Design of a Mobile Application for Wireless Network Monitoring Based on Android

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Abstract— **Information and communication technology that is increasingly widespread today uses a computer network system as a medium for transforming information and data. One of the common network utilizations today is a wireless network using Wi-Fi (Wireless Fidelity) technology. The problem experienced at Junior High School Muhammadiyah 3 Metro is that the network administrator still uses a simple way of checking the network connection, namely by pinging the hosts connected to the network. The goal that the authors achieve is to monitor data traffic on wireless internet networks by designing Android applications as network controllers. With this problem, the authors made a thesis with the title "Designing an Android-Based Wireless Network Monitoring Mobile Application". The results achieved are in the form of a network monitoring application with the name "PRIMEWEB", using a local internet network connected to the Mikrotik RouterBoard and then distributed via Wi-Fi Access Point. The network monitoring application displays system settings, monitoring statistics, network status, and user hotspots in detail. The test results of this application have the advantage of using Mikrotik for network monitoring settings and using network traffic indicators with an independent and more efficient menu.**

Keywords— Android application, Mikrotik, Network, Wi-Fi.

I. INTRODUCTION

Information technology and computer networks are communication media that are utilized by the community to date. The need to use resources in software and hardware networks has resulted in the growth of various technological developments in the network. Currently, information and communication technology utilizes computer network systems as a medium in transforming information and data. A company or agency that uses more and more computer networks will also be more complex network systems in the company or agency, so that better handling is needed so that the system can run optimally. One of the common network utilizations today is a wireless network using Wi-Fi (Wireless Fidelity) technology. Wi-Fi technology can organize the connection, communication, and transfer of data between two or more computers and can be applied to hardware, software or a combination of both. Some of the advantages of Wi-Fi include that this technology is more flexible, has advantages in terms of mobility so that internet networks can be accessed more easily, as well as more efficient use of electricity [1]. However, with the advantages that this technology has, there are unavoidable drawbacks, such as networks that are less secure and can be tapped, devices that are quite expensive, and signal quality that is not good in certain conditions.

The problem that occurs at Muhammadiyah 3 Metro Junior High School is that the network administrator still uses a simple way to check the network connection, namely by pinging the hosts connected to the network. This is possible to do if there are only a few connected hosts, but if the connected hosts have a relatively large number, it will take a lot of time so it is not efficient to do. In its application, Flutter-based source code is needed as a network traffic facilitator program and Android Studio as a Java and Flutter programming language application builder to remote network traffic activities specifically for mobile devices by generating notifications and several further utilities made on the author's PC / laptop so that it becomes a standalone application so that it can be used on an Android smartphone.

The internet has had a significant impact on various aspects of life following the rapid development of information technology. With the internet we get the cheapest, fastest and most up-to-date information. The internet usually uses computer network devices. A computer network is a collection of several computers and other devices such as printers, hubs, and so on that are connected to each other through intermediary media [2]. A computer network is a group of computers that are interconnected through intermediary media to share information using hardware such as printers, hard drives and so on [3]. Computer networks make it possible to communicate with each other electronically. Connected computers may be connected by cable media, telephone lines, radio waves, satellites or infrared [4]. Computer networks based on transmission media are divided into two, namely wired networks and wireless networks [5].

Besides using computer networks, the Internet can also use android devices. Android is a mobile operating system. Android does not distinguish between core applications and third-party applications [6]. Android is a Linux-based

operating system that is widely used on cellular phones such as smartphones and Personal Digital Assistence computers. Android provides an open platform for developers to create applications that are used with various mobile devices. Currently, Android is a popular mobile operating system whose development is inseparable from the role of Google. Android was founded in 2002 by Andy Rubin, Rich Minner, Nick Sears and Chris White in 2003.

Android Studio is a software developer feature or commonly referred to as an IDE (Integrated Development Environment) for designing Android applications. Android Studio is a developer of the Eclipse IDE, and is made from a well-known Java IDE, namely IntelliJ IDEA [7]. The launch of Android Studio was announced by Google on May 16, 2013 at the Google I / O Conference event for 2013. Since then, Android Studio has taken over Eclipse as the formal IDE in designing Android applications.

Many Android Studio features are offered to increase work productivity in creating Android applications [8], for example:

- Flexible Gradle-based build system

- Fast and feature-rich emulator

- A unified environment for developing apps on all Android devices

- Apply Changes to push code and resource changes to the running app without restarting the app

- Code templates and GitHub integration to help you create common app features and import sample code

- Comprehensive testing framework and tools

- Lint tools to record performance, usability, version compatibility, and other issues

- C++ and NDK support, built-in support for Google Cloud Platform

Visual Studio Code is a free and open source code editor developed by Microsoft. Some of its key features include support for debugging, syntax highlighting, intelligent code completion, code refactoring, and Git integration [9]. It also has a large extension market with thousands of plugins that can be installed to enhance its functionality. In addition, Visual Studio Code is highly customizable, allowing users to personalize their workspace with themes, icons, and button bindings.

Microsoft enhanced its free code editor Visual Studio Code (VSCode), which is used by more than 11 million users. In a StackOverflow developer survey from 2019, close to 50% of participants reported that they use VSCode, showing how popular this editor has become. The underlying source code is free (as is interactive use) and processed through Code-OSS [10].

This research aims to monitor data traffic on a wireless internet network by designing an Android application as the network controller. A monitoring system that sends notifications to network administrators via email, depending on the internet connection, notifications on the network cannot be sent if the internet connection is having problem and can detect computer network damage faster, easier, and cheaper [11]. Package on Java-based Android applications called apttools is built in APK files [12]. The use of Flutter and Midtrans which can increase efficiency in applications and can be run on different network platforms [13].

The network monitoring design using android has been running in accordance with the provisions and mechanisms by public agencies in repairing and analyzing existing weaknesses in computer networks [14]. The android system can monitor the system when not in the server room using WI-FI [15]. Network monitoring can also be done with Dude, which displays the Service interface for each device and the success of the email gateway as a network alert system [16]. Smartphone-based wireless structural vibration monitoring system can accurately identify the modal parameters of the tested structure [17]

II. RESEARCH METHOD

This research uses a descriptive qualitative design.

A. *Software*

1. Android Studio

   Specifications: Android Studio Flamingo | 2022.2.1 Patch 2

2. Mikrotik Winbox (64bit)

   Specifications: version 3.38

3. Visual Studio Code

   Specifications: Version: 1.80.1 (user setup)

4. Firebase

5. Laragon

   Specifications: Laragon Full 6.0.220916 php-8.10-Win32-vs16-x64

B. *Hardware*

1. ASUS X455LAB laptop

   Specifications:

   - Intel ® Core i3-5005U 2.00 GHz

   - 12GB RAM

   - 476GB SSD

   - 465GB HDD

2. Smartphone

   Specifications:

   - Android operating system (min. Android version 5 (Lollipop)

   - 1GB RAM

   - Internal Storage 4GB

   - Support microSD access

3. Mikrotik RouterBoard type RB750r2 + adapter.

   Specifications:

   - Has 1 ethernet port from LAN ISP

   - Has 4 LAN ports for network peripherals or PC / laptop

4. WiFi modem Tenda Router N300 type 4G03 + adapter Specifications:

   - 4G LTE equipped with mini SIMcard slot

   - Wi-Fi speed reaches 300Mbps, frequency 2.4GHz

- Has 2 ports (WAN/LAN and LAN)

5. Tenda WiFi Router Repeater/Access Point type N301 + adapter

    Specifications:

    - Access speed reaches 300Mbps

    - Antenna range of 2*5dBi

6. Unshielded Twisted Pair (UTP) cat6 cable

    Specifications:

    - Straight type at both ends

    - Connection from eth2 Mikrotik RouterBoard to LAN port Laptop 2

7. TP-LINK Hub/Switch

    Specifications:

    - 4 LAN ports

In the following display the author assumes the network topology found in the computer laboratory room. The network topology mapping technique uses a star topology.
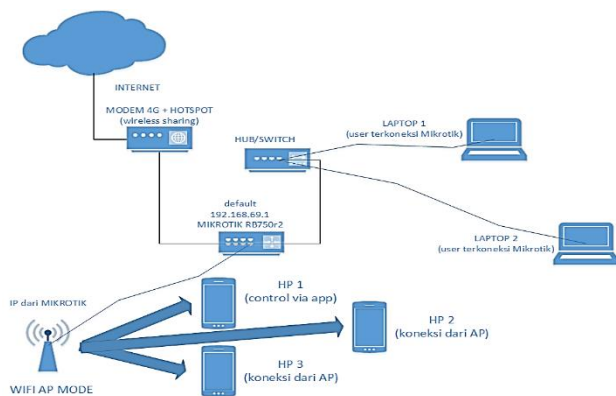
Fig. 1. Topology of Wi-Fi network monitoring deployment

Explanations related to the presentation in Figure 1 are as follows.

- In generating internet access, the network provider or ISP is generated from a 4G hotspot modem where the connected adapter is distributed (shared) through the Tenda router on the Laptop device either from an ethernet plug or from Wi-Fi provided that it can access the web page.

- Then the WAN / LAN port found on the Tenda modem device is connected to the eth1 port on the Mikrotik RB750r2 where the default IP is 192.168.69.1.

- Furthermore, it is also connected to the eth2 port of Mikrotik, configuration is carried out on Laptop 2 as a server using Winbox software.

- For additional devices, it is also connected to the Mikrotik eth4 port to a hub where the sample tested as a client uses two laptops and is connected from the hub using two straight LAN cables.

- On the Laptop server the author acts as a host in running the application via a web client to monitor the network.

- Furthermore, the authors distributed the network through the Wi-Fi AP Router Tenda N301 by setting the device configuration web page as AP Mode.

- Before carrying out the distribution stage via the Wi-Fi AP Router Tenda N301, the authors have made a connection from Mikrotik on port eth3 to equalize the IP address to 192.168.69.xx/24. The "xx" segment is filled according to the connected devices, both PCs and smartphones, sequentially using Static IP. The purpose of the Static IP selection chosen by the compiler is so that the IP set is the IP of the main router, namely from the Mikrotik RouterBoard, provided that the compiler has changed its configuration as AP Mode on the Wi-Fi AP.

- Finally, when the network spread via Wi-Fi AP is implemented, the authors open the mobile application on an Android Smartphone and can be seen in a number of images in the next subsection.

The design of the Mobile Application Development process(basic) and depicted with Activity Diagram.

Fig. 2. Android Application Creation Flow

III. RESULTS AND DISCUSSION

The first display after the network monitoring application has been installed on an Android mobile device is shown in Figure 3. The first page displays the "PRIMEWEB" logo with a dark purple background (Dark). Then the first slide appears after the initial page of the application shows the word "Monitoring" in the header with an illustrative image and below it is the sentence "Monitoring network devices". Furthermore, the second slide in the header section shows the words "Realtime Graph", an illustrative image with the caption "Realtime Graph Tx and Rx of all devices". Finally, the third slide as well as the closing of all the slides displays the word "Setting" in the header section with an illustration along with the caption "Setting the proxy connection and network admin" and a button that reads "Done" to start the application to the dashboard page. On the first, second and third slides, there is a text link on the bottom right that says "Skip" to skip the start display step. While the second slide and third slide display a text link in the lower left corner that reads "Prev" which directs to the previous slide if in the second slide the user types "Prev" it will return to the first slide and if in the third slide the user types the text link it will return to the second slide.

Fig. 3. Getting started "PRIMEWEB"

The test is presented in the form of Table I. which shows whether the installation or installation of the network monitoring application is successfully installed on the client's smartphone.

TABLE I. APPLICATION INSTALLATION TESTING

Test Case and Result (True Data)			
Input Data	Expectations	Objective	Conclusions
Test install the application on the client's Mobile device	Welcome banner slide until ready to run	As expected, where the application appears done button login page	[OK] Success
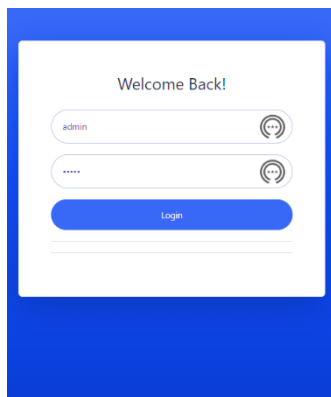
Fig. 4. Admnistrator Login Session

The rules that apply if the user will see the data presented in real time to find out how effective the tool works is to fill in the login page. In Figure 4 describes the commands that are filled in generally especially for users who act as administrators are inputting User and Password.
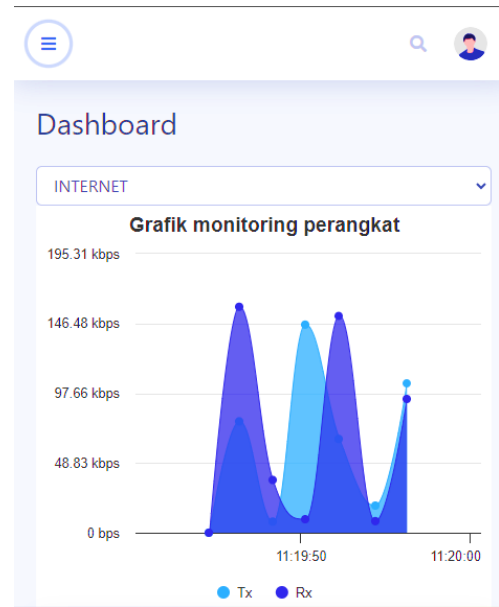

Fig. 5. Dashboard view with each monitoring graph Interface

In Figure 5, the Dashboard view is presented, which shows the device monitoring graph in the form of traffic waves running according to the selected interface. Seen below is the display of the "INTERNET" interface on the connected router. The meaning of Tx shows uploaded data while Rx shows downloaded data where all of them are traffic that runs periodically for one second.
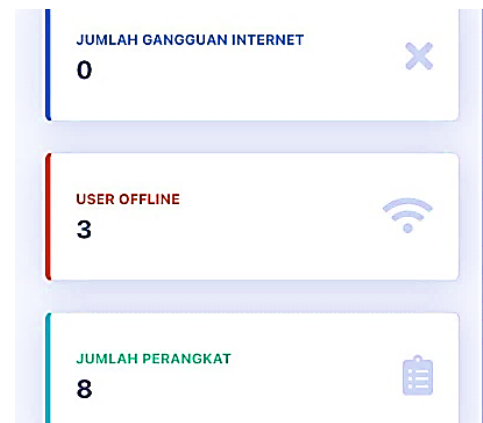

Fig. 6. Network Status Display

Figure 6 displays Network Status, a slide that displays a graph of upload/download data transmission and the number of devices connected to it. Admins can see the number of all devices from the "Number of Devices" column and see which users are not connected to the same connection from the "Number of Offline" column. The "Number of Internet Interruptions" column indicates the failure of devices connected to the network, which is shown in Figure 5 below as zero devices.
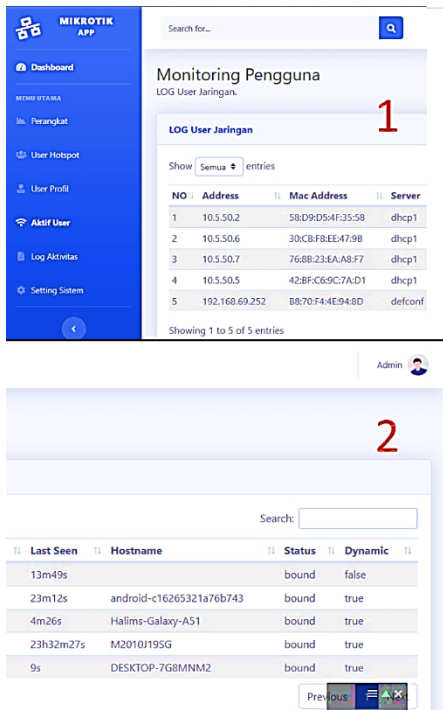
Fig. 7.   Desktop web version of Active User view

In Figure 7, there is an active multiuser slide connected to a wireless network in the desktop view. This view will be available within 24 hours as seen in the "last seen" column. The fourth column shows a number of Servers where dhcp1 allows the server to dynamically distribute IP addresses and configuration information to clients based on the type of connection. For example, Hostname "Halim-Galaxy-A51" is connected to server "dhcp1" with Wi-Fi network connection type. While the Hostname "DESKTOP-7G8MNM2" is connected to the "defconf" server where the device uses a connection to a LAN cable network.
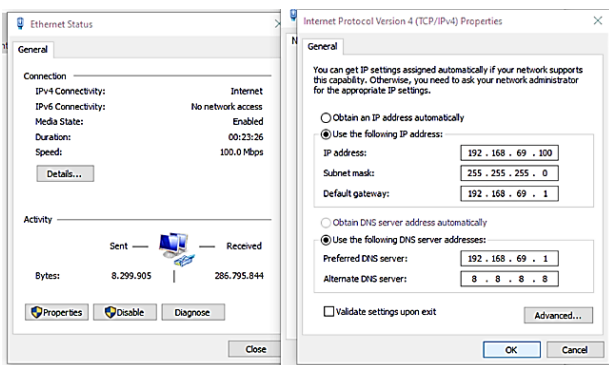

Fig. 8.   Change of IP Address and DNS Server on the Ethernet

In Figure 8, the instruction window is displayed by making changes in the IPv4 properties on the ethernet adapter to become a Static IP by equalizing the third segment, namely 69 belonging to Mikrotik. In Figure 4.18 the compiler fills in the IP address column with the contents "192.168.69.100" with the subnet mask "255.255.255.0" and the gateway "192.168.69.1". And DNS filled in "192.168.69.1" and "8.8.8.8".

Next, in Figure 9 the authors log in from the Public Wi-Fi using a mobile device.
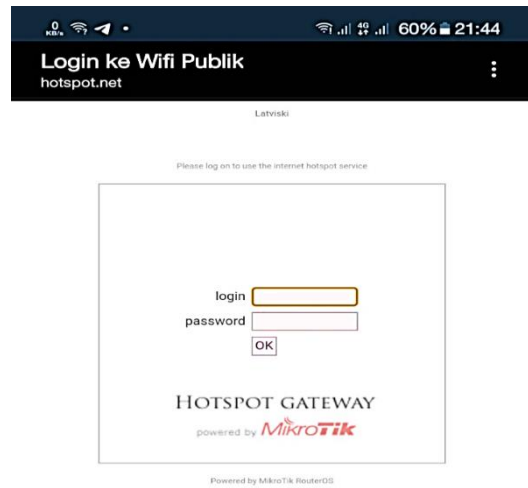

Fig. 9.   A device attempt to log into the network

Table II describes how users get internet access to the Wi-Fi network as a single-sign-on (SSO) login account from the Access Point Router by adding a user and password.

TABLE II.   TESTING ADDING SSO IN THE APP

Test Case and Result (True Data)			
Input Data	Expectations	Objective	Conclusions
Add a hotspot account to log in via SSO (Single-sign-on) Wi-Fi	Display login to the Wi-Fi network to enter the network monitoring application hotspot account into the SSO	Hotspot User data added successfully. SSO successfully inputted and entered the Wi-Fi network from admin to client device.	[OK] Success, with sample username "user" and password "user", username "hape1" and password "hape1"

In Table III, the tests of activating the Apache and MySQL services in the Laragon software are presented by taking the treatment of the network monitoring application on the compiler's laptop server by activating the Apache and MySQL services in Laragon.

TABLE III.   COMMANDS TO ENABLE SERVICE IN LARAGON SOFTWARE

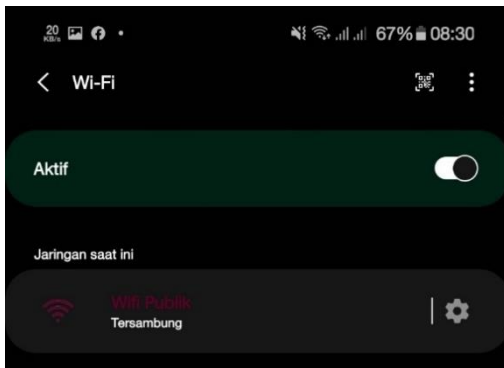| Test Case and Result (True Data)			
Input Data	Expectations	Objective	Conclusions
Activating Apache and MySQL on Laragon software	As a service for managing network monitoring applications to run on client devices	The application successfully runs on web view and Android devices aligned with port 8888 active on Apache and MySQL	[OK] success

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Fig. 10. Success after connect into Wi-Fi

A. Testing Results

The results of the tool testing on the "PRIMEWEB" are expected to facilitate managers who work in monitoring wireless networks as network administrators, because it has an interface that is easy to operate. By using this application, the wireless network monitoring process that connects the wireless router with PC and smartphone devices becomes easier and can be used as a reference in managing the network in the room. Testing is done by testing each process and possible errors that occur for each process. Testing is intended to determine whether the input and output functions of the software are as needed.

B. Comparison of the Old System with the latest

The following are the results of the analysis of the old system and its comparison with the new system offered at SMP Muhammadiyah 3 Metro:

TABLE IV.   DIFFERENCES BETWEEN THE OLD SYSTEM AND THE LATEST SYSTEM

Old System	Latest System
- The old system displays network information but is limited to the default router page	- Latest system displays a more efficient monitored network
- Active user info only uses the network provider web and access point router web	- Active users use the network monitoring application
- Not using Mikrotik as network management	- Using Mikrotik for network monitoring
- Unable to display network traffic indicators	- Using a network traffic indicator with an independent menu in the application

The results of this design research using android can display the monitored network efficiently. In addition, network traffic indicators with an independent menu in the application and using proxy so that active users can be monitored. A monitoring system that sends notifications to network administrators via email depending on the internet connection. Notifications cannot be sent if the problematic internet connection and detect computer network damage faster, easier, and cheaper.

In the design using a wireless network, the program sent from the server computer can only be received or accessed by a computer or client whose IP has been determined.

IV. CONCLUSIONS AND SUGGESTIONS

The results of this study as a material knowledge for agencies in network implementation. This system minimizes the possibility of access interference to a device connected to a Wi-Fi network. Network deployment is only centralized in one local area so that this implementation must be developed in future researchers. The suggestion given is the need for this application to work using the compiler's local network tool and must use a virtual private network so that this application can run independently and maintenance of the system needs to be considered so that system performance can operate properly.

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