumantri1812@gmail.com

ABSTRACT

This bibliometric analysis explores the ever-changing field of Internet of Things (IoT) research, with a particular emphasis on how smart home technologies have developed in academic discourse. We uncover important trends, significant figures, and developing topics influencing the story of IoT in smart homes by thoroughly examining scholarly papers. Our study covers a certain time period and provides insights on the direction of research, technical developments, and the relationship between security and innovation. We map the intellectual environment using bibliometric approaches, which helps researchers, practitioners, and policymakers navigate the complex world of IoT-enabled smart homes.

Keywords: *The Internet of Things, Technologies for Smart Homes, Bibliometric Evaluation, Innovation, Security, Technological Evolution*

1. INTRODUCTION

Compared to traditional communication technologies, IoT applications for smart grid and smart housing are very advantageous, although they are still quite rare. By using a thorough literature study, this research aims to bridge the gap between the state-of-the-art smart home apps available now and the potential for their integration into an IoT enabled environment. In order to successfully include smart home devices into a cloud-centric IoT solution, our proposal is a complete framework that incorporates several components from current IoT designs and frameworks. We identify a smart home management model and the main responsibilities at each level for the proposed framework. We continue to examine real-world design challenges, focusing on data processing and intelligent. [1].

The Internet of Things (IoT) is the foundation for the new and disruptive technology of smart home applications, or apps for short. These apps are now quite restricted and dispersed. We must be aware of the alternatives and gaps in this field of study in order to help researchers and offer insightful analyses of technology surroundings. Consequently, a review is carried out in this work in order to organize the research environment into a logical taxonomy. We do a concentrated search for every publication relevant to (1) smart homes, (2) applications, and (3) IoT in three major databases, namely, Web of Science, ScienceDirect, and IEEE Explore. These databases provide material on Internet of Things-based smart home apps. 229 articles total, broken down into four classes, make up the final dataset produced by the categorization technique [2].

Since its introduction, the Internet of Things (IoT) has become more and more significant. It includes anything from conventional technology to commonplace home items like WSNs and RFID. IoT has enormous promise, but it also presents a number of difficulties. Among all the other issues, the security issues are the main topic of this essay. Since the Internet is the foundation of IoT, security issues with it will also arise. Furthermore, because the Internet of Things is composed of three layers—the perception layer, the transportation layer, and the application layer—this article will examine the security issues specific to each layer and look for fresh issues and fixes [3].

In recent months, it has been nearly hard to avoid encountering the term "Internet of Things" (IoT) in some capacity. The Internet of Things has witnessed a phenomenal spike in attention, particularly in the last year. To specify the IoT's frameworks and standards, consortiums have been established. Many IoT-based products and services are beginning to be introduced by businesses. Additionally, a number of IoT-related purchases have been in the news, such as Google's well-known $3.2 billion takeover of Nest and Nest's following acquisitions of Dropcam and SmartThings. Both politicians and industry experts are beginning to see the Internet of Things (IoT) as a legitimate commercial prospect, and current projections indicate that the IoT may expand [4].

The growing cost and demand for energy are forcing many businesses to devise innovative ways to monitor, control, and save energy. An intelligent Energy Management System (EMS) can assist in cost reduction while maintaining sufficient energy supply to meet demand. Two emerging technologies that might be utilized to better regulate energy usage in the commercial, industrial, and residential sectors are big data and the internet of things (IoT). This research presents an Energy Management System (EMS) for smart houses. By integrating data acquisition modules—Internet of Things items with unique IP addresses—with every home gadget, this method forms a vast network of wireless devices. Smart home devices provide information about energy usage to ones that are becoming more sophisticated [5].

The Internet of Things, sometimes known as the IoT, is a dynamic global information network composed of internet-connected devices such as RFIDs, smart appliances, actuators, and sensors. These gadgets are swiftly emerging as crucial components of the future internet. Many IoT solutions developed by start-ups, small and medium-sized enterprises, multinational corporations, academic research institutions (such universities), and public and private research organizations have made their way onto the market in the past 10 years. In this paper, we investigate over a hundred IoT smart solutions that are already on the market, carefully analyzing each to ascertain its intended applications and underlying technology. More importantly, we identify the trends, opportunities, and unsolved problems in the IoT solutions based on industry. [6].

The Internet of Things (IoTs), which provides the ability to recognize and link disparate physical things globally into a single system, is introduced in this article. Serious questions about the access of personal data related to devices and individual privacy are brought up by IoTs. The IoT's security risks and privacy issues are compiled in this survey [7].

Electric power and energy systems (EPESs) are undergoing a transition to supply distributed energy that is clean for sustained global economic growth. The Internet of Things (IoT) is leading this transformation by bringing capabilities like cyber security, control, situational awareness and intelligence, and real-time monitoring to make the current EPES into an intelligent cyber-enabled EPES that is more resilient, efficient, secure, and sustainable. IoT-based digitization of the electric power ecosystem also reduces energy waste, maximizes distributed generation management, enhances asset visibility, and generates savings. EPESs are greatly impacted by IoT, which also presents a number of growth and development prospects. Using IoT for EPESs presents a number of difficulties [8].

The Internet of Things, or IoT, is a dynamic worldwide information network made up of various instruments and smart appliances that are increasingly becoming an essential part of the Internet, along with other Internet-connected things including radio frequency identification (RFID) tags, sensors, and actuators. We have witnessed a proliferation of IoT solutions entering the industry

market in the past few years. In the past several years, context-aware computing and communications have been essential to ubiquitous computing, and they are predicted to be crucial to the Internet of Things paradigm as well. In this article, we analyze many well-liked and creative IoT solutions from the standpoint of context-aware technology [9].

The Internet of Things (IoT), a new paradigm, has replaced traditional living with a high-tech style of life. Smart homes and communities, energy saving, pollution reduction, smart transportation, and smart businesses are just a few of the improvements brought about by IoT. A great deal of significant research has been done in an attempt to use the Internet of Things to advance technology. In order to fully achieve the potential of the Internet of Things, several issues and barriers still need to be overcome. It is necessary to consider these issues and concerns from a range of Internet of Things angles, such as applications, obstacles, enabling technologies, impacts on the environment and society, etc. The main goal of this review article is to provide a comprehensive analysis from a social and technological perspective. [10].

Table 1. Researchers on the topic REVEALING THE ACADEMIC TERRAIN: A BIBLIOMETRIC ANALYSIS OF AI VIRTUAL REALITY RESEARCH PATTERNS have conducted some bibliometric analysis.

Autrhor & Year	Citation	Source	Research Findings
[2&2016]	984	GOOGLE SCHOLAR	The hypothesis that modern dwellings, an expansion of the passive family, would eventually supplant residential buildings is covered in this article. They would install their own solar panels and tiny wind turbines to produce their own electricity, enabling them to trade energy on the smart power grid. Smart homes will need IoT-based services since it is predicted that in the upcoming years, smart products will become more and more common in consumer homes and on the market. Using a variety of search queries, this study provides a method to find the most relevant papers from the literature that address this topic. The selected articles were divided into two main categories based on semantics: IoT concepts and WSN applications.
[5&2017]	420	GOOGLE SCHOLAR	IoT applications and smart home technologies have seen a recent disruptive trend. Although definitions and restrictions connected to this tendency are still ambiguous, research on it is still underway. Gaining understanding of this new trend is crucial. This article surveys and categorizes relevant works in an attempt to provide such insights. It is possible to identify certain trends among the different smart home app functions. These works may be broadly categorized into four groups: research studies on applications, evaluations or surveys, development attempts, and general design ideas. The difficulties, advantages, and suggestions pertaining to IoT and its applications in smart homes are identified and explained through a thorough examination of the articles. The findings show the kinds of apps that are now on the market and the gaps that exist in the application of these applications in Internet of Things smart homes. Scholars have recognized problems and offered solutions, such as appropriate technology usage. Additionally, we advise users to commit to the designated runtime. Wearable IoT-connected devices may be the next trend in smart home technology. These devices are powered by new-generation integrated sensors and

			controlled by apps. Research on Internet of Things-based smart home applications that manage wearable technology or embedded sensors in real-world scenarios is still lacking.
[5&2014]	852	GOOGLE SCHOLAR	The perception layer, the transportation layer, and the application layer are the three levels that make up the Internet of Things. In this study, we have concentrated on the security architecture and IoT security problems. The features and vulnerabilities of each layer were analyzed, and the standard solutions were provided. While we waited, we looked at the underlying technology to assess the features of these different solutions. RFID and WSNs are essential to the perception layer. First, we looked at the security issues surrounding RFID technology and the related fixes, including trust management, conflict collision, consistent coding, and RFID privacy protection. We then looked at the security issues surrounding WSNs and the related technological fixes, such key management and cryptographic methods. Additionally
[2&2015]	478	GOOGLE SCHOLAR	The scientific IS community is finding motivation for future research on basic subjects such as the impact of IoT-based innovation on strategy and corporate IT infrastructures. In the Internet of Things, digital technology becomes a crucial element in strategy formulation. Therefore, existing methods of managing IT as a standardized commodity and integrating IT with business strategy must be challenged and supplemented by new frameworks that view IoT technologies as a crucial element of value creation and a source of competitive advantage. To manage, organize, and link the required resources both inside and outside of particular organizations, corporate IT infrastructures will need new governance concepts, tools, and procedures. This will make it possible to apply these fresh approaches to digital innovation.
[5&2017]	404	GOOGLE SCHOLAR	New opportunities for intelligent energy management on IoT and big data platforms are expected to arise from the proposed effort. The system architecture builds a smart EMS to support many stakeholders with their respective rights by utilizing data analytics and scalable storage. With the help of an intuitive smartphone application, customers may generate bills online and remotely monitor and operate equipment.
[3&2015]	365	GOOGLE SCHOLAR	An overview of IoT solutions in the developing market was provided in this article. Five main categories were used to group the solutions available on the market: smart wearables, smart homes, smart cities, smart environments, and smart enterprises. We spoke about and summarized the functionalities that each solution offered within each area. We also looked at how each solution helped to make society as a whole and the lifestyles of its customers more productive and efficient. Emphasizing the market's abundance of wearable solutions is crucial. Even though wearable computing has been around for a while, the mainstream market did not see these devices until lately. It's obvious that during the next several years, an increasing number of wearable solutions will enter the IoT market. In conclusion, we spoke about the insights gained and enumerated a few of the main obstacles and prospects for future study. We think that additional study that tackles these unresolved issues would contribute to the creation of more intriguing Internet of Things solutions and fortify the ones that are already in existence in the academic and industrial domains.

[5&2018]	426	GOOGLE SCHOLAR	This study highlighted how much IoT is influencing EPESs. The integration of distributed energy resources (DERs) is improved, energy waste is reduced, savings are generated, and the efficiency, security, resilience, and sustainability of electric power networks are all improved by the application of Internet of Things (IoT) in digitizing the electric power ecosystem. This research included a detailed assessment of the technical specifications of IoT sensors as well as a discussion of the use of IoT sensors in smart home scenarios. Additionally, a research was done on IoT sensors that are currently on the market.
			IoT for EPESs offers a stimulating environment for innovation and development and has a significant impact on the environment, society, and economy in terms of growth.

The main goal of this study article, which focuses on the bibliometric analysis of IoT-related academic trends, is to unveil the complexities within the scholarly landscape examining the junction of Internet of Things (IoT) and smart home technologies. The objective of this scholarly project is to shed light on the complex web of academic publications, clarifying developing trends, networks of collaboration, and important figures in this rapidly developing subject. Using bibliometric approaches, the study closely examines patterns and developments in academic research on IoT and smart home technologies, offering insightful information to scholars, business experts, and policymakers. By navigating this academic terrain, the publication aims to provide a thorough grasp of the current situation and possible future directions in IoT-related research, adding to the growing body of knowledge in this rapidly academic domain.

2. METHODS

The aim of this article is to examine the corpus of academic work that addresses the complex interplay between smart home technology and the Internet of Things (IoT). The main focus is a bibliometric analysis of academic research trends concerning IoT and smart home technologies. The focus is on closely examining breakthroughs, innovations, and influential figures in this quickly changing field. The journal aims to shed light on the intricate web of academic publications by offering insights into publishing trends, collaboration networks, and subject areas of interest within the ever-evolving field of IoT and smart home technology research. Additionally, it seeks to provide insightful viewpoints that will aid professionals, academics, and decision-makers in navigating the scholarly environment by offering a comprehensive and precise grasp of the potential and current status offuture trajectories in IoT-related research.

2.1 Journal Reputation

At this stage, a reputable journal has been selected and is being processed. Table 2 presents the results of the journal check.

Table 2. A bibliometric analysis demonstrating the evolution of smart home technology in academic discourse, featuring the profile of a journal dedicated to insights into IoT

Point of View	WOL	JoNaC	IJoCA	JoB	SN	IEEE	CE
Publisher	Wiley Online Library	Journal of Network and Computer Applications	International Journal of Computer Applications	Journal of Big Data	Springer Nature	IEEE	Elsevier

First published	2015	2017	2014	2019	20020	2017	2020
Last published	2016	2017	2014	2019	20020	2017	2020
Scopus Indexed	Yes	Yes	Yes	YES	Yes	Yes	Yes
Web of Science Indexed	Yes	Yes	Yes	Yes	No	No	No
Impact factor by SJR	1.98	2.38	0.36	2.71	2.42	5.95	2.8

Table 2 demonstrates that all journals designated as Q1, along with IEEE and CE, are indexed using WOL, JoNaC, and JoB on the scale. In this situation, journalism about artificial intelligence on virtual reality is combined with analysis, which is equally significant.

2.2 *Journal Metrics Information*

The characteristics and metrics of the three chosen journals—Frontiers, SN, and CE—are clearly described in this section. Table 3 summarizes key findings from the three chosen journals. The Publish or Perish program is used to extract this metric data from metadata (PoP).

Table 3. Metrics Information of Selected Journals

Metrics data	JoNaC	IJoCA	JoB
Publication years	2022	2022	2020
Citation years	6192	498	3
Papers	133	108	213
Citations	353	12989	1512
Cites/year	88.25	324.22	923.30
Cites/paper	88.25	123.40	24.02
Authors/paper	2.75	3.55	3.42
h-index	129	19	61
g-index	4	20	24
hI,norm	4	14	9
hI,annual	1.00	1.56	4.43
hA-index	4	10	11

2.3 *Reference Management*

After downloading papers from three different journal sites, the last stage was adding references using the Mendeley tool. (JoNac, IEEE, WOL, JoB, CE, IJoCA, and more journals). Each article's metadata, which includes author details, keywords, an abstract, and other information arranged in a more thorough and comprehensible manner, must have references.

2.4 *Bibliometric Analysis*

After confirming that all of the article metadata is accurate, the next stage is bibliometric analysis. VosViewer, an application that operates on database files, was used to do the bibliometric analysis in this work.csv file that was discovered while searching for "IoT Smart Home" on Google Scholar.

3. RESULTS AND DISCUSSION

Researchers use VOSViewer software to determine the type of data and bibliographic data to trace the growth of multimedia research on face recognition. Next, we read information from reference management files whose file formats are RIS-compatible in the data source. After that, employ the thorough counting approach, permitting a minimum of 5 and a maximum of 25 writers per document. As a result, 22 authors out of 531 satisfy the requirement.
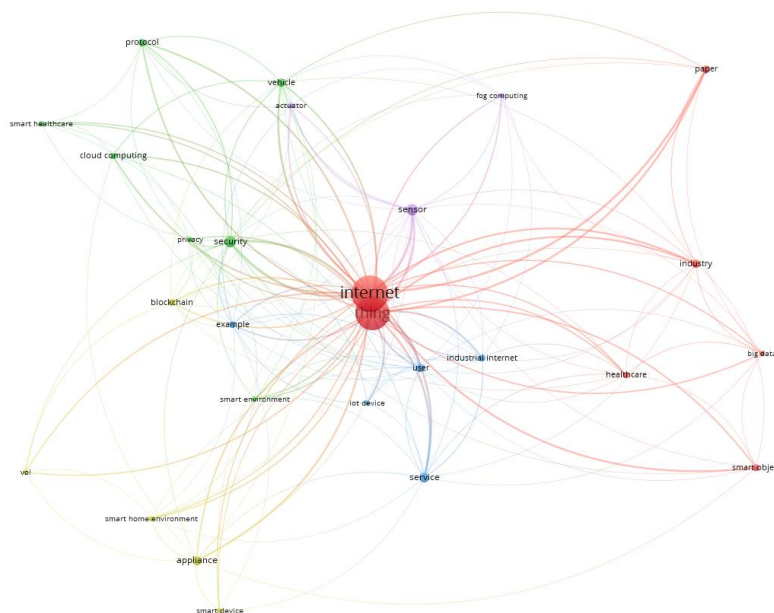
Figure 1. Network Visualization Map of Keywords

Several groups are represented by the colors blue, yellow, red, green, and purple in Figure 1. A list of terms that occur most frequently in the cluster is shown for the duration of the article. This cluster indicates that there are now five categories for published articles. Table 4 provides further information.

Table 4. Clusters and keywords therein

Cluster	Total items	Most frequent keywords (occurrences)	Keywords
1	17	internet (260), smart object, thing (232), industry (14)	Big data, healthcare, industry, internet, smart object, thing
2	7	security (28), vehicle (15), protocol (12)	cloud computing, privacy, protocol, security, smart environment, smart healthcare, vehicle

3	5	service (19), user (14), iot device (10)	example, industrial internet, iot device, service, user
4	5	appliance (17), blockchain (10), smart home environment (7)	appliance, blockchain, smart device, smart home environment , vol
5	3	Sensor (27), fog computing (7), actuator (6)	actuator, fog computing, sensor

We may examine the replies that were extracted directly from the cluster to learn about the most recent developments in multimedia research related to facial recognition. A depiction of article density is shown in Figure 2. The phrase "facial expression recognition" is most commonly used in Cluster 1.
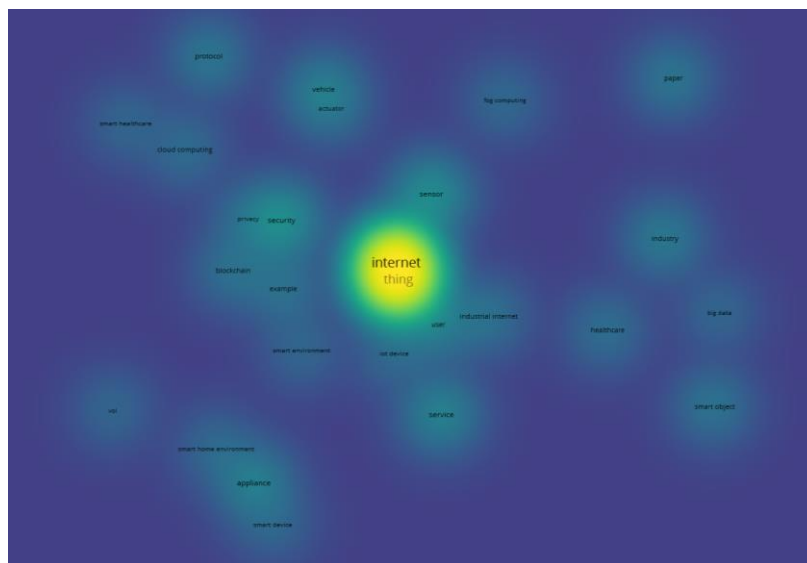

Figure 2. Density Visualization Map of Keywords

One of these mapping clusters, cluster 1, is present at least in keywords. "Smart Home" is the topic of this cluster on the Internet of Things. Moreover, certain terms—like "user," "vehicle," and so on—do not frequently show up in keyword lists inside any cluster. Put another way, there is still a research gap that will probably contribute to future trends—trends that are, of course, specific to the conditions that exist in the world both now and in the future.

CONCLUSION

Numerous publications pertaining to "Smart Home" themes and the Internet of Things are reviewed in this research. IEEE, CE, Journal of Network and Computer Applications (JoNaC), and other sources were used to assemble the information for this article. Our research led us to the conclusion that given their growing influence in the virtual reality area these days, a number of the publications mentioned above would be intriguing topics for AI articles.

There are at least two issues with the current study. First off, the author's subjective evaluation is still there and may reveal flaws even if the study makes use of formal procedures (PoP software, VOSviewer, and Mendeley). The research primarily focuses on journals that are indexes scopus, even if many other journals also meet the criteria for becoming Thomson Reuters. Subsequent investigations have to employ intricate sample sizes that encompass many sources not included in the Scopus index.

ACKNOWLEDGEMENTS

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BIOGRAPHIES OF AUTHORS

Fitri Syifaul Ummi. Semester 5 Students of Informatics Engineering, Majalengka University in 2021. fitrisyifa594@gmail.com

Lugi Sumantri. Semester 5 Students of Informatics Engineering, Majalengka University in 2021. lugisumantri1812@gmail.com