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A Systematic Literature Review of Automation Quality of Service in Computer Networks: Research Trends, Datasets, and Methods

Budi Sunaryo[1], Muhammad Ilhamdi Rusydi[2*], Ariadi Hazmi[3], Minoru Sasaki[4]
[1]Department of Network Computer Engineering Technology, Faculty of Industrial Technology, Universitas Bung Hatta, Padang City, Indonesia
[1,2,3]Department of Electric Engineering, Faculty of Engineering, Universitas Andalas, Padang City, Indonesia
[4]Intelligent Production Technology Research & Development Center for Aerospace (IPTeCA), Tokai National Higher Education and Research System, Gifu University, Gifu City, Japan
[1]budi.sunaryo@bunghatta.ac.id, [2]rusydi@eng.unand.ac.id, [3]ariadi@eng.unand.ac.id, [4]sasaki@gifu-u.ac.jp

Abstract

The article is a systematic literature review of the use of automation for quality of service (QoS) in computer networks. It summarizes the research trends, datasets, and methods used in the field and provides an overview of the current state of the art. The focus of the review is on the use of automation for QoS management and improvement in computer networks, including the use of machine learning, artificial intelligence, and other computational techniques. The review highlights the need for further research and development in this area and provides insights into future directions for the field. The review covered a wide range of studies, including research papers and conference proceedings, and involved a comprehensive database search of the Scopus database covering journals and proceedings such as the Institute of Electrical and Electronics Engineers (IEEE) Xplore, Association for Computing Machinery (ACM) Digital Library, Springer, and ScienceDirect databases between 2017 and September 2022. From these databases, 1856 metadata were found, which eventually became seventy-three metadata after going through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol.

Keywords: systematic literature review, automation QoS, computer networks

1. Introduction

Research to conduct a systematic and thorough evaluation of the literature [1] on the use of automation to enhance the quality of service (QoS) in computer networks is known as a systematic literature review (SLR) project. The review would involve searching for and identifying relevant studies on the topic, evaluating the quality of those studies, and synthesizing the findings to provide a comprehensive overview of the current state of knowledge [2] on the use of automation for QoS in computer networks. By conducting a systematic review, researchers can identify gaps in the current knowledge and provide recommendations for future research on the topic.

The review would likely include a wide range of studies, including research papers, conference proceedings, technical reports, and other relevant sources between 2017 and September 2022. The review would involve a comprehensive search of databases in the Scopus database such as the Institute of Electrical and Electronics Engineers (IEEE) Xplore, the Association for Computing Machinery (ACM) Digital Library, and ScienceDirect.

This review will involve evaluating the quality of the studies included in the review using predefined criteria; such as datasets, methods, and topics in QoS automation, especially in computer networks. The findings of the review will be synthesized and presented clearly and concisely, highlighting key findings and implications for practice and research.

Quality of Service (QoS) is a concept used to organize and control how a network handles data traffic [3][4]. QoS uses various techniques to prioritize data traffic [5] and guarantee a level of service that matches the needs of the application or service being used [6]. It is useful for ensuring that a network can provide reliable and predictable service to its users [7], regardless of the level of network load. While automation QoS is a concept that focuses on improving the quality of service and efficiency of automation systems. This can be done by optimizing the configuration of automation systems [8][9], improving system reliability [10][11] and speed

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[12][13], and reducing system downtime [14] and the number of interruptions that occur [10][15].

Overall, this systematic literature review on automation for QoS in computer networks aims to provide a comprehensive overview of the current state of knowledge on using automation to improve QoS in computer networks and identify gaps in current knowledge that can be addressed in future research. Based on this review, the most promising improvements that can be proposed for future research will be found.

2. Research Methods

2.1 Review Method

The literature review on automation QoS for computer networks will be systematically reviewed. To provide answers to specific research questions, an SLR is described as a method to search, evaluate and interpret all available study information [1]. In addition, the review technique, style, and images in this section of the article were inspired by some literature articles that use SLR [16][17][2].

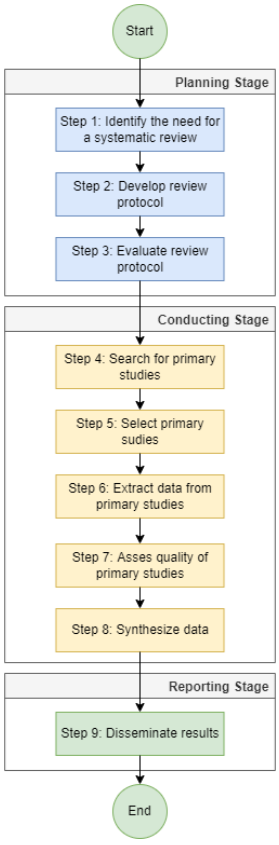

Figure 1. Systematic Literature Review Steps [2]

SLR is carried out in three stages: planning, conducting, and reporting the literature review, as seen in Figure 1. The requirements for a systematic review are determined in the first phase (Step 1). The introduction of this chapter includes the purpose of conducting a literature review, namely to identify and analyze relevant literature sources related to the research topic being studied regarding QoS automation, especially related to computer networks. Then, the systematic reviews on automation QoS for computer networks that have already been published are found and evaluated. The review procedure was created to provide direction for how the review would be conducted and to lessen the chance of researcher bias (Step 2). It specified the study selection procedure with inclusion and exclusion criteria, the research questions, the search method, the quality evaluation, and lastly the data extraction and synthesis process. Section 2.2, Section 2.3, Section 2.4, and Section 2.5 present the review protocol. The review protocol was created and assessed.

2.2 Research Questions

To keep the review narrowly focused, specific Research Questions (RQ) were developed. The Population, Intervention, Comparison, Outcomes, and Context (PICOC) criteria were used to assist create them [1]. The PICOC structure of the research topics is displayed in Table 1.

Table 1. Summary of PICOC

Population	Computer Network, Bandwidth Management.
Intervention	Automation QoS, Models, Methods, Techniques, Datasets.
Comparison	n/a.
Outcomes	Accuracy of Automation QoS, Successful Automation QoS Methods.
Context	Studies in Industry or Academy, Small, and Large Datasets.

Table 2 lists the research questions and driving forces behind this literature evaluation.

Table 2. Research Questions on Literature Review

ID	Research Question	Motivation
RQ1	Which journal is the most significant about automation QoS?	Identify the most significant journals in the automation QoS field.
RQ2	Who are the most active and influential researchers by country in the automation QoS field?	Identify the most active and influential researchers by country who contributed so much to a research area of automation QoS.
RQ3	What kind of research topics are selected by researchers in the automation QoS field?	Identify research topics and trends in automation QoS.
RQ4	What kind of datasets is the most used for automation QoS?	Identify datasets commonly used in automation QoS.
RQ5	What kind of methods are used for the automation of QoS?	Identify opportunities and trends for the automation QoS method.
RQ6	What kind of method improvements are proposed for the automation of QoS?	Identify the proposed method improvements for automation of QoS.

Automation QoS techniques and datasets to address RQ4 through RQ6 are extracted from the primary studies. Then, it was determined which methods and

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datasets in automation QoS are significant and which are not by analyzing the methods and datasets (RQ4 to RQ6). The key research questions are RQ4 to RQ6, while the other questions (RQ1 to RQ3) aid in our understanding of the background of the primary studies. A summary and synthesis of a specific area of research in the automation QoS field are provided in RQ1 to RQ3.

2.3. Search Strategy

The following procedures were used to create the search string: (1) Determining the search terms from PICOC, particularly from Population and Intervention; (2) Determining the terms from research questions; (3) Determining the terms from pertinent titles, abstracts, and keywords; (4) Determining synonyms, alternate spellings, and antonyms of the terms; and (5) Building an advanced search string using the identified terms and boolean ANDs and ORs.

The following search string was eventually used in Scopus databases. Based on the keyword of "TITLE-ABS-KEY ("automation" AND "quality of service")" has been found as many as 1856 metadata. Based on the keyword of "TITLE-ABS-KEY ("automation" AND "quality of service") AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO(PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017))" between 2017 and 2022 has been founded in as many as 723 metadata.

Based on the keyword with the subject of "computer" and "engineering" in "TITLE-ABS-KEY ("automation" AND "quality of service") AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017)) AND (LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "ENGI"))" has been found as many as 697 metadata.

Based on the keyword with the document type of "Conference Proceedings" and "Journal" in "TITLE-ABS-KEY ("automation" AND "quality of service") AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017)) AND (LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "ENGI")) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar"))" has been found as many as 656 metadata.

Based on the keyword with the language of "English" only in "TITLE-ABS-KEY ("automation" AND "quality of service") AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017)) AND (LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "ENGI")) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))" has been founded as many as 640 metadata.

The last, based on the keyword with the source type of "conference proceedings" and "journal" in "TITLE-ABS-KEY ("automation" AND "quality of service") AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017)) AND (LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "ENGI")) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "p") OR LIMIT-TO (SRCTYPE, "j"))" has been founded as many as 577 metadata. The last result of searching will be included and excluded in some criteria in the study selection steps.

The search string was altered, but the previous one was retained because the altered search string will significantly lengthen the already lengthy list of useless research. Following that, the search phrase was modified to meet the demands of each database. Title, keyword, and abstract searches were performed on the databases. The range of years covered by the search was 2017–2022. There were two different types of publications: journal papers, and conference proceedings. Only English-language articles were allowed in the search.

2.4 Study Selection

The primary studies were chosen based on inclusion and exclusion criteria. These standards are displayed in Table 3.

Table 3. Inclusion and Exclusion Criteria

Inclusion Criteria	Studies in industry and academics from small to large-scale datasets. Studies discussing and comparing modeling performance in the area of automation penalty QoS. For studies that have both the conference and journal versions.
Exclusion Criteria	Studies without a strong validation or including experimental results of automation penalty QoS. Studies discussing automation penalty datasets and methods in a context other than automation penalty QoS. Studies not written in English.

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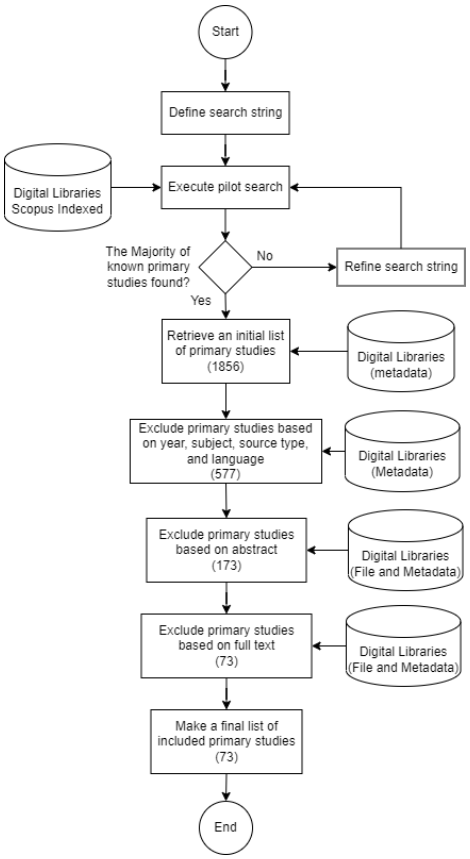

Figure 2. Search and Selection of Primary Studies

The method used in this systematic review is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol which is illustrated in Figure 2. PRISMA has complete and detailed stages for conducting literature reviews. This literature reviews the automation of QoS penalty on abnormal data transmission in computer networks. The type of literature to be analyzed is articles published in reputable indexed international journals. Article references are taken from literature search engines Scopus databases that include journals and proceedings namely ScienceDirect, IEEE, SpringerLink, Emerald Publishing, and Wiley Blackwell.

There were seventy-three primary studies on the final list of those chosen. The complete texts of seventy-three primary studies were subsequently analyzed. The standard of the original studies, their relevance to the research topics, and study similarity were taken into account in addition to the inclusion and exclusion criteria. Identical papers by the same authors published in different journals were omitted.

After excluding papers based on the full-text selection, seventy-three primary studies were still included. The final section of this report includes a complete list of the studies that were chosen in Table 4.

2.5 Data Extraction

Iterative data extraction is done, and the results are displayed in Table 5.

Table 5. Data Extraction Properties Mapped to Research Questions

Property	Research Questions
Researchers and Publications	RQ1, RQ2
Research Trends and Topics	RQ3
Automation QoS Datasets	RQ4
Automation QoS Metrics	RQ4
Automation QoS Methods	RQ5, RQ6

Table 4. The List of Primary Studies in the Field of Automation QoS for Computer Networks

Year	Primary Studies	Publications	Publisher	Datasets	Methods	Trend Topics
2017	[38]	Proceedings - 2017 6th IIAI International Congress on Advanced Applied Informatics, IIAI-AAI 2017	IEEE Inc.	Private	Network-level QoS metrics	Quality of Service Assurance
	[39]	ICAC 2017 - 2017 23rd IEEE International Conference on Automation and Computing: Addressing Global Challenges through Automation and Computing	IEEE Inc.	Private	Hadoop Distributed File System (HDFS)	Smart city
	[3]	IEEE International Symposium on Broadband Multimedia Systems and Broadcasting, BMSB	IEEE Computer Society	Private	QoS-based routing	Quality of Service
	[40]	IEEE International Conference on Emerging Technologies and Factory Automation, ETFA	IEEE Inc.	Private	ISO/IEC 62443 cyber security standard	Cyber security QoS
	[41]	2016 2nd IEEE International Conference on Computer and Communications, ICCC 2016 - Proceedings	IEEE Inc.	Private	Communication Based Train Control (CBTC) system	TD-LTE based train-ground communication
	[42]	IEEE Transactions on Power Delivery	IEEE Inc.	Private	Secondary Substations Automation	Smart Grids
	[10]	IEEE Transactions on Smart Grid	IEEE Inc.	Private	Mixed-integer nonlinier programming (MINLP)	Automated Distribution Networks

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Year	Primary Studies	Publications	Publisher	Datasets	Methods	Trend Topics
2018	[31]	Proceedings: IECON 2018 - 44th Annual Conference of the IEEE Industrial Electronics Society	IEEE Inc.	Private	Real Time Calculus (RTC) and Modular Performance Analysis (MPA)	Quality of Service
	[32]	2018 4th IEEE Conference on Network Softwarization and Workshops, NetSoft 2018	IEEE Inc.	Private	Testbed	Quality of Service Assessment
	[43]	Sustainable Energy, Grids and Networks	Elsevier Ltd	Private	Low Voltage (LV) Network	Smart Grids
	[8]	IEEE International Workshop on Factory Communication Systems - Proceedings, WFCS	IEEE Inc.	Private	Theoretical state-based method	Mapping of Cyber Security
	[44]	WiSec 2018 - Proceedings of the 11th ACM Conference on Security and Privacy in Wireless and Mobile Networks	Association for Computing Machinery, Inc	Private	Self Organizing Network (SON)	Mobile and wireless security
	[45]	IEEE Transactions on Industrial Informatics	IEEE Computer Society	Private	Elimination method	Privacy-Preserving Automation
	[46]	IEEE Access	IEEE Inc.	Private	Evaluation method	Multi-radio access technologies (multi-RAT)
	[18]	IEEE Transactions on Automation Science and Engineering	IEEE Inc.	Public	VSM, LDA, TA-LDA, SUF, CF, SPR-BA, SPR	Web service
	[7]	Computers and Electrical Engineering	Elsevier Ltd	Private	Redundancy	Cyber-Physical Systems
2019	[19]	2019 6th IEEE International Conference on Advances in Computing, Communication and Control, ICAC3 2019	IEEE Inc.	Public	Random Forest, SVM, KNN, Decision Tree	Network Slice Allocation
	[47]	IFIP International Conference on Wireless and Optical Communications Networks, WOCN	IEEE Computer Society	Private	Network simulation	Smart Grid Communication
	[48]	International Journal of Web Information Systems	Emerald Group Holdings Ltd.	Private	Dynamic service composition algorithm	Dynamic service composition
	[5]	2019 IEEE 10th Annual Information Technology, Electronics and Mobile Communication Conference, IEMCON 2019	IEEE Inc.	Public	Simulation method	Quality of service
	[49]	Computers in Industry	Elsevier B.V.	Private	The value network analysis	Network slicing
	[27]	Future Generation Computer Systems	Elsevier B.V.	Private	Linear regression	Quality of service
	[50]	Proceedings of 2019 the 7th International Conference on Smart Energy Grid Engineering, SEGE 2019	IEEE Inc.	Private	Challenge Driven Education (CDE)	Smart grid
	[51]	Journal of Communications Technology and Electronics	Pleiades Publishing	Private	Enhanced distributed channel access (EDCA)	Wireless Network
	[52]	Proceedings - 2019 7th IEEE International Conference on Mobile Cloud Computing, Services, and Engineering, MobileCloud 2019	IEEE Inc.	Private	A Dynamic Algorithm	Factory automation
	[53]	2019 11th International Conference on Communication Systems and Networks, COMSNETS 2019	IEEE Inc.	Private	Kalman filter	Sensor network
	[54]	Journal of Systems and Information Technology	Emerald Group	Private	Semantic web	Cloud-service matchmaking

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Year	Primary Studies	Publications	Publisher	Datasets	Methods	Trend Topics
			Holdings Ltd.			
	[55]	2018 28th International Telecommunication Networks and Applications Conference, ITNAC 2018	IEEE Inc.	Private	Virtualization	Virtual network
	[33]	Proceedings - 2018 10th IEEE Latin-American Conference on Communications, LATINCOM 2018	IEEE Inc.	Private	Testbed	Quality of service
	[56]	Procedia Manufacturing	Elsevier B.V.	Private	Reconfiguration protocols	Wireless Control Network
	[57]	Journal of Theoretical and Applied Information Technology	Little Lion Scientific	Private	Partial Least Square-Structural Equation Model (PLS-SEM)	Automation System
2020	[58]	2020 IEEE Global Communications Conference, GLOBECOM 2020 - Proceedings	IEEE Inc.	Private	Mixed Integer Programming (MIP)	Industrial Internet of Things (IIoT)
	[59]	Advances in Science, Technology and Engineering Systems	ASTES Publishers	Private	Priority-based Scheduling Algorithm	Scheduling Algorithm
	[60]	Journal of Ambient Intelligence and Humanized Computing	Springer Science and Business Media Deutschland GmbH	Private	self-controlled service component (SCC)	Quality of Service
	[61]	International Journal of Communication Systems	John Wiley and Sons Ltd	Private	Fuzzy logic	Mobile edge computing
	[62]	Wireless Personal Communications	Springer	Private	Optimized Radio Energy Algorithm (OREA)	Wireless sensor networks
	[20]	2020 11th International Conference on Computing, Communication and Networking Technologies, ICCCNT 2020	IEEE Inc.	Public	Predictive algorithms	Cloud computing
	[28]	IEEE INFOCOM 2020 - IEEE Conference on Computer Communications Workshops, INFOCOM WKSHPS 2020	IEEE Inc.	Private	Reinforcement Learning	Interference management
	[63]	Proceedings of the 2020 IEEE Conference on Network Softwarization: Bridging the Gap Between AI and Network Softwarization, NetSoft 2020	IEEE Inc.	Private	Benchmarking methods	Industrial Internet of Things (IIoT)
	[64]	Baghdad Science Journal	University of Baghdad	Private	Bellman-Ford and Dijkstra Algorithm	Software defined network (SDN)
	[65]	2020 16th International Conference on the Design of Reliable Communication Networks, DRCN 2020	IEEE Inc.	Private	Generic Object Oriented Substation Event (GOOSE)	Real-Time Communication Protocols
	[66]	Proceedings - 15th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering, TCSET 2020	IEEE Inc.	Private	Dynamic Switch Migration Method	Intent-Based Networking
	[67]	IEEE Access	IEEE Inc.	Private	5G/NR-U Opportunity-Cost-Based Offloading Algorithm (OCBOA)	Internet of Things (IoT)
	[68]	International Journal of Advanced Computer Science and Applications	Science and Information Organization	Private	Traffic Split Routing (TSR)	Virtual Private Networks (VPN)
	[69]	International Journal of Cloud Computing	Inderscience Publishers	Private	Optimised Radio Energy	Wireless sensor networks

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Year	Primary Studies	Publications	Publisher	Datasets	Methods	Trend Topics
					Algorithm (OREA)	
	[35]	International Journal of Communication Networks and Information Security	Kohat University of Science and Technology	Private	Novel Dynamic Bandwidth Allocation (NoDBA), Offline Cooperative Algorithm (OCA), and Particle Swarm Optimization (PSO)	Dynamic Bandwidth Allocation
	[29]	IEEE Access	IEEE Inc.	Private	Deep Reinforcement Learning (DRL)	Data Aggregation
2021	[21]	Energies	MDPI	Public	K-means	Smart Grid
	[70]	Proceedings of the 2021 IEEE/ACM 25th International Symposium on Distributed Simulation and Real Time Applications, DS-RT 2021	IEEE Inc.	Private	Stochastic Petri Nets (SPN)	Home Automation System
	[22]	2021 22nd Asia-Pacific Network Operations and Management Symposium, APNOMS 2021	IEEE Inc.	Public	Intent-based Networking (IBN)	Network Slicing
	[6]	International Journal of Communication Systems	John Wiley and Sons Ltd	Public	Optimized Compressed Sensing Routing Protocol (OCSRP)	Wireless multimedia sensor networks
	[30]	Proceedings of the 2021 IEEE Conference on Network Softwarization: Accelerating Network Softwarization in the Cognitive Age, NetSoft 2021	IEEE Inc.	Private	Machine Learning-based routing and Dijkstra algorithm	Network Automation
	[71]	7th IEEE World Forum on Internet of Things, WF-IoT 2021	IEEE Inc.	Private	Load sharing techniques	Dynamic Load Sharing
	[25]	IEEE International Conference on Communications	IEEE Inc.	Private	XGBoost, Random Forest, and AdaBoost	Digital Twin
	[72]	IEEE International Conference on Communications	IEEE Inc.	Private	Mixed Integer Programming (MIP)	Fog Node Placement
	[73]	2021 IEEE International Conference on Communications Workshops, ICC Workshops 2021 - Proceedings	IEEE Inc.	Private	Time series model Facebook Prophet	System Failure Prediction
	[36]	2021 IEEE International Black Sea Conference on Communications and Networking, BlackSeaCom 2021	IEEE Inc.	Private	Virtual Charmed Factors (vCFs) and Virtual Network Functions (VNFs)	Quality of Service
	[23]	ICSCCC 2021 - International Conference on Secure Cyber Computing and Communications	IEEE Inc.	Public	Message Queue Telemetry Transport (MQTT) protocol	Internet of Things (IoT)
	[74]	Computers, Materials and Continua	Tech Science Press	Private	Fog computing algorithm	Internet of Things (IoT)
	[34]	IEEE Vehicular Technology Conference	IEEE Inc.	Private	The real testbed and the vehicular service	Internet of Things (IoT)
	[13]	IEEE Internet of Things Journal	IEEE Inc.	Private	QoS-based joint energy and entropy	Smart Automation Systems

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Year	Primary Studies	Publications	Publisher	Datasets	Methods	Trend Topics
					optimization (QJEEO) algorithm	
	[75]	2021 IEEE Global Communications Conference, GLOBECOM 2021 - Proceedings	IEEE Inc.	Private	Mixed Integer Linear Programming (MILP) and Umizatou	Quality of Service
	[26]	Proceedings of the IEEE Madras Section International Conference 2021, MASCON 2021	IEEE Inc.	Private	Artificial Neural Network, SVM, K-Nearest Neighbor, Decision Tree, and Naive Bayes	Quality of Service
	[76]	IEEE/ACM International Conference on Computer-Aided Design, Digest of Technical Papers, ICCAD	IEEE Inc.	Private	Hybrid scheduling strategy	Time-sensitive networking
	[77]	2021 30th Wireless and Optical Communications Conference, WOCC 2021	IEEE Inc.	Private	Resource Management with Multiple Applications in Edge (RMMAE)	Edge Computing
	[37]	Engineering	Elsevier Ltd	Private	Genetic Algorithm (GA), Dijkstra's shortest path algorithm, and a queuing algorithm	Edge Computing
	[78]	International Journal of Distributed Sensor Networks	SAGE Publications Ltd	Private	energy-efficient distributed heterogeneous clustered spectrum-aware (EDHC-SA) network	Smart Grid
2022	[12]	Journal of Network and Systems Management	Springer	Private	Network Application (NetApp) service	Next-generation networks are
	[79]	Wireless Personal Communications	Springer	Private	Techno Economic Analysis (TEA)	Wireless Network
	[80]	IEEE International Conference on Communications	IEEE Inc.	Private	Novel Approach	Network virtualization
	[81]	2022 23rd IEEE International Conference on Automation, Quality and Testing, Robotics - THETA, AQTR 2022 - Proceedings	IEEE Inc.	Private	Mininet-WiFi	Network simulation and programmability
	[82]	Computers, Materials and Continua	Tech Science Press	Private	Multi-agent Deep Q-Networks (MADQNs)	Quality of Service
	[24]	Computers, Materials and Continua	Tech Science Press	Public	Intent-Based Networking (IBN)	Network Service

3. Results and Discussions

3.1 Significant Journal Publications

To examine the effectiveness of automated QoS, there are seventy-three primary papers included in this research. The distribution over time is displayed to demonstrate how interest in QoS automation has evolved. Since 2021, more papers have been published, which suggests that more recent and pertinent studies were incorporated. Figure 3 shows that until 2021, the field of study on automation QoS has increased by twenty. From 2002 until September 2022, there were six articles. It is likely that by the end of 2022, this number of articles will continue to grow.

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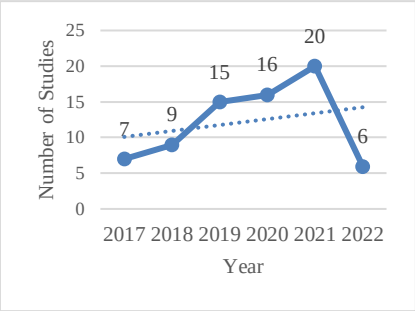

Figure 3. Distribution of Selected Studies over the Years

The most significant automation QoS journals are included in Table 6 along with their Scimago Journal Rank (SJR) scores and Q categories (Q1–Q4). The SJR rating of journal publications determines their order.

Table 6. Scimago Journal Rank (SJR)

No	Journal/Proceeding	Publisher	SJR	Q Category
1	Advances in Science, Technology and Engineering Systems	(ASTES) Publishers	0.19	Q3 in Engineering
2	International Journal of Distributed Sensor Networks	SAGE Publications Ltd	0.5	Q2 in Computer Networks and Communications
3	International Journal of Advanced Computer Science and Applications	Science and Information Organization	0.28	Q3 in Computer Science
4	Baghdad Science Journal	University of Baghdad	0.2	Q4 in Computer Science
5	Journal of Communications Technology and Electronics	Pleiades Publishing	0.31	Q3 in Electrical and Electronic Engineering
6	International Journal of Cloud Computing	Inderscience Publishers	0.22	Q4 in Computer Networks and Communications
7	Energies	MDPI	0.65	Q1 in Engineering
8	WiSec 2018 - Proceedings of the 11th ACM Conference on Security and Privacy in Wireless and Mobile Networks	Association for Computing Machinery, Inc	0	-
9	Journal of Theoretical and Applied Information Technology	Little Lion Scientific	0.2	Q4 in Computer Science
10	International Journal of Communication Networks and Information Security	Kohat University of Science and Technology	0.33	Q3 in Computer Networks and Communications
11	International Journal of Web Information Systems	Emerald Group Holdings Ltd.	0.25	Q3 in Computer Networks and Communications
12	Journal of Systems and Information Technology	Emerald Group Holdings Ltd.	0.42	Q2 in Computer Science
13	International Journal of Communication Systems	John Wiley and Sons Ltd	0.52	Q2 in Computer Networks and Communications
14	IFIP International Conference on Wireless and Optical Communications Networks, WOCN	IEEE Computer Society	0	-
15	IEEE Transactions on Industrial Informatics	IEEE Computer Society	4.33	Q1 in Electrical and Electronic Engineering
16	IEEE International Symposium on Broadband Multimedia Systems and Broadcasting, BMSB	IEEE Computer Society	0	-
17	Engineering	Elsevier Ltd	1.61	Q1 in Engineering
18	Computers and Electrical Engineering	Elsevier Ltd	1.11	Q2 in Electrical and Electronic Engineering
19	Sustainable Energy, Grids and Networks	Elsevier Ltd	1.21	Q1 in Electrical and Electronic Engineering
20	Computers, Materials and Continua	Tech Science Press	0.67	Q2 in Electrical and Electronic Engineering
21	Wireless Personal Communications	Springer	0.48	Q2 in Electrical and Electronic Engineering
22	Journal of Network and Systems Management	Springer	0.56	Q2 in Computer Networks and Communications
23	Journal of Ambient Intelligence and Humanized Computing	Springer	0.91	Q1 in Computer Science
24	Computers in Industry	Elsevier B.V.	2.43	Q1 in Engineering
25	Future Generation Computer Systems	Elsevier B.V.	2.23	Q1 in Computer Networks and Communications

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Figure 4 displays the most significant QoS journal automation as indicated by the chosen key research. With 46 articles, IEEE has the most publications. This information indicates that Proceedings has the most articles published.

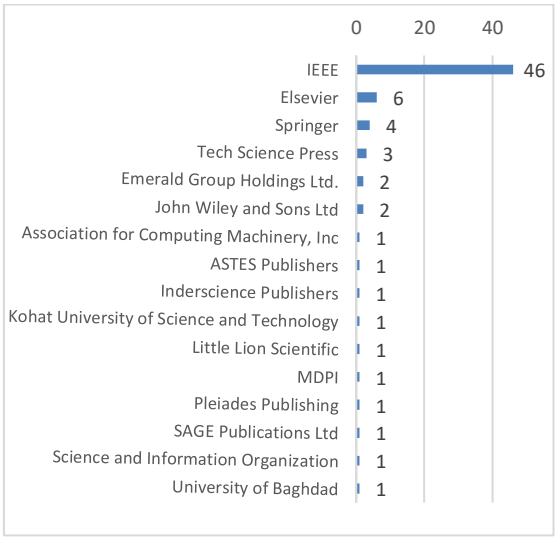

Figure 4. Journal Publications and Distribution of Selected Studies

3.2 Most Active and Influential Researchers by Country

Most Active and Influential Researchers by the Country snapshot of the distribution studies over the years is shown in Table 7. Based on the three highest numbers of articles from the countries, there are thirteen, seven, and five articles related to QoS automation in computer networks, namely India, South Korea, Germany, the United Kingdom, and Italy. This table also shows the Q category of each country. India still dominates every quartile except Q1.

Table 7. Most Active and Influential Researchers by Country

No	Country	Q1	Q2	Q3	Q4	N/A	Total
1	India	0	4	1	1	7	13
2	South Korea	0	3	0	0	4	7
3	Germany	0	0	0	0	7	7
4	United Kingdom	0	1	0	0	4	5
5	Italy	0	0	0	0	5	5
6	China	1	0	0	0	2	3
7	France	1	0	0	0	2	3
8	Taiwan	0	0	0	0	3	3
9	United States	0	1	0	0	2	3
10	Spain	0	1	0	0	1	2
11	Finland	2	0	0	0	0	2
12	Saudi Arabia	0	0	1	0	1	2
13	South Africa	0	1	1	0	0	2
14	Pakistan	1	0	0	0	1	2
15	Hong Kong	1	0	0	0	0	1
16	Ukraine	0	0	0	0	1	1
17	Tanzania	0	0	0	0	1	1
18	Russian	0	0	1	0	0	1
19	Greece	0	0	0	0	1	1
20	Indonesia	0	0	0	1	0	1
21	Canada	0	0	0	0	1	1
22	Singapore	1	0	0	0	0	1
23	Tunisia	0	0	1	0	0	1
24	Slovenia	0	0	0	0	1	1
25	Romania	0	0	0	0	1	1
26	Iraq	0	0	0	1	0	1
27	Brazil	0	0	0	0	1	1
28	Portugal	0	0	0	0	1	1

3.3 Research Topics in Automation for QoS of Computer Network

Based on the keyword plus field in R Bibliometrix with a minimum word frequency parameter of five and number of words per year of five in Table 8, there are several trend topics found including in 2019 with the topics of “automation”, “software defined networking”, “virtual reality”, “smart power grids”, and “electric power transmission networks”. Then in 2020 topics were found regarding “quality of service”, “5g mobile communication systems”, “industrial automation”, “internet of things (iot)”, and “queueing networks”. Then in 2021, there were topics on the “internet of things”, “quality-of-service”, “quality control”, “network architecture”, and “network function virtualization”.

Table 8. Trend Topics

Topics	2018	2019	2020	2021	2022
internet of things				15	
quality-of-service				**9**	
quality control				7	
network architecture				7	
network function virtualization				6	
quality of service			**60**		
5g mobile communication systems			12		
industrial communication			8		
internet of things (iot)			7		
queueing networks			6		
automation		**13**			
software defined networking		7			
virtual reality		5			
smart power grids		5			
electric power transmission networks		5			

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From 2019 to 2021, sixty-nine topics related to "quality-of-service" and “quality of service” were found. The topics related to "automation" were found in 2018, 2019, 2020, and 2021 with a term frequency of thirteen topics. Mostly, each paper has a topic related to automation and QoS. These topics are related to computer networks. Also related to special topics can be seen in Table 4.

3.4 Datasets Used for Automation for QoS of Computer Network

Based on Figure 6, Nine (12%) articles used public datasets and Sixty-four (88%) used private datasets. Public datasets are sourced from ProgrammableWeb [18], Unicauca-Version-2 [19], ITU and Ericsson [5], PlanetLab [20], OpenStreetMap and Google Maps [21], MATERNA [22], Wiley [6], Zeek [23], GWA-T-13 MATERNA [24].

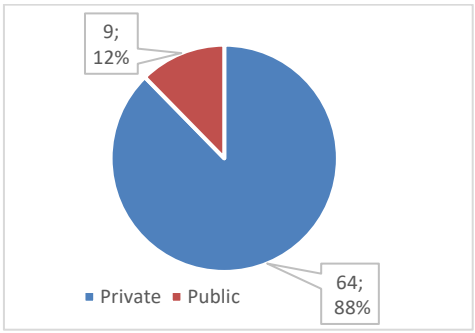

Figure 6. Dataset Used

The distribution of dataset sources from public and private is presented in Figure 7. Every year, most datasets are private datasets. There are sixteen private datasets in 2021. Meanwhile, the most public datasets were also found in 2021 with four pieces. The use of private datasets is because research with the keyword QoS automation on computer networks is related to data security.

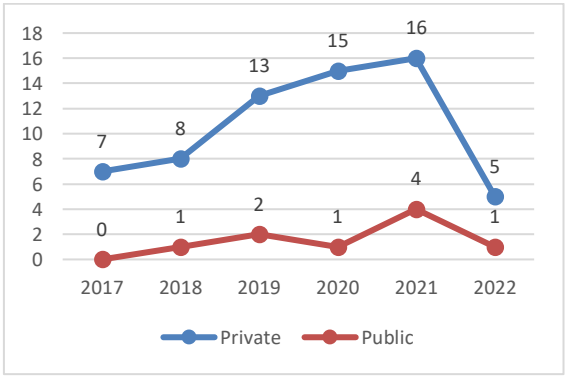

Figure 7. Distribution of Public and Private Datasets

3.5 Methods Used in Automation for QoS of Computer Network

Seventy-three papers according to Table 6 show that the methods used in research related to QoS automation keywords are diverse. Some studies use algorithms in machine learning such as Random Forest [19][25], Support Vector Machine [19][26], K-Nearest Neighbor [19][26], Decision Tree [19][26], Linear Regression [27], Reinforcement Learning [28], Deep Reinforcement Learning (DRL) [29], K-Means [21], Machine Learning-based routing [30], Artificial Neural Network [26], and Naive Bayes [26].

Some primary studies also use other methods that are used together, such as Testbed. The testbed is a method of conceptualizing separate modules that are tested on a computer network. Some studies that use this method are the QoS evaluation of various classes of Raspberry Pi-based Industrial Ethernet Protocols [31], QoS assessment of live video streaming with Remotely Controlled [32], QoS for IEC 61850 Traffic in a Software Defined Networking (SDN) environment [33], and Session Initiation Protocol (SIP)-based Service Platform Implementation [34].

3.6 Proposed Methods Improvements for Automation for QoS of Computer Network

The researchers proposed several methods to improve the performance of QoS automation, especially in computer networks. Even one research can use several methods such as QoS evaluation of various classes of raspberry Pi-based industrial Ethernet protocols using Real-Time Calculus (RTC) and Modular Performance Analysis (MPA) as methods in 2018 [31]; web services using reconstructed profiles with VSM, LDA, TA-LDA, SUF, CF, SPR-BA, SPR methods [18]; slice allocation algorithms in 5G networks using machine learning methods such as Random Forest, SVM, KNN, Decision Tree [19]; dynamic bandwidth allocation algorithms using Novel Dynamic Bandwidth Allocation (NoDBA), Offline Cooperative Algorithm (OCA), and Particle Swarm Optimization (PSO) methods [35]; Intent-Based Networking approach for Service Routing and QoS control using Machine Learning-based routing and Dijkstra algorithm [30]; digital twin-based prediction using XGBoost, Random Forest, and AdaBoost methods [25]; A Quality-of-Service Scenario Awareness using Virtual Charmed Factors (vCFs) and Virtual Network Functions (VNFs) methods [36]; intelligent automation system in IoT using QoS-based joint energy and entropy optimization (QJEEO) algorithm [13]; performance analysis of Optical Mesh networks using Artificial Neural Network, SVM, K-Nearest Neighbor, Decision Tree, and Naive Bayes methods [26]; and flexible resource scheduling using Genetic Algorithm (GA) method, Dijkstra's shortest path algorithm, and queuing algorithm [37].

The combination of several methods in one study is an improvement to improve the results or find the best accuracy. In the performance analysis on Optical Mesh networks which helps to maintain the network’s Quality of Service using Artificial Neural Network (ANN),

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Support Vector Machine (SVM), K-Nearest Neighbor, Decision Tree, and Naive Bayes; The results revealed that ANN was the best method with an accuracy of 96%. [26]. Another research that uses two methods is about the Intent-Based Network Approach for Service Routing and QoS control at KOREN SDI in Korea. The methods used are Machine Learning and Djikstra. Machine Learning is used to calculate the best routing path, while Dijkstra is used to calculate the shortest path [30].

4. Conclusion

This literature analysis intends to identify and assess the trends, datasets, and methods utilized in QoS automation research, which mostly focuses on computer networks, between 2017 and September 2022. Seventy-three automation QoS studies were eventually published and reviewed based on the stated inclusion and exclusion criteria. This review of the available literature was done methodically. The process of locating, evaluating, and interpreting all available study material to supply answers to particular research questions is known as a systematic literature review. The shortcomings of this study are that data collection was carried out in September 2022, so the number of distribution of review articles obtained in 2022 was not maximally presented until December 2022.

Analysis of the selected key studies revealed that current QoS automation research focuses on five topics and trends: internet of things, quality-of-service, quality control, network architecture, and network function virtualization. Most topic trends are about the quality of service itself with sixty-ninth topics from 2019 to 2021. On the other hand, the topic regarding automation itself is 13 topics found in 2018, 2019, 2020, and 2021. Of all these main studies, 12% used public datasets and 64% used private datasets. Each article in the research has a different method. Some studies use algorithms in machine learning. There are ten types of machine learning algorithms as Random Forest, Support Vector Machine, K-Nearest Neighbor, Decision Tree, Linear Regression, Reinforcement Learning, Deep Reinforcement Learning (DRL), K-Means, Machine Learning-based routing, Artificial Neural Network, and Naive Bayes. Using a variety of approaches in primary studies can help to improve the outcomes or identify the most accurate methods.

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