

Designing a Fiber to the Home (FTTH) Network Using Google Earth in Taman Sekata Indah Housing Estate

Laila Nurzanah¹, Mhd Fikry Hasrul Hasibuan², Putra Edi Mujahid³, Yopie Lahardo Soselisa⁴

¹ Universitas Islam Negeri Sumatera Utara; lailanurzannah99@gmail.com

² Universitas Islam Negeri Sumatera Utara; mfikryhasrul04@gmail.com

³ Universitas Prima Indonesia; putraedimujahid@unprimdn.ac.id

⁴ Sekolah Tinggi Teknik Harapan; yopie8soselisa@gmail.com

ABSTRACT

This research discusses the design of a fiber-to-the-home network in Taman Sekata Indah Housing, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra 20351 using the Google Earth Pro application. This research aims to find out in detail how to design a fiber to the home network starting from the boundaries of the area and the data collection of the number of buildings in the area. area restrictions and data collection on the number of buildings in the area, designing the Optical Distribution Point (ODP) pole. The research methods include making a flow chart and searching for data sources using observation, interviews, and case studies. In this research, the data obtained in the form of the total number of buildings in the surrounding area, and the number of distribution cable lengths that must be provided during installation. Length of distribution cable that must be provided when installing a fiber network to the home, as well as the determination of the Optical location point. to the house, as well as the determination of the location point of the Optical Distribution Point (ODP) and the Optical Distribution Point (ODP) and Optical Distribution Cabinet (ODC) pole. In detail and detail.

Keywords: Fiber to The Home, Google Earth, Optical Distribution Point, Network Installation Design

Corresponding Author:

Laila Nurzanah

Universitas Islam Negeri Sumatera Utara; lailanurzannah99@gmail.com

This is an open access article under the [CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/) license.



1. INTRODUCTION

In this digital age, internet speed and connectivity have become an important factor in our everyday lives. The more devices connected to the internet, ranging from smartphones, computers, and Internet of Things (IoT) devices, the higher the demand for internet connection speed and stability. For internet connection speed and stability (Susilo, 2018). To meet these needs, network technology continues to evolve, and one of the leading innovations in this field is Fiber to the Home (FTTH). Fiber to the Home (FTTH) is a network technology that utilizes optical fiber to transmit high-speed data signals directly to the Internet. To transmit data signals at high speed directly to the user's

home. In FTTH, optical fibers, made of glass or highly polished plastic, are used as a transmission medium to transfer data in the form of light (Wadly & Fitriani, 2023).

Transmission medium to transfer data in the form of light. Compared to other network technologies network technologies such as DSL (Digital Subscriber Line) or coaxial cable, FTTH offers much higher speed and capacity. And much higher capacity. In its implementation, optical fibers are pulled into users' homes, replacing copper cables which are usually used in conventional networks. Optical fiber has the ability to transfer data at high speeds and overcome the electromagnetic interference issues that often occur with copper cables. With FTTH, users can enjoy the same speed, both for downloading and uploading data, which can reach up to hundreds of Mbps. Data, which can reach hundreds of Mbps to several Gbps (Ridho et al., 2020).

In some previous studies, research has been carried out which includes FTTH network design in several regions in Indonesia and network analysis such as FTTH networks in several regions in Indonesia and network analysis such as the calculation of loss power budget, bit error rate (BER), and so on. Calculation of loss power budget, bit error rate (BER), and so on. As for This research aims to design an FTTH network in Taman Sekata Indah Housing, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra 20351 by using the Google Earth Pro application and the data provided is expected to be in the form of the data provided is in the form of the number of ODCs, ODP poles, and the length of the distribution cable that must be pulled to be distributed to residents' homes and to be distributed to residents' homes. To be distributed to residents' homes and inform readers about the potential use of FTTH networks in the area. in the use of FTTH network in Taman Sekata Indah Housing Estate Taman Sekata Indah, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra 20351.

2. LITERATURE REVIEW

2.1. Fiber Optic

Optical fiber is a transmission line or cable made of glass or plastic that is used to transmit light from end to end of the cable. The light used in optical fiber is LED (Light Emitting Diode). There are 3 optical fiber structures, namely core, cladding, and coating (Syahrin, 2023). The use of fiber optics depends on the principle of light in the medium glass medium that can carry more information more information and over longer distances than electrical signals carried by copper or carried by copper or coaxial media. Coaxial media. The purity of glass fiber combined with advanced electronic systems, allows the fiber to transmit digital light signals over a distance of 100 km without amplifying devices. Fiber optic is an ideal transmission medium with little transmission loss, low interference, and potentially high bandwidth potential (Darmawan et al., 2016).

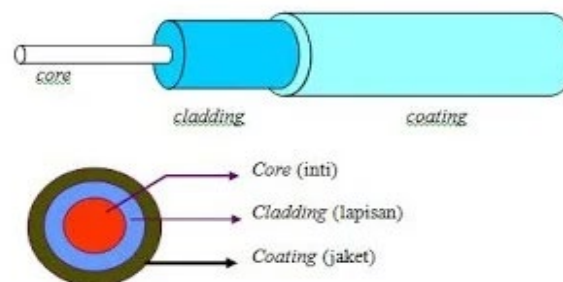


Figure 1. Structure of Fiber Optic Cable

In principle, fiber optics reflects and refracts the light that propagating through it. This principal centers on how fiber optics work which limits the the angle at which light waves are sent and allows for efficient control of efficiently to the destination. The light source used is usually a laser or LED beam that passes through the fiber optic array (Mahrifatika, 2023). Each fiber optic cable structure has a function as in the following Table 1.

Table 1. Structure of Fiber Optic Cable

No	Structure of Fiber Optic Cable	Description
1	Coating	Usually, this part is made using special materials to hold the cable from external pressure.
2	Cladding	Cladding is the part used to cover the core which functions to reflect light on the core.
3	Core	The core is the smallest part where this part is a part made of glass or plastic which is specially designed so that the refractive index value of the material.

There are several types of fiber optic cables used in various communication and networking applications. Here are some types of fiber optic cables and their descriptions.

1. Single Mode

This cable has a smaller core than multimode around 9 microns using a wavelength of 1300 or 1550 nm. It is called single-mode because the use of this FO cable only allows for one mode of light to be scattered through the core at a time (Tjahyaningtyas, 2012).

2. Multi-Mode

These cables have cores of about 50 to 100 microns, using wavelengths of 850 or 1300 nm. It is called multi-mode because this type of FO allows hundreds of modes of light to propagate through the fiber simultaneously (Hanif & Arnaldy, 2017).

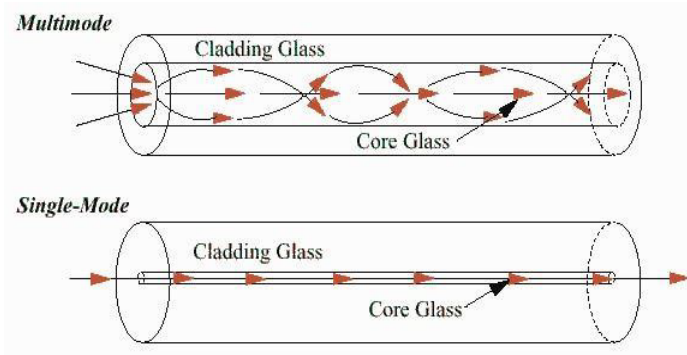


Figure 2. Multimode and Single-Mode

Of course, fiber optic cables have advantages and disadvantages as for the following advantages and disadvantages:

Table 1. Advantages and Disadvantages of Fiber Optics

No	Advantages	Disadvantages
1	Wide bandwidth.	Installation is quite difficult as it requires more precision.

No	Advantages	Disadvantages
2	Higher level of security higher.	Maintenance is expensive and difficult
3	Does not take up much space (compact), and lightweight.	The least flexible among other wired transmission media.

2.2. *Fiber To the Home (FTTH)*

FTTH is a derivative of FTTX technology where this technology functions to provide triple play services from the provider center to the user area using fiber optic cable as a medium. The emergence of this technology is due to public demand for the best service with easy access (Harpawi et al., 2017). This triple-play service can support data or internet, voice, and video. Adi Nugroho said: "And also driven by the desire to get services known as Triple Play Services, namely fast internet access services, voice (telephone network, PSTN) and video (cable TV) in one infrastructure at the customer unit (Mahjud et al., 2022)."

Fiber to The Home (FTTH) access network is a fiber optic technology architecture that sends information from the provider to the users where the ONU device is located in customer's homes. The customer terminal is connected to the ONU using an indoor copper cable with a fairly short distance. The development of this technology is inseparable from advances in the development of fiber optic technology that can replace the use of conventional cables and also driven by the desire to get services known as Triple Play Services services, namely services for patient internet access, voice (telephone network, PSTN), and video (Cable TV) in the (telephone network, PSTN) and video (Cable TV) in one infrastructure at the customer unit. One infrastructure at the customer unit (Fitri et al., 2021).

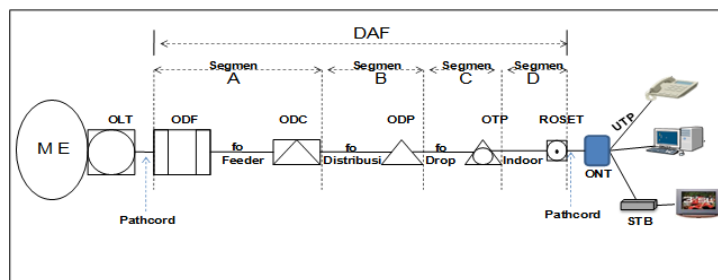


Figure 3. FTTH Element and Network

Telkom Indonesia explained that: "In general, FTTH/B networks are divided into 4 cable supply segments in addition to active devices such as OLT and ONU/ONT", which are as follows;

1. Segment A: Feeder cable
2. Segment B: Distribution cable
3. Segment C: Dates/Drop cables
4. Segment D: House/Building cable

2.3. *FTTH Device*

The following are devices used in the process of distributing networks from the central office (CTO) or commonly known as the main office/branch network provider aimed at the community as customers, including the following:

1. Optical Line Terminal (OLT)

OLT Also called optical line termination is a device that serves as the service provider endpoint of a passive optical network. To perform the conversion between the electrical signals used by the service provider equipment and the fiber optic signals used by the passive optical network. To coordinate the multiplexing between the conversion devices at the other end of that network (called optical network terminals or optical network units) (Mutaharrik, 2016).



Figure 4. Optical Line Terminal (OLT)

2. Optical Distribution Cabinet (ODC)

Optical Distribution Cabinet (ODC) is one of the devices in the FTTH (fiber to the home) network topology. The location of the ODC in the topology is between the ODF and ODP and is the place to connect the feeder cable with the distribution cable. The function of the ODC is to install fiber optic cable network connections (Tjut Adek et al., 2022). Installation of an Optical Distribution Point (ODP) has 2 procedures, namely; the initial procedure with the technique of picking one of the cores of the main distribution cable from ODC that goes directly to ODP and the core is taken in order after that the core will be connected to the passive, The passive used in ODP is passive 1: 8 (Lamsihar et al., 2015). Furthermore, the second way is the Branching Technique, this technique adds ODP which is done by adding distribution cables that lead to the ODP. done by adding distribution cables that lead to the main distribution cable in other words the main distribution cable will be branched due to customer needs (Jamal et al., 2021).



Figure 5. Optical Distribution Cabinet (ODC)

3. Optical Distribution Point (ODP)

ODP functions as a single-mode optical network connection installation place, especially for connecting distribution fiberoptic cables and drop cables. ODP devices can contain

optical pigtailed, connector adapters, and splitter rooms and are equipped with fiber management rooms with a certain capacity (Subhan et al., 2021). ODP installation method by picking one of the cores from the distribution cable in order. Then the core is inserted into the passive, the passive commonly used in ODP is 1/8 passive. So the passive is split into eight. Types of ODP include ODP Pole and Closure which are often found on the side of the highway (Angga, 2024).



Figure 6. Optical Distribution Point (ODP)

2.4. Google Earth pro

A map application that can display location plans precisely and with a 3D perspective that allows users to more clearly locate a desired location or area. This application has performance and capabilities such as high-quality image quality and the many marker features offered in it compared to the standard Google Earth (Syahrin, 2023). This program maps the earth from the superimposition of images that are collected from satellite mapping, aerial photography, and three-dimensional GIS (geographic information system) globes. three-dimensional (Sitohang, 2018).

Currently, the Google Maps API has undergone development, until now the Google Maps API has reached version 3. However, version 3 of the Google Maps API can still only be used by web-based programming using Javascript (Tjahyaningtyas, 2012). For the use of the Google Maps API on mobile devices such as Android, the Google Maps API that can be used at this time has reached version 2. The development of Google Maps Version 2 is to have complete features from the previous version, one of which is that it can display maps with the desired angle and in the form of 3D views. In addition, in the Google Maps API, there are several choices of map models displayed such as Roadmap, Satellite, Terrain, and Hybrid (Abdellaoui et al., 2021).

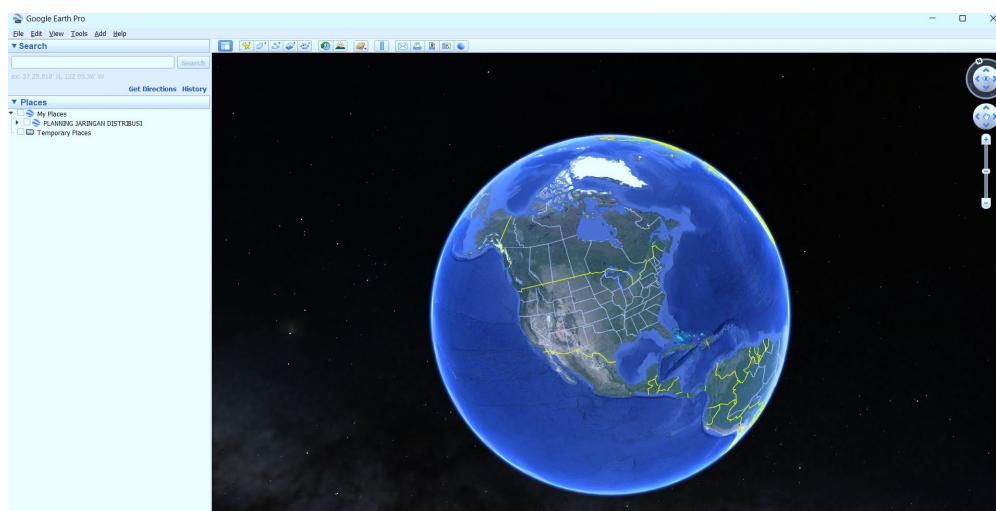


Figure 7. Google Earth Pro view

3. METHODS

3.1 Flowchart

Flowchart of Fiber to The Home network design in this research, the author made an FTTH network design flowchart to make it easier for the author to design the FTTH network. The design flowchart is as follows:

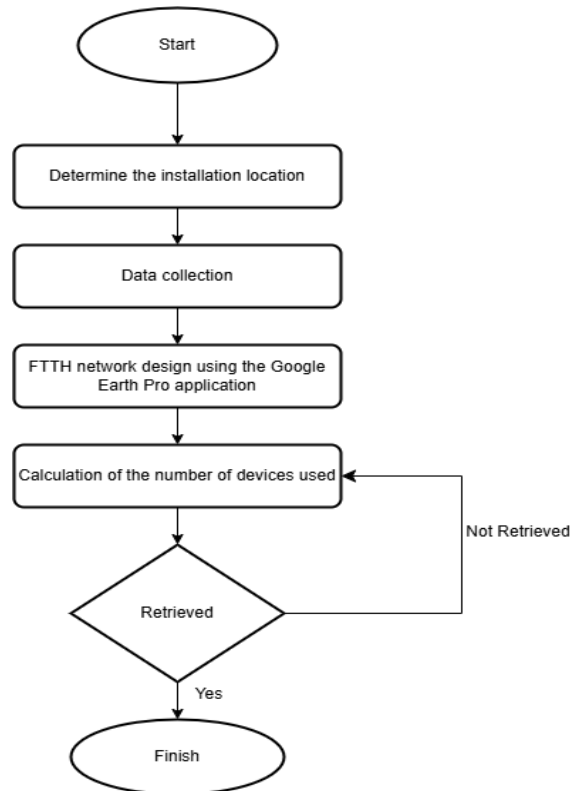


Figure 8. Fiber to the Home Network design flow chart

FTTH network design begins with determining the location that you want to use as a research target after that make observations as well as take and collect data, then the data is processed and the FTTH network design process is carried out using the Google Earth Pro application. After completing the design, match the data taken in the field with the data in the application related to the target location points if it is appropriate, then carry out the final stage, namely reporting in the form of writing, but if it is not appropriate, do the data collection again and take steps by the written procedures.

3.2 Data Source

Data collection is done by retrieval of data obtained using primary data collection. Primary data collection primary data collection in this study was conducted at the Taman Sekata Indah Housing, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra. The data obtained then processed to be used as projections in the design of the Fiber to The Home network design.

3.3 Data Collection Technique

In this study, the authors conducted data collection (Observation, Interview, and Literature Study), techniques were used to collect the required data based on supporting facts in the field, namely by:

1. Field Observation

The data collection process is carried out using field observations at PT Telkom Indonesia (Persero) Tbk Regional-1 Sumatra. This direct observation technique does not use special equipment - equipment but by observing and recording important things that are needed.

2. Direct Interview

Direct interview is the process of collecting data by asking questions to the supervising representative. Data obtained during direct interviews at PT Telkom Indonesia (Persero) Tbk Regional-1 Sumatra.

3. Literature Study

Data is obtained from searching the literature on research problems. This stage plays a very important role because in understanding and writing it is necessary to prepare a basic theoretical framework, namely the basic theories related to this research.

4. RESULTS AND DISCUSSION

4.1 *Determination of Design Location*

The location of the FTTH network design is in the Taman Sekata Indah Housing, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra. From complex A to complex B with a total of 47 houses. The location was chosen because at that location there is no Fiber Optic access network service. This housing has the potential for the growth of potential customers and the development of FTTH networks.



Figure 9. FTTH Network Design Location

4.2 *Polygon Design*

Pylogon design on the FTTH network covers the entire area in Taman Sekata Indah Housing, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra with a total area of 0.49 kilometers as shown in Figure 10.



Figure 10. Polygon design

4.3 Pole Construction Design

One of the design parts of the fiber to the home network is the pole. The construction of the pole design in Taman Sekata Indah housing, North Sumatra totals 7 pieces as shown in Figure 11.



Figure 11. Pole construction design

Table 2. Coordinate point of New Pole

No	Device	Latitude	Longitude
1	TB-1	3°32'29.87"n	98°35'18.74"e
2	TB-2	3°32'30.17"n	98°35'17.67"e
3	TB-3	3°32'27.42"n	98°35'18.05"e
4	TB-4	3°32'28.35"n	98°35'16.16"e
5	TB-5	3°32'31.68"n	98°35'18.10"e
6	TB-6	3°32'30.40"n	98°35'16.65"e
7	TB-7	3°32'31.38"n	98°35'19.19"e

From TB-1 to TB-7 is a new pole that crosses Latitude 3°32'29.87 "N-3°32'31.38 'N and Longitude 98°35'18.74 'E- 98°35'19.19" E. Where each new pole has a distance of ±50m.

4.4 Distribution Cable Design

The design of the distribution cable on the Fiber To The Home network in Taman Sekata Indah Housing is done by taking the shortest distance to reduce costs in field installation with a total cable length of 315 meters.



Figure 12. Distribution cable design

4.5 Optical Distribution Point (ODP) Location Design

The design stage of the pole and ODP location points was carried out using the Google Earth Pro application. Earth pro. At this stage, the poles and ODPs needed are 6 ODP poles that are scattered at various points. Scattered at various points. The design of the location points of the poles and ODP was carried out by placing the poles on intersecting roads. Poles on the intersecting roads, this is so that when there is a problem with the ODP device and in the installation process, the poles will be placed on the road. ODP device and in the installation process it takes time and a place for the technicians to there will be no traffic congestion or disruption. Installation of ODP poles are also installed sequentially, starting from the edge of the highway, symbolized by ODP 1, and continuing until the end. ODP 1 and then continued until finally ending with ODP 6 which was also installed on the edge of the highway, this is intended to make it easier for technicians to carry out maintenance, installation, or repair of ODP later.



Figure 13. ODP location design

Table 3. ODP coordinate point

No	Device	Latitude	Longitude
1	ODP-1	3°32'28.33"N	98°35'16.17"E
2	ODP-2	3°32'29.85"N	98°35'18.74"E
3	ODP-3	3°32'31.65"N	98°35'18.09"E
4	ODP-4	3°32'27.39"N	98°35'18.06"E
5	ODP-5	3°32'30.14"N	98°35'17.67"E
6	ODP-6	3°32'30.37"N	98°35'16.66"E

From ODP-1 to ODP-6 across Latitude 3°32'28.33 "N- 3°32'30.37 'N, and Longitude 98°35'16.17 'E-98°35'16.66" E. Each ODP has a distance of ± 250m. In designing the Fiber-to-Home Network, the first thing to do is to make direct observations in the field to determine the number of devices to be used and determine the coordinate points. Coordinate points are used to determine the location of the device placement in the design using the Google Earth Pro application. Designing using the Google Earth Pro application aims to calculate the number of devices and facilitate the repair process. The design of the FTTH network in the Taman Sekata Indah housing complex with a Polygon area of 489 does not cover the entire housing area with the number of ODP 6 pieces with 1: 7 splitters so that it can serve 47 homepasses. Table of the number of FTTH network devices Taman Sekata Indah Housing, North Sumatra.

Table 4. FTTH network devices

No	Device name	Quantity
1	Optical Distribution Point	6 pcs
2	New Pole	7 poles
3	Distribution Cable	315 Meters

4.6 Results

Figure 14 is the result of all the designs that have been done in the previous explanation. This design requires as many as 8 ODP points, and 7 new poles, and uses as many as 315 meters of distribution cables as in Table 5. Each point that is used as a reference for ODP installation is of course based on direct observation, this is done to make it easier for researchers to design through Google Earth Pro. The next thing that will be done is to carry out the design directly in the location that has been determined in Figure 14. Of course, it will be carried out by technicians related to this field.



Figure 14. Final Design Result

5. CONCLUSION

Overall, this research is focused on creating an efficient FTTH network design in Taman Sekata Indah Housing Complex, Tanjung Selamat, Sunggal, Deli Serdang Regency, North Sumatra, using data collection techniques such as observation, interviews, and literature studies. The results showed that the design location in the housing has the potential for growth and development of the FTTH network. The design includes a polygon design that covers the entire area of the housing complex, a pole construction design with 7 poles, a distribution cable design with a total length of 315 meters, and an Optical Distribution Point (ODP) location design using Google Earth Pro. The ODP is strategically placed at the crossroads for technicians to access and maintain it easily. This design aims to serve 47 home passes in a residential complex. In the discussion, it was emphasized that direct observation in the field is critical to determine the number of devices and coordinate points.

REFERENCES

- Abdellaoui, Z., Dieudonne, Y., & Aleya, A. (2021). Design , implementation and evaluation of a Fiber To The Home (FTTH) access network based on a Giga Passive Optical Network GPON. *Array*, 10(February), 100058. <https://doi.org/10.1016/j.array.2021.100058>
- Angga, A. D. sidik, H. A. (2024). 3253-Article Text-12810-1-10-20240718. *Analisis Redaman Pada Jaringan Fiber To The Home (FTTH) Berteknologi Gigabit Passive Optical Network (GPON) Di Pt. Telkom Palmerah*, 2406–2418.
- Darmawan, N., Teknik, J., & Universitas, E. (2016). *ANALISA PENGEMBANGAN JARINGAN FIBER OPTIC SITE NANGKA*.
- Fitri, S., Aulia, S., & Asril, A. (2021). *Perancangan Dan Pengukuran Performansi Jaringan Fiber To The Home Dengan Teknologi Gigabit Passive Optical Network Menggunakan Aplikasi Optisystem Di Kelurahan Surau Gadang*. 11(2), 22–27.
- Hanif, I., & Arnaldy, D. (2017). Analisis Penyambungan Kabel Fiber Optik Akses dengan Kabel Fiber Optik Backbone pada Indosat Area Jabodetabek. *Multinetics*, 3(2), 12. <https://doi.org/10.32722/vol3.no2.2017.pp12-17>
- Harpawi, N., Putra, E. H. P. H., & Qory, R. . R. (2017). Desain Jaringan Fiber Optik Menggunakan Optisystem Untuk Kawasan Kota Pekanbaru. *Jurnal Elektro Dan Mesin Terapan*, 3(2), 21–30. <https://doi.org/10.35143/elementer.v3i2.183>
- Jamal, N., Ulfah, M., & Irtawaty, A. S. (2021). *Analisis Jarak Jangkauan Jaringan Fiber To The Home (FTTH) dengan Teknologi Gigabit Passive Optical Network (GPON) Berdasarkan Link Power Budget*. September, 203–207.
- Lamsihar, I. D., Si, S., & Bambanghyowidodo, R. (2015). *PERANCANGAN JARINGAN FIBER TO THE HOME (FTTH) MENGGUNAKAN GIGABIT PASSIVE OPTICAL NETWORK (GPON) UNTUK PERUMAHAN JINGGA BANDUNG DESIGN OF FIBER TO THE HOME (FTTH) NETWORK USING GIGABIT PASSIVE OPTICAL NETWORK (GPON) FOR JINGGA RESIDENCE BANDUNG*. 2(3), 7125–7133.
- Mahjud, I., Nirwana, H., Andhika, A., Mimsyad, M., Litha, A., Yuniarti, Y., & Halide, L. (2022). Perancangan Jaringan Fiber To The Home (FTTH) PT. Telkom Indonesia (Persero) Tbk Witel Makassar di Desa Bontomanai Bulukumba. *Jurnal Teknologi Elekerika*, 19(2), 123. <https://doi.org/10.31963/elekerika.v6i2.3803>
- Mahrifatika, P. (2023). *Perencanaan Jaringan Akses Optik Ftth Menggunakan Teknologi Gpon (Gigabit*

- Passive Optical Network*). 1(2), 52–58.
- Meyer, H. J., Wienke, A., & Surov, A. (2019). Associations between GLUT expression and SUV values derived from FDG-PET in different tumors—A systematic review and meta analysis. *PLoS ONE*, 14(6). <https://doi.org/10.1371/journal.pone.0217781>
- Mutaharrik, M. I. (2016). Perancangan Jaringan Fiber To the Home (FTTH) Menggunakan Teknologi Gigabit Passive Optical network (GPON) Di Central Karawaci. *E-Proceeding of Engineering*, 3(1), 576–583.
- Ridho, S., Andra, S., Nikken, D., Sirin, S., & Apriono, C. (2020). *Perancangan Jaringan Fiber to the Home (FTTH) pada Perumahan di Daerah Urban*. 9(1), 94–103.
- Sitohang, S. (2018). IMPLEMENTASI JARINGAN FIBER TO THE HOME (FTTH) DENGAN TEKNOLOGI GIGABIT PASSIVE OPTICAL NETWORK (GPON). 9(2), 879–888.
- Subhan, A., Haji, W. H., Mercu, U., Yogyakarta, B., & Korespondensi, P. (2021). Analysis and Design of Management Information Systems for. *Jurnal Teknologi Informasi Dan Ilmu Komputer (JTIK)*, 8(6), 1107–1116. <https://doi.org/10.25126/jtiik.202182884>
- Susilo, J. (2018). *Perancangan jaringan fiber to the home (ftth) di desa pedan telkom klaten menggunakan teknologi gigabit passive optical network (gpon) untuk layanan triple play*. 4(3), 2700–2707.
- Syahrin, A. (2023). Perancangan Jaringan Fiber To the Home (Ftth) Pada Wilayah Kelurahan Mustikasari Rt/Rw 004/04 Menggunakan Google Earth Pro. *Jurnal Sain Dan Teknik*, 5(2), 111–124.
- Tjahyaningtyas, H. P. A. (2012). Penggunaan Google Earth Untuk Menghitung Home Passed Dalam Perencanaan Pelayanan Fiber To the Home. *Jte*, 1, 69–76.
- Tjut Adek, R., Yunizar, Z., Maha, D. T. P., & Fajriana, F. (2022). Perancangan Desain Jaringan Fiber Optik Dengan Teknologi Gigabit Passive Optical Network Di Universitas Malikussaleh. *Jurnal SAINTEKOM*, 12(2), 168–175. <https://doi.org/10.33020/saintekom.v12i2.305>
- Wadly, F., & Fitriani, W. (2023). *Perancangan Jalur FTTH (Fiber to the Home) di Desa Kota Pari Menggunakan Aplikasi SmallWord*. 3(4), 163–169.