Original Research Article

Biometric voting using IoT to transfer vote to centralized system: A bibliometric analysis

Abstract: Several studies have empirically explored biometric voting using the IoT to transfer votes to the central system. There aren't many bibliometric studies that categorize the output in this area, though. By keeping an eye on the papers posted on the Scopus platform, this study's goal is to give research bibliometric analysis on biometric voting utilizing IoT to transfer votes to a central system, classifying trends, the state of the art, and other indications. 267 different materials made up the sample. Using the VOSviewer program, the data was processed and the outcomes graphically represented. According to the study, which examined publications' simultaneous occurrence by year, trends of keyword, co-citations, coupling bibliographic, and co-authorship analysis, institutions, and countries, the body of knowledge on biometric voting that uses the Internet of Things to transfer votes to a central system is expanding quickly. More than 530 citations were found in just eight works. However, there are other industrious writers. The most significant of the 267 sources used in the review were published in 26.066 percent of the papers. China is the world's leader in this field. This study offers knowledge about the current state of the art and indicates research opportunities and gaps in IoT-based biometric voting.
Keywords: IoT, blockchain, centralised system, Vos viewer, bibliometric

1. Introduction

The astounding spread and quick development of technology in many spheres of life has greatly aided humankind as a whole [1]. Voting has historically been the main way for people to express their thoughts on topics and subjects that are important to them [2]. Voting is a democratic practice. The election process is crucial in democracies because it takes place on a regular basis with the participation of people who have attained voting age and are permitted to do so. Because of this, it is urgently necessary to guarantee the integrity of the elections by providing citizens with protection and security so that they can vote in comfort [3]. Many nations have had authoritarian governments that lacked honesty and openness in the voting process. Having an election system focused on safety, integrity, protecting votes from repetition, manipulation, and tampering, as well as faster results delivery, is a solution for several governments seeking to improve and demonstrate their transparency and credibility in the public eye [4]. In democratic administrations, the practice of voting is utilized to allow the populace to select their representatives. Modern democracies are founded on voting, whether it is by electronic voting (e-voting) or traditional voting based on ballots. Apathy voters have been rising recently, particularly among the younger, more tech-savvy generation [5]. E-voting is promoted as a potential way to get more young people to vote [6, 7]. Many security and functional requirements, such as transparency, correctness, auditability, data and system integrity, privacy and secrecy, authority distribution, and availability, are listed for a reliable e-voting scheme [8,9,10]. Our suggested method depends on blockchain and Internet of Things (IoT) technology to provide security and high performance because the IoT and its applications have become nations' future looking to expand their fields [11]. IoT is viewed as numerous devices' collection linked together in a network to exchange data that, once processed, can be utilized to make the proper decisions when they are needed. The word "IoT" often defines interconnected objects' networks. It is made up of billions of interconnected "things" or gadgets that can perceive, calculate, communicate, and maybe trigger [12]. The technology of blockchain has been around since the 1980s, and today there is more interest in it than ever before thanks to the 2009 invention of the digital currency known as Bitcoin [13]. Blockchain equations were the technology used in the development of Bitcoin, which was regarded as a widely used digital currency in financial transactions [4]. Credibility and security issues affect voters' ability to cast valid ballots in elections. Others stay away from the polls to escape the commotion and lengthy lines [3]. The use of traditional voting procedures in elections has a number of drawbacks, including fraud in the voting process; stuffing extra ballots; faking certain ballots; difficulty with counting; and delays in reporting the results. For governments, the voting process is challenging because of all these issues. To tackle these issues, it is a good idea to create a quick, secure, and dependable system [4]. In some nations, such as India, for example, there is a difficulty with voting centers (kiosks), as they are not widely dispersed. Because these facilities are located in different locations, remote from some communities, they require employees to maintain them. Voters must travel great distances to cast their ballots, which will decrease the number of citizens who should vote [4]. As a result, our method is viewed as a solution to this problem because machines do not require human intervention to operate, allowing authorities to position them near all populous areas and are capable of placing multiple devices in the same space. Voting centers, punch-card voting, optical scan voting, and electronic voting are a few examples of technologies that were deployed (kiosks). It also covers a variety of network types, including mobile networks, private computer networks, and

online social media usage. These outdated electronic voting systems have evolved, though, as a result of technical advancements, and the academic community is now more interested than ever in voting equipment that uses the Internet of Things [15]. This system will only be used in government elections. Likewise, in questionnaires and referendums, as well as by private and governmental organizations to learn what the public thinks about a particular service or product, or by community organizations or institutions that want to understand what the general public thinks about a particular issue. The solution depends on blockchain and the IoT working together to provide speed, efficiency, and security in biometric voting. Similar studies have been done on biometric voting using IoT to transfer vote to centralized system [22], [23]. Thus, there is the need to measure these similar studies as well as to assess the productivity of specific scholars, nations, journals, and other performance levels.

2. Literature review

Along with the suggested works in this paper to advance the voting electronic process and improve its reliability and efficiency, we will present several solutions that were stated in previous researchers' works that combined electronic voting and blockchain in this section to permit decentralization for the voting electronic process and its services. South Korea participated in tests with electronic voting on the blockchain. Gyeonggi-do Province launched it in March 2018 and did so initially. Officials feel that despite the fact that this was only tried on a small scale, with only 9,000 participants, it demonstrates the possibility of adopting Blockchain technology for voting online [3]. A specific mechanism has been put forth by researchers [4] in an effort to address the issues with the central electronic voting procedure. By fragmenting and encrypting the data and building a network of peer-to-peer, the blockchain technology of Ethereum, which is centered on a network decentralized, assures a secure vote. It is the method of uniquely identifying a vote using the Aadhar number provided by the government, which is connected to a distributed ledger that buries the inner difficulties of the consumer. By connecting all voters with a private and public key, it is possible to assure voter verification and prevent double voting. Because the Aadhar number verification technique is not totally secure, additional measures like a verification code and biometric authentication One Time Password (OTP) must be used. In a different piece [2], they build and enhance electronic voting while increasing its effectiveness on the blockchain of Ethereum. Through the mobile phone number of the voter, a decentralized and trustworthy approach for guaranteeing data's transparency and accuracy has been presented. The voter can then cast his or her ballot using the verification system of the OTP, which transmits a code to the phone number of the voter. So that each vote is associated with just one phone number, increasing the effectiveness of verifying the vote, as they say. However, the necessity for biometric verification is essential and required to dispel any uncertainty regarding confirming that the person actually cast their ballot and not someone else. Another security flaw is the absence of verification using a government-issued voting card number. A plan to create a voting electronic system founded on smart contracts and blockchain that ensures voter security and privacy was put forth in the paper [16]. By connecting a phone number and the Aadhar card, the two methods were also connected to validate the vote before it was cast. The OTP is delivered to the phone of the voter to enable him to cast his vote just once, but there is no method to ensure that the person casting the vote is actually the voter, which is the biggest disadvantage.

3. Review methodology

The bibliometric review of biometric voting using IoT to convey votes to a central system is the basis for this work. The bibliometric review methodology is significant because it offers a classified perspective of the publications in each study field based on impartial standards for evaluating and categorizing publications. In turn, using the VOSviewer software gives the option to exhibit the data graphically using category maps. Data from one of the most significant bibliographic databases, Scopus, was gathered in January 2012. Information was gathered from the Scopus database, which includes additional sub-databases. The query for the terms "internet of things" yielded a total of 137,008 results; "transfer vote" yielded a total of 4 results; and "voting" yielded a total of 55,238. The query for the terms "internet of things, voting, and transfer vote" yielded a total of 267 results. Operators of Boolean were used to filter the outcomes: TITLE-ABS-KEY ("Internet of Things" AND voting OR "transfer vote"). The mechanisms employed to analyze and interpret the data gathered were bibliometric indicators, which were used in the bibliometric analysis [17]. 267 bibliographic resources were collected after the use of Boolean operators; these materials are examined in the current study. A similarity visualization application (VOSviewer) was used to analyse the data and illustrate some of the potential outcomes graphically. The study made use of authorship analysis between both nations and institutions, keyword trends, co-citation, bibliographic coupling, and simultaneous occurrence of publications by year. According to influence, major journals, publications, themes, authors, institutions, and nations, the findings identified the status of development and the key trends. With results relating to biometric voting using IoT to transfer votes to a central system and mapping of the key trends in the area, graphic

representation and analysis are crucial because they can aid professionals and academics in understanding what is being researched in the sustainability field. A quotation is created when the same article is quoted in two different documents. The author, journal, and document all use this strategy. The most frequently used terms in papers are measured by the author's co-occurrence of keywords. Once 2 documents cite similar documents, this is known as coupling bibliographic, and co-authorship shows the number of publications for a group of variables and how they are related to one another [18]. It is possible to use this strategy with organizations and nations.

4. Results and Discussion

4.1 Publications by Year

Studies associated with biometric voting using IoT to transfer votes to a central system started in 2012 with 3 publications. It dropped in 2013 to 2 publications and further dropped in 2014 to 1 publication. The publications started increasing in 2015 and from there it kept increasing (see Fig 1). The last article related to biometric voting using IoT to transfer votes to a central system that was identified in Scopus is from 2022 and it was published in Future Generation Computer Systems with the title "Improving IoT data availability via feedback- and voting-based anomaly imputation" by Li et al. [19]. This article aimed to "develop a feedback-and voting-based anomaly imputation technique that improves IoT data availability by imputing anomalous sensor data" (p. 194). As for yearly productivity, only 1 article was published every year between 2012 and 2022. Five articles were published in 2015; 13 in 2016, 13 in 2017, and 28 in 2018. In 2019, 34 articles were published, 48 articles in 2020, 69 articles in 2021, and by July 2020, 51 articles. The annual trends in publications on this subject are shown in Figure 1 and were derived from a sample of 694 articles. With 126 papers published, 2019 marked the highest number of publications. Additionally, as data gathering began in September 2020 and the subject is expanding, more articles are anticipated to have been published in 2020 than in 2019. Many publications on biometric voting using IoT to transfer vote to centralized system that have been published over time will be analyzed, and the study will be furthered to reveal data that will permit a better understanding of earlier studies' applicability.

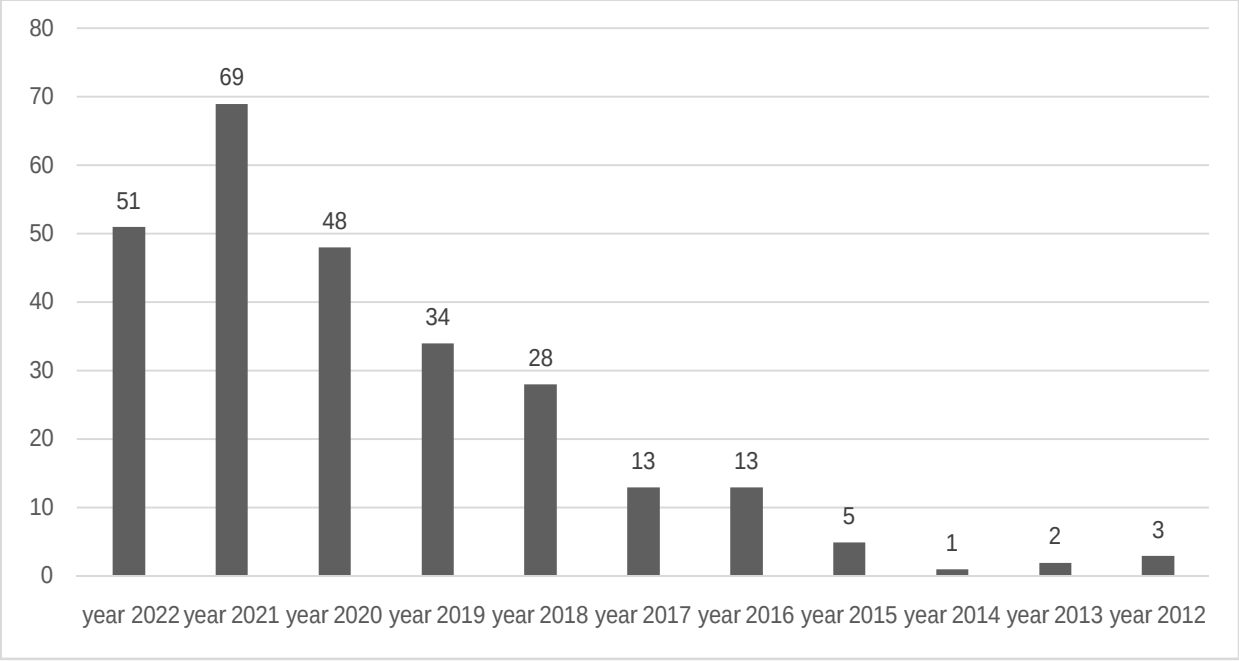

Fig 1: Publication by year

The 19 subject areas listed in Table 1 are used to categorize the 267 articles. With 225 related articles, or 84.270 percent of the total, the subject field "Computer Science" is the dominant subject area. Engineering, with 115 articles, is the second subject area with the greatest number of related articles, followed by "Decision Sciences," with 45 articles. It is vital to remember that a single article might be categorized under multiple headings, which can affect both total and partial statistics.

Table 1. Number of publications by category

Scopus Subject Area	Number	% of 267
Computer Science	225	84.270
Engineering	115	43.071
Decision Sciences	45	16.854
Mathematics	43	16.105
Physics and Astronomy	24	8.989
Materials Science	16	5.993
Business, Management and Accounting	15	5.618
Medicine	13	4.869
Social Sciences	13	4.869
Energy	7	2.622
Biochemistry, Genetics and Molecular Biology	6	2.247
Chemistry	6	2.247
Multidisciplinary	3	1.124
Chemical Engineering	2	0.749
Neuroscience	2	0.749
Arts and Humanities	1	0.375
Earth and Planetary Sciences	1	0.375
Economics, Econometrics and Finance	1	0.375
Environmental Science	1	0.375

Articles by Journal. The 267 publications were published in 161 distinct journals, according to our analysis of the journals (shown in Table 2).

Table 2. Productivity of journals summary (2012 - 2022)

Production volume by journal	Journals	% of 161
17 articles published	1	0.621
10 articles published	1	0.621
9 articles published	1	0.621
8 articles published	2	1.242
6 articles published	2	1.242
4 articles published	2	1.242
3 articles published	7	4.348
2 articles published	20	12.422
1 article published	125	77.640
Total	161	100

Out of 161 journals, 77.640% published simply 1 article on the topic researched, which is an indicator that these journals are not from the biometric voting area using IoT to transfer votes to a central system; 12.422% (20 journals) published only 2 articles; 4.348% (7 journals) published 3 articles; 1.242% (2 journals) of 4 articles published; 1.242% (2 journals) of six articles published; 1.242% (2 journals) of eight articles; 0.621% (1 journal) published nine articles; 0.621% (1 journals) published ten articles and 0.621% (1 journals) published seventeen articles. They can be considered journals of biometric voting using IoT to transfer votes to a central system as they published more than one article (see Table 2). Additionally, we can see in Figure 2 how interdisciplinary this study topic is and how it may be published in journals from other domains and using various methodologies. Figure 2 presents journals with more than three publications relating to biometric voting using IoT to transfer votes to a central system.

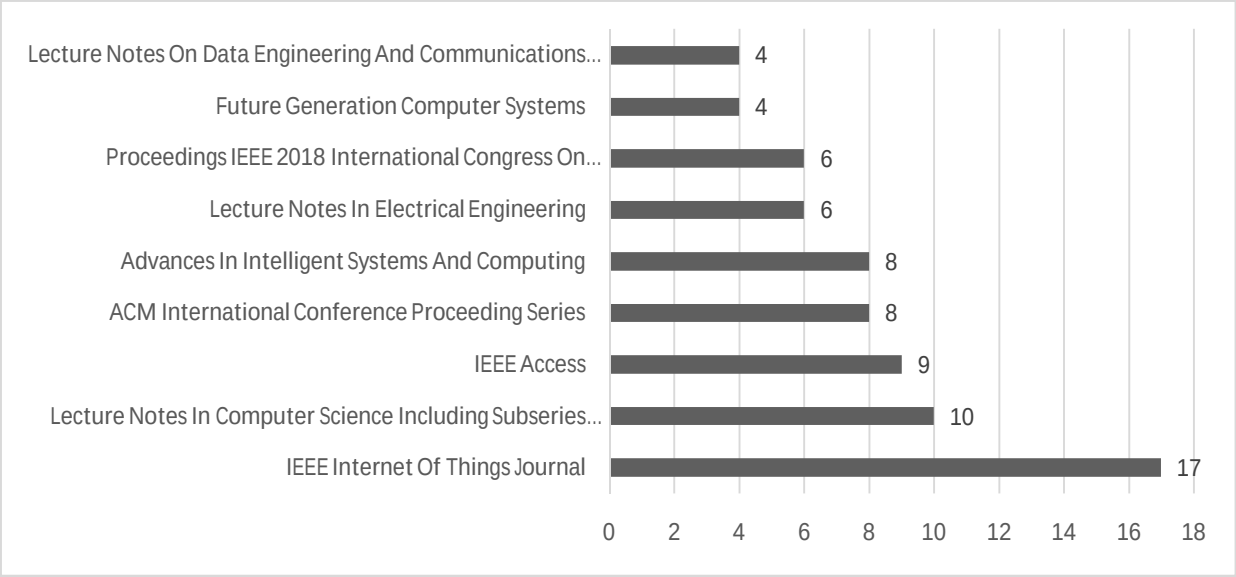

Figure 2. Publications by year (2012 - 2022)

As shown in Table 3, we looked at 9 journals that have 4 or more publications on the topic. These journals published 72 articles, accounting for 26.366 percent of the sample articles. As can be seen, "IEEE Internet Of Things Journal" has the most articles published (17 articles altogether), accounting for 6.367 percent of the sample as a whole, followed by the "Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics" with 3.745 percent (10 articles).

Table 3. Publications of journal (2012 - 2022)

Publication by journal	**Number**	**% of 267**
IEEE Internet Of Things Journal	17	6.367
Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics	10	3.745
IEEE Access	9	3.371
ACM International Conference Proceeding Series	8	2.996
Advances In Intelligent Systems And Computing	8	2.996
Lecture Notes In Electrical Engineering	6	2.247
Proceedings IEEE 2018 International Congress On Cybermatics 2018 IEEE Conferences On Internet Of Things Green Computing And Communications Cyber Physical And Social Computing Smart Data Blockchain Computer And Information Technology Ithings Greencom Cpscom Smartdata Blockchain CIT 2018	6	2.247
Future Generation Computer Systems	4	1.498
Lecture Notes On Data Engineering And Communications Technologies	4	1.498

4.2 Keyword Analysis

The 267 items in the sample were categorized using the most popular keywords that were found and examined. The subjects that come up more frequently in the analyzed area stand out as a result of this analysis. The map shown in Figure 3 organizes the keywords into 55 groupings. The internet of things, blockchain, and security are further highlighted in this map as areas where new research possibilities may be developing.

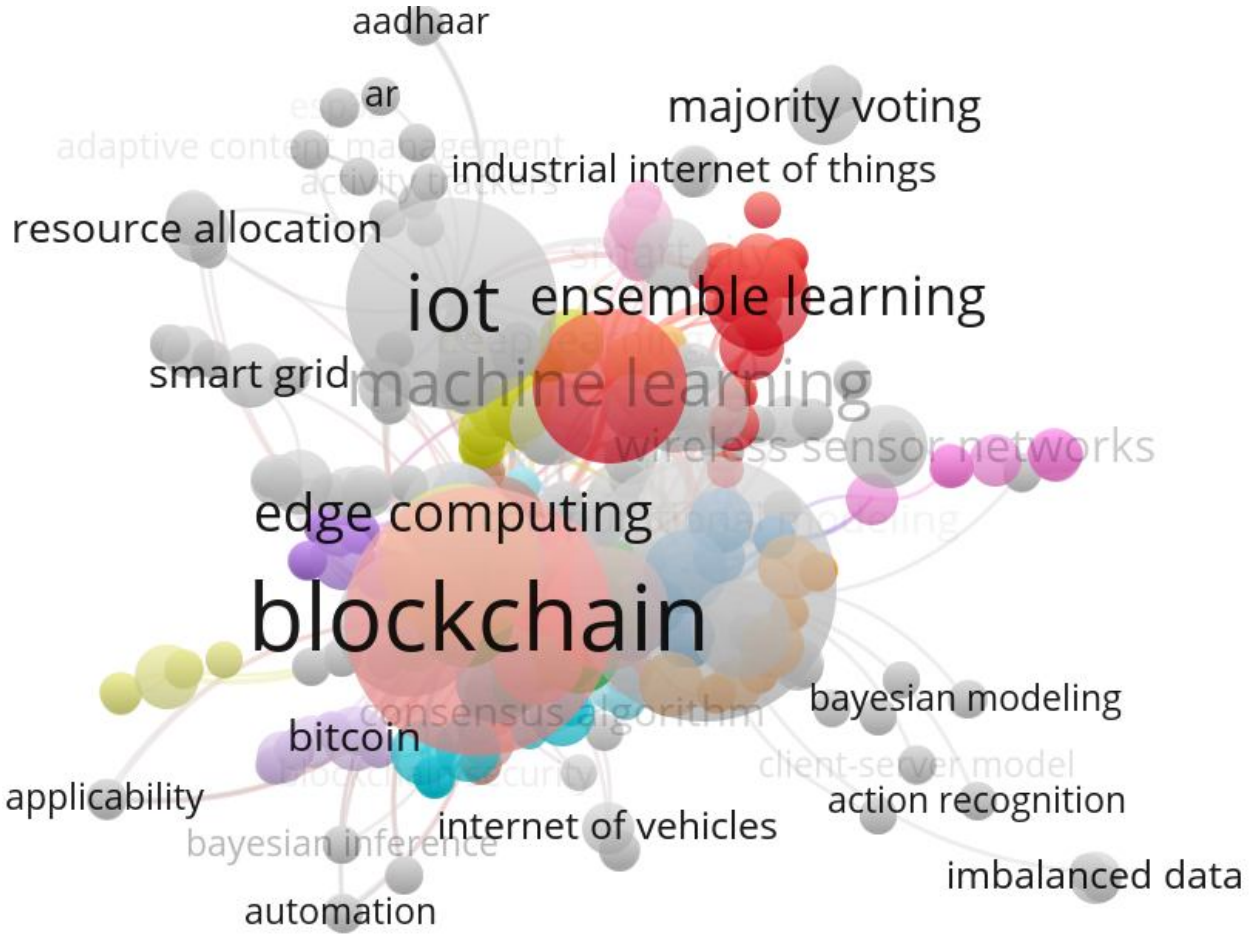

Figure 3. Keyword trends (2012 - 2022)

From the 267 articles, 831 keywords were recognized. Of these, we present three of the most frequent keywords. The keyword "Internet of things" has an occurrence in 97 articles, being the word that is used often most often to summarize the analyzed articles' key subjects, which means 11.673% prevalence with the highest overall link strength of 551 (see Table 4). Blockchain appeared fifty-one times with the second highest overall link strength of 234, equivalent to 6.137%; and security was recognized as a minimum of 18 articles, i.e., 1.16% with an overall link strength of 133. The keywords "Internet of things", "Blockchain", "Security", "Machine learning", "Voting", "Smart contract", "Electronic voting", "Edge computing", "Ensemble learning" and "e-voting" appeared more than six times.

Table 4. Ten most occurred keywords

Keyword	Occurrence	Total link strength
Internet of things	97	551
Blockchain	51	234
Security	18	133
Machine learning	17	120
Voting	11	64
Smart contract	11	54
Electronic voting	10	50
Edge computing	8	53
Ensemble learning	8	44
e-voting	7	39

4.4. Geographical Analysis of Publications

The 267 publications that make up the sample are spread across 71 different nations, indicating that this study issue is international when the country of affiliation of the authors is examined. This indicates that each of these nations has at least one article published. The five nations with the greatest number of scholarly articles on biometric voting using the internet of things to transfer votes to a central system are listed in Table 5. They account for 72.285 percent of all articles published collectively. The findings show that China, with 74 articles, 590 citations, and 49 total link strengths, has the largest number of publications, citations, and overall link strength. This is followed by India with 60 articles, 284 citations and 27 total link strength. The United States of America is in 3rd place in publication with 34 articles, 253 citations, and 23 total link strength (see Table 5).

Table 5. Publications in co-authorship by country (2012 - 2022)

Co-authorship by countries	Number	Citations	Total link strength
China	74	590	49
India	60	284	27
United States of America	34	253	23
South Korea	13	97	5
Saudi Arabia	12	44	18

The national co-authorship map from the sample of 267 articles is shown in Figure 4. The group of nations consisting of China, India, the United States of America, South Korea, and Saudi Arabia may be seen. The distance between the clusters on the map and the lines connecting them illustrate the intensity of the relationships between the countries and how frequently they publish as co-authors. This is a good indication of the strength of international cooperation in the biometric voting field using IoT to transfer votes to a central system of research.

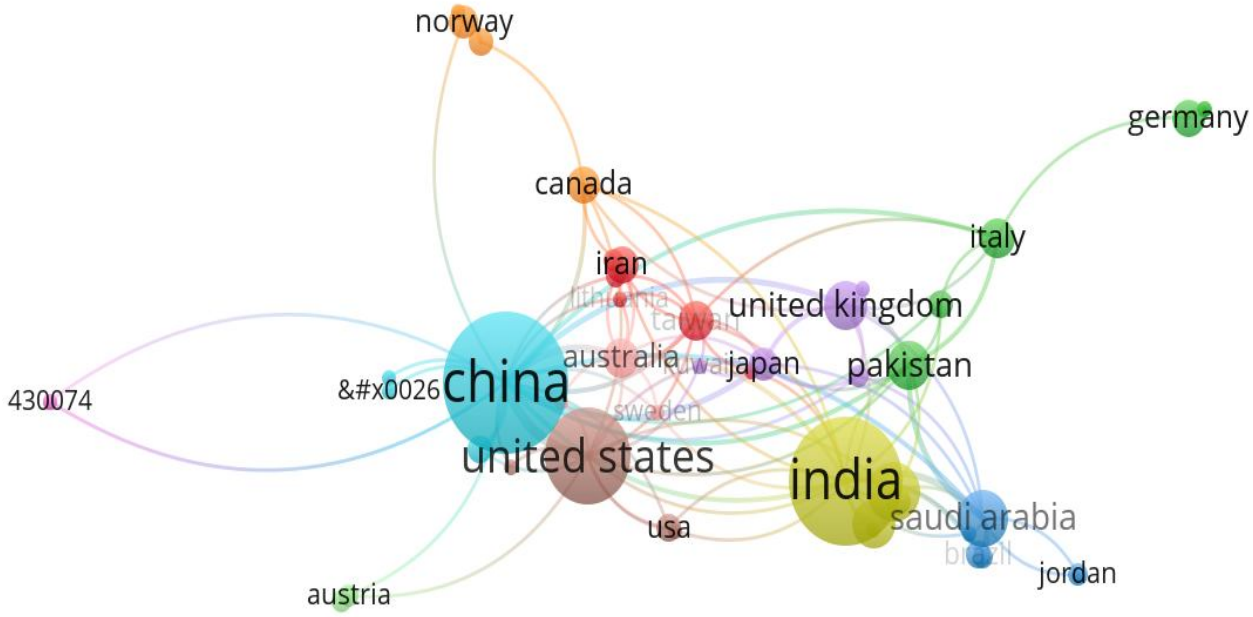

Figure 4. Publications in co-authorship by country (2012 - 2022)

4.5. Publications Analysis by Organization

The top six universities accountable for the 267 articles' publications are Beijing Jiaotong University, China University of Technology and Mining, Zhejiang University, Norwegian University of Technology and Science, Sri Krishna College of Technology, and Sungkyunkwan University. However, it is obvious that the occurrences are extremely dispersed concerning papers' volumes produced by an organization, unlike what occurs in journals or nations of publication. With three publications each, or 1.124 percent of the 267 articles, the Information and Electronic Engineering School and the University of Beijing Jiaotong tie for first place. The six organizations that have generated the most scholarly publications in the field of research are listed in Table 6.

Table 6. Publications by organization

Organization	Number	% of 267

Beijing jiaotong university	3	1.124
China university of mining and technology	2	0.749
Zhejiang university	2	0.749
Norwegian university of science and technology	2	0.749
Sri krishna college of technology	2	0.749
Sungkyunkwan university	2	0.749

The key universities that have published publications on biometric voting using IoT to transfer vote to centralized system, as well as the collaboration between the institutions, are displayed on the map created by the VOSviewer program (Figure 5). The sample of 267 articles used in this research was used to create the aforementioned map.

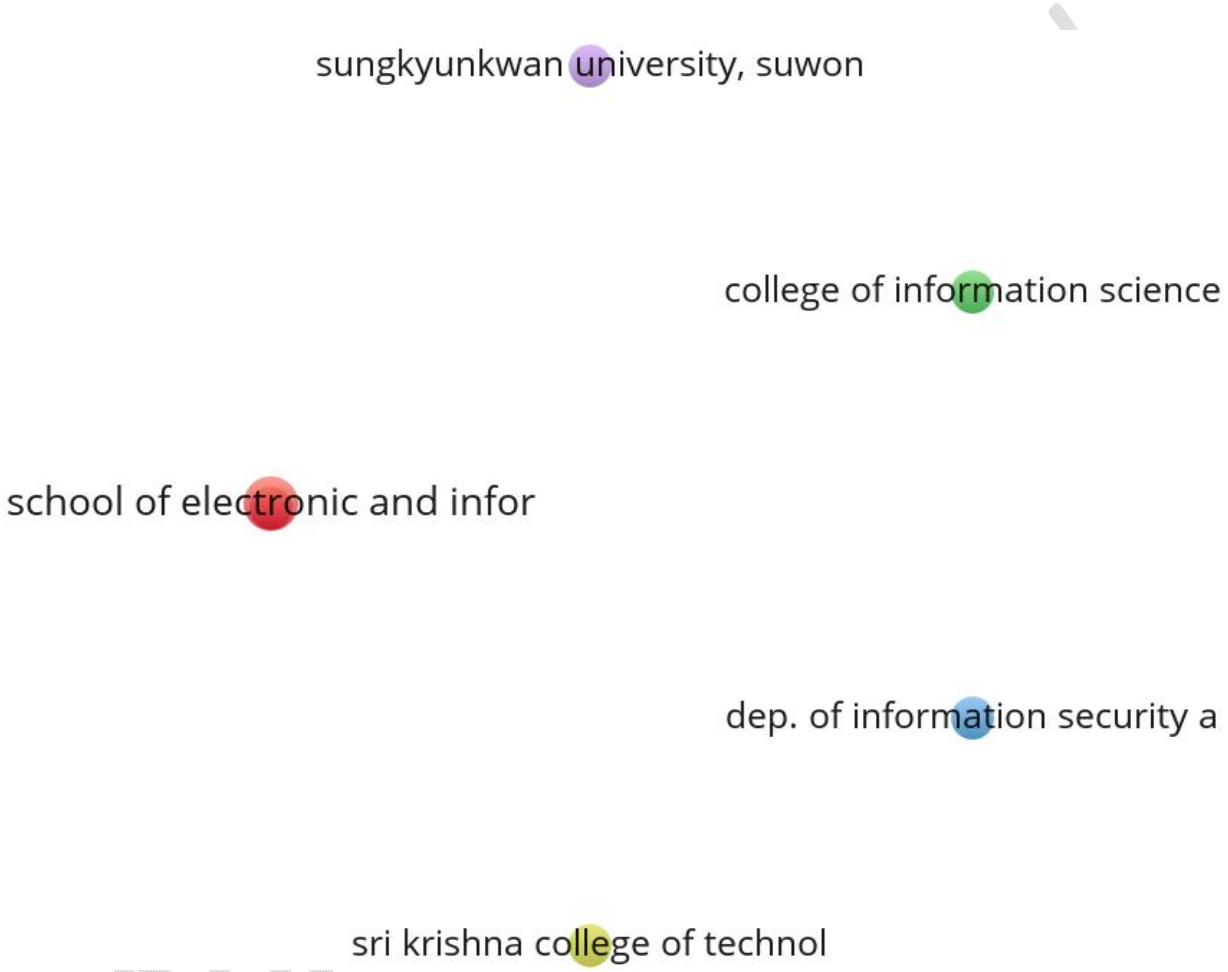

Figure 5. Publications by organization

It is feasible to determine the publishers' organizations and the relationships among them by analyzing Figure 5. In the Scopus-generated results shown in Figure 5, we can find Beijing Jiaotong University without its school of electrical and information engineering. as well as the control and information engineering school at the China University of Technology and Mining, the college of electronic engineering and information science at Zhejiang University, the department of communication technology and information security at the Norwegian University of Technology and Science, and others.

4.6 Analysis of Citations

Since it identifies the important papers in the field of study, the analysis of article citations is the most popular technique for evaluating the influence of authors, journals, and articles [18]. Table 7 examines the citation structure in the pertinent field of study. The reference publication, "Hybrid of anomaly-based and specification-based IDS for the Internet of Things utilizing unsupervised OPF based on the MapReduce technique," has a total of 120 citations, making it easy to see which works are most frequently cited in this field.

Table 7. Citations by articles with the highest citation

Title	Authors	Journal	Citations
Hybrid of anomaly-based and specification-based IDS for Internet of Things using unsupervised OPF based on MapReduce approach	Hamid, B. and Mansour, S.	Computer Communications	120
AI-based two-stage intrusion detection for software defined IoT networks	Jiaqi, L.; Zhifeng, Z.; Rongpeng, L.; Honggang, Z.	IEEE Internet of Things Journal	83
Blockchain trust model for malicious node detection in wireless sensor networks	Wei, S.; Qi, L.; Zhao, T.; Jian-Sen, C.; Bo, W. and Wei, L.	IEEE Access	79
The survey on near field communication	Vedat, C.; Busra, O. and Kerem, O.	Sensors (Switzerland)	65
Astraea: A Decentralized Blockchain Oracle	John, A.; Ryan, B.; Andreas, V.; Zissis, P.; Neil, V. and Anastasia, K.	Proceedings - IEEE 2018 International Congress on Cybermatics: 2018 IEEE Conferences on Internet of Things, Green Computing and Communications, Cyber, Physical and Social Computing, Smart Data, Blockchain, Computer and Information Technology, iThings/GreenCom/CPSCom/SmartData/Blockchain/CIT 2018	64
E-Voting with Blockchain: An E-Voting Protocol with Decentralisation and Voter Privacy	Sheer, H.F.; Apostolos, G.; Naeem, A.R. and Konstantinos, M.	Proceedings - IEEE 2018 International Congress on Cybermatics: 2018 IEEE Conferences on Internet of Things, Green Computing and Communications, Cyber, Physical and Social Computing, Smart Data, Blockchain, Computer and Information Technology, iThings/GreenCom/CPSCom/SmartData/Blockchain/CIT 2018	60
Large-scale Election Based on Blockchain	Baocheng, W.; Jiawei, S.; Yunhua, H.; Dandan, P. and Ningxiao, L.	Procedia Computer Science	60

Researchers can find the foundational content that can be utilized as their studies' support reference by understanding the most-cited publications, giving them an obvious place to start. It is feasible to determine the author citation network by looking at Figure 6. When two documents make reference to the same document, a citation is generated. This method is used to illustrate a document's applicability to a specific topic area and is applied to papers, journals, and authors [18]. Along with other names like Song, J. and Cho, S.H., the red cluster of authors most frequently mentioned includes the Chinese author Wang, Y. from Beijing Jiaotong University.

Figure 6. Author citation network

4.7. Analysis by Author

The last analysis discusses publication and author production. The most prolific author is seen in Table 8. Chinese professor Wang, Yipeng from Information and Electronic Engineering School, University of Beijing Jiaotong, Beijing, China has nine of the 267 publications with 29 total link strength, followed by the Chinese authors Liu,

Yizhi from China University of Geosciences, Zhang, H. from Army Engineering University of Pla and Yang, W. from Beijing Jiaotong University.

Table 8. Publication by authors

Author	Number	Total link strength
Wang Y.	7	29
Liu, X.	5	19
Zhang, H.	5	17
Yang, W.	5	14

When two documents quote the same source, this is known as bibliographic coupling [18], which can show how strong a certain publication is in comparison to other publications' group. This method can be used with articles, journals, writers, institutions, and nations. It is feasible to identify the articles and writers who are frequently cited by looking at the authors' bibliographic coupling. Authors' bibliographic coupling is represented in Figure 7, which enables us to see and gauge the strength of the relationship between them. The map shows fifteen clearly identified clusters, and the connected lines provide author citations.

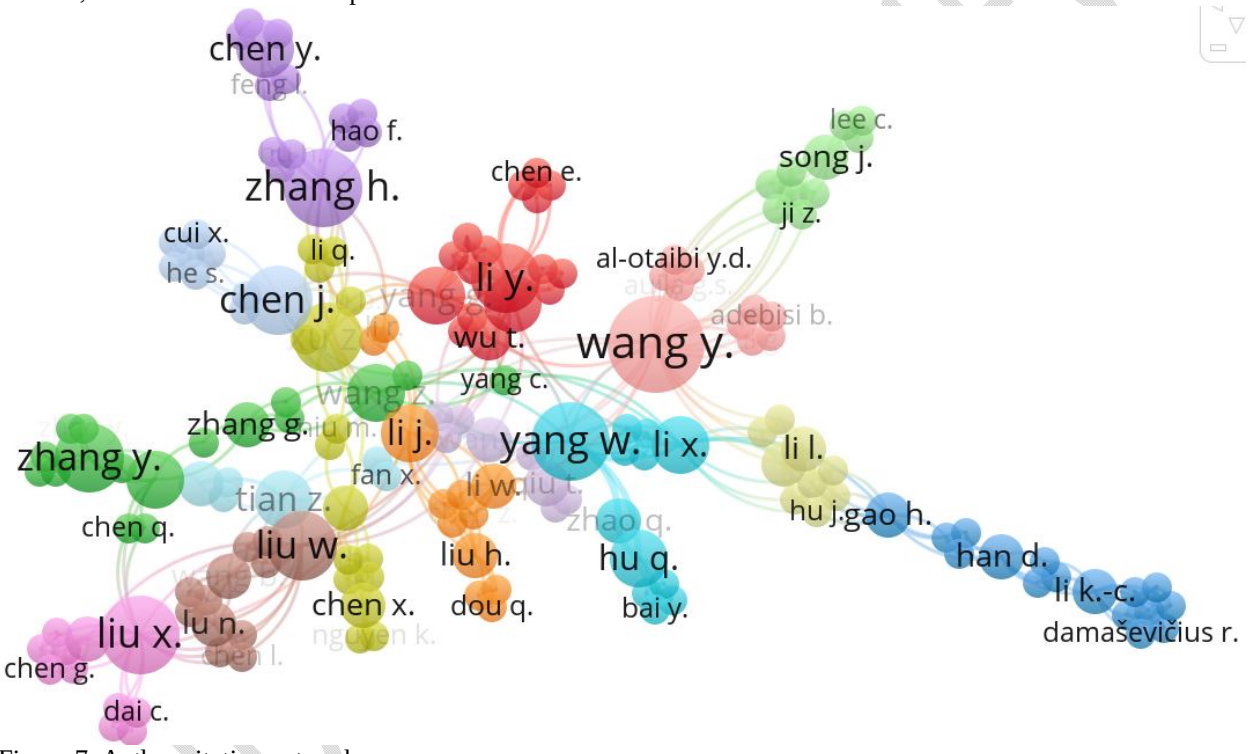

Figure 7. Author citation network

4.8 Analysis of Research Opportunities

This study's objective is to highlight the key research possibilities in this area, as well as give a research overview and the investigation directions on biometric voting utilizing IoT to transfer votes to a central system. As a result, the purpose of this section is to evaluate and suggest future possibilities for research in this area based on content analysis. The review of eight of the most recent and pertinent publications recommended by Scopus led to the selection of the eight papers shown in Table 7. They were thought to be the most mentioned and pertinent because they were published during the last five years. Although blockchain technology holds a lot of promise, its existing limitations may prevent it from realizing its full potential. Research on the fundamentals of blockchain technology needs to be intensified in order to enhance its capabilities and support for sophisticated apps that can run on the network of the blockchain [20]. The voting procedure can be made considerably simpler in future studies by using other means for verification, for example, the fingerprint sensors found in phones [21].

5. Discussion

The current study contributes to our understanding of the state-of-the-art in studies on biometric voting that uses IoT to convey votes to a central system. It is useful to discover the nations and organizations that publish the most in journals, with a focus on biometric voting utilizing IoT. In particular, the significance of publications from the co-citation networks, trends in the covered themes centered on keywords, and transfer votes to the central system As a result, it is crucial to identify knowledge gaps in this domain and potential future trends in research. This study analyzes the top journals, writers, keywords, and institutions, demonstrating that (a) the body of knowledge on using IoT to transfer votes to a central system via biometric voting is rapidly expanding. (b) Eight publications alone accounted for 60 or more citations, and a sizable portion of the study was written by a number of prolific authors. (c) Of the 267 publications included in this review, 26.066 percent were found in primary sources. (d) China is the top nation with regards to citations and documents. Finally, this area of the literature on biometric voting has a lot of potential and is predicted to increase significantly over the next few years. The outcomes show a clear trend as a result of the increased emphasis on biometric voting [19,20,21]. People are more concerned about the effectiveness of the electronic voting system for smooth and peaceful elections. Individuals wish to understand the direct voting impact on society. Therefore, since people are more aware of election problems, the study of biometric voting using IoT to transfer votes to a central system can help businesses, governments, and countries have effective and peaceful elections. To establish clear and long-lasting biometric voting methods, it is crucial to understand the different types of electronic voting and the advantages and disadvantages they provide. It is crucial to involve all interested parties in the development of effective biometric voting, including local government, people, and public and private service providers. The studies of biometric voting by Othman et al. [20] and Mallikarjuna et al. [21] make important contributions. Customers and other stakeholders have become significant players in the chain of sustainable tourism. As more parties become involved in this process, the development of biometric voting solutions may actually contribute to and benefit from peaceful elections.

6. Conclusions

By giving information on the current state of the art and classifying gaps, trends, and research opportunities through content analysis and the most pertinent and recent publications' selection published in this field of research, the current study adds to the body of existing research. The public and service institutions make up the government sector. Through a web system connected to IoT devices, citizens can easily participate in elections or referendums. This allows them to simply express their ideas and acquire the results of elections or referendums promptly, correctly, and without duplicate votes. The system uses the blockchain to preserve and maintain the privacy of the citizens' data. Only adults or those who are entitled to vote may cast ballots when logging in to vote. After entering his or her personal information and electoral card number, the citizen's data is checked and cross-referenced with the government's database of citizen records. In order to cast a ballot in a governmental election, a voter must visit one of the many voting machines that are located throughout the country after completing the online voting process to verify his vote using his fingerprint, which would then be compared to previously recorded information about him in the government's database of voter records. Only governmental elections require this fingerprint verification technique. With fingerprint verification's exception to speed up the process of voting since it is not as crucial as elections, the voting process in referendums or governmental surveys is the same as in governmental voting elections. By matching the data entered with the database of the government's citizen records, the voter's information is verified. Instead, the private sector, which consists of organizations or businesses that work in the social sector, wants to hold a referendum or create surveys to get the views of the public. They can organize referendums, and the system aids in gathering opinions from citizens in a timely and accurate manner. Without going through the verification and confirmation processes required for voting in the public sector, citizens can access the website directly to complete the questionnaire and cast their votes. Because it is a standard procedure, the person's identification does not need to be verified or confirmed. The group or establishment that organized the poll or referendum can quickly obtain the voting results. Each vote, if it be for public or private voting, triggers the creation of a new node in the blockchain by the smart contract. The vote is then recorded in the database, guaranteeing that it is secure from tampering or fraud. One can highlight further contributions made by the current study. First, a description of the evolution of the terminology employed in this field of study. The most common terms used to refer to studies on biometric voting using IoT to transfer votes to a central system are "Internet of Things" first, followed by "blockchain." Understanding the growing interest in the study of biometric voting using the Internet of Things to convey votes to a central system is the foundation of a second contribution. The number of publications has increased over the past ten years, from 3 articles in 2012 to 267 articles as of 2022, demonstrating the expanding tendency in this field of study. The keyword clusters seen with VOSviewer indicate a rise over time. Such increasing interest clearly indicates the effects of biometric voting using IoT and its results, as well as the prospective paths of

future research. The categorization and source of relevant research are shown as a third contribution. The most prevalent subject area overall is "Computer Science," with 225 related articles, or 84.270 percent of the 267 articles, demonstrating publications' significant predominance in specialized biometric voting journals. The research centers on around 71 nations that collectively comprise 100% of the articles published, with China leading the pack with 74 publications. Fourthly, the paper helps identify the journals that publish the research majority that falls under the chosen criteria. With 17 articles, or 6.367 percent of the publications, the IEEE Internet of Things Journal is at the top of the list. Lecture Notes in Computer Science, including Lecture Notes in Bioinformatics and Subseries, published 10 papers, accounting for 3.745 percent of all papers published. Lecture Notes in Artificial Intelligence comes in second. The research concludes with the most pertinent and recent articles' content study, examining the locations and subjects under consideration that appear to be more well-liked as well as the general directions under investigation. This work could provide invaluable hints to individuals looking into or planning to explore this field of inquiry. Future studies can look into various points of view regarding the viability of biometric voting. Another development is comparative studies in the area of electronic voting. The most intriguing issues in this area appear to be those involving various situations, particular destinations, the major roles of citizens, and their perspectives. It is likewise recommended that voting variables be addressed in particular research bibliometric, looking at their association with IoT variables in academic literature as part of future research. Another recommendation for bibliometric future analyses might be to address a potential cybersecurity risk in academic research's creation in the electronic voting area, against the backdrop of a pandemic that restricts people's ability to move around locally and globally, making it more difficult to vote. The findings for the year 2022 are only valid up to the month of July, which is when the data collection was done. To give a comprehensive account of scientific output in 2022, future studies may cover the entire year. The bibliometric analysis is dependent on technical choices, such as selecting a research and language area, which may exclude important works. Another drawback is that, after consulting alternative databases, it was determined to only use Scopus. A multisource approach comparing several databases could provide a thorough review of the research in this area and a clearer understanding of the key distinctions and implications of using various databases. [23]The ability of bibliometric analysis to analyze the contexts and drivers of citation activity is restricted. A bibliometric technique offers an analysis that is primarily descriptive and might not include enough content analysis to improve the capacity of explanation and offer a deeper examination of the findings and consequences.

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