

2.4GHz Wi-Fi Analyzer

Muhammad Khairul Amizul Mohammed Maidin¹, Azlina Bahari¹,

¹Department of Electrical Engineering Technology, Faculty of Engineering Technology,
Universiti Tun Hussein Onn Malaysia, 84600 Pagoh, Johor, MALAYSIA

*Corresponding Author Designation

DOI: <https://doi.org/10.30880/peat.2023.04.02.002>

Received 15 January 2023; Accepted 12 February 2023; Available online 12 February 2023

Abstract: Wi-Fi enables computers, tablets, cellphones, and other devices to connect wirelessly and with the internet. Wi-Fi is a wireless router's radio transmission to a nearby device. The gadget turns signal data into usable data. Wi-Fi analyzers examine the connection, collect essential data, and determine the cause of a weak Wi-Fi signal. Wi-Fi analyzers collect data from your network's access points and channels and present it in visual reports and dashboards. 2.4GHz Wi-Fi Analyzer is created using Eclipse IDE, Android Studio, Java, and Kotlin. The OOSD method is used to construct this application. 2.4GHz Wi-Fi analyzer will provide channel graph, time graph, and nearby access points.

Keywords: Wi-Fi, Access Point, Analyzer, Signal, 2.4GHz, Data, Eclipse IDE, Android Studio

1. Introduction

Wi-Fi analyzer's primary function is to assess the connection, gather data, and diagnose the issues causing a poor Wi-Fi signal. Wi-Fi analyzers collect data from various access points and channels in your network and display it visually in reports and dashboards. When it comes to Wi-Fi connections, signal disruptions are typical. On some days, the signal strength is good, but on others, it is weak or even awful[1]. Wi-Fi analyzer also assists administrators in locating the places where the fault exists. For example, using a Wi-Fi analyzer, you may determine the channel with the most traffic and switch to a less crowded one to enhance network performance. Network administrators may use a Wi-Fi analyzer to discover issues and do root cause analysis to locate troubled nodes, endpoints, and other devices. Administrators can solve the issue by exploring alternative remedies, such as moving to a different channel to minimize congestion[2]. In summary, a Wi-Fi analyzer will assist administrators in improving and maintaining connection quality by detecting regions in your facility that may have a poor Wi-Fi connection. You may also determine the optimal locations for the router to avoid interference.

*Corresponding author: lina@uthm.edu.my

2023 UTHM Publisher. All rights reserved.

publisher.uthm.edu.my/periodicals/index.php/peat

1.1 Problem Statement

Without Wi-Fi analyzer, we can't know the detail of the Wi-Fi signal around us such as the signal strength, the statistic of the Wi-Fi signal and to recognize the speed of the connection. Next, if this application is not developed, it's hard to people to get an accurate data and learn about the Wi-Fi signal around us. This study will help us to learn more detail about the signal. From this app, we can know the properties of the signal that it carries.

1.2 Objective and Scope

In general, this project has three objectives which are:

- I. To develop a user-friendly app that is easy to use and make the process of analyzing and understanding Wi-Fi easier.
- II. To analyse the characteristic of the 2.4 GHz Wi-Fi frequency.
- III. To help the user identify the problem if there is problem occur with the connections.

The scope of this project is listed below which is:

- I. This app's main function is used to help user obtain information about the Wi-Fi connection that available.
- II. This app will show the stability of the 2.4 GHz Wi-Fi connection that is available.
- III. This app will show all the information that it gets from the Wi-Fi in the simplest form so that the user will not have a hard time to understanding the information that been given.

2. Materials and Methods

The procedure that researchers follow in order to carry out an investigation that requires the collection and examination of data is known as a methodology. In order to ensure that the creation of a project moves forward without hiccups and in the desired course of action, it is necessary for every project to make use of a methodology in the capacity of a guide. The study being conducted or the requirements of the system that must be developed which is consist of two factors that have a role in the process of selecting or designing an acceptable approach. The object-oriented software development methodology was used throughout the creation of this system (OOSD).

2.0.1 Programming Language

A programming language is a collection of grammatical rules and a vocabulary for commanding a machine to accomplish specified tasks. High-level languages like as BASIC, C, C++, COBOL, Java, FORTRAN, Ada, and Pascal are commonly referred to as programming languages[3].

2.0.2 2.4GHz Frequency

With a practical speed of 50-70 Mbps (depending on real-world circumstances), the 2.4 GHz frequency of the Wi-Fi router provides a broad coverage area and is better at penetrating solid objects, but it has a reduced data range and is more susceptible to interference and disruption [4].

2.0.3 Wi-Fi Analyzer

Wi-Fi Analyzer is a program that turns your PC/laptop, tablet, or mobile device into a wireless network analyzer, allowing you to diagnose Wi-Fi issues, select the optimal channel, and locate the ideal location for your router/access point [5]. Consistent Wi-Fi scanning with a Wi-Fi network analyzer lets you collect data, detect problems, and suggest alternative remedies, such as switching to a different channel to relieve congestion. Wi-Fi scanning software may also be used to locate places in your business where the Wi-Fi signal is poor.

2.0.4 Android, IOS, Window Phone OS, KaiOS

The Android platform consists of an operating system based on the Linux kernel, a graphical user interface (GUI), a web browser, and end-user apps that may be downloaded [6]. Android was published under the Apache v2 open-source license, which enables for many other implementations of the operating system to be created for various devices such as game consoles and digital cameras. Although Android is built on open-source software, most Android smartphones have a suite of proprietary applications such as Google Maps, YouTube, Google Chrome, and Gmail.

IOS (iPhone Operating System) is the operating system for the iPhone, iPad, and other Apple mobile devices (AAPL). Apple iOS, which are based on Mac OS, the operating system that runs Apple's line of Mac desktop and laptop computers, is designed for simple, seamless networking between a variety of Apple products.

Microsoft's Windows Mobile operating system was designed for smartphone and Pocket PCs. It debuted with the Pocket PC 2000 operating system and was built on the Windows CE kernel [7]. Windows Mobile offered basic programs created with the Microsoft Windows API as well as capabilities for customisation and software creation with no limitations imposed by Microsoft. The software's applications may be purchased via the Windows Marketplace for Mobile.

KaiOS evolved from the open-source Firefox OS project, which began in 2011 and has operated independently of Mozilla since 2016 [8]. KaiOS is now a web-based operating system that enables a new category of lightweight phones and other IoT devices with little memory while yet providing a great user experience via top apps and services.

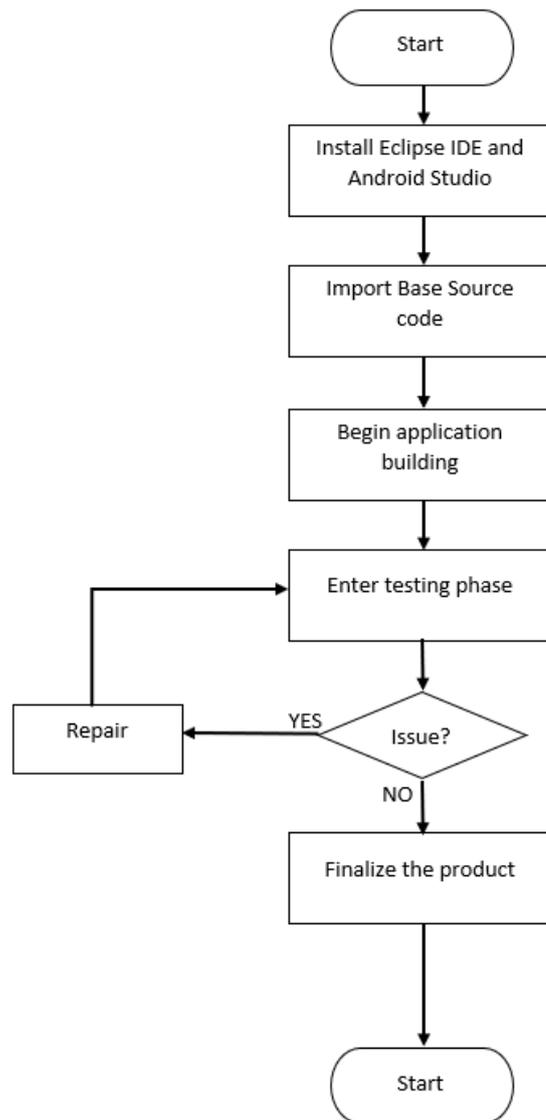


Figure 2.1 Flowchart Project

2.1 Object-Oriented Software Development Approach (OOSD)

Both object-oriented requirements analysis and object-oriented design are included in the Object-Oriented Software Development Method (OOSD), which stands for Object-Oriented Software Development Method. The Object-Oriented Software Development (OOSD) methodology is an approach to the design of software systems that maintains a concentration throughout development on the objects involved in the issue. In OOSD development, an early focus on objects, along with the objective of producing a useful model, results in a representation of the system that is adaptable, reusable, dependable, and intelligible. In addition, the requirements analysis, design, implementation, and testing stages are each split into their own distinct phase under this paradigm.

2.2 Requirement Analysis Phase

The first step in the process of developing the project was to do the requirement analysis. Prior to the beginning of the project, the goals for the project were deliberated upon and outlined. In addition, the scopes were developed so that limitations could be established, and the project could be brought back down to earth.

In addition, problem statements were written to ensure that the project could comply with instructions and find a solution. To acquire knowledge that would be used in later stages of software development, many aspects of the project were explored by employing research papers and online articles as sources of information.

2.3 Hardware Specification

One of the crucial components in the development of an application is the hardware. Table 2.1 show the hardware that is used to develop this 2.4GHz Wi-Fi Analyzer using Android as the base. FORGE15S 1650 TI laptop from LEVEL51 are used with Intel i7 processor and 16GB of ram. The device that is used to test the application is Redmi Note 11 Pro 5G which it has Qualcomm SM6375 Snapdragon 695 5G (6 nm) with an internal memory of 128GB and 8GB RAM. This phone use android version 12.

Table 2.1 Hardware Specification

HARDWARE	SPECIFICATION
FORGE15S 1650 TI laptop	Central Processing Unit (CPU): Intel i7 Storage: LEXAR NM620 500GB NVME SSD Random Access Memory (RAM): 16GB Display size: 15.6" FHD 144 HZ WIDE VIEWING ANGLE DISPLAY (1920X1080)
Redmi Note 11 Pro 5G Phone	Central Processing Unit (CPU): Qualcomm SM6375 Snapdragon 695 5G (6 nm) Storage: 128GB Random Access Memory (RAM): 8GB Display Size: Super AMOLED, 120Hz, 6.67 inches

2.4 Software Specification

The software used in the development process to produce the application is listed in Table 2.2. Canva software are used to design the app logo. The entire application is designed using Eclipse IDE and Android Studio using Java programming language and Kotlin programming language.

Table 2.2 Software Specification

Software	Function
Canva	Graphic design
Eclipse IDE Android Studio Android Software Development Kit (SDK) Android Development Tools (ADT)	Developed Android Application

3. Results and Discussion

In accordance with the chapters that came before it, the emphasis of this chapter is on the actual implementation and testing of the 2.4GHz Wi-Fi Analyzer application. There will be an in-depth explanation of the 2.4GHz Wi-Fi Analyzer's user interface and its development schedule in increments. In addition, testing and assessment will be carried out to receive a review and response about how successfully the programme functions. Before delivering the application to the end user, it is necessary to verify that this phase of the development can guarantee that the application can fully run in accordance with the application's aim.

3.1 Implementation

The Implementation method of the 2.4GHz Wi-Fi Analyzer starts with utilising Eclipse IDE and Android Studio to design the application interface layout, develop application modules, and interactivity the function. Every step of the process is necessary to guarantee that the application will develop without interruptions and perform as intended. Following the completion of the implementation, the application will have the Android Application Package. (APK) extension developed and integrated into it. . APK file extension program was required in order to successfully install the application on a mobile device.

3.2 Application Icon



Figure 3.1 Icon of 2.4GHz Wi-Fi Analyzer Application

Figure 3.1 shows the icon for the 2.4 GHz Wi-Fi Analyzer application. This icon consists of three symbols: Wi-Fi, a signal tower, and a laptop. This symbol was chosen because the function and use of the application are synonymous with the icon, which shows that this application is about signal and connectivity. This will help the user easily recognise the application. The user can access the application by clicking on the icon. This icon was designed using Canva.

3.3 Page Interface



Figure 3.2 Main Interface

Figure 3.2 shows the main interface that will pop up when users click the application icon. The main interface will consist of a menu button at the top left and four tabs for modes of operation depending on how you want the application to operate. The four tabs consist of access points, channel ratings, channel graphs, and time graphs.

3.3.1 Access Point



Figure 3.3 Access Point

Figure 3.3 Show the list of Access Points that are available near the user. This tab only shows a 2.4GHz Wi-Fi connection. This tab will show the name of the connection, the type of Wi-Fi standard whether Wi-Fi 4, 5, or 6 and the serial number of that Wi-Fi connection.

3.3.2 Channel Rating



Figure 3.4 Channel Rating

Figure 3.4 shows the channel rating of the Wi-Fi connection using the star symbol and the color of the star which is green color means that the signal is good, yellow star means that the connection is average and red star means that the connection is bad. This tab also shows the channel number and the Access Point count.

3.3.3 Channel Graph

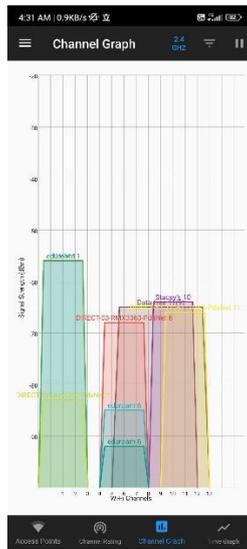


Figure 3.5 Channel Graph

Figure 3.5 show channel graph for each Wi-Fi connection that is available near user. This graph shows graph of Wi-Fi channel versus Signal strength in dBm. The different of access points being differentiated by using a different color for each access point.

3.3.4 Time Graph

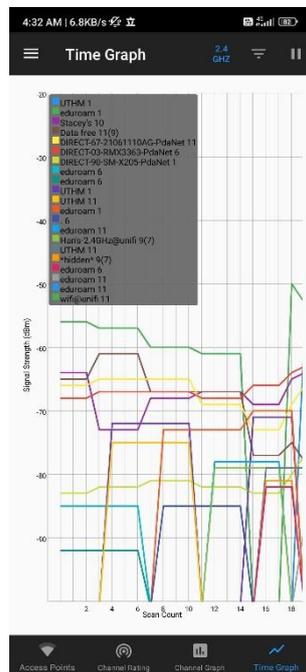


Figure 3.6 Time Graph

Figure 3.6 shows a time graph for each Wi-Fi connection that is available near user. This graph shows graph of Scan Count versus Signal strength in dBm. The difference of access point being differentiated by using a different color for each access point.

3.4 Application Testing

The 2.4GHz Wi-Fi Analyzer application underwent testing in order to locate any errors that may have been there. Testing the application is necessary to guarantee that all of its components can work as intended and meet the goals set for its development. This application test was divided into two distinct parts: the testing of the function application and comparing the application result with other applications.

3.4.1 Function Application Test

The purpose of the function application testing is to guarantee that all the modules in the application can work correctly and without hiccups. This testing was also done to reduce the number of errors that may arise whenever a user used the application.

2.4GHz Wi-Fi Analyzer application was tested using Redmi Note 11 Pro 5G. Table 3.1 show the results of functional testing for the application.

Table 3.1: Functioning Test

NO	Function test	Result
1	Access Point [5]	User can see all 2.4GHz Wi-Fi connections that available nearby.
2	Channel Rating	User can see the rating for the nearby connection base on the color of the star and the total number of it, channel number and Access Point Count
3	Channel Graph	All Access Point connections successfully convert to graph Wi-Fi Channel versus Signal Strength form.
4	Time Graph	All Access Point connections successfully convert to graph Scan Count versus Signal Strength form.
5	Menu button/tab	Menu button/tab works perfectly.

3.4.2 Comparison with other Applications

The graph below shows a reading of time graph between the 2.4GHz Wi-Fi Analyzer and another application that can be downloaded from Google Play Store. The primary objective of this test is to monitor the consistency of the connection by referring to the time graph that has been produced based on two different apps. The access point that will be used for the first test and second test is UTHM Wi-Fi connection and mobile hotspot.

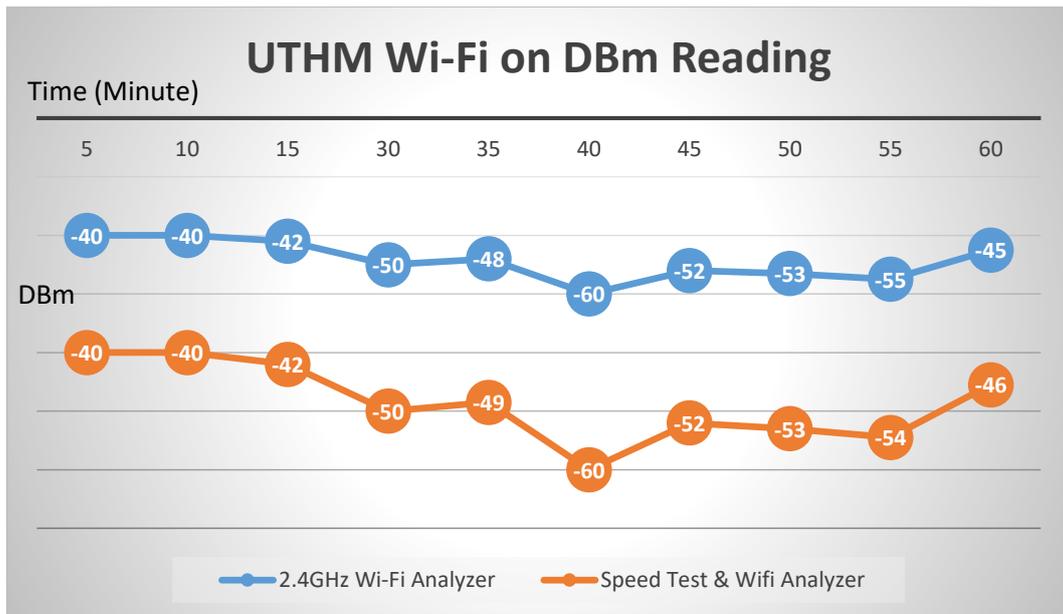


Figure 3.7 UTHM Wi-Fi on DBm Reading Result

Following one hour of observation and data collection, the values and pattern of the dBm measurement are shown in Figure 3.7. Both readings were taken at the exact same moment in the same area. The first thirty minutes of the data are logged, and there is just a little difference in value from one application to another that occurs. The rest of the data are nearly identical to one and other.

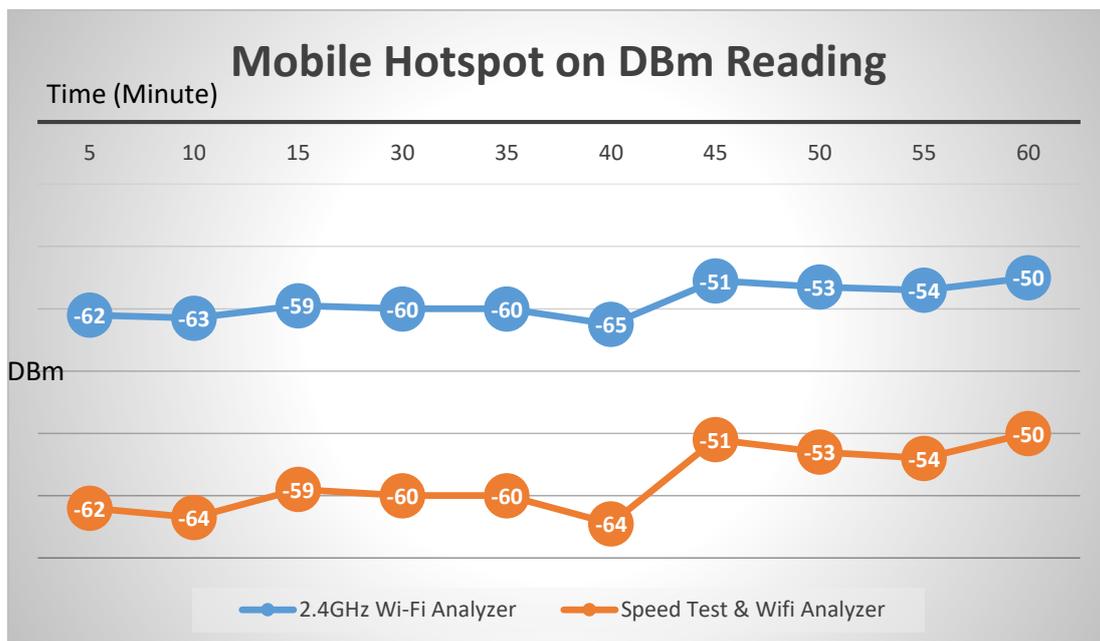


Figure 3.8 Mobile Hotspot on DBm Reading Result

Following one hour of observation and data collection, the values and pattern of the dBm measurement are shown in Figure 3.8. Both readings were taken at the exact same moment in the same area. The graph shows that there is just a little difference in value from one application to another that occurs. The rest of the data are nearly identical with one and other. As a result of these two types of tests, both applications recorded almost identical patterns, which indicates that the 2.4GHz Wi-Fi analyzer is functioning nearly as well as a conventional as other application, with just a few nuances in the readings to differentiate them.

4. Conclusion

Based on the results of the assessment process covered in the chapter before this one, this chapter draws some conclusions and provides a summary of the 2.4GHz Wi-Fi Analyzer application. This chapter discusses the outcomes that came about because of the goals being met, including the benefits of the application, the constraints it faces, and recommendations for how to make the application better.

Through the process of developing the 2.4GHz Wi-Fi Analyzer application, a significant amount of fresh information has been obtained and learned. The goal was successfully accomplished with this final year project. The ability to think critically and manage one's time well is essential to finishing a job within the allotted window of time.

Acknowledgement

The authors would like to thank the Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia (UTHM) for its support.

References

- [1] "What is Android OS?" <https://www.techtarget.com/searchmobilecomputing/definition/Android-OS> (accessed Jun. 22, 2022).
- [2] "CONDUCTING ROOT CAUSE ANALYSIS OF COMMON WI-FI ISSUES." <https://www.linkedin.com/pulse/conducting-root-cause-analysis-common-wi-fi-issues-don-cook> (accessed Jun. 22, 2022).
- [3] "Eclipse desktop & web IDEs | The Eclipse Foundation." <https://www.eclipse.org/ide/> (accessed Jun. 22, 2022).
- [4] Geier, J. T. (2005). *Wireless Networks first-step*. Cisco Press.
- [5] "Pang, W. L. (2016). *Control4kids: Android-based Kids Control App* (Doctoral dissertation, Universiti Tun Hussein Onn Malaysia).."
- [6] Sarkar, A., Goyal, A., Hicks, D., Sarkar, D. and Hazra, S., 2019, December. Android application development: a brief overview of android platforms and evolution of security systems. In *2019 Third International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC)* (pp. 73-79). IEEE.
- [7] Novac, O. C., Novac, M., Gordan, C., Berczes, T., & Bujdosó, G. (2017, June). Comparative study of Google Android, Apple iOS and Microsoft Windows phone mobile operating systems. In *2017 14th international conference on engineering of modern electric systems (EMES)* (pp. 154-159). IEEE.
- [8] "KaiOS Operating System - javatpoint." <https://www.javatpoint.com/kaios-operating-system> (accessed Feb. 02, 2023).