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UBL ICETD
2013

The Second International Conference on Engineering and Technology Development

2nd ICETD 2013

27, 28, 29 August 2013, Bandar Lampung, Indonesia

PROCEEDINGS

UBL In Cooperations With : Universiti Kebangsaan Malaysia, APTIKOM, International Islamic University Malaysia, SURYA INSTITUTE

Hosted by :
Faculty of Engineering and Faculty of Computer Science,
Bandar Lampung University (UBL), Indonesia

2nd ICETD 2013

The Second International Conference On Engineering And Technology Development

28 -30 January 2013
Bandar Lampung University (UBL)
Lampung, Indonesia

PROCEEDINGS

Organized by:

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PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (2nd ICETD 2013) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, APTIKOM – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, Starch Technology Center – Lampung, Universitas Islam Indonesia – Indonesia, Politeknik Negeri Malang – Malang,University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung, Starch Technology Center – Lampung, Universitas Riau – Riau, Hasanuddin University – Indonesia, Diponegoro University – Indonesia, King Abdulaziz University – Saudi Arabia, Parahyangan Catholic University – Indonesia , National Taiwan University– Taiwan, Surakarta Christian University – Indonesia, Sugijapranata Catholic University – Indonesia, Semarang University – Indonesia, University of Brawijaya – Indonesia, PPKIA Tarakanita Rahmawati – Indonesia, Kyushu University, Fukuoka – Japan, Science and Technology Beijing – China, Institut Teknologi Sepuluh Nopember – Surabaya, Researcher of Starch Technology Center, Universitas Muhammadiyah Metro – Metro, National University of Malaysia – Malaysia.

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

Bandar Lampung, 29 August 2013-08-26

Mustofa Usman, Ph.D
2nd ICETD Chairman

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WIFI NETWORK DESIGN FOR HIGH PERFORMANCE

Ir. HeruNurwarsito, M.Kom, Ir. KasyfulAmron, MSc.,BektiWidyaningsih,S.Kom.
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Abstract-*Indoor wireless network connectivity is strongly influenced by the presence of interference. Usually transmitted signal can be received in free space or by more than one pathway, because the effects of multipath propagation such as reflection, refraction and scattering of radio waves by the structure of the building, and these effects may be a phenomenon called multipath fading. Multipath Fading is triggered by the presence of loads and very high performance. Propagation model based on user capacity has been identified for possible outcomes, which provide the propagation characteristics as the initial evaluation. Two wireless propagation models, namely empirical and theoretical models related to the coverage, capacity and performance of wireless network users. Empirical and theoretical models used for laying planning system. In addition, this comparison can help to identify the accuracy of the survey measurements when wireless indoor monitoring and it can help to provide an estimate of the coverage and performance of wireless networks in the form of a new topology, along with contour display. Optimization of the planning system laying Wi-Fi user capacity planned by generating an average RSSI reaches -40 dbm to -55 dbm with power 17-18 dbm and canals that channel 1 is applied to 11 non-overlapping in the network design consisting of AP in the adjacent lot. The optimization results are reflected in the new topology along with contour display and spread throughout the area.*

Keywords-*interference, empirical models, theoretical models, laying planning system, user capacity, the average RSSI*

Introduction

Wireless network in the room with loads and high performance is strongly influenced by the presence of interference. In addressing the need for optimization of interference to create a reliable communication. Application of optimization using two models of propagation are theoretical models and empirical models with calculations based on user capacity. Theoretical model of the measurement of the propagation aspects of the wireless network that includes the number of transmitter (access point), free space loss, Received Signal stength (RSSI), coverage can be served, measure the attenuation barrier (concrete walls, soft partitions, doors, floors). Empirical model of the monitoring is done directly to obtain the actual field data. Force measurement data wireless network in the form of received power level is used for optimization, the new topology is accompanied by tissue contour display.

On the basis of the above description, proposal writing this thesis will discuss how
WIRELESS NETWORK DESIGN WITH HIGH PERFORMANCE(Case study at Program TeknologiInformasidanIlmuKomputer, UniversitasBrawijaya, PTIIK-UB) with measurement and analysis to determine feasibility based on user capacity. And is expected to provide a reference for the application in the case study so that wireless network services can be implemented properly.

1. Wifi Concept

Wireless Local Area Network (WLAN) is a flexible data communication system, can be implemented as an extension or as an alternative to a wired LAN [2].Distribution processes Wi-Fi signal can not be separated from the propagation aspects. WLAN propagation aspect is

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everything that happens in wireless signal when the signal goes from one point to another [7].Two wireless propagation models, namely empirical and theoretical models related to coverage, overlapping channels, and wireless network performance, applying IEEE802.11 a / b / g / n [1]. Planning is based on a theoretical model (measurement) and empirical models (monitoring). Measurement criteria on the theoretical aspects of the propagation models[2] : the number of transmitter (accesspoint), the calculation of free space loss, Received Signal stength (RSSI), coverage can be served, measure attenuation in the barrier (concrete walls, soft partitions, doors, floors).

2. Building a 802.11-Based Wireless Networks

To build an 802.11-based wireless networks, requires an understanding of the following factors:

- Channel Selection

To avoid interference, the network requires a minimum distance of the center frequency of the channel [6].

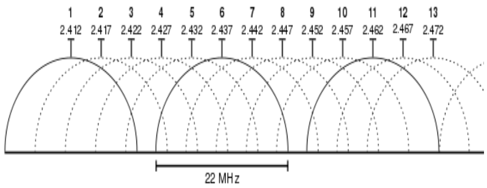

Figure 1. the distribution channel
Sources: [6]

- Calculation of Number of Access Point

Number of AP can also be viewed from the user capacity [2]:

$$N_{AP} = \frac{BW_{user} \ x \ N_{user} \ x \ Activity}{\%Effficiency \ \ x \ Association \ \ Rate} (2)$$

Description:

BW user: Bandwidth required @user.

N user : The number of users in area.

%Activity: The number of active users

%Eficiency: Eficiency channel

3. Measurement Power Wireless Networks

Measurements were made with the application of empirical models (monitoring) throughout the area by using the Ekahau software and NetSurveyor. From the empirical results, field data obtained was then measured using a theoretical model (calculation) based on propagation aspects.Strength of wireless networks in the form of received power level is based on a comparison of the two models of the propagation.

5. Measurement And Design

Design process of the measurement results for area optimization of wireless network coverage in indoor building case studies PTIIK UB. Measurement process based on the capacity of a wireless network power user.

So that the estimated number of transmitters that will be tailored to the user based on the calculation capacity of the existing circumstances.

- Library building3rd floor

  Signal strength based on user capacity

Table 1. Specifications Transmitter for Library building 3rd floor

Name	Model	Type	2.4 GHz	
			Channel	Power
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 10* - Pwr 17	AP320	802.11n	10	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm

- Library building 5th floor

  Signal strength based on user capacity

Table 2. Specifications Transmitter for Library building 5th floor

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Name	Model	Type	2.4 GHz	
			Channel	Power
Ch 9* - Pwr 17	AP320	802.11n	9	17 dBm
Ch 4* - Pwr 17	AP320	802.11n	4	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 7* - Pwr 17	AP320	802.11n	7	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 8* - Pwr 17	AP320	802.11n	8	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 10* - Pwr 17	AP320	802.11n	10	17 dBm

- PTIIK-A 1st Floor
  Signal strength based on user capacity

Table 3. Specifications Transmitter for PTIIK-A 1st Floor

Name	Model	Type	2.4 GHz	
			Channel	Power
Ch 10* - Pwr 17	AP320	802.11n	10	17 dBm
Ch 3* - Pwr 17	AP320	802.11n	3	17 dBm
Ch 9* - Pwr 17	AP320	802.11n	9	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 3* - Pwr 17	AP320	802.11n	3	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 8* - Pwr 17	AP320	802.11n	8	17 dBm

- PTIIK-A Building 2nd Floor
  Signal strength based on user capacity

Table 4. Specifications Transmitter for PTIIK-A 2n floor

Name	Model	Type	2.4 GHz	
			Channel	Power
Ch 8* - Pwr 17	AP320	802.11n	8	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 9* - Pwr 17	AP320	802.11n	9	17 dBm
Ch 10* - Pwr 17	AP320	802.11n	10	17 dBm
Ch 7* - Pwr 17	AP320	802.11n	7	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 4* - Pwr 17	AP320	802.11n	4	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 3* - Pwr 17	AP320	802.11n	3	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm

- PTIIK-B Building
  Signal strength based on user capacity

Table 5. Specifications Transmitter for B Building

Name	Model	Type	2.4 GHz	
			Channel	Power
Ch 1* - Pwr 17	AP320	802.11n	1	17 dBm
Ch 11* - Pwr 17	AP320	802.11n	11	17 dBm
Ch 10* - Pwr 17	AP320	802.11n	10	17 dBm
Ch 8* - Pwr 17	AP320	802.11n	8	17 dBm
Ch 5* - Pwr 17	AP320	802.11n	5	17 dBm
Ch 2* - Pwr 17	AP320	802.11n	2	17 dBm
Ch 6* - Pwr 17	AP320	802.11n	6	17 dBm
Ch 3* - Pwr 17	AP320	802.11n	3	17 dBm
Ch 9* - Pwr 17	AP320	802.11n	9	17 dBm

6. Implementation

In this chapter contains the implementation of the simulated design. Implementation can be done after observing aspects of propagation in PTIIK, namely the application of empirical and theoretical models. Design which then be implemented in the simulation, done by measuring and set up a wireless network strength spread across the area to the extent expected (-75 dB).

To determine the capacity of the wireless network, the throughput needs to be determined as a trade off quality of service to users. With specified minimum throughput of 100 Kbps, while the actual throughput of the WLAN itself is 24.7 Mbps.

Here's the calculation to get maximum number of active users that can be served by 1 AP:

$$\sum user = \frac{throughput\ aktual}{throughput\ peruser}$$

$$\sum user = \frac{24700\ Kbps}{100\ Kbps}$$

$$\sum user = 247$$

So the% of active users: $\frac{247}{150}$
= 1,64 = 164 %

So the bandwidth @ user @ AP = $\frac{(Datarate/2)}{\max user} = \frac{(54000/2)}{247}$ = 109,3 Kbps

So the number of AP can be calculated as follows:

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$$N_{AP} = \frac{BW_{user}\, xN_{user}\, xActivity}{\%EfficiencyxAssociationRate}$$

BW user : 109,3 Kbps = 0,1093 Mbps
Number of users : 150
% Activity rate : 164 %
Network efficiency: 50 %
Baseline/AP : 8 Mbps

$$N_{AP} = \frac{0{,}1093\; x\; 150\; x1{,}64}{0{,}5\; x8}$$

N_{AP}= 6,75 = 7 AP

From these calculations it is obtained 7 pieces AP can serve a total of 150 users. When in the classroom estimated 40 active user then takes 2 AP in the classroom.

7. Testing And Analysis

This chapter contains the results of the testing and analysis of network systems has been realized. Ie comparative analysis of measurement results of theoretical, empirical, user capacity.

In the process of measuring the power of a wireless network based on user capacity has been obtained:

Number of users that can be served by one transmitter or AP Engenius EAP 9550 is 40 active user based on the calculation formula

$$N_{AP} = \frac{BW_{user}\, xN_{user}\, xActivity}{\%EfficiencyxAssociationRate}$$

The capacity per user up to 109.3 Kbps.

- Library building3rd floor

The number of transmitters that were estimated as many as 6 units. Results of design picture 3 generate a new topology optimization coupled with contour display network that can cover the entire area of the third floor of the library building by applying channel 1, 6, 5, 11, 10, 2 to the power 17 dbm and the average RSSI is generated -50 dbm.

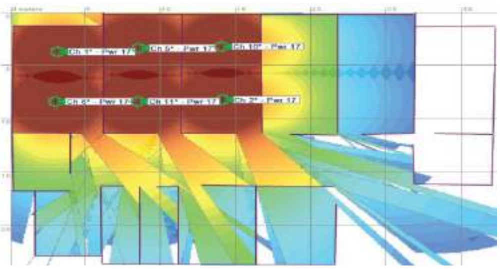
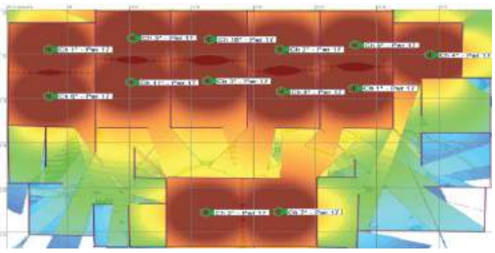


Figure 2.Library building 3rd floor (user)

- Library building 5th floor
-



The number of transmitters that were estimated as many as 13 pieces. 4 image design produces results in the form of a new topology optimization coupled with contour display network that can cover the entire area of the fifth floor of the library building by applying channel 1, 6, 5, 11, 10, 3, 2, 8, 9, 1, 4, 2 , 7 to 17 dbm power and average the resulting RSSI is -45 dbm..

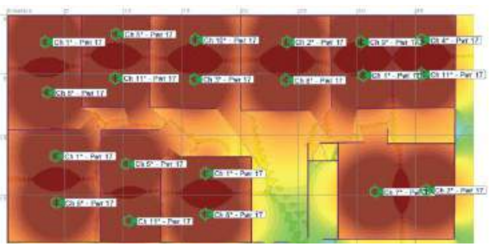


Figure 3.Library building 5th floor (user)

- PTIIK-A Building 1st Floor

The number of transmitters that were estimated as many as 9 pieces. 5 images produces results of designing a new topology optimization coupled with contour display network that can cover the entire floor area of a building by

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applying 1 channel 1, 6, 10, 5, 11, 3, 9, 3, 8 to 17 dbm power and average the resulting average RSSI is -45 dbm.

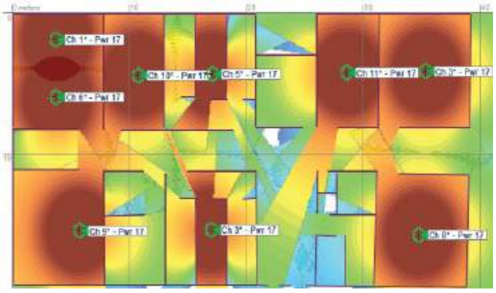

Figure4.PTIIK-A Building 1st Floor(user)

- PTIIK-A Building 2nd Floor

The number of transmitters that were estimated as many as 20 pieces. Result of design Figure 6 produces a new topology optimization coupled with contour display network that can cover the entire floor area of a building by applying a 2 channel 1, 6, 5, 11, 10, 3, 2, 8, 9, 1, 4, 11 , 1, 6, 5, 11, 1, 6, 7, 2 to the power 17 dbm and the average RSSI is -40 dbm generated.

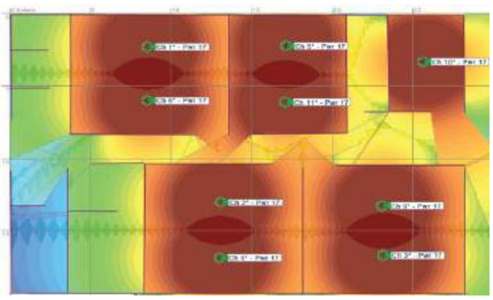

Figure 5.PTIIK-A Building 2nd Floor (user)

- PTIIK-BBuilding

The number of transmitters that were estimated as many as 9 pieces. 7 images produces results of designing a new topology optimization coupled with contour display network that can cover the entire area of the building B by applying channel 1, 6, 5, 11, 10, 2, 8, 9, 3 to 17 dbm power and the average the resulting RSSI is -40 dbm.

8. Conclusion

Based on the testingandanalysisthat has been done, it can be concludedthat:

a. Optimization of wireless network coverage area in the room with the calculation of the theoretical and empirical aspects of propagation produces output that improvement is accompanied by a new topology contour display network that can cover the entire area planned. Optimization is shown to increase the average RSSI value is initially -100 to -55 dbm to -40 dbm in the entire area.

b. Difference of results between measurements and calculations caused by interference path that is the path of reflection and change of direction signal as it passes through different mass something like walls, doors, and partitions so that the software can lower the level of the signal emitted by the access point.

c. Power and channel settings reduce the interference in indoor wireless networks. Minimize power an AP, which is in the classroom with an area of 72 m^2using 18 dbm power and length to diameter 9550 AP Engenius EAP can be reached is 11.166 m. Use the right channel is applied 1 to 11 in non-overlapping in network design consisting of AP in the adjacent lot.

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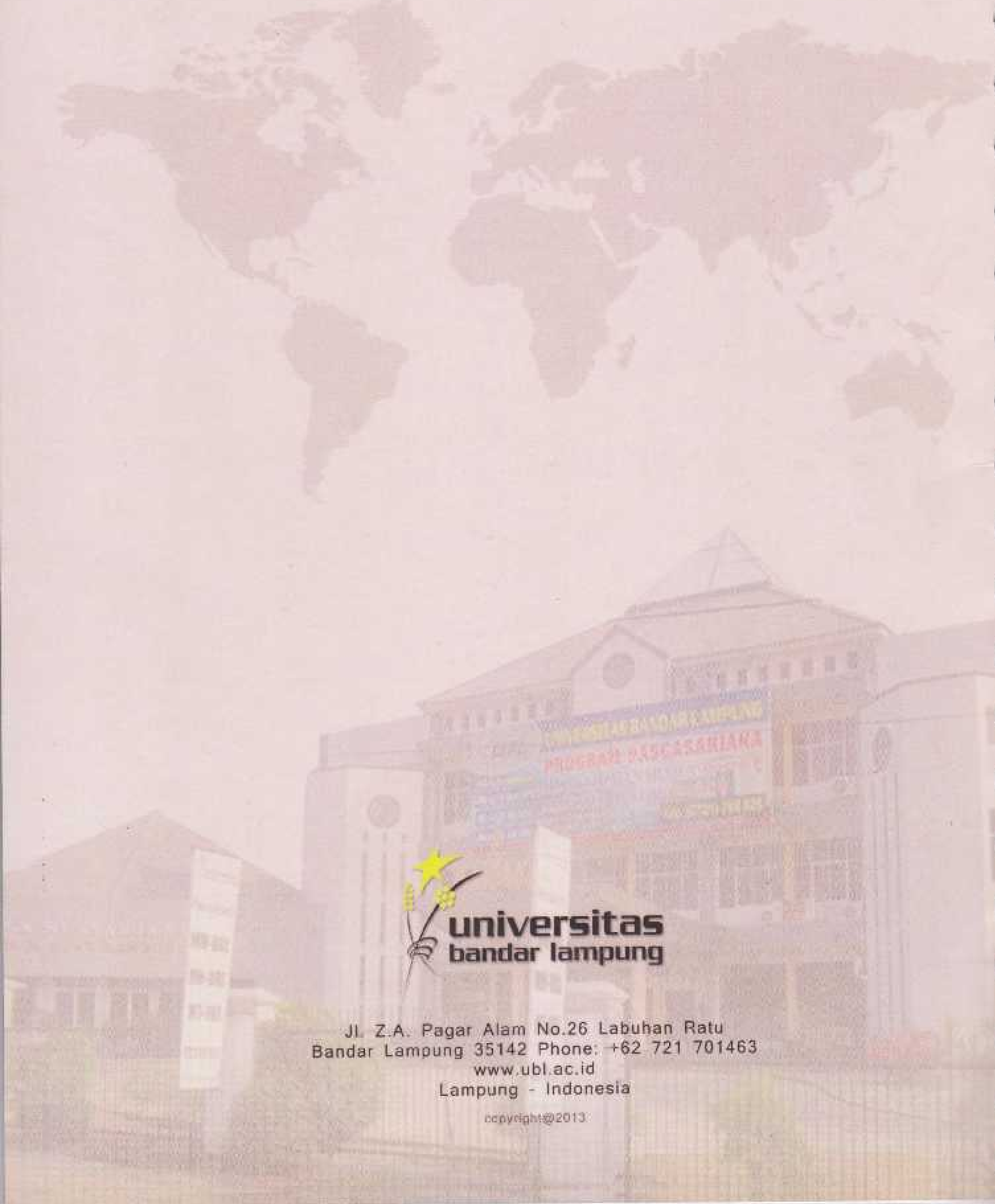

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