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"Comparison of Capture Power of Wajanbolic Antenna with Parabolic Directional Antenna to the Distance of Capture Wireless LAN Signal 2.4 GHz"

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***Abstract*— The wokbolic antenna captures the 2.4 GHz wireless LAN signal—the reflector is made of a frying pan. Focus on using a foil-lined pipe. At the focus is given, a USB adapter captures the signal reflected by the reflector. A tool's feasibility needs to compare with equipment with a standard data sheet. So, the research compares the wokbolic antenna's capture power with a directional parabolic antenna. The research is an experimental method: an experimental signal strength measurement of both antennas at the exact location and altitude under LOS conditions. The results experiments conduct five distances: at a radius of 50 meters, 73 meters, 120 meters, 150 meters, and 290 meters. The farther the capture distance, the smaller the received signal; this happens to both antennas. After the data obtains in the signal strength form, the antenna gain calculate. The results of the antenna gain calculation show the difference between the gain of the wokbolic antenna and the directional satellite dish. To see if the difference in antenna gain is significant, it analyzes by a t-test. The t-test shows that the t count is greater than the t table, concluding that the antenna gain difference is insignificant.**

Index Terms*— *Wireless*; Antena; *strength; wajanbolic

***Abstrak*—Antena wajanbolic digunakan menangkap sinyal *wireless* LAN 2,4 GHz. Reflektor terbuat dari wajan. Fokus menggunakan pipa paralon yang diberi *foil*. Pada bagian fokus diberi USB *adapter* untuk menangkap sinyal yang dipantulkan reflektor. Untuk melihat kelayakan sebuah alat perlu dibandingkan dengan peralatan yang memiliki *data sheet* standar. Maka dilakukanlah penelitian dengan membandingkan daya tangkap antena wajanbolic dengan antena *directional* parabola. Metode penelitian yang digunakan adalah metode eksperimen sungguhan, yaitu percobaan pengukuran *signal strength* terhadap kedua antena pada lokasi yang sama, ketinggian pada kondisi *LOS*. Dari hasil percobaan yang dilakukan di lima jarak: pada radius 50 meter, 73 meter, 120 meter, 150 meter, dan 290 meter. Semakin jauh jarak tangkap semakin kecil sinyal yang diterima, hal ini terjadi pada kedua antena. Setelah data didapatkan berupa *signal strength* selanjutnya dilakukan perhitungan *gain* antena. Hasil perhitungan *gain* antena terlihat perbedaan *gain* antena wajanbolic dengan antena *directional* parabola. Untuk melihat apakah perbedaan gain antena signifikan dianalisis dengan uji t. Dari uji t tersebut ternyata t hitung lebih besar dari t tabel, maka dapat disimpulkan bahwa perbedaan *gain* antena adalah tidak signifikan.**

Kata Kunci*— *Wireless*; Antena; *signal strength; wajanbolic

I. INTRODUCTION

Antenna is a component that makes wireless communication possible between two or more users when communication occurs. The development of the antenna itself cannot be separated from the rapid development of information technology, especially in the communication technology section. At this time the use of antennas is not only for voice communication but also for audio and video communications that involve large bandwidth, so antenna hardware is needed that can support these needs. This development eventually gave rise to the concept of Wireless Local Area Network (WLAN).

In wireless communication systems, the role of the antenna is very important, namely to transmit and receive electromagnetic waves from one device to another. Such as transmitting antennas, and there are also receiving antennas, thus enabling communication in a wireless network. One of the wireless telecommunications systems is an internet network that uses a Wifi Router as a connecting medium from a LAN (Local Area Network) to several devices or from one device to another with a wireless system. In this system, the antenna is used as a conductor and receiver of electromagnetic waves (Muhammad Hanafi, et al. 2017). With the increasing use of telecommunication devices, both computers, laptops and smartphones,

the need for data transfer from one device to another is very large which is separated by different distances and time zones, so that the use of wire-based networks is less able to answer the existing challenges. This condition encourages the creation of findings on a new concept in communicating with the media called Wireless Local Area Network (WLAN). Although the WLAN concept is considered very effective, it still has a few weaknesses, including the limited area that can be covered by the access point.

Increasing the range for WLAN requires an external antenna with a gain greater than the standard antenna that is already available in laptops. The alternative that is tried to be offered is to use a directional antenna which is a form of smart solution for computer, laptop and smartphone users who want to stay connected to the access point. The antenna is popular in the community, especially those working in the wireless world. But in terms of price and how to get this antenna is relatively expensive. A few years ago, it was found that the wajanbolic antenna was deemed necessary to test the feasibility of the antenna so that it could be recommended to the general public and society in general. Basically, the wajanbolic function is almost the same as the directional antenna, which is made from materials that are around us and is relatively cheaper. However, to determine the feasibility of a wifi antenna, in-depth testing and analysis is needed, so that it can assist humans in analyzing and determining the right type of antenna that is suitable for use according to the location and distance of the use of the wifi antenna itself.

Antenna Types

Antennas can be classified based on the size of their frequency and directivity (direction of radiation). However, in general, antennas are divided into three types based on their function, namely transmitting antennas, receiving antennas and reciprocal antennas. The transmitting antenna is a conducting rod that converts radio frequency (RF) current into electromagnetic waves and transmits them. In a good communication system, only the antenna is allowed to transmit. The receiving antenna is a conducting rod that converts induced electromagnetic waves into electric current. Antenna reciprocity means an antenna that can be used to transmit or receive electromagnetic waves.

1. Frequency Measure

The antenna used in the HF frequency band is different from the VHF, and also different from the antenna for the microwave. The wavelength will be different at each frequency difference, therefore antennas must differ in size to be able to radiate waves at the right wavelength. In the ISM 2.4 GHz frequency band, the wavelength is 12.5 cm, while at the 5 GHz frequency it is 6 cm. A dipole antenna will have different lengths if used for the HF and UHF frequency bands.

2. Directivity (direction of radiation)

The antenna can have omnidirectional, sectoral and directional radiation directions.

a. Omnidirectional antenna radiates power in all directions around the antenna with a radiation pattern of 360^{o}. The shape of the radiation pattern is described as a donut shape with an overlapping center. The most popular types of omnidirectional antennas are dipole and ground plane.

Figure 1. Antenna type *dipole Omnidirectional*

b. Sectoral antennas spread power radiation mainly in certain directions. The radiation pattern of sectoral antennas can be as wide as 90^{o}, 180^{o} or as narrow as 60^{o}.

Figure 2. Antenna type *Sectoral*

c. Directional antenna or directional antenna is an antenna that radiates power in a certain direction. The gain of this antenna is relatively larger than omnidirectional antennas and sectoral antennas. Directional antennas have the highest gain. Several types of directional antennas are yagi, biquad, helical, patch antenna, horn, parabolic antenna.

Figure 3. Antenna type *Yagi directonal*

Figure 4. Antena parábola *directional*

The type of antenna above is a single antenna and the shape of the radiation pattern cannot be changed without changing the physical antenna or rotating the antenna physically.

II. METHOD

The research method used is true experiment. Experimental research contains three main components; dependent variable, independent variable and treatment. The dependent variable receives the stimulus and is measured for the effect of the treatment. The independent variable is the part of the existing situation

from which the stimulus is given to the dependent variable, including treatment, state variables, such as age, size, weight, treatment means either the removal or addition of a stimulus in order to measure effort (Shahla Qasim, *et al.* 2014)

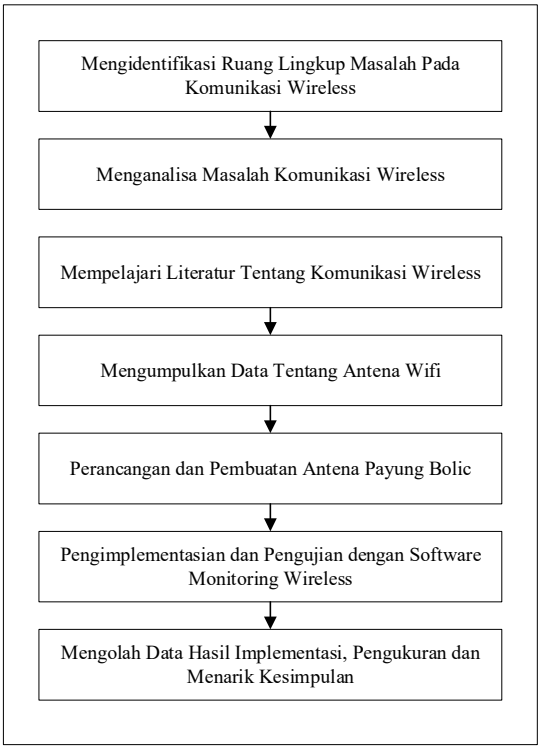

Figure 5. Research Framework

Object Of Research

1. Wajanbolic Antenna

In principle, the wajanbolic antenna on the reflector uses a frying pan and in the middle of the frying pan is placed a feeder (focus) with a USB wifi as a wireless LAN signal receiver that works at a frequency of 2.4 GHz.

Tabel 1. Datasheet wajanbolic antenna

Diameter *reflector*	70 cm
Wajan depth	19,7 cm
Focus distance	15,5 cm
The length of the paralon pipe covered with aluminum foil	20 cm
Focus distance with USB adapter	4 cm

Figure 6. Wajanbolic antenna

2. Parabolic Directional Antenna

Parabolic directional antenna is a category of parabolic antenna consisting of a reflector and a wavequide (wave guide). The reflector is a surface made of metal in the shape of a circular paraboloid and is cut in a circular rim that forms the diameter of the antenna. This reflector plate is in the form of a wire mesh (grid) in its construction which can be completely circular, there are also rectangular.

Tabel 2. Datasheet Parabolic Directional Antenna

ElectricalSpecifications	
Frequency Range	2.4 – 2.5 GHz
Impedance	50 Ω
Gain	24 dBi
VSWR	≤1.5
Horizontal Beamwidth	14°
Vertical Beamwidth	10°
F/B Ratio	>30 dB
Polarization	Vertical or Horizontal
Maximum Input Power	100 W
Connector	NFemale
Application	Outdoor
Mount Style	Pole mount/wall mount
Mechanical Spesifications	
Antenna dimension	600 **x** 1000mm
Weight	3.5 +/- 0.15 kg
Mounting Mast Diameter	30-50 mm
Rated Wind Velocity	216 Km/h

Figure **7**. Parabolic Directional Antenna

Research Data Collection Techniques

In conducting data collection, it is first determined where to install the antenna that will be used in the study. Data retrieval is carried out at 5 different measuring distances (radius) by complying with the Line Of Sight principle. The data collection technique was carried out several times to observe signal strength using the WirelessMon software simultaneously. This data retrieval technique applies to both types of antennas which are carried out in turns for the same time and place.

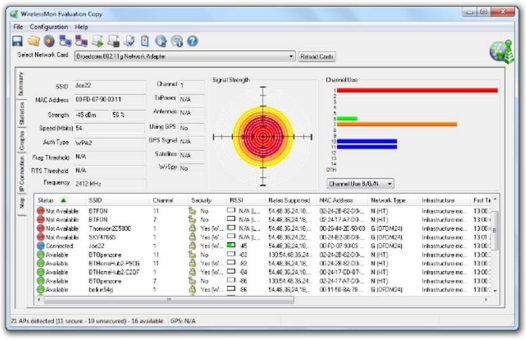

Figure 8. *Wirelessmoon App*

III. RESULT AND DISCUSSION

Using a wajanbolic antenna, the following signal strength is obtained:

Tabel 3. Data *signal strength* wajanbolic antenna

Radius (m)	Signal strength at position (-dBm)			$\bar{X}$
	1	2	3	
50	-29 dBm	-30 dBm	-31 dBm	- 30 dBm
73	-36 dBm	-36 dBm	-36 dBm	- 36 dBm
120	-46 dBm	-47 dBm	-45 dBm	- 46 dBm
150	-48 dBm	-50 dBm	-49 dBm	- 49 dBm
290	-55 dBm	-56 dBm	-54 dBm	- 55 dBm

The following is a graphic image of the decrease in the strength of the wajanbolic antenna signal:

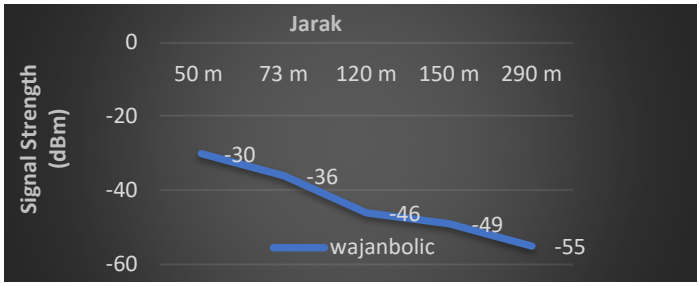

Figure 9. Graph of the decrease in the strength of the antenna of the wajanbolic antenna

Using a parabolic directional antenna, the signal strength is obtained as follows:

Tabel 4. Data *signal strength* parabolic directional antenna

Radius (m)	Signal strength at position (-dBm)			$\bar{X}$
	1	2	3	
50	-29 dBm	-29 dBm	-29 dBm	-29 dBm
73	-35 dBm	-35 dBm	-35 dBm	- 35 dBm
120	-39 dBm	-39 dBm	-39 dBm	-39 dBm
150	-42 dBm	-42 dBm	-43 dBm	-42,3 dBm
290	-47 dBm	-48 dBm	- 49 dBm	-48 dBm

The following is a graphic image of the decrease in the signal strength of a parabolic directional antenna:

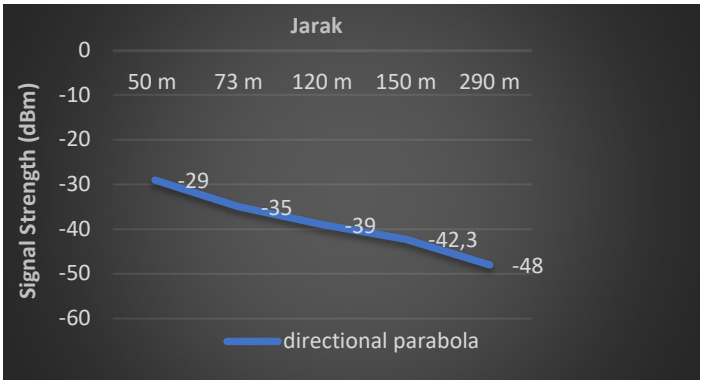

Figure 10. Graph of the decrease in signal strength of a parabolic directional antenna

Based on the description of the data of the wajanbolic antenna and the directional parabolic antenna above, it can be seen that at each measurement distance the signal decreases. At a distance (radius) of 50 meters with three data retrieval locations, the wajanbolic antenna can capture a signal of -30 dBm, then at a distance of 73 meters, the Pan-Ganbolic antenna can capture a signal of -36 dBm (table 5), experiencing a decrease of - 6 dBm. Parabolic directional antennas also experience a decrease in signal at each measurement distance, at a distance of 50 meters the directional antenna can capture a signal of -29 dBm, then at a distance of 73 meters the antenna can capture a signal of -35 dBm (table 6), decreased by - 6 dBm . For more details, see the graphic below:

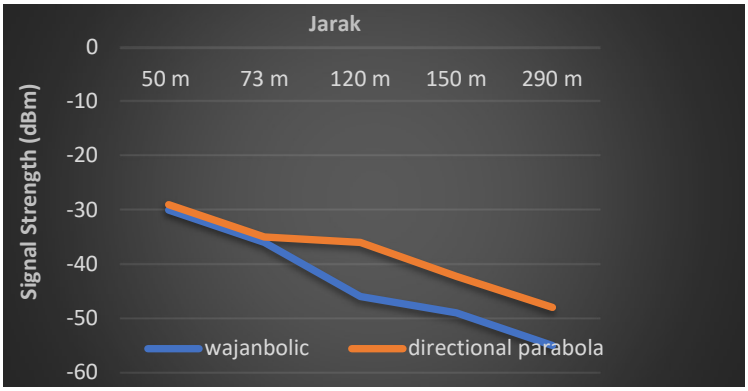

Figure 11. Comparison graph of the decrease in signal strength to the catching distance of the two antennas.

From the graphic image, it can be seen that at a radius of 50 meters, 75 meters, 125 meters and 150 meters, the gankbolic antenna with a parabolic directional antenna experienced almost the same decrease in signal. The difference in signal loss is only visible at a distance of 300 meters.

Tabel 5. t test data capture power of antenna signal strength

No	Radius	X_1	X_2
1	50 meter	15	14
2	73 meter	15	14,3
3	120 meter	21	14
4	150 meter	21	14,3
5	290 meter	21,3	14,3
	$\sum$ X	**93,3**	**70,9**
	$\overline{X}$	**18,7**	**14,2**
	N	**5**	**5**

S	**0,67**	**0,27**
s^2	**0,45**	**0,07**

Ket :

X_1 = wajanbolic antenna
X_2= Parabolic Directional Antenna
$\sum \mathbf{X}$ = Total antenna signal strength data
$\overline{X}$ = Average antenna signal strength
S^2 = Variants of antenna signal strength data
S = Antenna signal strength standard deviation
r = Antenna signal strength correlation
n = Number of sample radius measurement

t-test Analysis (Significant Test)

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$= \frac{18,7 - 14,2}{\sqrt{\frac{0,07}{5} + \frac{0,45}{5}}}$$

$$= \frac{4,5}{\sqrt{0,014 + 0,09}}$$

$$= \frac{4,5}{\sqrt{0,104}}$$

$$= \frac{4,5}{0,322}$$

$$= 13,97$$

$$= 14$$

The t-count value is 14, then this value is compared with the ttable value with dk n1 – 1 or n2 – 1 (Sugiono: 139) i.e. 5-1= 4. Based on the attachment of table II (Sugiono: 370) in the value of the t distribution, if dk 4 for an error rate of 5%, then the value of ttable = 2.132. Based on these calculations, it turns out that tcount = 14 is greater than ttable = 2.132. So it can be decided that there is an insignificant difference in gain between the wajanbolic antenna and the parabolic directional antenna.

IV. CONCLUSION

From the results of the research that has been carried out, it is concluded that the wajanbolic antenna with a parabolic directional antenna does not have a significant difference in signal strength capture power to capture a 2.4 GHz WLAN signal at a distance of 300 meters in a Line Of Sight state based on data analysis with the t test. Awanbolic antenna is more efficient than a directional antenna in terms of manufacturing and purchasing costs and awanbolic antenna has almost the same effectiveness as a parabolic directional antenna based on research data and t-test analysis. For those who want to develop this research, it is necessary to focus research on increasing antenna gain, so that this antenna can indeed be used as an alternative antenna for the people with a relatively cheap price and can be used for long distance communication, especially to access the internet from a distance.

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