# Wireless Network Channel Interference for Mobile Communication: a Systematic Literature Review and Research Agenda

Irfan Mujahidin[1], Ivandi Julatha Putra[2]

[1,2) *Telecommunication Engineering Electrical Engineering Department, Politeknik Negeri Semarang*

**Abstract**— The development and renewal of wireless technology is currently a necessity. Wifi technology has now reached wifi 6. Network infrastructure is currently the main thing in the process of distributing data using wireless media to mobile phone or laptop users. By looking at the need for wireless in offices, schools, public places, hospitals, and indoor or outdoor buildings that use a large number of access point devices. Based on a review of existing research obtained problems and opportunities for development, this literature study taken from 25 journal articles aims to be able to plan the construction of wireless network infrastructure so that channel interference does not occur. Research on wireless network channel interference has been carried out in several scenarios, for example, by increasing the number of wireless networks in adjacent areas, providing obstacles, and managing different channels. The eight most common methods used in wireless network channel interference research are descriptive analysis, comparative study, method analysis, model development, case studies, regression models, literature studies, and optimization. Research related to wireless network channel interference can still be further developed by using the latest wireless technology which can simultaneously test existing channel interference.

**Keywords**— Interference, Literature Study, Wireless Network, Wifi Technology

## 1. Introduction

Internet usage in the world today is very rapid and infrastructure development in Indonesia is growing with various technologies. There is an increasingly large bandwidth capacity and demand from so many users. Therefore, currently, the internet backbone is using fiber optic cables. Then, to connect the internet to the user, you can use a LAN cable to go to a laptop or computer. Apart from that, there are currently many uses of wireless aimed at making it easier for users to connect mobile devices or laptops to the network. Wireless itself is a transmission medium used to access the internet.

Currently, many wireless users in Indonesia use the main route for sending internet between sites, then some are used as wifi transmitters in indoor rooms. The basis for wireless standards issued by the Institute of Electrical and Electronics Engineers (IEEE) are IEEE 802.11, IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac, IEEE 802.11ax. The IEEE 802.11ax standard is a WiFi standard released in 2019. This standard specifies WiFi that offers data rates of up to 10 Gbps or 30-40 percent faster than 802.11ac. In addition, the 802.11ax standard will also increase network capacity, enhanced MU-MIMO, and enable more simultaneous data transfers. Initially, WiFi 6 only used the 2.4 GHz and 5 GHz spectrum. In 2020 the development of the WiFi 6 standard has increased by using the 6 GHz frequency spectrum. This development is known as WiFi 6. WiFi 6 has a bandwidth of up to 1200 MHz, providing greater network capacity, higher efficiency, better performance, low latency, and high data rate.

An access point (AP) is a network device that has specifications in which the transceiver and antenna aim to transmit and receive signals to and from users. Through the AP, the user can be connected to the internet through the signal emitted by the antenna.

WiFi is currently commonly found indoors and outdoors. Due to the current demands of many users, you must be able to adjust the needs and coverage area to cover them. With more and more Wi-Fi users utilizing the 2.4 GHz frequency, such as in offices, computer laboratories, school buildings, and public outdoor places, this has a negative impact due to the unlicensed 2.4 GHz frequency band, causing co-channel interference between the users. A co-channel is a fellow radio wave signal that operates on the same channel frequency; as a result, the client device will experience problems when connecting to the wifi network.

In planning the development of a Wi-Fi network, it is not just about installing the access point device infrastructure. Various factors that need to be considered include the transmit power of the access point signal, the design, and infrastructure of the room, the distribution of access point users in groups, the occurrence of radio wave interference, signal obstacles such as radio frequency, and obstructions that can cause interference with signal reception from the access point. transmitter) to the receiving device (receiver), where the position of the access point is very influential.

Taking into account the layout of the building structure, a Line Of Sight (LOS) analytical probability model is needed, which has the aim of researching scenarios in rooms with a typical shape, which has rooms and corridors that have rectangular shapes.. By considering this, it is hoped that it can maximize the performance of the WiFi device, reduce the number of devices that are not functioning properly, and minimize the possibility of channel interference between wireless devices.

## 2. Literature Review

The topic of channel interference in wireless networks is dealt with dynamically by using available channel forecasting knowledge to aggregate the strongest AP signal chosen for each user and reduce the estimated amount of interference from all other users at the same time [1]. The influence of Line-of-Sight (LOS) propagation probability is very important for channel modeling and evaluation of small cell networks [2].

The blockages in the indoor environment are corrected when the building layout is given. It can be predicted that the probability of LOS in buildings with a fixed layout is not a simple, fixed exponential function or a randomly distributed function. On the one hand, the exponential LOS probability function reduces the accuracy of network performance evaluation [2].

Wireless transmission capacity demands are continuously growing, with Infrared Optical Wireless Communication (IR-OWC) being considered a promising solution for future high-speed indoor applications as it can easily offer bandwidth over 10 GHz with commercially available devices of the communications system using optical fiber [3].

Topological Interference Management (TIM) based on transmitter cooperation is required for Multiple-Input Multiple-Output (MIMO) Interference Channels (IC), in which case there is no channel status information beyond just topology information on transmitter and receiver to cancel interference [4].

In research on Interference Neutralization (IN), it is considered a promising interference management technique for multi-hop wireless networks. However, most of the existing IN outputs are limited to two-hop networks, such as relay-assisted cellular networks. Little progress has been made so far in exploring IN in generic multi-hop (more than two hops) networks [5].

Research that considers wirelessly powered two-way communication called transmit harvest responds is related to cochannel interference. The two-way communication considered here consists of three steps: first, with the step of the transmitter sending the data signal, both receivers decode the information and take the energy output simultaneously from the received signal, then use it according to the policy of time switching (TS) or power splitting (PS), and a third receiver sends a response back to the transmitter using the previously acquired energy. With this step, it is aimed to find the maximum transmit power and energy harvesting ratio for the sum level of the forward link while ensuring the minimum level requirement exists for each reverse link. [6].

Degrees of freedom (DoF) gain is studied in a wireless network with cooperative transmission under backhaul load constraints, which limit the average number of messages that can be sent from the central controller to the base station transmitter. Backhaul load is defined as the sum of all messages available on all transmitters per channel used, normalized by the number of users. For a Wyner linear interference network, where each transmitter is connected to a receiver having the same index as well as one subsequent receiver, the DoF per user is characterized, and an optimal scheme is presented [7].

Planning wireless private network power is the basis for building a reliable terminal communication access network everywhere, is a close link for residential users, and requires inaccurate planning and optimization [8].

In this paper, research to provide services with varying quality-of-service (QoS) requirements in energy-limited systems is investigated, including energy-saving power allocation for cognitive satellite-terrestrial networks. Using statistical delay-QoS metrics, the power allocation scheme is formulated as an optimization problem to maximize the effective energy efficiency of secondary satellite communications while meeting the interference constraints imposed by primary terrestrial communications [9].

With the massive increase in wireless data traffic in recent years, multi-tier wireless networks have been used to provide much higher capacity and coverage [10].

The design and analysis of networks with Optical Wireless (OW) links require careful investigation of cross-link interference, which greatly affects the efficiency of systems that reuse the same channel for multiple transmissions [11].

Research into specific phenomena in the THz band, including severe reflection loss, indoor clogging effects, multi-band fading, analysis of possible interference, and coverage on the downlink, is challenging. In this paper, the effects of indoor clogging caused by walls and the human body are analyzed [12].

Design a recursive predictor that predicts future interference values by filtering the measured interference at a given location. Predictor parameterization is done offline by translating the interference autocorrelation into an Autoregressive Moving Average (ARMA) representation [13].

A wireless-powered communication network investigation has been carried out on interference channels. In these systems, due to the asymmetrical allocation of downlink and uplink time among some cells, cross-link interference can occur, which significantly affects the overall performance. Considering this interference problem, the minimum tariff maximization problem is studied to overcome the severe imbalance in tariff distribution among users [14].

Advanced device-free localization systems infer the presence and location of users based on measurements of the received signal strength of line-of-sight links in wireless networks [15].

Mesh networks are considered for maritime communications due to their extended range, self-repair, and high capacity. With the development of multi-radio technology, frequency interferences can be sharply reduced by proper channel assignment [16].

Then, related to the problem of determining the route with maximum end-to-end spectral efficiency in a multihop wireless network [17]. Additionally, it considers the problem of minimizing the average and peak Age Of Information (AoI) in a wireless network, which consists of a series of source-destination links, under the general interference limitation [18].

Experiments have been carried out in various deployments, including flat-frequency and frequency-selective channels, under static and mobile conditions. Experiments highlight that a channel-adaptive Wireless Power Transfer (WPT) architecture based on beamforming and shared waveform design offers significant performance improvements in DC power harvested over conventional single-antenna or multiantenna continuous wave systems [19]. Interference alignment (IA) is an excellent technique for managing interference, and artificial noise (AN) can be used to mitigate one of the main security threats, passive eavesdropping [20].

Multi-CQ is the first software-defined networking (SDN)-based MAC design for wireless LANs that supports SIC technology and can significantly increase channel utilization. Multi-CQ, adopting the idea of functional separation of SDN and Orthogonal Frequency-Division Multiple Access (OFDMA), can make contention and data transmission run through two subchannels independently and simultaneously, where the useful superposition encoding is used to decode the combined signal, and multiple CQ (contention queues) are introduced to coordinate concurrency. This concurrent execution greatly reduces waste in channel contention. [21].

In an interference-limited communication scenario, interference can damage data transmission and further degrade delay performance [22].

Two-user single-input multiple-output (SIMO) interference channel, which provides a tight outer bound to the treating interference as noise (TIN) tariff area with coded time division [23].

Combining the orientation measured by the motion sensor with the anatomical constraints of body movement, each sensor node can locally estimate its instantaneous position relative to the gateway. Based on the probabilistic model, the power level selection is converted to calculate the optimal probability of selecting each power level at a certain position, to minimize transmission costs [24].

It has been explained to architects how to design buildings with the desired wireless performance and to radio-related researchers how densely packed wireless access points can be used to approximate wireless performance results in a building's intrinsic [25].

## 3. Methods

This study used the systematic literature review (SLR) method. SLR is the process of identifying, evaluating, and interpreting all available research evidence to provide answers to specific research questions [26]. Systematic Literature Review (SLR) is a method that uses research identification, results evaluation, and interpretation where there is research that is relevant to the problem formulation or topic area studied [27]. Retrieval of data sources is done by using a search in well-known international indexed journals. The total data for this study is from a journal that focuses on interference-channel wireless networks.
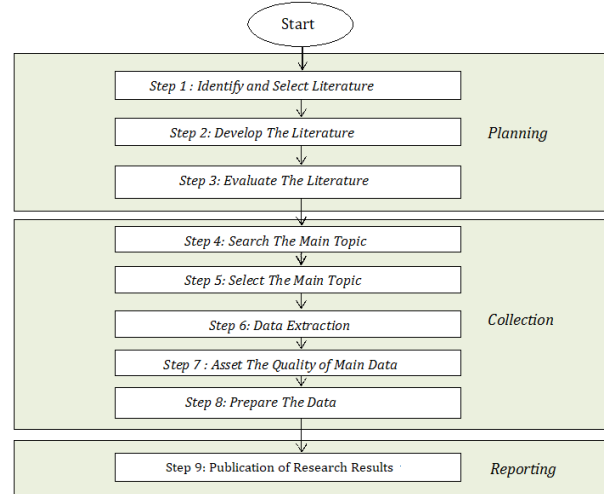


Figure 1. Steps of the systematic literature review

Systematic Literature Review (SLR) was carried out through three stages: planning (planning) includes identifying and fulfilling the requirements of a systematic literature review referring to the specified topic, namely interference of wireless network channels in the room, the second stage is implementation (conducting), which includes following the SLR protocol to reduce the possibility of bias in research. What must be done is to define research questions, a search strategy, a selection study process with inclusion and exclusion criteria, quality assessment, and data extraction and synthesis processes. The third stage is reporting, namely by writing down the results of the research based on the literature that has been passed using the protocol, writing up the discussion of the research results, and concluding.

### 3.1. Reseach Question

This research question is to keep the SLR conducted focused according to the specified objectives. Research questions are structured using guidelines, namely Population/Population (P), Intervention (C), Comparison (C), Outcome (O), and Context (C) criteria which are abbreviated as PICOC [26]. Table 1 shows the PICOC structure of the research question (RQ) on SLR of wireless network channel interference.

Table 1. Summary of PICOC

| | |
|---|---|
| *Population (P)* | Wireless Network |
| *Intervention (I)* | Wireless network channel interference |
| *Comparison (C)* | Wireless count scenario |
| *Outcome (O)* | Optimization of channel interference wireless network |
| *Context (C)* | None |

The research questions (RQ) developed in this study are listed in the table below:

Table 2.  Research Questions on Literature Review

| ID | Research Question | Motivation |
|---|---|---|
| RQ 1 | What are the most significant journals on wireless network channel interference? | Identify the most significant journals that discuss wireless network channel interference. |
| RQ 2 | Who are the most active and influential researchers on the topic of wireless network channel interference? | Identify the most active and influential researchers on the topic of wireless network channel interference. |
| RQ 3 | What are the topics and trends chosen by researchers on wireless network channel interference? | Identify topics and trends chosen by researchers on wireless network channel interference. |
| RQ 4 | What methods are most commonly used for wireless network channel interference research? | Identify the most frequently used methods for wireless network channel interference research. |
| RQ 5 | What method performs best in wireless network channel interference? | Identify the most frequently used methods for wireless network channel wireless interference research. |
| RQ 6 | What methods are proposed for wireless network channel interference? | Identify the method that performs best in wireless network interference. |
| RQ 7 | What frameworks do researchers now propose for wireless network channel interference? | Identify the proposed framework for wireless network channel interference. |

The main research question in this systematic literature review lies in the research questions RQ 4–RQ 7. Wireless network channel interference analysis method The method used can be used as a basis for optimizing WiFi devices related to wireless network channel interference. The research questions in RQ1–RQ3 are research questions that will assist researchers in evaluating the main study context. RQ 1-RQ 3 can provide information to researchers about the summary and synopsis of certain research areas about wireless network channel interference.

This literature review has the aim of identifying methods for testing wireless network channel interference. The basic mind map from a systematic literature review is shown in Figure 2 below :
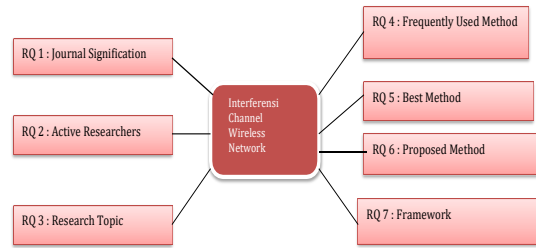


Figure 2.  SLR's mind map on wireless network channel interference

## 3.2.  Search Strategy

The fourth step in a systematic literature review is Search strategy as a search process, which consists of several activities, namely selecting digital libraries, determining search strings, executing searches, perfecting search strings, and pulling lists of main studies through the library to conduct appropriate and broad searches. Before starting the search, select data that is suitable for finding highly relevant articles. In digital search, a database list was used by IEEE Explore (https://ieeexplore.ieee.org/Xplore/home.jsp) and ScienceDirect (https://www.sciencedirect.com/).

Keyword searches in this systematic literature review identify search terms from PICOC, especially from populations and interventions. Identification is a search term for research questions. Identification has search terms in the title, such as journal or research abstracts, and relevant keywords. Identification of example words synonyms, correct spelling, and antonyms of search terms; sophisticated search string construction using identified search terms, i.e., AND and OR. The purpose of this keyword search is to get as many articles as possible that are relevant to the topic being reviewed.

## 3.3.  Study Selection

In the study selection process, inclusion and exclusion criteria were used to select the primary studies as described in Table 3.

Table 3. Inclusion and Exclusion Criteria in SLR

| | |
|---|---|
| Inclusion criteria | Wireless network channel interference research article using large and small scale data sets |
| | Research articles that discuss and compare wireless network channel interference |
| | Research articles included are only Scopus-indexed journal articles |
| | For duplicate publications of the same study, only the most complete and up-to-date one will be included |
| Exclusion criteria | Research without strong validation |
| | Research that only discusses wireless network channel interference |
| | Research written in English |

In managing search results and storing literature,

researchers use Mendeley's reference management. The steps in the search process are detailed, and the number of studies

| Framework | RQ7 |

identified in each phase is shown in Figure 3.

The figure below illustrates the study selection process (Step 5) carried out in two steps: main study exclusion based on title and abstract and main study exclusion based on full text.
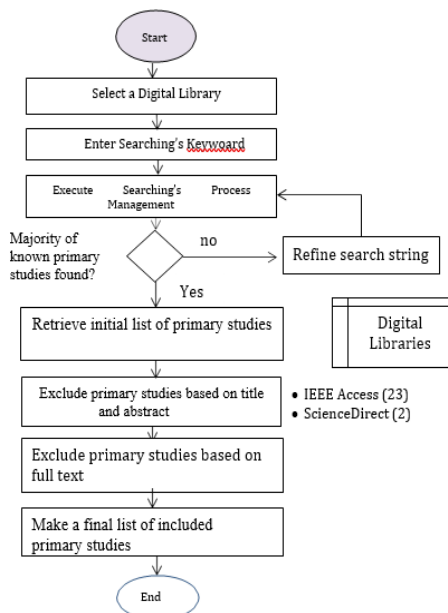
Figure 3. Search and Selection of Primary Study

### 3.4. Data Extradition

This data extraction step involves retrieving information from the collected articles and systematically entering it into the extraction data summary table. Extracting the main studies by collecting data that will be used as answers to research questions (RQ). A summary of data extraction identified through research questions and analysis conducted by researchers is shown in Table 4 below :

Table 4. Data Extraction

| Property | Research Question |
| --- | --- |
| Identification and publication | RQ1, RQ2 |
| Trend a research topic | RQ3 |
| Methods | RQ4, RQ5, RQ6 |

### 3.5. Study Quality Assessment and Data Synthesis

Assessment of the quality of studies is used to guide the synthesis of data to determine the strength of conclusions and avoid bias. The purpose of data synthesis is to collect evidence from selected studies to answer research questions. The strategy used in this data synthesis is the narrative method. The data is consistently tabulated according to the questions, using several visualization tools such as bar charts and pie charts. Curves and tables to improve the presentation of the distribution of the methods used in optimizing wireless network channel interference.

### 4. Result and Discussion

The results of the research that has been carried out are described in several discussions, namely significant journal publications, the most active influential researchers, and the methods used.

### 4.1 Significant Journal Publications

In research, it is necessary to evaluate studies to determine the strength of the conclusions. There are 25 journals that study channel interference in wireless networks. The most recent studies have been in the last four years, 2018–2021. Figure 4 below shows the distribution of researchers' interests in discussing and studying the topic of wireless network channel interference. Figure 4 also shows that the field of research on wireless network channel interference is still very relevant today.
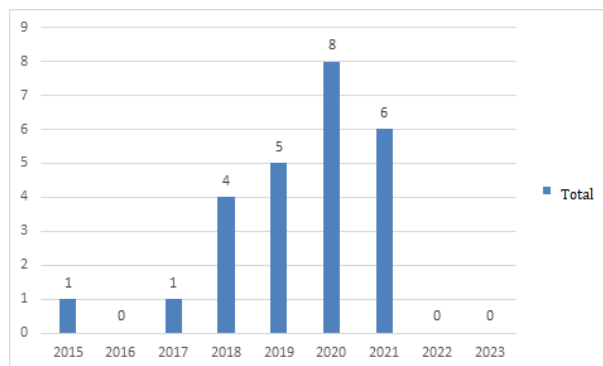
Figure 4. Distribution of wireless network channel interference studies

### 4.2 Most Active and Influential Researchers

From the selected literature, researchers who discuss wireless network channel interference have made an active contribution to studying the problems, risks, and constraints related to the performance of wireless network channel interference. Figure 5 shows active and influential researchers on wireless network channel interference.
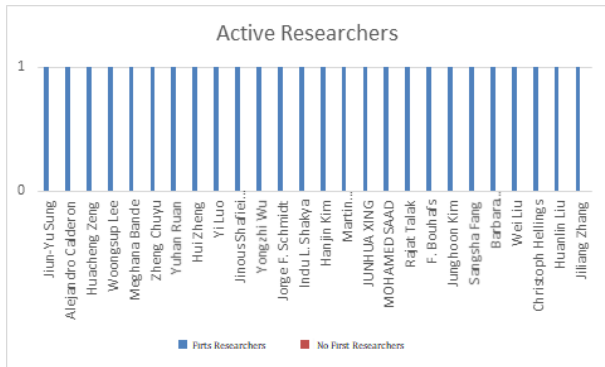
Figure 5. Influential researchers and several studies

### 4.3 Methodes Used

The method used in the research 8 methods have been applied as the best method in research namely descriptive analysis, comparative study, method analysis, model development, case studies, regression models, literature studies, and optimization. Each of the above methods has its meaning. Using descriptive analysis is a method of statistical analysis that has the aim of describing the research subject based on variable data obtained from certain subject groups. Comparative studies are used in research as studies based on comparisons with various parameters. Method analysis has the function of assisting researchers in conducting experiments based on the methods used for analysis. Model development is one of the important methods that involves creating and perfecting models to assist in understanding complex phenomena. The case study approach offers a detailed investigation of a particular incident or scenario, providing in-depth insight into a particular subject. Related to the regression model is a method for determining the relationship of a variable with another to see how much influence it has. A literature study is a form of research methodology that is often used to collect data by recording and reviewing the literature. The latter is optimization to improve the research conducted so that it is more precise, and efficient, and provides predictions of scenario results related to the research studies conducted.

### 4.4 Research Agenda

The research agenda is carried out based on a literature study of 25 articles. Researchers can carry out development and optimization related to wireless network interference research. In this study, the focus was on the effect of the many wireless devices used in one room. Experiments were carried out in different positions with several obstacles, such as walls or boards. In addition, researchers are expected to be efficient in planning the use of wireless numbers in the construction of indoor wireless network infrastructure because they can predict the interference that occurs. Researchers also need to influence the interference so that results can be obtained on whether it affects the speed and latency of wireless devices. Testing is carried out using several devices that have the same specifications. With this, it is hoped that researchers can minimize the interference of wireless network channels in buildings and when planning the construction of indoor wireless device infrastructure.

### 5. Conclusion

Based on this systematic literature review, it is used as a basis for identifying and analyzing current trends using data sets, methods, and frameworks in research on wireless network channel interference. Based on the designed inclusion and exclusion criteria, 25 research articles on wireless network channel interference were selected. This literature review is known as the literature review system (SLR) because it carries out the process of identifying research, evaluating research references, and interpreting existing research for the purpose of answering predetermined research questions.

In wireless network channel interference research some methods are often used including descriptive analysis, comparative study, method analysis, model development, case studies, regression models, literature studies, and optimization.

Corresponding author. Tel.: 0818087472301
Email: irfan.mujahidin@polines.ac.id

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