DEVELOPMENT OF OFFLINE LEARNING MEDIA REPOSITORY FOR UT-AKSES INDONESIA PROGRAM

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Abstract

Today, the repository is a potentially rich source of useful information, data, images, and research results. Open source software helps primarily in lowering initial and ongoing costs, eliminating vendor lock-in and allowing for greater application flexibility. The main advantage of open source software is that it is generally free to use like DSpace applications. DSpace is an open source software platform for storing, managing and distributing collections in digital format. The DSpace application supports creating digital archives that are more permanent and shareable than analog archives. DSpace can support a wide variety of artifacts, including learning media. The need for learning media by Universitas Terbuka (UT) students who live in remote parts of Indonesia who do not have reliable internet access have difficulty accessing UT Online is urgently needed. This condition creates a huge digital divide compared to their urban counterparts. For this reason, it is necessary to have support services and one of them is through the UT-AKSES program. This program provides a local server design for a wireless network system named "UT-AKSES" based on offline repository learning media. Offline Internet servers have two (2) main functions to serve the student learning process and support offline Internet network operations. The SSH, DHCP, and DNS servers are used to perform offline Internet network operations. Apache Web Server, Moodle e-Learning, Kiwix, and file sharing for online libraries to aid the student learning process. Kiwix is used to make Wikipedia accessible offline for students. Two major system requirements, namely, performance and affordability, are critical for remote students for Offline Internet operations. Following the desired performance sequence, the Internet server design can use Raspberry Pi 3 or 4, mini pc, or personal computer to serve 100 students. The project also discovered the most feasible service in term of budget, capacity and the reliability services. The compared budget for the server ranges from Rp. 700,000 to 8 million with the wifi-coverage ranges from 10 meters to 2 km. The mini PC seems to become affordable and reliable choice to be implemented for upscaling digital literacy and access for UT students in Internet blank spot areas.

Keywords: learning media, repository, UT-AKSES program, blank spot

1 INTRODUCTION

Entering the era of the industrial revolution 4.0, all parties began to improve to make adjustments. Human resources are required to have 21st century skills in order to be able to compete in the industrial environment. Educational institutions are starting to apply 21st century learning methods to unlock the potential of every student. The era of the Industrial Revolution 4.0 was marked by the increasing number of job automation using the internet,

robots, and AI (Artificial Intelligence). Referring to this, it is predicted that several professions will disappear and be replaced by technology. Types of work that are quite vulnerable to being replaced are jobs that are repetitive in nature. This condition is quite threatening for workers with low levels of education who tend to work in repetitive lines of work.

This global problem encourages the need to formulate skills or skills that are needed to deal with this revolution. WEF or the World Economic Forum formulates a framework called 21st Century Education. This formulation is then used by educational institutions to form a 21st century learning model that can spark the potential of students so that when they graduate they can become superior human resources. Seeing the demands of the world of work above, the contribution of learning media is by utilizing repository applications in supporting learning processes that are relevant to current and future conditions. Currently the repository is a rich potential source of useful information, data, images and research results. Repositories are systems that enable institutions to store and manage digital documents as well as interact and collaborate between users within one institution. There are several digital library software available as "open source" or as "proprietary format". Open source software helps primarily in lowering initial and ongoing costs, eliminating vendor lock-in and allowing for greater application flexibility. The main advantage of open source software is that it is generally free to use such as the DSpace application.

Internet access, especially in rural/rural areas, will usually largely depend on the presence of mobile/3G/4G operators. It is clear from the data nperf.com from one of the mobile operators; there are still many blank spots in various regions in Indonesia. Consequently, Internet access in the area is also challenging. There are many blank spots, especially outside Java. On the nperf.com site, we can evaluate mobile operator coverage in Indonesia with data collected by nperf.com since 2019.

An offline internet server is a device that enables users to access digital content without requiring an internet connection. These devices typically store web pages, educational materials, and other digital content on a local network, making them accessible to users within that network. Efforts to make internet access offline may not be new. Since the beginning of Internet development, some groups, especially in developing countries, have been trying to find solutions to read internet content while offline. They start from simple by backing up email, SMS, WhatsApp to more complex activities such as downloading songs, movies, files, PDFs, ebooks.

In the UT-AKSES case study, the focus was given for making educational content accessible offline. These efforts are nothing new; several steps seem to be made globally from the initiative of several state institutions and non-governmental organizations supported by various technologies that support the offline Internet. So, there are some offline Internet initiative activities, but not many. Only a handful of institutions/research in the world are trying to provide solutions for areas with scarce internet access. Therefore, Universitas Terbuka is developing an offline Internet system for student access residing in remote areas with limited telecommunications/ Internet networks. This project focuses on providing online learning support for Universitas Terbuka (UT) students who are living in remote areas without a reliable Internet network. It aims to develop a local hotspot in five areas in Java island where UT's students are located, to enable them to access UT's online support services. The project will also develop a learning design that is adapted to low bandwidth capacity.

2 OFFLINE LEARNING MEDIA REPOSITORY

The DSpace collection system workflow is a critical part of the DSpace architecture allowing the collection, processing, and eventual addition of content to an existing repository. The model owned by DSpace, including EPeople, is a user who is registered with the system and has certain authorizations, roles, rights, and privileges that translate the ability to complete certain tasks in the DSpace system. Collection usually begins with the system asking the user a few questions about the digital documents to be added to the repository and some of the files associated with the collection. The system leads the user through several steps:

Description 1: Describe Users enter metadata about the documents they collect, including the author, title, keywords, and description

Description 2: Upload Users select and upload files present on the local machine that they will upload as part of the submission. Each file type is identified by the system and the user verifies it.

Description 3: Verify Here an overview of all the details of the collection is given, including a summary of the metadata that has been entered and the files associated with the collection.

Description 4: License The user is shown and must agree to the license the system administrator has assigned to collect content for this collection.

Description 5: Complete The user action in the collection process has been completed. Based on the defined workflow steps for collection, items may be added immediately to the collection or must be reviewed by a system administrator prior to addition to the collection.

Deployment items that have been collected and archived into DSpace digital library repository. Can be distributed and accessed by users via the internet and browsers. DSpace provides its users with the ability to search for DSpace items in a simple, easy, and sophisticated way. From the DSpace home page, users can see all the items in DSpace by category of author, title, or publication date.

Provides a way to organize research and publication materials in professionally organized repositories to provide great visibility and accessibility over time. It can help to:

a. Get research results quickly, to a worldwide audience
b. Reaching a worldwide audience through its openness with course management systems
c. Archiving and distributing material that can be placed on personal websites
d. Save examples of student projects (with approval)
e. Displaying student thesis (with approval)
f. Keeps track of personal publications/bibliographies
g. Have a strong network identifier to work with, which will never change or get corrupted.

Product development results:


Repositori
Home
Repositori
Contact
Home / Repositori / AR/VR
AR/VR
Contoh AR mata
EasyAR
Pengembangan Media Virtual Reality pada Konsep Sistem Optika Mata
Admin
July 27, 2022
Materi sistem optika mata merupakan materi yang abstrak dan banyak menimbulkan miskonsepsi dalam pembelajarannya. Untuk itu diperlukan media yang menggabungkan dunia nyata dengan visualisasi yang berupa Media Augmented Reality (AR).
Media Augmented Reality sistem optika mata yang dikembangkan berupa uraian materi dan visualisasinya dari sub materi bagian-bagian mata, proses mata dapat melihat, cacat mata dan cara mengatasinya.
Contoh AR mata
EasyAR
Pada Media AR sistem optika mata ini dilengkapi pula dengan interactivity untuk mengukur kemampuan mahasiswa dalam bentuk pre tes dan post tes.
TIM PENELITI
Dr. Widiasih, M.Pd.
GALERI RISET DAN INOVASI PTJJ UNIVERSITAS TERBUKA
PRI PTJJ
UNIVERSITAS TERBUKA
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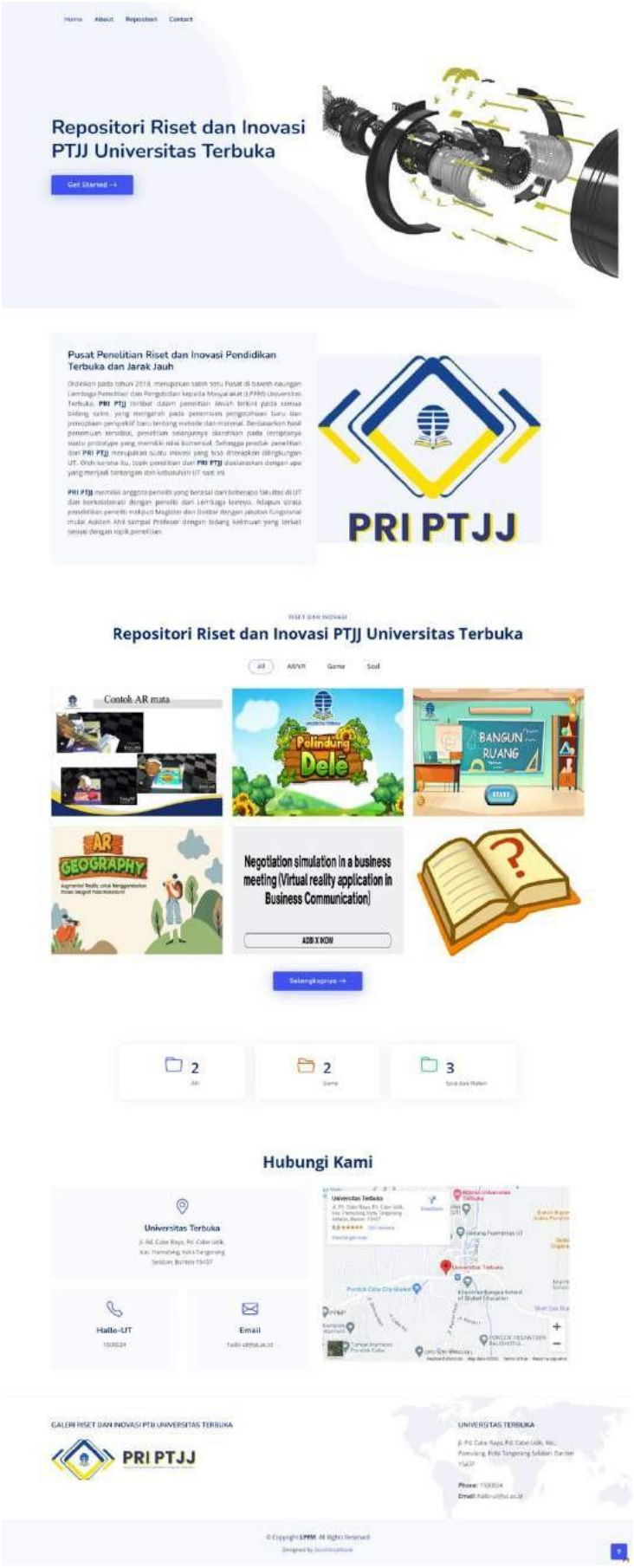
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Pusat Penelitian Riset dan Inovasi Pendidikan Terbuka dan Jarak Jauh
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Contoh AR mata
Pelindung Dele
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AR GEOGRAPHY
Negotiation simulation in a business meeting (Virtual reality application in Business Communication)
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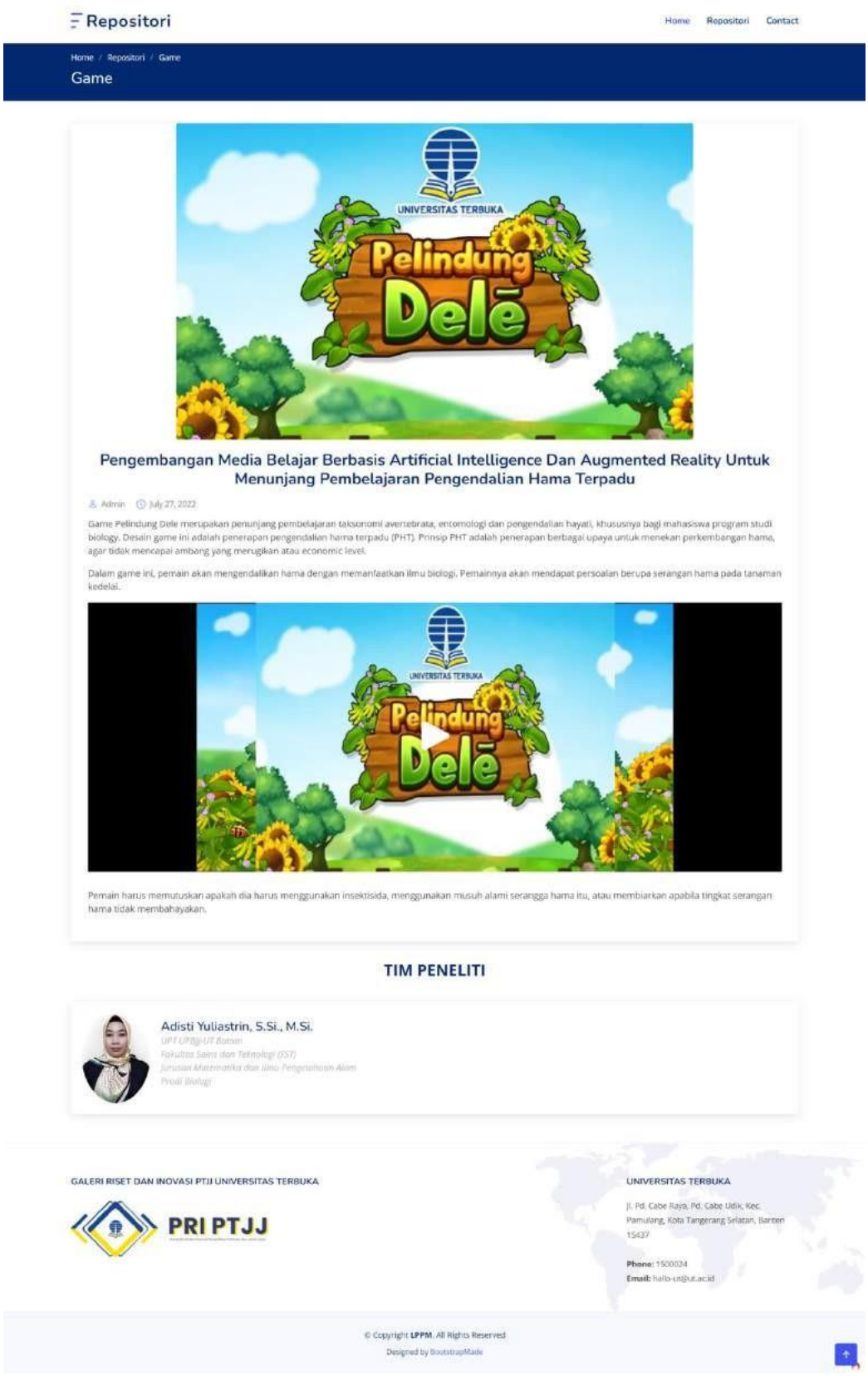
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UNIVERSITAS TERBUKA
Pelindung
Delē
Pengembangan Media Belajar Berbasis Artificial Intelligence Dan Augmented Reality Untuk Menunjang Pembelajaran Pengendalian Hama Terpadu
Admin
July 27, 2022
Game Pelindung Dele merupakan penunjang pembelajaran taksonomi avertebrata, entomologi dan pengendalian hayati, khususnya bagi mahasiswa program studi biology. Desain game ini adalah penerapan pengendalian hama terpadu (PHT). Prinsip PHT adalah penerapan berbagai upaya untuk menekan perkembangan hama, agar tidak mencapai ambang yang merugikan atau economic level.
Dalam game ini, pemain akan mengendalikan hama dengan memanfaatkan ilmu biologi. Pemainnya akan mendapat persoalan berupa serangan hama pada tanaman kedelai.
Pemain harus memutuskan apakah dia harus menggunakan insektisida, menggunakan musuh alami serangga hama itu, atau membiarkan apabila tingkat serangan hama tidak membahayakan.
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Adisti Yuliastrin, S.Si., M.Si.
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3 UT-AKSES INDONESIA PROGRAM

In this section we will discuss several case studies on the process of designing and implementing long- distance wireless access networks that are required by the OFFLINE Internet. In this design process, usually the constraints will be:

- Minimum number of towers. As far as possible the number of towers used is minimal even though the goal is to reach as many users as possible. Tower is the most expensive investment in wireless networks.
- Shortest possible distance. As far as possible the distance from the client to the nearest tower is around 1-2 km so that it is easy to direct the antenna.
- Power and security on servers and towers. The tower should be placed at a school or an agreed location, where there are people, electricity that allows the server to be turned on 24 hours.

3.1 Wireless Access Network Design in Jasinga-Bogor

In this section we will try to show the design of a wireless access network for 7 Open University students who are in Jasinga, Bogor Regency. For an example of network planning here, the coordinate data for student locations are:

-6.454047,106.460922
-6.441695,106.462051
-6.446236,106.460457
-6.411963,106.490471
-6.426875,106.475693
-6.451865,106.461388
-6.478530,106.462738

Alternative server locations are at:

-6.447597,106.46081 - SMPN2 Jasinga
-6.482854,106.468242 - SDN Jasinga 01
-6.46436,106.459506 - SDN Sukamanah 03

The steps that need to be taken are:

- Create a PtMP (Point to Multi Point) connection
- Click the location of a school.
- Use the Ubiquiti Bullet AC 2.4GHz omni antenna on the school site.
- Check connection conditions one by one for each client, assuming a parabolic antenna, such as Ubiquiti PowerBeam, on the client. In fact, it is likely that the client will use a cheap Wajanbolic antenna.

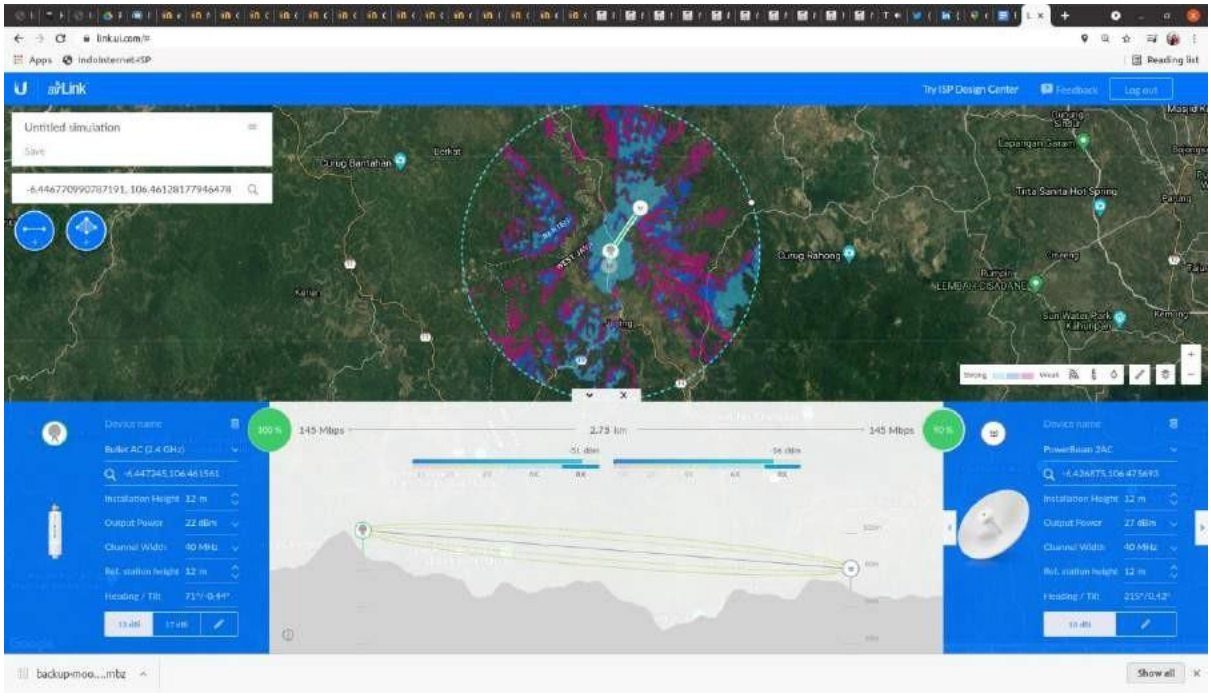

Figure 1: 2.4GHz connection from SMPN2 Jasinga.

The tower is placed behind SMPN 2 Jasinga which is a rather high hill at coordinates -6.447597,106.46081. Site construction was a bit tolerable as it is a small forest. Connection analysis results for each client.

Client	Ways (m)	Kec. (Mbps)	Tower (m)
-6.454047,106.460922	720	153	12
-6.441695,106.462051	672	153	12
-6.446236,106.460457	157	153	12
-6.411963,106.490471	5,15 km	126	20
-6.426875,106.475693	2.83 km	145	12

-6.451865,106.461388	480	153	12
-6.478530,106.462738 (hindered)	3.45 km	0	

It can be seen that only one (1) client cannot be granted access because the location is too low. Others can be given access with an average speed of around 150Mbps.

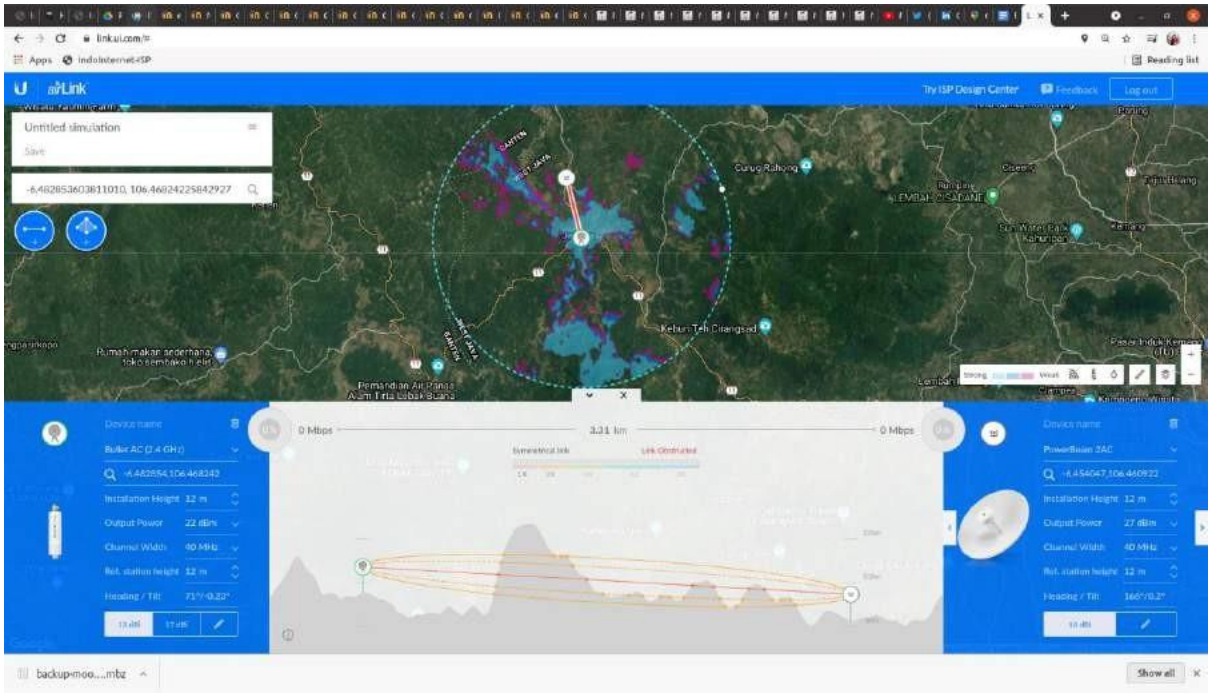

Figure 2: 2.4 GHz connection from SDN Jasinga 01

The tower is placed in the Jasinga 01 SDN yard so it is relatively safe at coordinates -6.482854,106.468242. The height of the tower is 20 meters, with Ubiquiti Bullet AC equipment so that the coverage is rather good.

Client	Ways (m)	Kec. (Mbps)	Tower (m)
-6.454047,106.460922 (hindered)	3.31 km	0	
-6.441695,106.462051 (hindered)	4.63 km	0	
-6.446236,106.460457 (hindered)	4.17 km	0	

-6.411963,106.490471 (hindered)	8.27 km	0	
-6.426875,106.475693 (hindered)	6.29 km	0	
-6.451865,106.461388 (hindered)	3.53 km	0	
-6.478530,106.462738	777 m	153	12

Unlike before, it was seen that only one (1) client could be granted access, while the other 6 clients were all blocked by hills. The average speed is around 150Mbps.

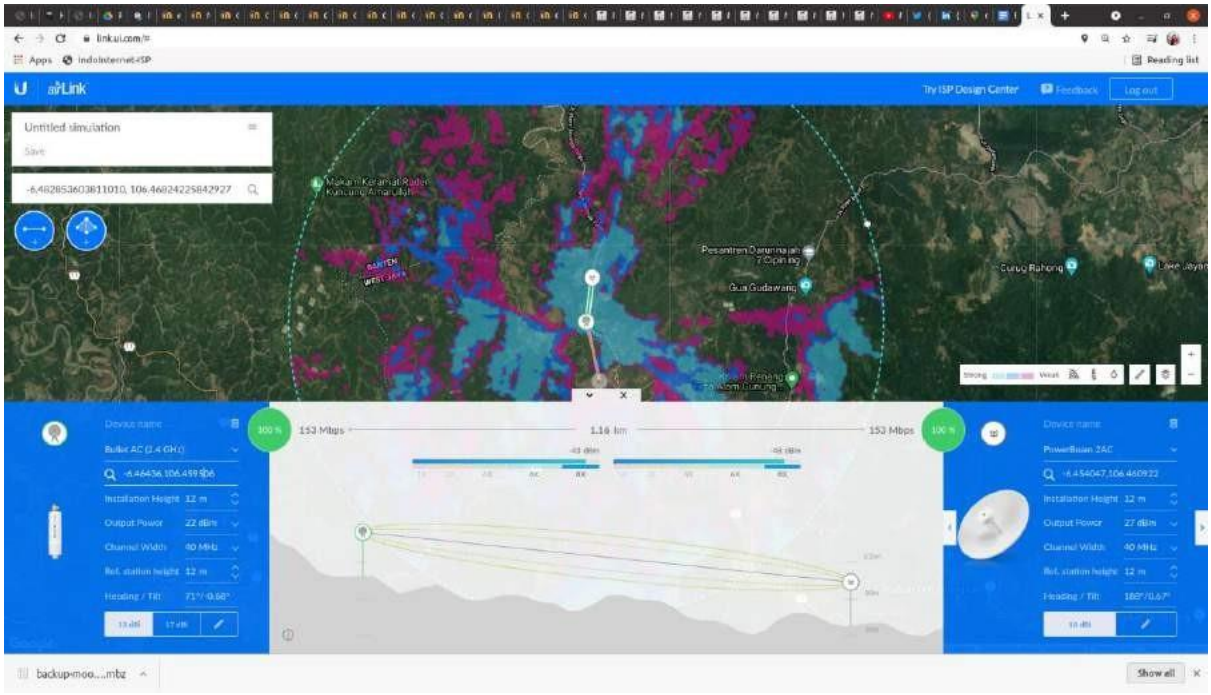

Figure 3: 2.4 GHz connection from SDN Sukamanah 03

The tower is placed on the Sukamanah 03 SDN page so it is relatively safe at coordinates -6.46436,106.459506. The height of the tower is 20 meters, with Ubiquiti Bullet AC equipment so that the coverage is rather good.

Client	Ways(m)	Kec. (Mbps)	Tower (m)
-6.454047,106.460922	1.16 km	153	12
-6.441695,106.462051 (hindered)	2.54 km	0	

-6.446236,106.460457	2.03 km	153	20
-6.411963,106.490471	6.76 km	80	20
-6.426875,106.475693	4.54 km	103	20
-6.451865,106.461388	1.41 km	153	12
-6.478530,106.462738 (hindered)	1.62 km	0	

It can be seen that there are two (2) clients who cannot be granted access because they are blocked by a hill. The tower that must be used on the client side is on average around 20 meters or very high.

The provisional conclusion is that the best connection is from SMPN2 Jasinga which can provide services to most clients, namely with an average tower height of only 12 meters.

3.2 Manado Ternate Talaud wireless connection

A very legendary long distance wireless network in Indonesia is the Manado Ternate Talaud network which is operated by friends in Manado led by Insan Balandatu and Nielson Assa from PT. Infotech Global Network. They push the limits of long-distance wireless networks between islands in North Manado to Ternate in Maluku.

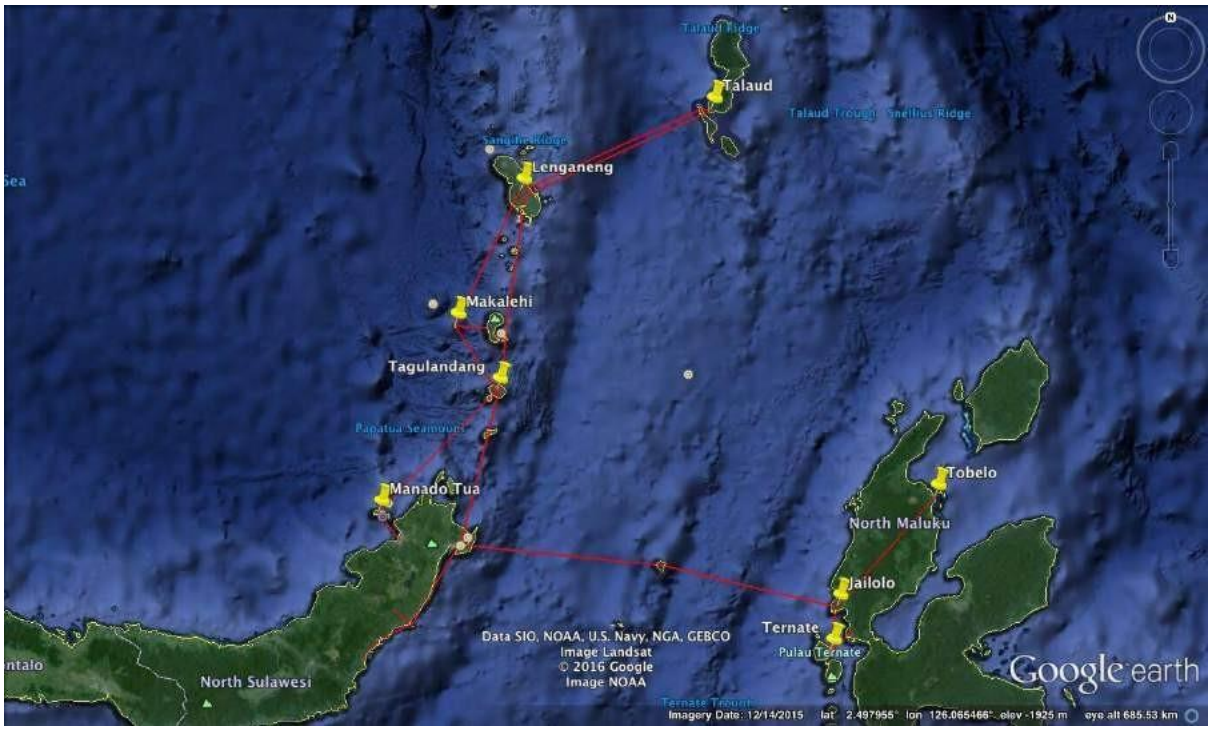

Figure 4: Manado Ternate Connection Using AirFiber

The picture shows a map of a high-speed wireless network using Ubiquiti AirFiber equipment with a speed of around 100 Mbps between islands. North of Manado they managed to make a connection through several islands to Talaud Island which is quite close to the Philippines. To the east of Manado, these friends succeeded in connecting Manado to Halmahera and Ternate which later became hubs for the surrounding islands. The farthest distance that must be taken on this system is about 130 km.

In terms of price, Ubiquiti AirFiber kits can be had for between US$500-1000+ per unit depending on the type you want. For a distance of 10-20 km, we can use Ubiquiti AirMax products which are cheaper, around US$100 per unit. With such an affordable price, villagers or rural areas are enough to justify residents to buy and build their own high-speed wireless infrastructure independently of the community.

Below are some photos of Ubiquiti equipment installed on the various islands to give you an idea.

Figure 5: Relay Tower on Batang Dua Island between Manado Ternate.

The picture above is of the relay tower on Batang Dua island which is roughly in the middle between Manado and Ternate. The total distance between Manado and Ternate is about 300 km. Thus, each of the antennas in the photo above has to push the wireless signal so that they can travel about 150 km each. This is a very, very long distance for a wireless connection.

It can be seen that solar cell equipment is installed on this tower, because on Batang Dua Island one cannot really expect to be able to rely on electricity from PLN because it is far from everywhere. Friends in Manado are experts in making Solar Power Plants (PLTS) so they don't have to depend on PLN.

Figure 6: Wireless Network Tower in Sidangoli, West Halmahera.

The picture above shows a photo of a wireless network tower in Sidangoli, West Halmahera which is connected to Batang Dua Island which is about 130-150 km away. To then connect to Manado. From Sidangoli it is also connected to Ternate.

It is clear that the Solar Power Plant (PLTS) equipment is installed under the tower. With the PLTS, the power supply for wireless equipment is independent.

Figure 7: Wireless network tower on Bunaken Island.

As we all know Bunaken Island is one of the famous marine tourism areas for Indonesia. Friends in Manado don't want to waste this opportunity by building towers to cover the Bunaken area and provide Internet access services for tourists visiting Bunaken. As with other towers, PLTS equipment is installed under the tower.

3.3 Wireless Connection in Banten Lampung

One example of a provider (ISP) that concentrates on helping connections to villages is awi.net.id. The word AWI was taken from Sundanese because at the beginning of the struggle AWI.NET.ID connected the villages by installing WiFi equipment on bamboo. In Sundanese, bamboo is awi, so people call it the Internet using Awi. Finally the name stuck as AWI.NET.NET.

Later, AWI.NET.ID identified itself as Alternative Wireless Internet (AWI). Interviews with AWI.NET.ID activists Pak Usman and Pak Hasan can be viewed on the OnnoCenter youtube channel https://www.youtube.com/watch?v=CNQEY6pSr9M

The AWI.NET.ID network is deployed using long-range wireless and is documented on the map below, which connects Banten, South West Java to Lampung.

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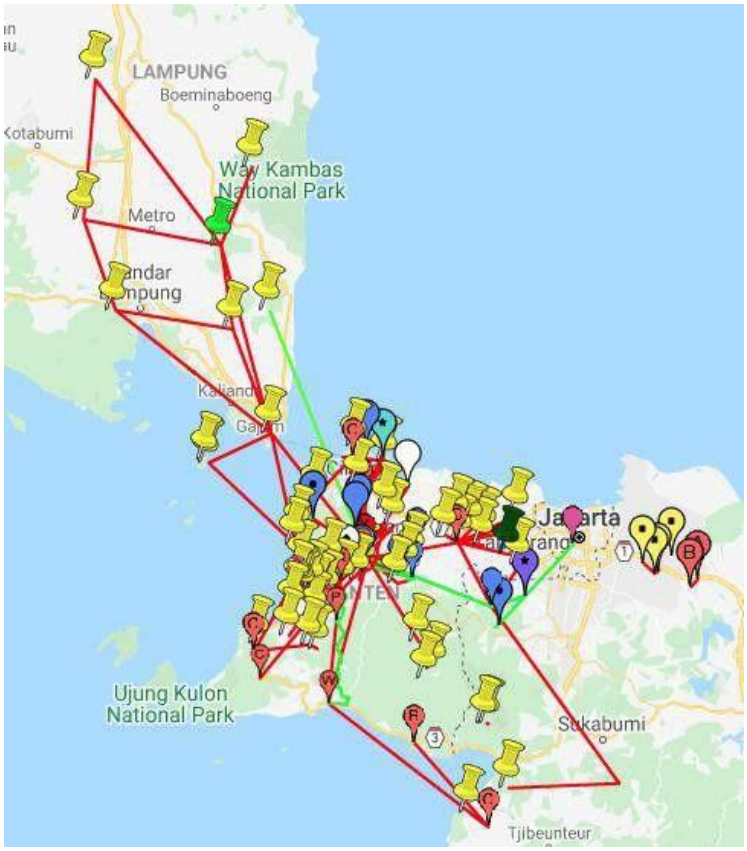


Figure 8: Awi.net.id connection in general.

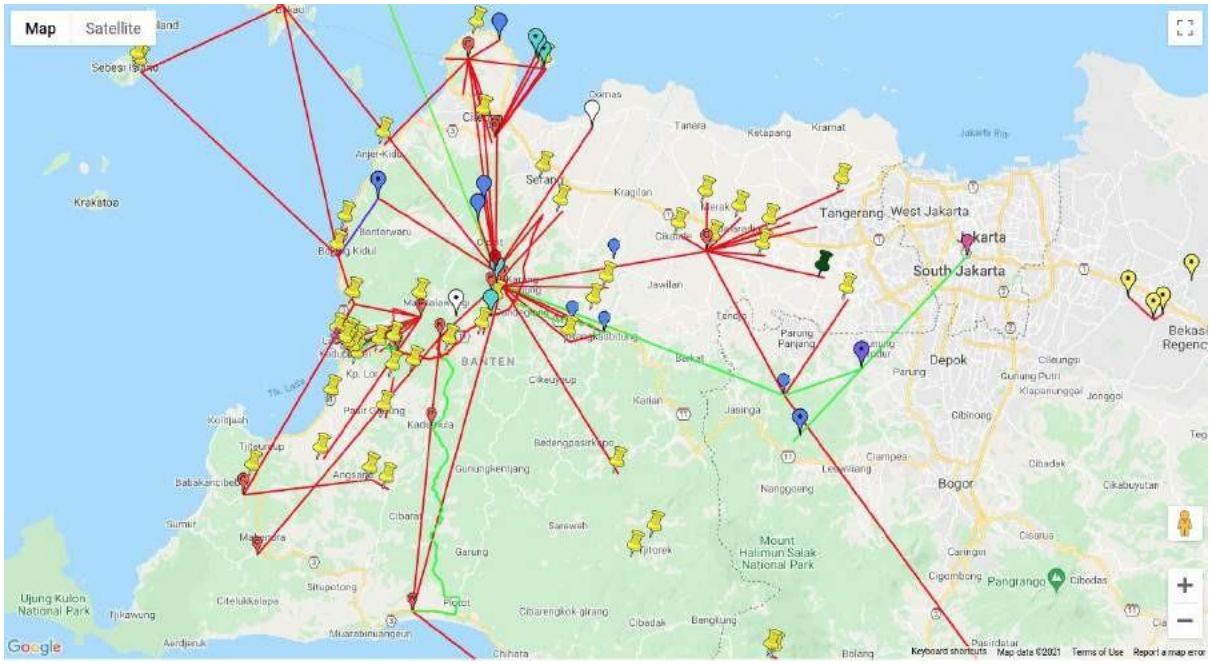


Figure 9: Map of the awi.net.id Network in the Banten region

In the Banten area, centered in Pandeglang, Banten, connections are spread throughout Banten. In the south it is connected to the Pelabuhan Ratu area, Sukabumi which is then connected to the southern part of West Java. Of course West Banten, tourist areas such as Anyer are all passed by the AWI.NET.ID network. The villages between Pandeglang Bogor are also passed by the AWI.NET.ID backbone.

Figure 10: Relay installation awi.net.id on the mountain.

The picture shows the installation of one of the AWI.NET.ID relays installed on a mountain which is about 1-2 hours from Pelabuhan Ratu. Seen in the relay installation, electricity is obtained from solar power. The solar equipment is placed in a small iron house with a solar roof. Apart from being used for an Internet connection using a small parabolic antenna, the relay is also used as a repeater for radio/handy talkie equipment used by the local community. The radio repeater antenna looks like there are two vertical (omni- directional) antennas installed.

Figure 11: The Struggle to Carry a Tower in the Forest.

The struggle to install tower equipment is not easy. The terrain that must be taken is very heavy, so it is not possible to use four-wheeled vehicles. Consequently, to transport towers for Internet relays and other equipment such as solar power plants, etc., they must be transported by motorbike. Here, an ordinary moped is forced to transport the tower up the hill where the relay is located.

The most interesting part when looking at a remote wireless network installation is the installation at the network center. The picture shows the rack where the network cable is installed which is channeled to the tower where many radios and antennas are installed for many connections. At the bottom of the rack you can see the battery to provide electricity for the network equipment in the rack.

Figure 12: Outdoor Cable House at the center of AWI.NET.ID.

3.4 Fiber Optic Connection in Garut

Fiber optic equipment for connection to homes known as FTTH (Fiber To The Home) is now very cheap, affordable and freely available in online shops. Important keywords that can be used to search for FTTH equipment in online stores include “FTTH OLT”, “FTTH ONT”, “FTTP splitter”, and “Fiber Drop Cable”, it will be seen that the price of fiber equipment is very affordable. FTTH fiber optic speed is around 1Gbps so it is very interesting to implement because it makes the Internet very cheap.

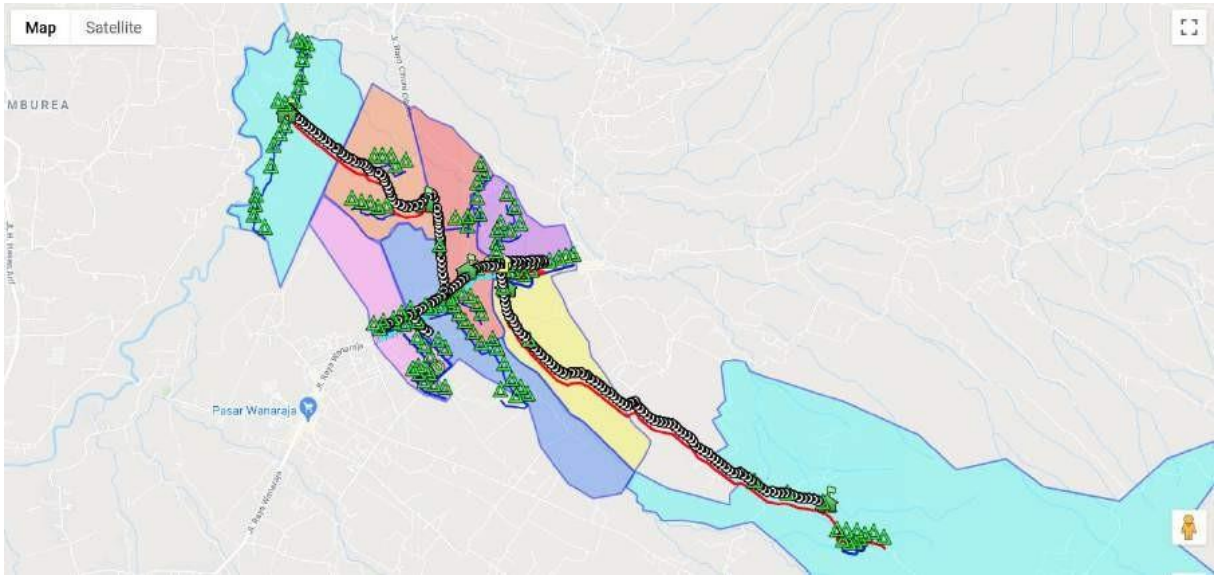


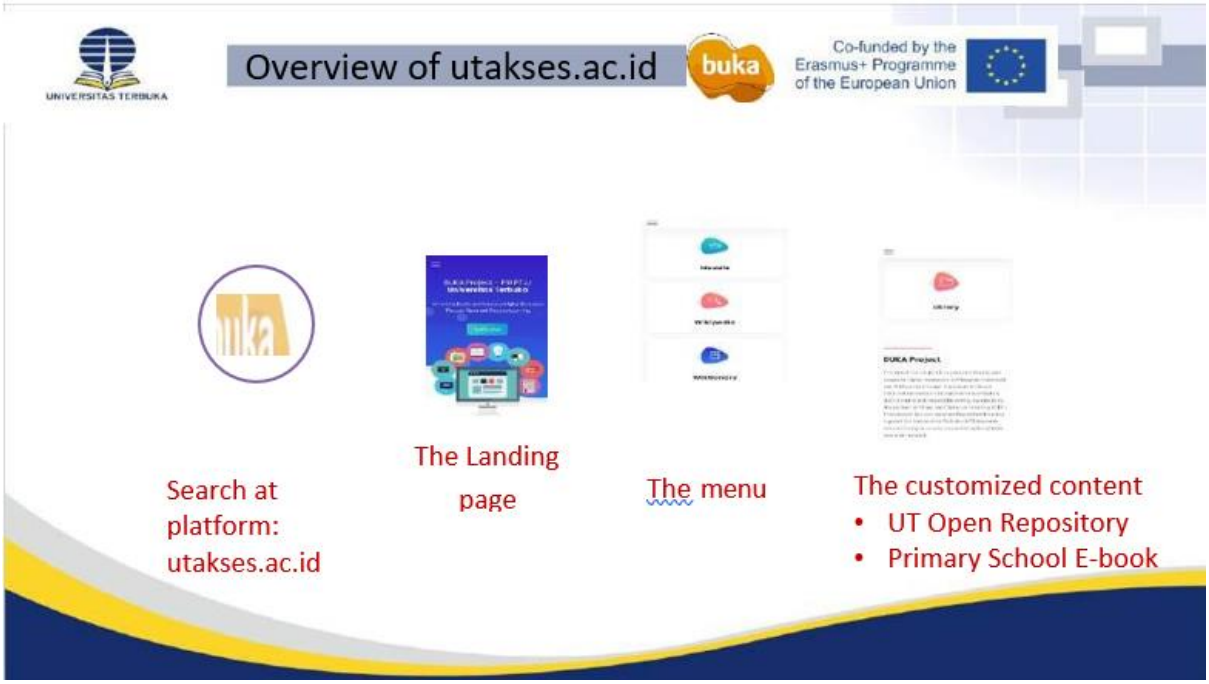
Figure 13: Salma.net.id connection in Garut.

One ISP that is struggling seriously to connect villages to the Internet using fiber optics is SALMA.NET.ID. The picture shows the "tower" point used for SALMA.NET.ID fiber optic connection. It can be seen from the map that the area of operation of SALMA.NET.ID is in the villages around Wanaraja between Garut- Tasikmalaya. Currently SALMA.NET.ID continues to expand to various locations in Indonesia.

It turns out that for some villagers, the monthly Internet fee using fiber optics is only around Rp. Unlimited 50-100,000/month still feels expensive. As a result, providers like SALMA.NET.ID have to think hard so that users/customers can still access the Internet cheaply.

One of the simplest solutions is to add a WiFi HotSpot at the end of the fiber cable. Shown in the picture SALMA.NET.ID technicians are installing WiFi HotSpot equipment so that users can retail the Internet at an even lower cost.

Using WiFi HotSpot Internet access can be retailed at a cost of Rp. 3000/day or Rp. 5000/2 days. It turns out that people's interest is very large to retail the very cheap Internet costs.



4 METHOD

Analysis, Design, Development, Implementation and Evaluations (ADDIE) Development Model Research and development methods or in English is Research and Development is a research method used to produce certain products, and test the effectiveness of these products (Sugiyono, 2017). Model development can be interpreted as an effort to expand or bring a condition or situation on a regular basis to a better situation or condition (Trisiana and Wartoyo, 2016). This research and development is longitudinal (in stages), because in producing a particular product research is used which is needs analysis in nature and in producing product effectiveness so that it can function in society it is necessary to test the effectiveness of the product. This research and development produces a product in the form of media. The ADDIE development model is a model used to design and develop learning programs that contain analysis, design, development, implementation and evaluation.

The study was conducted for 3 years using an action research approach. The action research is preferred to enable the experimental design in a real situation. an approach in which the action researcher and a client collaborate in the diagnosis of the problem and in the development of a solution based on the diagnosis". Action study assumes social world to be constantly changing, both, researcher and research being one part of that change.

The study was organized into several activities as follows:

Tabel 1. Activities on UT-AKSES

No.	Activities	2021	2022	2023
A	**Instructional Design**			
	Instructional Desain Assessment			
	Content Development			
	Small group evaluation			
	Content Deployment			
B	**Hot-Spot Infrastructure Development**			
	Pilot Target Location			
	Assessment of Existing Infrastructure			
	Equipment Procurement			
	Mockup Pilot Development (UT)			
	Mockup Trial (UT			
C	**Hot Spot Infrastructure Installment**			
	Setting Up Hot Spot Infrastructure			
	Installation of Hot Spot Infrastructure			
	Student's testing and Feed Back			
D	**System Design and Governance**			
	Development of system design and governance – (workhsop)			
	Training (Workshop)			
	Coaching and evaluation			
E	**Evaluation and Reporting**			
	Evaluation			
	Reporting			

5 CHALLENGES

The challenge of an offline internet server, also known as an offline web server or a disconnected network, is to provide a web-based service to users who are not connected to the internet or who have limited connectivity. One of the biggest challenges of an offline internet server is to ensure that users can access the information and services they need without an internet connection. This requires the server to store a large amount of data and content locally, which can be a significant technical challenge, particularly for large or complex websites.

Another challenge is to ensure that the server remains up-to-date and secure, particularly if it is being used in an environment where it cannot be regularly updated or maintained. This requires careful planning and management to ensure that the server is running the latest software and security patches, and that any potential vulnerabilities are addressed as soon as possible. Finally, an offline internet server may also face challenges in terms of scalability, particularly if the number of users accessing the server increases over time. This requires careful planning and resource management to ensure that the server can handle the increased load without compromising performance or availability.

One of the biggest problems in determining a server is ensuring that the server we set up is enough to handle the desired workload. The specifications of the processor used can vary depending on the load to be handled. For a small number of students, an arm processor machine such as Raspberry Pi 3 or 4 can be used. Raspberry Pi 3 has the lowest capability. Mini PC ASUS mobile processor with 2G RAM has the ability two-three times Raspberry Pi 3. Some tips to make the small servers work, images, videos, documents/files/pdf, etc., not on moodle servers, but elsewhere, such as youtube, google drive, etc. It may be good to set up its digital library server to accommodate various images, videos, documents, etc.

Moodle servers should be prioritized for handling exams/quizzes, especially if we adopt the pattern of exams that can be repeated for one semester. The ability to take exams on moodle servers becomes very special in offline Internet systems because the learning evaluation process is a core component/life of offline Internet systems. A computer with an i5 or i7 processor with 4G RAM capacity will be sufficient for supporting up to 50 students. For schools in areas/rural areas with students of 300-500 people would be better off using more RAM, for example, more than 8Gbyte.

The digital divide is not only a matter of level of access to technology and material infrastructure, as the government seems to believe, but is also related to factors such as education, socio-economic status, age, income and location, all of which affect the ability to adopt digital media. Rather than technology access per se, adoption depends on people's awareness of the potential benefits of using the internet. In that sense, internet skills go beyond the acquisition of practical computer skills to require specific forms of digital literacy.

6 FINDINGS

In September 2021, the Universitas Terbuka (UT)–BUKA Team explored the strength and weaknesses of the available proprietary and open-source softwares to be used as an operating system of the Internet Offline Server. Based on its functionality and affordability, the Linux operating system was selected. Network and IT technicians in Indonesia are also familiar with the Linux operating system, and it is easy to maintain and update programs.

The first package of the Internet offline infrastructure includes a mini pc, cellular network antenna, omnidirectional antenna, point-to-point bridge already set in place.

The dummy installation server parameters in developing the offline Internet system used the following specifications:

- Operating System – Ubuntu 20.04 or Debian 11
- 64bit mini-computer
- 8G RAM Memory
- 512 GB SSD

The mini-personal computer is quite easy to install as it requires only 10 cm square dimension with DC power supply. For the BUKA pilot project, some of the main applications supporting e-learning services are also installed, such as Apache web server, MariaDB database server, and PHP; Moodle for e-learning; and Kiwix for offline Wikipedia.

Meanwhile, the supporting intranet network operations use the following applications:

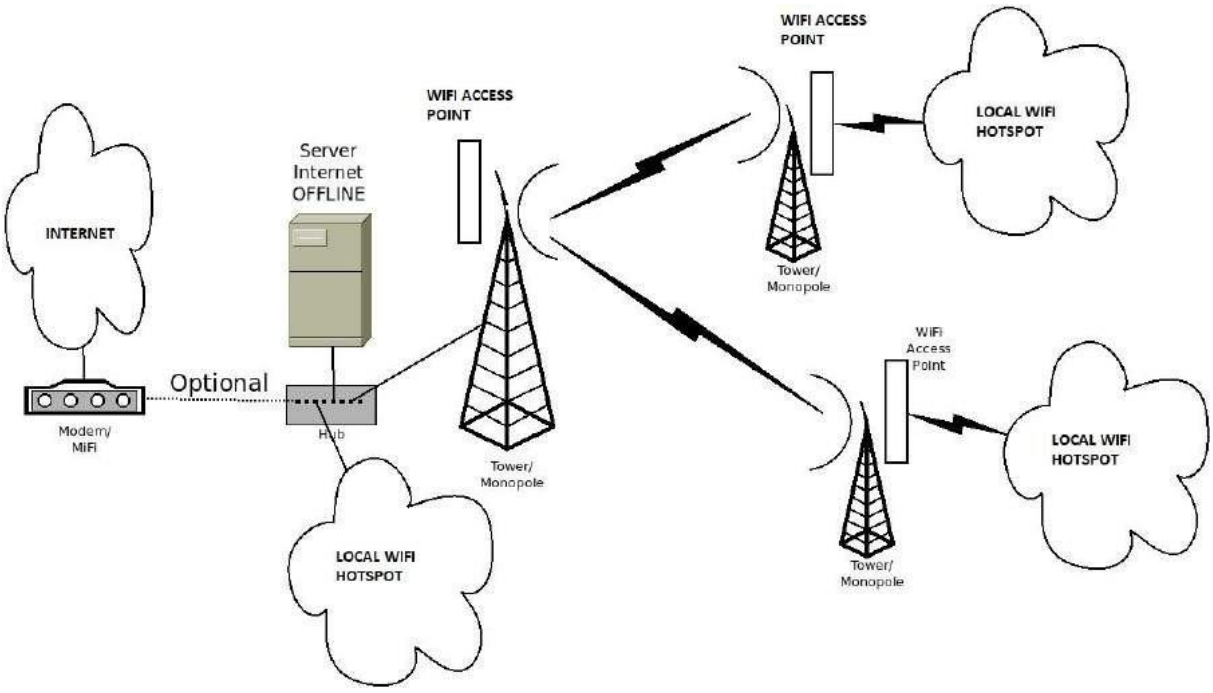
- Bind dns servers
- Server SSH
- DHCP Server
- SAMBA File Sharing server

In terms of technology, some exciting technologies are partly also used in UTAKSES Offline Internet system; at a glance, the technology includes

- SolarSpell - SolarSpell - Library powered by Raspberry Pi, with Access Point Wifi http://solarspell.org/ (SolarSPELL, 2021)
- Kiwix - is a free app that lets us search and read Wikipedia without an internet connection. Available for Android, iOS, Windows, MacOS, and Linux http://www.kiwix.org/ (Kiwix, 2021) (Lin, 2015, June) (Purbo, 2019)
- Wikipedia and Wiktionary
- Open content repository

There are not many initiatives similar to the Universitas Terbuka as open university undertaken, where lecture access is done offline, including digital libraries and even the student evaluation process.

Figure 14: UT-AKSES System Design



The Local Wifi Hotspots in this project are as follow:

1. Cikopomayak 03 Primary School Jasinga Bogor West Java Province
2. Barusari 02 Primary School in Barusari Garut West Java Province
3. Siliwangi Primary School Cigombong Sukabumi West Java Province
4. Sanghiang 1 Primary School Malingping Lebak Banten Province
5. Al Azhar Tuwel Junior High School in Tuwel Tegal Central Java

Some outcomes of this project include:

1. Performance analysis
    a. Hardware: The hardware of the server plays a critical role in its performance. The processor, memory, and storage capacity is sufficient to handle the load of the website or application being hosted.
    b. Software: The software running on the server, including the operating system and any web server software or applications, is optimized for performance and configured properly.
    c. Network: The network infrastructure, including the LAN (local area network), is designed and configured to provide optimal performance.
    d. Load testing: The server has been tested to determine its maximum capacity and identify any bottlenecks or performance issues. There is no performance issues found.
    e. Monitoring: The server has been monitored continuously to identify any performance issues or anomalies, and to ensure that it is functioning properly.
    f. Security: The server is secured against unauthorized access and protected from potential security threats.
2. User satisfaction analysis:

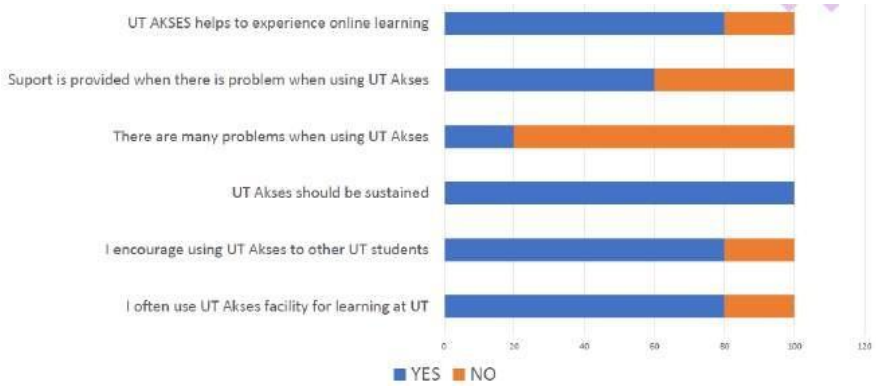


Figure 15: User experience analysis

    a. Security analysis: The study to investigate the security of UT-AKSES server, including vulnerability to hacking, data breaches, and malware, has been conducted. The server is safe and secure.
    b. Cost analysis: The study has been done to compare the costs of implementing and maintaining an offline internet server versus an online server, including hardware, software, and personnel costs. The cost for UT-AKSES server is affordable compare to online server.

c. Use case analysis: The study has been done to explore the potential use cases for an offline internet server, including in remote or low-connectivity areas, disaster recovery scenarios, or secure network environments. UT-AKSES is suitable in remote or low-connectivity areas.

7. Sustainability and Transferability

Most of the Indonesians live in rural areas, increasing the country's internet penetration will require a greater focus on rural villages. However, building expensive infrastructure for small populations in isolated areas is not economically feasible from a commercial operator's point of view. Especially in rural areas, a lack of internet affordability, skills, awareness and cultural acceptance, combined with a lack of content and services in local languages, constitutes a considerable hurdle to digital literacy.

As the internet grows, UT-AKSES has been looking into ways to build greater sustainability and transferability. UT-AKSES strategies focusing on learning management system and material infrastructure, are insufficient. The sustainability of rural digital networks also relies on technical education, building infrastructure in response to local demand, keeping costs down and exploring the economic opportunities that can arise from the use of digital technology. For offline Internet purposes in rural areas with 100 students can use a computer or mini pc process i7 with 8G RAM. The estimated budget is around Rp. 8 to 15 million for mini pc with maximum capability with 8G byte SSD memory RAM hard drive. For small schools can use moodlebox in raspberrypi 3 or 4 with a budget of around Rp. 700,000,- so it is very affordable for most schools and universities that want to provide knowledge for students and students with Internet problems.

Education is key to equip the citizens with Internet skills. Currently, the Indonesians have to rely on self- finance workshops, demos, seminars, online discussions to gain the required knowledge. Inclusion of ICT education in school curriculum and the deploy Internet in the schools will accelerate the empowerment process to gain Internet skills and Internet competence for the young Indonesians and, thus, reduce the barrier to greater Internet adoption.

In terms of sustainability, an offline internet server has the potential to be a very sustainable solution for communities that lack reliable internet access. By providing access to digital

content without requiring an internet connection, these devices can help bridge the digital divide and improve access to educational and other resources.

However, the sustainability of an offline internet server depends on several factors, including the quality and durability of the device, the availability of maintenance and repair services, and the availability of power sources. To ensure long-term sustainability, it is essential to select a high-quality device that is designed to last and to provide adequate maintenance and repair services.

In terms of transferability, an offline internet server can be an excellent solution for communities that lack reliable internet access, but it may not be appropriate for all settings. The device may be less effective in areas with limited access to power, as it requires electricity to function. Additionally, the content stored on the device may not be relevant or appropriate for all communities.

To ensure that an offline internet server is transferable to new settings, it is essential to carefully assess the needs of the community and select content that is relevant and appropriate. Additionally, it may be necessary to modify the device to work with different power sources or to address other logistical challenges. With careful planning and implementation, an offline internet server can be an effective solution for improving access to digital resources in a wide range of settings.

7 CONCLUSION

Research related to the creation of Institutional Repositories with various platforms, including:

1. The offline-based repository development program helps in providing a very massive variety of materials
3. The media repository that has been developed uses an application
4. One of the materials included in this offline repository application consists of learning materials and access UT
5. The results of application trials show various problems in storing material and require conditions of adjustment to the available application loads and the need for further development
6. Inclusive Learning Design (ILD): (a) Upscaling Lecturer skill on the ILD, (b) Deployment of MOOCs (Self-Pace MOOC) for UT student–in line with policy of liberation to learn. (2 semester), (c) Deployment of local content–Primary School Content and The Practice of National Assessment, (e) Encouraging the Teacher to upload and deploy the learning materials on the UT-Akses
7. The three data collection instruments include observation guideline, interview guideline, and questionnaire. Some of the findings from the monitoring and evaluation are: (a) ICT literacy is problem for the teachers and the students, (b) Since it is still in early stage, some components of learning materials are not ready yet, especially the web-based component (MOOCs), (c) Coordination and communication among Pilot Projects are still not running as expected. The Collaboration should be done among the 5 locations.

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