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Article

Smart Wifi Design for Integrated Tourist Destinations in Smart Tourism

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A B S T R A C T

The use of public wireless networks and not integrated between tourist destinations is an obstacle for visitors when moving to other tourist destinations. This is an obstacle to internet access in the tourism era 4.0. To overcome this, smart wifi is needed. Smart wifi is an integrated internet network access among other tourist destinations so as to expand the connectivity and interaction of tourist visitors. This study used the Network Development Life Cycle (NDLC) method. The result of this research was the design of smart wifi which was built on a wireless network with captive portal technology and barcode scanning. Smart wifi contributes to the development of digitalization in smart tourism, making it easier for visitors to get internet access in various tourist destinations.

INTRODUCTION

In industry developers' opinion from the technology segment, the development in the industrial era 4.0 is to compete in providing fast service to customers. Everything becomes borderless with the use of unlimited computing and data due to the rapid and massive development of the internet and digital technology [1]. Therefore, good and appropriate technology and information support are needed to improve a business in all fields.

The application of technology that can be done in the tourism industry is the availability of easy and fast internet access facilities for customers to support smart tourism. Smart tourism platforms are currently not fully integrated with various products, services, and functions. The use of the network that has not been optimal due to the weakness of security technology used so it becomes an obstacle for tourism managers [2]. Smart tourism refers to certain applications that can improve the visitor experience and create added value for visitors. Smart tourism technology requires higher connectivity, interaction, personalization, and co-creation [3]. State-of-the-art technology infrastructure is developed to create sustainable and accessible tourist areas for everyone [4]. There are several important components to successfully develop smart tourism, which are smart data including information quality, source credibility, interactivity, and accessibility [5]. Based on these various definitions, it can

be concluded that smart tourism is a tourism digitization concept that makes it easier for visitors to get information and internet connectivity related to tourism activities.

However, in terms of information technology, there are still obstacles that often occur in tourist destination locations, one of them is the use of wireless networks which are very simple and have not been integrated with tourist destinations. This is the basis for conducting a structured and precise study on wireless network technology that can be used as smart wifi to support smart tourism. With user devices as the Internet of Things (IoT) in the future that will never stop efforts to optimize the network [6]. IoT is important in the use of smart tourism [7]. The use of Wireless Local Area Network (WLAN) in wireless technology is needed in this study because basically WLAN is designed for wireless networks [8].

One of the methods used for network development is the Network Development Life Cycle (NDLC). NDLC is an analytical technique used to plan and manage network development. NDLC has elements that define phases, stages, and steps or specific process mechanisms [9]. The NDLC method not only can be used in developing the existing network infrastructure to be better and in accordance with user needs but also monitor network infrastructure to find out network activity. It can be used as a business process design development and infrastructure design [10].

A network administrator must have competence in performing NDLC analysis methods to produce an optimal network. The use of NDLC by network administrators serves as an infrastructure setting to mitigate risks. Therefore, the NDLC method can be used as a basis for developing the network contained in the smart tourism application.

Smart tourist destinations must be able to use smart technology. The development of an integrated wireless network architecture in several tourist destinations will create smart innovations that can be used for the next generation in smart tourism [11]. The competitiveness of smart tourism among travel agents in tourism services is the development of new innovation advantages and strengthening existing competitiveness by using Information Technology (IT) [12]. Thus, the main key to smart tourism is the use of ICT technology. The existence of an integrated wireless network in tourist destinations will support the sustainability of tourist destination technology in terms of data integration.

In a previous study [13] stated that by using a captive portal visitors do not require software installation on a mobile device. Visitors only scan the barcode on the mobile device and it will automatically lead to the captive portal without having a login first. The purpose of using barcodes is to provide benefits for customers [14]. The novelty of this study to be lies in the development of a wireless network using a captive portal and barcode scan to provide a better experience for tourist visitors who use it. Smart wifi was built to support digitization in accessing data at different tourist attractions by utilizing the captive portal.

To authenticate and validate visitor accounts, a radius server is used on the proxy router that is connected to the User Manager. Radius is widely used as security on hotspot networks [15]. The function of User Manager is integrating data from different routers at each tourist location publicly. This shows that the concept of smart tourism can adapt to technology [16].

I. LITERATURES REVIEW

Paper focus on design of smart tourism with smart wifi. This paper relevant with previous study that can be implemented with different cities with wireless technology that can be create new experience for visitors.

This paper relevant with previous study that can be mention components of smart tourism, example the visitors can be able to get smart experience with using smart wifi and for provider tourism can be increasing the business.Smart tourism can be defined as a “ubiquitous tour information service

received by tourists during a touring process[17].

II. FRAMEWORK

In this paper using NDLC framework. The explanation is as follows:

a. Analysis stage, the initial stages in analyzing are analysis of needs, analysis of existing problems, analysis of user desires, and analysis of existing network topologies.
b. Design stage, the data obtained previously will be designed for network topology drawings, data access designs, and others.
c. Simulation Prototype stage, this stage develops a network that will be made in the form of a simulation.
d. Implementation stage, in this stage, will be seen the influence of the development that was built on the system.
e. Monitoring stage, this stage is carried out after the implementation of the network. The monitoring stage is an important stage to ensure the network and communication run compatible with the purpose of this research contained in the early stages of the analysis.
f. Management stage, there is special attention in this stage regarding the policies, which are activities, maintenance, and management. To run the system that has been built smoothly, last a long time, and the element of reliability is maintained, requires policies [18].

III. METHODS

Some of the methods used in this study are based on the literature, which are:

1. Radius
   Radius is a client access management activity with three methods, which are authentication, authorization, and user account registration effectively [19]. User Manager is a feature of the Authentication, Authorization, and Accounting (AAA) server owned by Mikrotik. The user manager will make it easier for us to make public internet services widely, such as hotspots in cafes, malls, hotels, and others.[20].
2. Captive Portal
3. Captive Portal authentication technique responds to each Hyper Text Transfer Protocol (HTTP) request from a user via a web browser by providing a web page that is useful for authenticating legitimate users. After the user logs in by entering the correct user name and password, the Media Access Control address (MAC address) of the WLAN Network Interface Card (NIC) will make the user registered on the portal. Furthermore, the user data transfer process is made on the route (routing) normally [21].
4. Barcode Scanning
   The barcode scanning system not only captures timestamps but also tracks mediation and the time taken for each step of its process. Once the request is entered and verified, the request moves from a computerized receptor entry system to software technology automation [22].
5. Wireless Network
   A computer network uses electromagnetic waves or radio waves as its transmission medium [23].

IV. RESULT

Smart tourism is a social event of combining technology with tourism activities and experiences [24]. The technology in this study is wireless development to build smart tourism. Smart means tourism visitors get internet access to other tourist attractions that have been integrated. Integrated wireless technology is a network that can be used in different tourist attractions with a high level of security.

The fulfillment of needs in the form of easy internet access for visitors is a part that must be provided by the manager. The adoption of mobile technology can support the management and needs of visitors [25].

Based on interviews with tourists, they had a problem if they move to different tourism because another site has different password wifi.

The use of the NDLC method provided the addition of the concept of the research theme and the technology used, as well as relevant data collection techniques. This method aimed to meet the goals and benefits of developing smart tourism.

The developed technology was smart wifi. The data collection technique was using a literature study on smart tourism development in terms of technology. Observations of the use of wireless network technology systems were also used in this study which is in accordance with the practicality of the function. In addition, interviews were conducted regarding information related to wireless network users and tourist attractions managers.

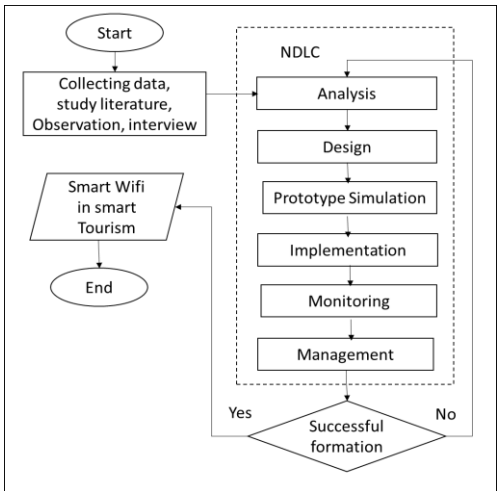


Fig 1. Research methodology

Figure 1 described the formation of smart wifi using the NDLC framework. The use of the NDLC method built a reliable network quality because it was a Life Cycle. It means that when something was not optimal, it would be repaired again until it reached optimal results

This study used several supporting facilities, which were hardware and software in order to achieve the results. As in general, a network required a router as a pointer to the destination network route and an access point as a support for wireless media with a frequency of 2.4 GHz. The software needed to build smart tourism is a user manager, winbox, and a radius server.

The user manager on Mikrotik had a radius server that provided AAA management services. Theywere integrated with the resources of a network. Researchers connected several Mikrotik routers with a wide network using the user manager. The user manager also managedthe user access and login page which included all routers connected to it. This arrangement was referred to as an integrated network with one another.

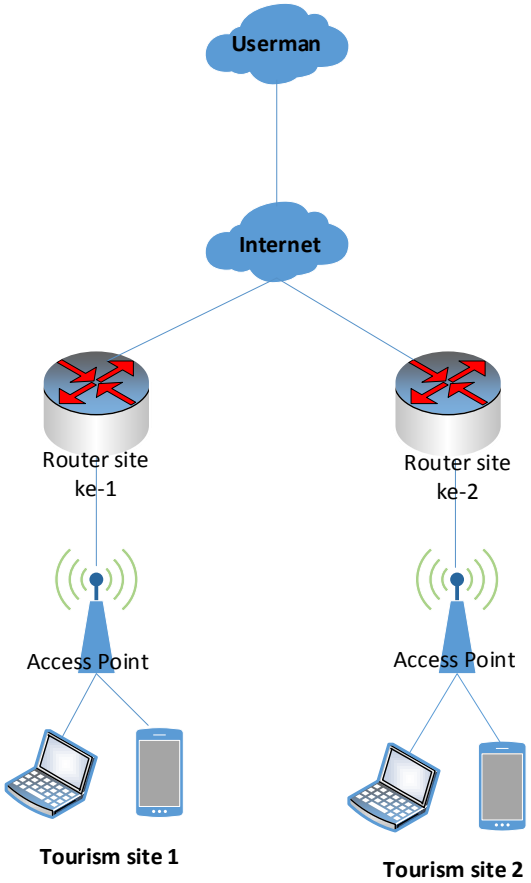


Fig 2. Network system topology

Figure 2 illustrated the network topology in designing smart tourism in different locations to make it easier for user devices to connect to the internet. If users switched sites, they could still use the same barcode or account because the system has been integrated into the cloud. There was a tourist visitor who was connected to the access point by scanning the barcode using a

smartphone at site 1, then the integrated router will automatically save the mac-address identity into the system. If tourist visitors moved to site 2, there was no need to scan the barcode again, just connect the same smartphone to the access point. Tourist visitors can get internet access easilyand quickly when moving to other tourist destinations because of an integrated network system. The use of the wireless network can already be smart when the access point can automatically authenticate the visitor's device even though they are in a different tourist destination. It was that what supports tourist destinations to be smart.Several configurations were needed in order to support this topology, especially on Mikrotik routers. As shown in Fig 2, it had been explained that the determination of network routes is carried out by each router using Winbox, there were several processes that must be implemented on each router, which are:

a) *Dynamic Host Configuration Protocol(DHCP)Client*

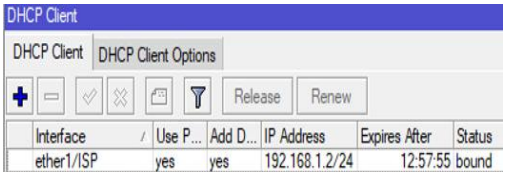


Fig 3. DHCP *client*

Figure 3 described a DHCP client to get an IP through a LAN connecting to internet service provider, so that visitors got an IP dynamically. The number of subnets used can be adjusted to the number of statistics on average visitors from each tourist spot.

b) *Internet Protocol (IP) Address*

	Address	Network	Interface
D	12.12.12.11	12.12.12.1	sstp-riset1
D	192.168.1.2/24	192.168.1.0	ether1/IS
	;;; remote/userman		
	192.168.1.3/24	192.168.1.0	ether2
	;;; sebar ke linksys (hotspot)		
	192.168.2.1/24	192.168.2.0	ether5
	;;; DHCP Client Wifi		
	192.168.50.1/24	192.168.50.0	*wlan1*
	;;; Office Lan 14 User		
	192.168.50.65/28	192.168.50.64	*ether3*
	;;; Admin		
	192.168.50.81/30	192.168.50.80	ether4

Fig 4. IP Address

Figure 4 described the IP address settings for each segment. Some segments were connected to Secure Socket Tunneling Protocol (SSTP), internet providers, access points, and admins. SSTP played an important role as a protocol connecting to the user manager by knowing the configuration criteria, such as the gateway IP address of the user manager.

c) Routing

Figure 5 described the performance of the route, there were several routes that must be implemented, which are the default route, SSTP, internetwork, local area, gateway user manager, and other routers.

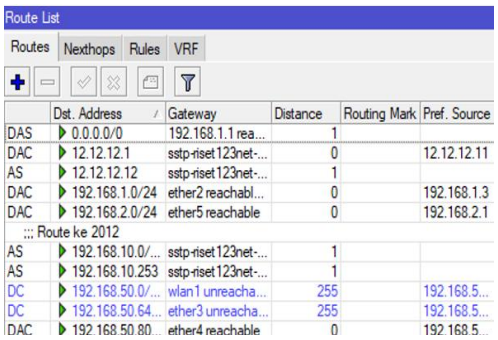


Fig 5. Routing

d) SSTP (*Secure Scoket Tunneling Protocol*)

SSTP was a security feature combining Secure Socket Layer (SSL) and Transmission Control Protocol (TCP). SSTP operates over TCP, in some cases controlled by IKEv2 or other User Data Protocol (UDP) based protocols.

Overall, SSTP was the best choice to solve connectivity problems or speed problems they have [26]. This protocol used port 443 by adding an SSL certificate for the client and server.

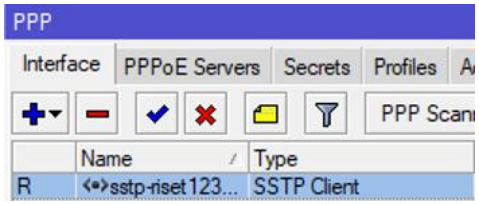


Fig 6. SSTP

Figure 6 described the security of visitor data connecting to the internet and the radius server used SSTP.

e) Radius servers

The role of the radius server was performing security and user management for hotspot service users [3]. Every visitor who connected to the access point would be managed by the server. There were several guaranteed services, which are authentication, authorization, and accounting.

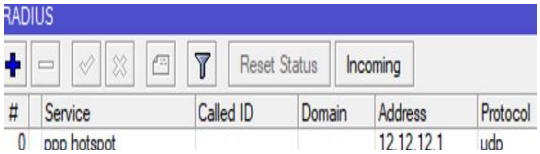


Fig 7. Radius

Figure 7 described each router that provided hotspot services must be connected to the user manager with the UDP protocol.

f) Hotspot

The thing contained in the hotspot was about the login page settings.

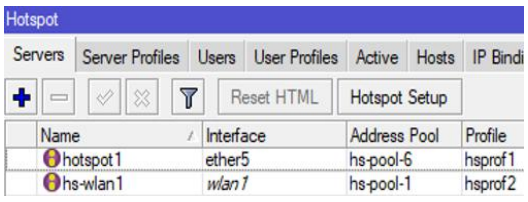


Fig 8. Hotspot

Figure 8 described the settings to be able to connect to every login page that will be provided by Mikrotik. There are two interfaces that spread the login page to visitors from the hotspot server and add cookies.

Set the router setting to connect to the internet and user manager. Access can use a publicly conFig URL. There were require several things to set the user manager, which were:

a) Adding a client router

Fig 9. Userman Router Client

Fig 9 described there were two routers connected in this study with IP addresses 12.12.12.11 and 12.12.12.12. The use of the userman aimed to conFig the router which will integrate the userman with other Mikrotik.

b) Visitor profile

The purpose of setting the visitor profile was that each visitor can use the hotspot service for 7 days at different tourist destinations. Assuming that if the visitor changes tourist destination, the account can still be used with a reduced time according to the date of payment at the checkout.

Figure 10 described the settings of visitors connecting to the network were only valid for seven days on all days (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday).

Fig 10. Visitor profile

c) Visitor accounts
This was a visitor account setting containing a barcode and id password as a backup option.

Username	Till time	Total time left
sepekan	07/18/2021 14:36:15	3d16h4m43s
oketes	07/18/2021 14:53:01	3d16h21m29s
tesoke	07/18/2021 15:26:30	3d16h54m58s
baru	07/18/2021 15:30:15	3d16h58m43s

Fig 11. Visitor accounts

In Figure 11 there were all accounts that have been created by the administrator. Each visitor get one (1) account. Account status can be seen, such as usage due date, total time, and actual profile.

d) Export voucher
Fig 12 showedthat was a ”Generate” menu. It can be used to export vouchers.

Fig 12. *Voucher*

Figure 12 showed a barcode that can be used by visitors. Each visitor scanned the barcode using their personal smartphone. If the visitor did not have a camera device, they used the user and password that had been provided. This voucher was given when the visitor had completed the payment with the cashier. In previous research, the development of smart tourism focused on developing online applications, but this study, focused on the development of wireless networks to support smart tourism.

V. DISCUSSION

Before the development of smart wifi, interviewed tourists stated problems with wifi connectivity if they moved to a different destination because other sites had different wifi passwords. However, with the smart wifi, tourists feel the convenience and benefit of using smart wifi.

The discussion of this study is about how to use the smart wifi network system in smart tourism in several ways. The smart wifi network usage system is in the Figure 13 below.

Figure 13 describes the diagram flow of the network system that was built for each tourist spot. Visitors must connect to the access point with the Same Service Set Identifier (SSID) on the voucher. Visitors can scan the barcodes using devices that are supported by camera technology.

If it doesn't work, the visitor can repeat the barcode scan or login on the web page. The system will automatically open a web page containing the user and password fields.

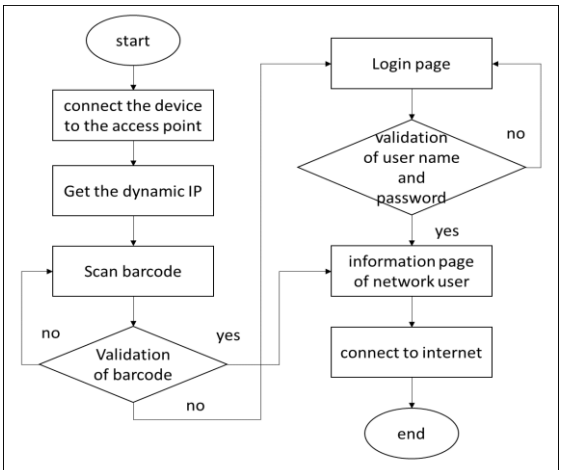
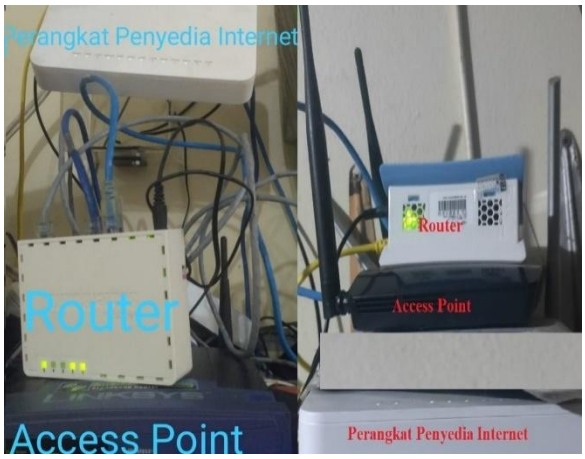


Fig 13. Flow of using smart wifi

The visitors will get detailed information



on network usage and go directly to the google.com page when the process was succeeded.

Fig 14. Implementation

The implementation of the device also uses internet provider sources with different locations, as shown in Figure 14. In that Figure, there are two sources of internet providers, routers, and access points in different locations. The design aims to build a network for smart tourism in different places with the smart wifi concept. The use of user managers aims to monitor and manage client routers that are connected centrally and integrated. The left with the blue font is on the 1st site and the right with the red font is on the 2nd site. The implementation design of this study is compatible with Figure 2.

This study uses Mikrotik routers RB 750 and RB941-2^{nD} series with certain specifications. The access point, which uses a single band frequency of 2.4 GHz, has a function to transmit the SSID and login page configuration that was previously created on the Mikrotik router. Then the router performs routing according to system requests.

The following is a discussion of testing the barcode scan method using a smartphone that supports smart wifi using wireless technology. The smart wifi concept provides a smart, simple wireless network without a password but still attaches the importance of security with solid encryption. This design also provides a different experience when you want to connect to a wireless network.

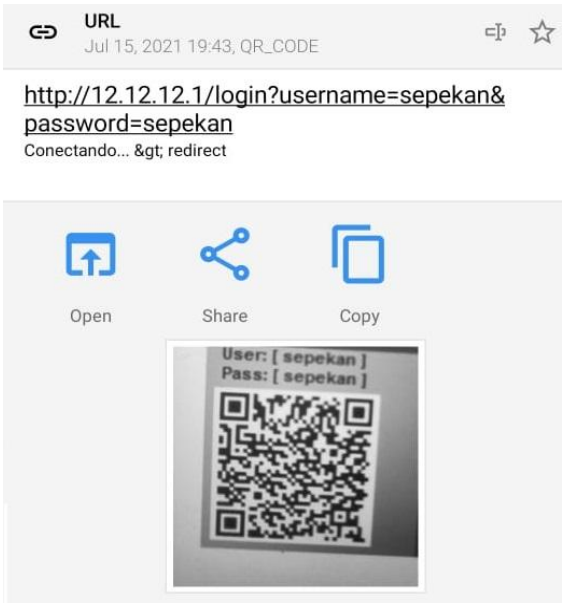


Fig 15. *Scan Barcode*

Figure 15 shows the process of the barcode scan on a smartphone using special software. Then, the URL address will appear and visitors can open the URL address directly so the system will automatically take visitors to a web browser with a google.com page.

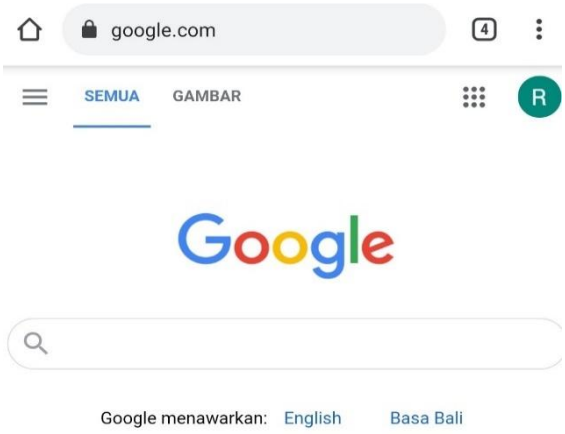


Fig 16. Connect to internet

Figure 16 describes the condition that the devices used by visitors are already connected to the smart tourism internet network. There is a cookie feature that makes visitors don't need to repeat the barcode scan if it is disconnected from the access point

connection because the mac-address has already been registered and there is no need to repeat it.

This study also provides an option if the visitor's device does not support the camera, visitors can login with a user and password manually. The system will automatically take you to a web browser with a special URL for the smart tourism network login.

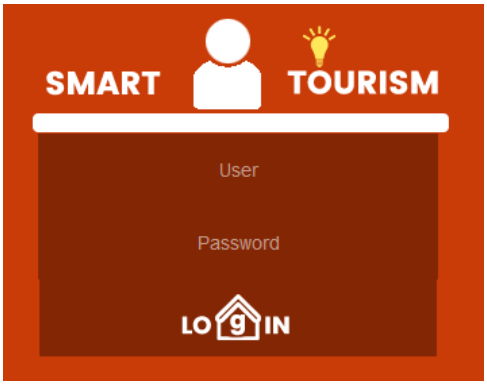


Fig 17. Login page

In Figure 17 the system will direct visitors to input the user and password that has been given by the cashier. Then visitors will be taken to the google.com page and get internet access. This method also uses cookies, which means there is no need to log in if the device connection is lost.

The performance of smart wifi appears when tourists switch location of destination.The tourists don't need to ask the receptionist to provide a wifi password, the system will auto-generate based on the entered mac-address. The concept of smart wifi of smart tourism is to make it easier for tourists to communicate in a wider area automatically.

VI. CONCLUSION

The design of Smart Wifi in this research has been done by a captive portal and barcode scan. Meanwhile, the use of the radius server on userman is very useful for exchanging data between integrated routers. Data exchanging still also can be processed in different providers and places.

Travelers can use the system for up to 7 days at speeds up to 5 Mbps. Tourists don't need to worry because they already use data encryption. This system has wireless security that is different in general because it has a private server to manage the connection and security.

The use of this software is not only helpful in building a smart tourism system that allows tourist visitors to get internet access in every different tourist destination but also provides a different experience for visitors to get internet access.

Routers with higher specifications can be used in order to accommodate a large number of users for tourist visitors for the future development. In terms of access point devices that already support dual band channels are 2.4 GHz and 5 GHz. The use of the 5 GHz frequency will result in a large bandwidth, which makes a better connectivity distance for the visitors. However, there must be a device that also support the needs of 5 GHz frequency. The development of wireless technology can be developed into finding the location of visitors' presence to support smart tourism.

VII. ACKNOWLEDGEMENT

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