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Enhancement of WiFi Signal Quality via Access Point Deployment at the Dana Mulia Girls' Orphanage

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ABSTRACT

Stable internet access is a critical factor in supporting learning activities for residents of the Dana Mulia Orphanage, Bandung. The primary issue identified was poor Wi-Fi signal quality on the second floor of the girls' dormitory due to the main router being located on the first floor. This community service project aimed to improve network performance by deploying an additional access point on the second floor. The methodology included initial assessment, signal strength measurement, network design, router repositioning, LAN cable installation, access point deployment, and performance evaluation. The results demonstrated a significant improvement in Wi-Fi signal strength across all rooms on the second floor, with an average of 23 dBm. This enhancement resulted in more stable internet access, thereby effectively supporting residents' learning and communication activities.

Keywords: *Wi-Fi, access point, signal quality, wireless network, dormitory.*

1. INTRODUCTION

The internet has become a crucial infrastructure in supporting educational activities, communication **(Bumbungan, 2025)**, and access to information **(Diana & Sari, 2024; Fadhillah & Yuniarti, 2023)**. The availability of a stable internet connection is essential to support various learning activities **(Akmad & Abatayo, 2024; Muhammad et al., 2026),** including those in orphanages. Building-based internet networks are typically acquired through an Internet Service Provider (ISP), which installs a modem and router on the premises **(Bytyqi & Jashari, 2024)**. The building owner then develops an internal network, either wired or wireless systems. Wireless Fidelity (Wi-Fi) is commonly used as part of a Wireless Local Area Network (WLAN) **(Pahlavan & Krishnamurthy, 2021).**

However, limitations in network infrastructure often become a major obstacle in providing evenly distributed internet services across different areas within a building **(Pons et al., 2023)**. A common issue is the limited coverage of Wi-Fi signals due to the router's inability to optimally reach all areas of the building **(Muhammad et al., 2026; Shah & Nasir, 2025)**, particularly when walls and floor structures attenuate the signal **(Bytyqi & Jashari, 2024)**. This issue is also observed at the Dana Mulia Girls' Orphanage in Bandung. The orphanage building consists of two floors and is equipped with an internet connection provided by INDIHOME Telkom. By placing a router on the first floor, the orphanage is able to provide PSTN telephone services as well as internet access distributed via Wi-Fi throughout the building.

Nevertheless, the current Wi-Fi coverage is highly limited. Optimal connectivity is only available on the first floor, while the second floor — predominantly occupied by residents and caretakers — experiences weak or no signal. Only a few spots provide limited internet access, making it difficult for residents to study effectively. Mosts residents, who are school-aged children, must gather on the first floor to use the internet, disrupting their learning activities. Based on these conditions, this community service activity aims to improve the coverage quality of the internet network by adding an access point on the second floor, thereby enabling a more even distribution of Wi-Fi signals across all rooms in the orphanage.

This community service activity adopts the Action Research framework as its methodological foundation. Action research is a cyclical, practice-oriented inquiry approach that integrates problem identification, planning, implementation, and reflective evaluation within real community settings **(Kemmis & McTaggart, 1988)**. This approach was selected because it enables the team to collaboratively identify problems with the orphanage management, design context-specific solutions, implement interventions, and evaluate outcomes in an iterative manner. The involvement of community members — particularly the orphanage management and residents — in the problem identification and feedback stages is central to this approach, ensuring that the solutions developed are genuinely responsive to the community's actual needs.

2. METHODS

The methodology of this community service activity follows the Action Research cycle, consisting of four iterative stages: reconnaissance (initial observation and problem identification), planning (network solution design), action (implementation), and reflection (evaluation and measurement) **(Kemmis & McTaggart, 1988).** Throughout each stage, the team maintained active communication with the orphanage management, incorporating their input on network conditions, usage patterns, and room occupancy to ensure the solution was both technically sound and contextually appropriate.

2.1 Reconnaissance: Initial Condition Observation

The initial stage involved observing the room conditions and existing internet network at the orphanage to identify areas with poor Wi-Fi coverage. The Dana Mulia Girls' Orphanage building covers approximately 27 × 14.5 square meters and consists of two floors. The first floor houses offices, kitchen, business space, dining area, storage room, and a caretaker's bedroom (Figure 1). The INDIHOME modem (GPON terminal Huawei Echolife HG8245H5) and telephone device are located at the corner of the dining area on the first floor.

On the first floor, three desktop PCs are present; however, only one (in the dining room) is actively used, as the others are damaged. All residents and functional PCs access the internet via Wi-Fi. The second floor serves as bedrooms for residents and one caretaker, and includes a reading room and library (Figure 2). According to the orphanage management, the Wi-Fi signal from the INDIHOME modem is barely detectable on the second floor, only near the staircase, making the modem's placement the primary cause of limited coverage on that level.

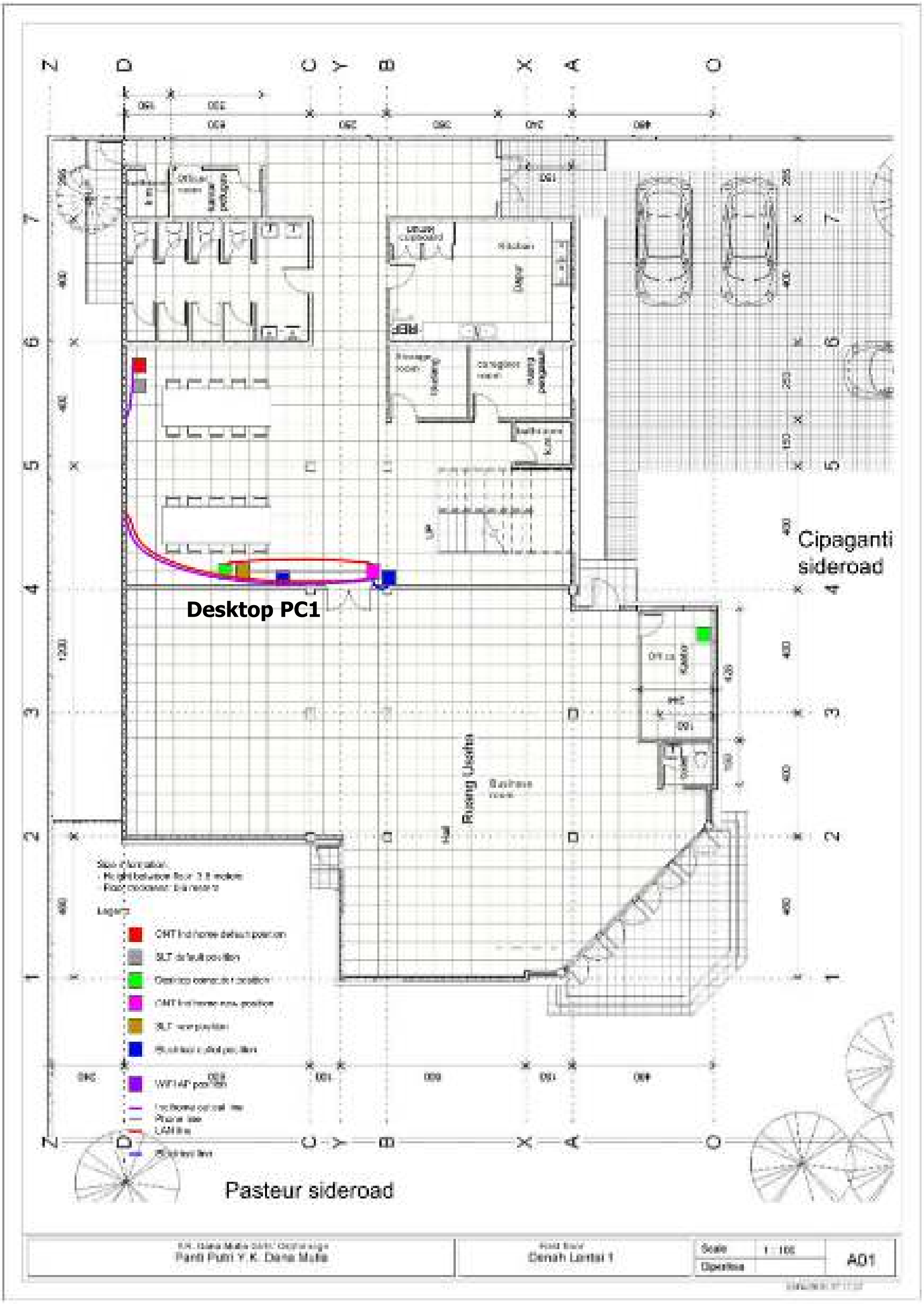

Figure 1. First Floor Layout of the Dana Mulia Girls' Orphanage, Bandung

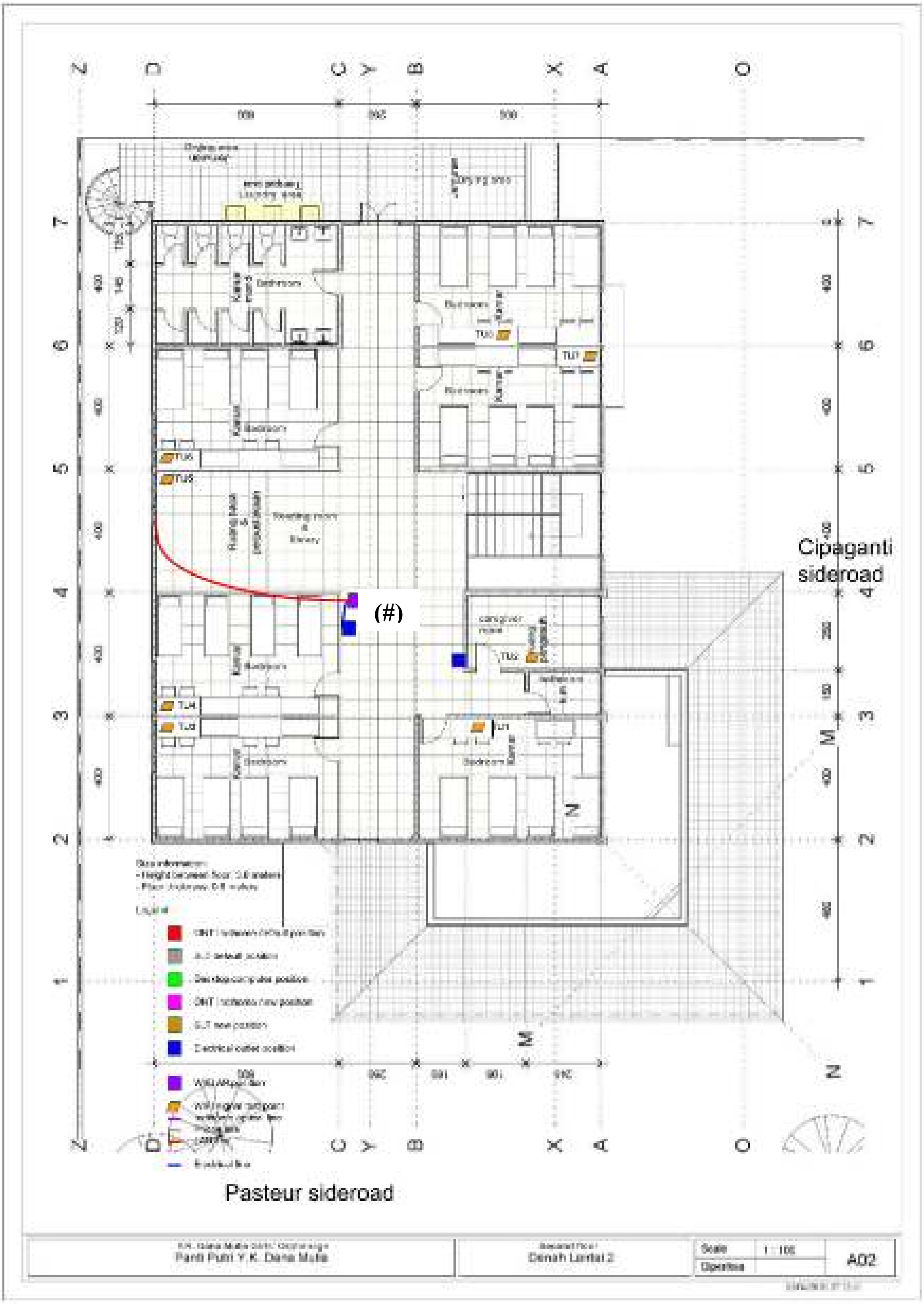

Figure 2. Second Floor Layout of the Dana Mulia Girls' Orphanage, Bandung

2.2 Reconnaissance: Signal Strength Measurement

Prior to measuring the Wi-Fi signal strength on the second floor, the PKM team conducted testing of the existing LAN and internet connections using a personal computer located on the first floor of the Dana Mulia Girls' Orphanage building. The computer was connected to the Wi-Fi network provided by the INDIHOME internet modem. The test results were obtained using the CMD console application, as shown in the console output.

Based on the CMD console output, the following observations were obtained:

- The test computer was assigned a host IP address of 192.168.100.43.
- The average round-trip time of IP packets between the test computer and the INDIHOME internet modem (IP address 192.168.100.1) was 0 ms.

From a network logic perspective, the internet access connection in the Dana Mulia Girls' Orphanage building is illustrated in Figure 3.

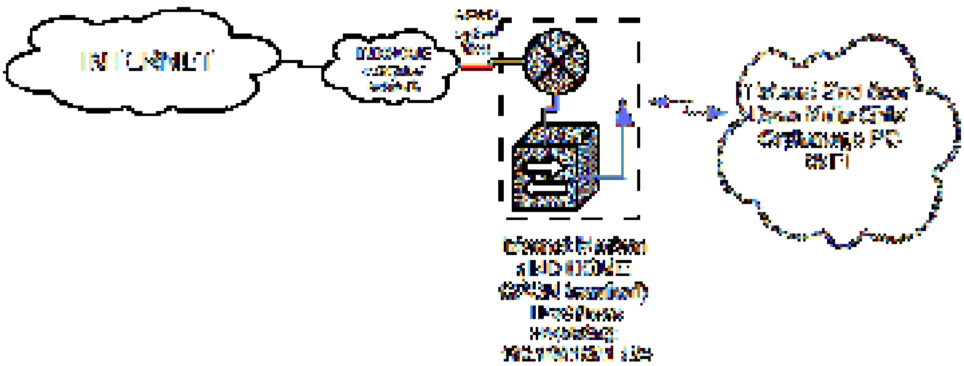

Figure 3. Initial Logical Diagram of the Internet Access Network at the Dana Mulia Girls' Orphanage

Based on Figure 3, all computing devices (PCs and smartphones) are connected to the internet through the Wi-Fi network provided by the INDIHOME modem, which functions as both a router and transceiver. The devices obtain automatic IP addresses ranging from 192.168.100.2 to 192.168.100.254. The INDIHOME modem itself uses a static IP address of 192.168.100.1 to access its web-based configuration interface and is connected to the INDIHOME internal network before accessing the internet via the GPON fibre optic network.

Following the LAN assessment, Wi-Fi signal strength was measured at eight test points (TUs) as seen on figure 4 on the second floor (shown in Figure 2) using a Samsung GT-I8190 device running the Wi-Fi Analyzer (open-source) application on Android 4.1.2, i.e., *Wi-Fi Analyzer* (open source).

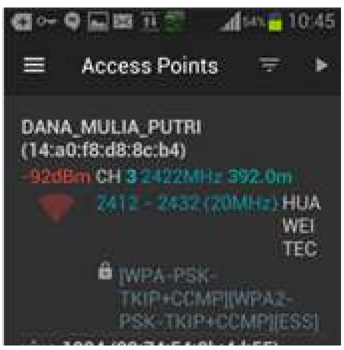

Figure 4. Example of the Wi-Fi Signal Strength Measurement Interface at Test Point TU5

These measurements served as baseline indicators for the subsequent network improvements. An example of the measurement interface is presented in Figure 4.

2.3 Planning: Network Solution Design

The improvement of internet network coverage, particularly via Wi-Fi on the second floor of the orphanage building, was carried out by adding a Wi-Fi access point device at a central location within the target service area. From a network logic perspective, the Wi-Fi access point extends the coverage of the local area network provided by the internet modem from the service provider (INDIHOME), which is installed on the first floor, as illustrated in Figure 5.

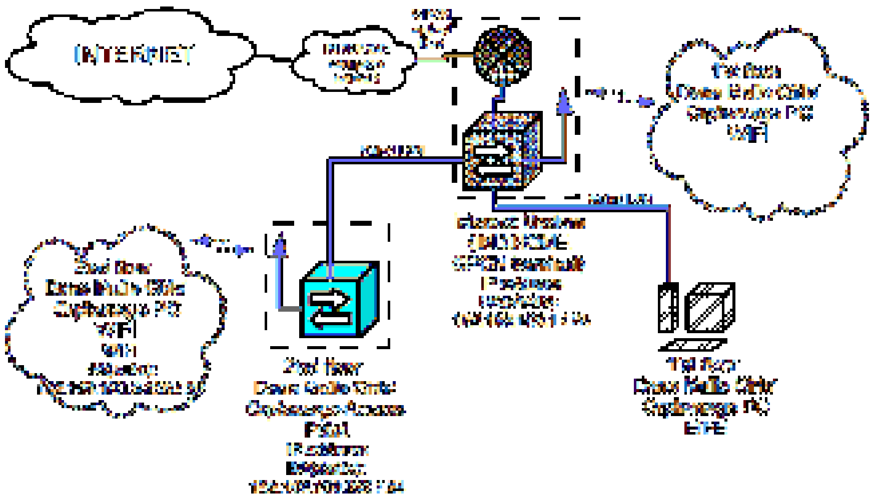

Figure 5. Logical Diagram of the Developed Internet Access Network at the Dana Mulia Girls' Orphanage

Based on Figure 5, first-floor devices connect to the INDIHOME modem via Wi-Fi or direct Ethernet. Second-floor devices access the internet through an additional access point (Dana Mulia Putri – 2nd floor), configured with a static IP of 192.168.100.250/24 and connected to the modem via wired LAN. All devices on both floors receive automatic IP addresses in the range 192.168.100.2–200.

Physically, the network development involved the following steps:

1. Relocating the modem and telephone to a new position near Desktop PC 1 to improve Wi-Fi coverage on the first floor and facilitate network extension to the second floor. This also included relocating the power supply line.
2. Installing an additional access point on the second floor along with its power supply and configuration.
3. Installing UTP cabling for the desktop PC.

The modem and telephone were relocated closer to Desktop PC 1 (see Figure 1) by extending the fibre optic and telephone cables, positioning the modem more centrally on the first floor for better signal distribution. The desktop PC was directly connected to the modem via UTP cable.
On the second floor, a new access point was installed at position (#) (see Figure 2) and connected to the INDIHOME modem on the first floor via a UTP cable.

2.4 Action: Modem and Access Point Installation

Based on the network design, several implementation activities were carried out:

a. Relocation of modem and telephone

The modem, initially located at the corner of the first floor, was moved to a central position. The fibre optic cable provided by PT. TELKOM was extended to reach the new location. Cable ducts were used to ensure neat cable management along the building structure.

An additional access point (ZTE F660) was installed on the second floor and connected to the modem using approximately 20 meters of UTP cable. Cable ducts were installed on both floors to organize the UTP cable and power cables. Figure 6 shows installation of fibre optic and telephone cables on the first floor and installation access point on the second floor.

Figure 6. Installation of Fibre Optic and Telephone Cables on The First Floor and Installation Access Point on The Second Floor.

b. Installation of UTP cable for desktop PC

To improve connection stability, the desktop PC on the first floor was connected to the modem via a 10-meter UTP cable. The LAN card was configured to enable internet access through the wired network.

c. Configuration of modem and access point

The additional access point was configured with a static IP address of 192.168.100.250/24, aligned with the modem's network (192.168.100.0/24). The DHCP range was adjusted from 192.168.100.2–192.168.100.254 to 192.168.100.2–192.168.100.200 via the modem configuration interface (192.168.100.1). Wi-Fi credentials (username and password) were also configured for second-floor access.

2.5 Reflection: System Testing

After completing the configuration, LAN and internet connectivity tests were conducted using a personal computer connected via wired LAN. The CMD console results indicated:

- The test computer obtained an IP address of 192.168.100.43.
- The packets lost to the modem (192.168.100.1) was 0 (0% loss).
- The packets lost to the additional access point (192.168.100.250) was 0 (0% loss).

Following installation, Wi-Fi signal strength measurements were repeated at the same eight test points on the second floor. Using the same devices and software, the results showed a significant improvement in signal strength, as presented in Table 2.

3. RESULTS AND DISCUSSION

3.1 Initial Network Condition

Initial measurements indicated that Wi-Fi signal quality in several rooms on the second floor was in the weak category, as shown in Table 1. This was primarily caused by the distance from the main router and structural obstacles within the building.

Table 1. Initial Measurement Results of Wi-Fi Signal Strength

	TU1	TU2	TU3	TU4	TU5	TU6	TU7	TU8
Test Point Location (TU)	TU1	TU2	TU3	TU4	TU5	TU6	TU7	TU8
Wi-Fi Signal Strength (dBm)	-97	-95	-92	-92	-92	-90	-85	-96

3.2 Implementation of Modem Relocation and Access Point Installation

The solution implemented in this study involved relocating the modem and installing an additional access point on the second floor, which was connected to the main router using a UTP cable. The modem was moved to the Desktop PC 1 table (see Figure 1).

(a) (b)

Figure 7. (a) Relocated Modem Position on the First Floor; (b) Installed Access Point on the Second Floor

The result of relocating the modem from its original position above the door, along with the telephone device, to the new position on the computer desk is shown in Figure 7a. The access point was installed at a location that could cover most of the residents' rooms, specifically at point (#) (see Figure 2). The final result of the access point installation is presented in Figure 7b. The installation results indicate that the UTP cable was neatly organized within the cable duct.

3.3 Analysis of Signal Strength Improvement

After the installation of the additional access point, Wi-Fi signal strength measurements were repeated at the same locations. The results indicate an improvement in signal quality at all measurement points, as shown in Table 2. This improvement demonstrates that internet network distribution has become more even, allowing residents to access the internet more reliably. The average of signal strength improvement is 23 dBm.

Table 2. Wi-Fi Signal Strength Measurement Results with Additional Access Point

	TU1	TU2	TU3	TU4	TU5	TU6	TU7	TU8
Wi-Fi Signal Strength (dBm) – Initial Modem Position	-97	-95	-92	-92	-92	-90	-85	-96
Wi-Fi Signal Strength (dBm) – With Access Point	-61	-62	-67	-61	-74	-71	-80	-72
Signal Strength Improvement (dBm)	36	33	25	31	28	19	5	24

The implementation of this activity provides several benefits for the orphanage residents, including improved internet access quality in second-floor rooms, support for internet-based learning activities, and increased comfort in using internet services.

This activity also enhances the awareness of the orphanage management regarding the importance of proper internet network infrastructure management. In addition to the technical measurements, the orphanage management provided informal feedback indicating that residents on the second floor experienced a noticeable improvement in internet accessibility following the installation of the access point. Residents were observed to be able to conduct internet-based learning activities directly from their rooms, rather than gathering on the first floor as previously necessary. A structured evaluation of user satisfaction, such as through a standardized questionnaire or Google Form survey administered to the residents, is recommended as a follow-up measure to quantitatively capture the perceived impact of the network improvement on daily learning and communication activities.

4. CONCLUSIONS

This community service activity conducted at the Dana Mulia Girls' Orphanage successfully improved internet network quality through the addition of an access point on the second floor. The measurement results show a significant increase in Wi-Fi signal strength compared to the pre-installation condition. Specifically, the average Wi-Fi signal strength on the second floor improved from −92.4 dBm prior to installation to −68.5 dBm following the deployment of the additional access point, yielding an average signal strength improvement of 23 dBm. Post-installation signal levels across all eight test points fall within the acceptable to good range according to standard Wi-Fi signal quality classifications, confirming that the implemented solution effectively resolved the coverage issue on the second floor. This simple network solution effectively enhances internet accessibility for the residents, thereby supporting learning activities and digital communication.

The success of this activity is confirmed through three verifiable indicators: (1) Wi-Fi signal strength on all eight test points improved from the weak range to the acceptable-to-good range (−70 to −60 dBm), enabling stable connectivity; (2) all eight test points, which previously showed weak or no signal, now demonstrate functional Wi-Fi coverage; and (3) the desktop PC on the first floor was successfully migrated to a wired LAN connection, reducing wireless load and improving overall network stability.

To ensure sustainability of the improvements, several follow-up measures are proposed. In the short term, the orphanage management is advised to periodically monitor Wi-Fi signal quality and conduct basic maintenance of the installed infrastructure. In the medium term, a

PKM team follow-up visit is planned to reassess coverage and address any issues, accompanied by a structured user satisfaction survey to capture residents' qualitative feedback. In the long term, if the number of residents or connected devices grows significantly, installing an additional access point or upgrading to a mesh networking system may be considered.By applying the Action Research framework, this activity demonstrated that a participatory, iterative approach — combining collaborative problem identification, community-responsive planning, and reflective evaluation — can yield measurable outcomes even with modest resources. The active involvement of the orphanage management throughout all stages was key to the relevance and sustainability of the solution.

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