OPTIMIZATION OF ACCESS POINT POSITION IN WI-FI NETWORK USING THE SIMULATED ANNEALING ALGORITHM

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Article Information	Abstract
	As the internet develops, many offices or companies use the internet to facilitate the flow of information communication in it. Network speed is also necessary to assist in completing work, so it needs to be maintained stable. Maintaining a fair and equitable network can be done in several ways, one of which is by determining the location of the access point must be very good. Access point placement is necessary to optimize the signal strength received by the transmitter to the receiver. The parameter that influences the performance of the access point is the signal strength value, this is what will be used to determine the coverage area (signal coverage) of an access point. The strength of the signal received by the receiver does not only depend on the distance between the transmitter and receiver but shows large variations in fading and shadowing at a location, also the effect of interference can cause a decrease in the signal received by the receiver, therefore this study uses the Simulated Annealing method with testing Quality of Service (QoS) to solve theseproblems

1. Introduction

The application of information and communication technology (ICT) has now become a necessity in all aspects, both individuals, organizational groups and even government agencies. ICT implementation in government is intended so that every level of government can improve public services in accordance with Law Number 25 of 2009 concerning E-Government and Presidential Instruction Number 3 of 2003 concerning Public Services. Good public services can improve people's welfare in general, so that later government institutions will createefficient, effective, transparent and accountable government [1]. The Pasaman Regent's office is one of the offices in the province of West Sumatra. The capital is located in Lubuk Attitude which is led by H. Benny Utama, SH., MM and his deputy, Sabar S, AG., M.SI. This regency has an area of 3,947.63 km2 and has a population of 253,299 according to the 2010 census and a total of 301,444 people in 2021. It is located at Jln. Jendral Sudirman No 40 Lubuk Attitude.

The problem being faced at the Pasaman Regent's Office is the lack of optimal placement of access points, especially on the 1st floor due to the large number of rooms, resulting in internet network access being distributed unfairly and evenly. Therefore it is necessary to optimize the access point by applying the

Simulated Annealing Method which will determine the best placement of the available options so that the signal strength received from the transmitter to the receiver is optimal [8].

Access Point is a tool on a wireless network or WLAN (Wireless-LAN). The Access Point receives and retransmits data in the form of waves. Access Points connect one computer to another on a WLAN and sometimes also function as a bridge (Bridge) between WLANs and wired networks. Access Point has the same function as a hub for networks that use cables. Small WLANs only use one Access Point, but large WLANs require several Access Points at once[7].

According to the National Institute of Standards and Technology (NIST) optimization problems are computational problems where the goal is to find the best of all possible solutions. Solving optimization problems where there is no definite method or a computationally deterministic method is too complex to implement. Simulated Annealing can be one of the answers to solve this case to solve the combination problem [2]. From these problems, an alternative solution is to apply the Simulated Annealing algorithm method by creating an android application in which there are formulas from the Simulated Annealing algorithm.

2. Research Method

The method used is Simulated Annealing by combining it with Eclipse in making Android- based applications. The simulated annealing method is a searching method that utilizes probability theory to find the global minimum of an optimization problem. Simulated annealing is generally used for categorical variables [5]. Whereas Eclipse is a command line program for building applications on Android, the command line is entered in the form of the Java programming language and XML[9].
The Simulated Annealing (SA) algorithm is a metaheuristic method that is widely applied in solving combinatorial optimization problems [3]. Simulated Annealing Algorithm to solve optimization problems. SA usually uses a temperature parameter that controls the search. If the new point has a better function value, then that point replaces the previous point. Steps

like this sometimes help find new search areas in terms of getting a better minimum value [10].

3. Results of the Discussion

Implementation is done by using Wireshark to look for Quality of Service (QoS). What needs to be underlined is Troughput, Packet Loss, Delay, and Jitter. Each of them has 5 rooms. The test conducted by the author is by monitoring the access point where the best position for the best positioning uses the Simulated Annealing method with the help of the Eclipse application to create android-based applications. At this stage the author tries to find QoS which is a quality of service that refers to any technology that manages data traffic to reduce packet loss, latency and jitter on the network [4].

The following shows the capture file properties of the wireshark test before using the Simulated Annealing method:

a)   Room Testing 1

Figure 1 Display of the Assistant
II Room
Test

Figure 1 describes the tests carried out using the Wireshark 4.0.1 application. The test subjects used the website https://sisfo.upiyptk.ac.id/. The image contains 935 packets, the time span is 6.003 s, the average bits/s reaches 901 kb, the delay is 0.00641997 m/s and the jitter is 0.004138 m/s.

b)   Room Testing 2

Figure 2 Display of Economic and NaturalResources Room Tests

Figure 2 describes the tests carried out using the Wireshark 4.0.1 application. The test subjects used the website https://sisfo.upiyptk.ac.id/. The image contains 937 packets, the time span is 6.429 s, the average bits/s reaches 714 kb, the delay is 6.858 m/s and the jitter is 0.001413 m/s.
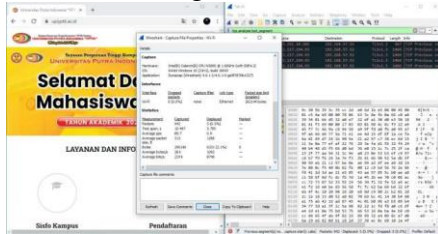
c)   Room Testing 3

Figure 3 Display of Government and LawRooms

The design of an android application made using eclipse contains Simulated Annealing formulas to optimize the placement of access points.
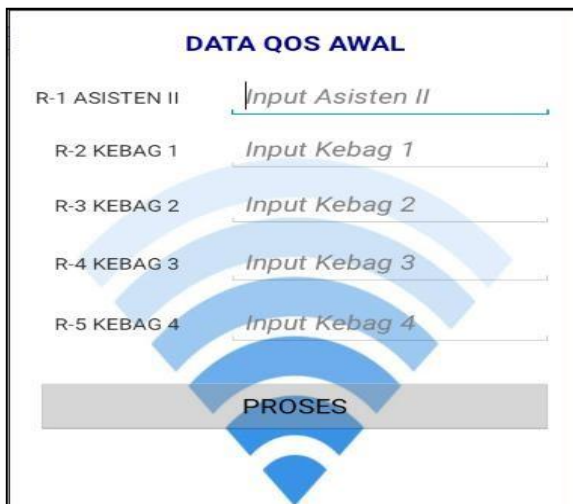

Figure 4. Application Input Display

The picture above is an application design for finding the placement of wifi positions, similar to the test above there are 5 rooms to be tested, after getting QoS the test results will be entered into the input menu and the results will be likefigure 7 below :

Figure 5. SA Output Display

The picture above is the result of Simulated Annealing processing of the 5 rooms tested, the room with the highest probability will be the solution room so we can conclude that room 4 (Administration and Development) is the room with the highest probability reaching 2.059910134797803 being the main solution room Wi-Fi network placement.

where you can see the initial QoS delay is 6.419972 m/s, 6.859 m/s, 11.14 m/s,10.296 m/s and 6.2423 m/s, you can see the QoS packet loss initial test without simulated annealing delay experienced a significant change, reaching 4.8977 between the Government and Law room and the Procurement of Goods and Services room. The test uses the simulated annealing packet loss method of 13.180357 m/s, 12.44349 m/s, 10.584603 m/s, 10.906597 m/s, 9.072 m/s, where we can conclude that the delay comparison uses The simulated annealing comparison is not too far away from the difference in other rooms, the biggest is only in the Assistant II room with the Procurement of Goods and Services room with a difference of 4.108357 m/s.

where you can see the initial QoS jitter is 0.04138 m/s, 0.001413 m/s, 0.09605 m/s, 0.104528 m/s, and 0.05661 m/s, you can see QoS jitter testing initially without simulated snnealing on jitter, testing used the simulated annealing jitter method of 0.123614 m/s, 0.001413 m/s, 0.252927 m/s, 0.360862 m/s, 0.002798 m/s, where we can conclude that the method using simulated annealing is the best solution search method at this time

used the website https://sisfo.upiyptk.ac.id/. The image contains 942 packets, the time span is 10.497, the average bits/s reaches 224 kb, the delay is 0.01114 m/s and the jitter is 0.09605 m/s.

4. Conclusion

The use of the simulated annealing algorithm in the optimization process greatly affects network speed, this research has proven that in the initial QoS there were several uneven networks, after using SA the network speed did not differ much from the rooms tested in the form of throughput, packet loss, delay, and jitters

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