

INTERNATIONAL CONFERENCE



The Second International Conference on
Engineering and Technology Development

2nd ICETD 2013

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



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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

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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

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Table Of Content

Organizing Committee	i
Table Of Content.....	v
Keynote Speaker	
1. Recent Advances in Biofuel Cell and Emerging Hybrid System Abdul Aziz Ahmad and Raihan Othman	1
2. Waste Utilization Study Tailing Gold Mine in Way Linggo-Lampung, as Fine Aggregate Materials for Producing Mortar Materials based on concept of Green Technology Lilies Widodojoko & Susilawati	8
3. Infrastructure Health Monitoring System (SHM) Development, a Necessity for Maintance and Investigation Prof. Dr. Priyo Suprobo, Faimun, Arie Febry	17
4. Four Phases Quality Function Deployment (Qfd) By Considering Kano Concept, Time And Manufacturing Cost Prof. Dr. Moses L Singgih, Dyah L. Trenggonowati, Putu D. Karningsih	22

Speaker

1. Comparative Analysis for The Multi Period Degree Minimum Spanning Tree Problem
Wamiliana, Amanto, and Mustofa Usman..... 39
2. Choosing The Right Software In Supporting The Successful of Enterprise ERP Implementation
Yodhie Yuniarthe, Idris Asmuni..... 44
3. Climate Adaptive Technology In Maintaining Vernacularism Of Urban Kampong Case study: Kampung Adat (Indiginous) Mahmud, Bandung District, West Java
Marcus Gartiwa..... 50
4. The Prospect Of Diesohol In Facing Fossil Fuel Crissis
M.C. Tri Atmodjo..... 63
5. The Potential Of Agriculture And Forestry Biomass Wastes As Source Of Bioenergy
Hardoyo..... 66
6. The Importance of Education Facility as Sustainable Urban Generation Tool
Fritz Akhmad Nuzir, Haris Murwadi and Bart Julien Dewancker 71
7. The implementation of Secton Method for Solving Systems of Non Linear Equations
Nur Rokhman 80
8. Quality Control Analysis Into Decrease The Level Defects On Coffee Product
Heri Wibowo, Sulastri and Emy Khikmawati 85
9. Public Transpotion Crisis In Bandar Lampung
Ida Bagus Ilham Malik 89
10. Geospatial Analysis of Land Use Change in Way Kuripan Watershed, Bandar Lampung City
Candra Hakim Van Rafi'1., Dyah Indriana Kusumastuti2., Dwi Jokowinarno..... 99
11. Material Utilization Technology Of Agriculture And Forestry Waste
Hardoyo..... 105
12. The Supply Chain System Of Cassava On The Tapioca Industry
Hardoyo..... 108
13. Glass Technology In Natural Light Glasses On Aperture Element In The Architecture World
Muhammad Rija & MT Pedia Aldy 113

14. An Eksperimental Permeable Asphalt Pavement Using Local Material Domato Stone On Quality Of Porous Asphalt Firdaus Chairuddin, Wihardi Tjaronge, Muhammad Ramli, Johannes Patanduk	117
15. Coordination Of Architectural Concepts And Construction Systems Eddy Hermanto.	129
16. Seismic Assessment of RC Building Using Pushover Analysis Riza Ainul Hakim.	136
17. Viscosity and Liquidity Index Relation for Elucidating Mudflow Behavior Budijanto Widjaja and Shannon Hsien-Heng Lee.	143
18. The Use of Pozzolanic Material for Improving Quality of Strontium Liquid Waste Cementation in Saline Environment during Nuclear Waste Immobilization Process Muhammad Yusuf, HayuTyasUtami, Tri SulistiyoHariNugroho, SusetyoHarioPutero	148
19. Geospatial Analysis Of Land Use And Land Cover Changes For Discharge At Way Kualagaruntang Watershed In Bandar Lampung Fieni Yuniarti, Dyah Indriana K, Dwi Joko Winarno.	153
20. Wifi Network Design For High Performance Heru Nurwarsito, , KasyfulAmron,BektiWidyaningsih	161
21. Studi on The Efficiency Using Nature Materials in The Structural Elements of Reinforced Concrete Beam Yasser , Herman Parung , M. Wihardi Tjaronge, Rudy Djamaluddin.	167
22. The Research Of Slow Release Nitrogen Fertilizer Applied In Sugarcane (Saccharum Officinarum) For Green Energy Bioethanol M.C. Tri Atmodjo, Agus Eko T. Nurul Rusdi, Sigit Setiadi, and Rina.	179
23. Energy Utilization Technology Of Agriculture And Forestry Waste Hardoyo.	185
24. Implementation Of Fuzzy Inference System With Tsukamoto Method For Study Programme Selection Fenty Ariani and Robby Yuli Endra.	189
25. The Analysis of Video Conference With ITU Standarization (International Telecommunication Union) That Joining in Inherent At Bandar Lampung University Maria Shusanti F, Happy Reksa	201

26. The E-internal audit iso 9001:2008 based on accreditation form assessment matrix in study program for effectiveness of monitoring accreditation Marzuki, Maria Shusanti F.	207
27. The Developing Of e-Consultations For Effectiveness of Mentoring Academy Ahmad Cucus, Endang K	214
28. The Evaluation of information system performance in higher education case study with EUCS model at bandar lampung university Reni Nursyanti, Erlangga.	221
29. The Analysis Of History Collection System Based On AndroidSmartphone With Qr Code Using Qr CodeCase Study: Museum Lampung Usman Rizal, Wiwin Susanty, Sutrisno.	230
30. Application of Complaint Handling by Approach Model of ISO 10002 : 2004 to Increase Complaint Services Agus Sukoco and Yuthsi Aprilinda.	235
31. Towards Indonesian Cloud Campus Taqwan Thamrin, Iing Lukman, Dina Ika Wahyuningsih	252
32. Bridging Router to ADSL Modem for Stability Network Connection Arnes Yuli Vandika and Ruri Koesliandana.	257
33. The Effect of Use Styrofoam for Flexural Characteristics of Reinforced Concrete Beams Yasser , Herman Parung, M. Wihardi Tjaronge, Rudy Djamaluddin	261
34. The Estimation Of Bioethanol Yield From Some Cassava Variety M.C. Tri Atmodjo	273
35. Effect of Superficial Velocity of Pressure Difference on The Separation of Oil And Water by Using The T-Pipe Junctionl Kms. Ridhuan and Indarto.	277
36. The use of CRM for Customer Management at Cellular Telecommunications Industry Ayu Kartika Puspa.	293
37. Indonesian Puslit (Centre Of IT Solution) Website Analysis Using Webqual For Measuring Website Quality Maria Shusanti Febrianti and Nurhayati.	297
38. The E-internal audit iso 9001:2008 based on accreditation form assessment matrix in study program for effectiveness of monitoring accreditation Marzuki, Maria Shusanti F.	307

39. Enhancing Quality Software Through CMMI-ISO 9001:2008 and ISO 9126 Agus Sukoco	320
40. Value Analysis Of Passenger Car Equivalent Motorcycle (Case Study Kartini Road Bandar Lampung) Juniardi, Aflah Efendi	337
41. Alternative Analysis Of Flood Control Downstream Of Way Sekampung River Sugito, Maulana Febramsyah.	347
42. Analysis Of Fitness Facilities And Effective Use Of Crossing Road Juniardi, Edi Haryanto.	353
43. Study On Regional Development Work Environment Panjang Port Lands In Support Bandar Lampung City As A Service And Trade Ir. A. Karim Iksan, MT, Yohn Ferry.	359
44. Analytical And Experimental Study Bamboo Beam Concrete Hery Riyanto, Sugito, Juli	370
45. Comparative Analysis Of Load Factor Method Static And Dynamic Method (Case Study Akdp Bus Route Rajabasa - Bakauheni) A. Ikhsan Karim, MT., Ahmad Zulkily.	378
46. Optimization Utilization Of Water Resources dam Batuteji Using Method Of Linear Program Aprizal, Hery Fitriyansyah	386
47. Characteristics Generation Traffic Patterns And Movement In Residential Area (Case Study Way Kandis Residential Bandar Lampung) Fery Hendi Jaya, Juniardi,	392
48. Use Study On Slight Beam Reinforced Concrete Floor Plate in Lieu Of Secondary Beam Hery Riyanto, Sugito, Lilies Widodjoko, Sjamsu Iskandar	399
49. Observation Of The Effect Of Static Magnetic Field 0.1 Mt On A-Amylase Activity In Legume Germination Rochmah Agustrina, Tundjung T. Handayani, and Sumardi.	405
50. Effectiveness Analysis Of Applications Netsupport School 10 Based Iso / Iec 9126-4 Metrics Effectiveness Ahmad Cucus, Nelcy Novelia	413
51. Comparative Performance Analysis Of Banking For Implementing Internet Banking Reza Kurniawan	418

WIFI NETWORK DESIGN FOR HIGH PERFORMANCE

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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 strength (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

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 strength (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].

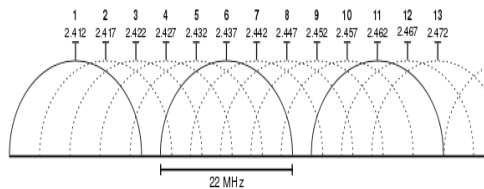


Figure 1. the distribution channel Sources: [6]

- Calculation of Number of Access Point

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

$$N_{AP} = \frac{BW_{user} \times N_{user} \times Activity}{\%Efficiency \times Association \ Rate} \quad (2)$$

Description:

BW user: Bandwidth required @user.

N user : The number of users in area.

%Activity: The number of active

users

%Efficiency: Efficiency 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 building 3rd 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

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:

$$\sum \text{user} = \frac{\text{throughput actual}}{\text{throughput peruser}}$$

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

$$\sum \text{user} = 247$$

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

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

So the number of AP can be calculated as follows:

$$N_{AP} = \frac{BW_{user} \times N_{user} \times Activity}{\%Efficiency \times AssociationRate}$$

BW user : 109,3 Kbps = 0,1093 Mbps

Number of users : 150

% Activity rate : 164 %

Network efficiency: 50 %

Baseline/AP : 8 Mbps

$$N_{AP} = \frac{0,1093 \times 150 \times 1,64}{0,5 \times 8}$$

$N_{AP} = 6,75 = 7 \text{ AP}$

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

$$N_{AP} = \frac{BW_{user} \times N_{user} \times Activity}{\%Efficiency \times AssociationRate}$$

The capacity per user up to 109.3 Kbps.

- Library building 3rd 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.

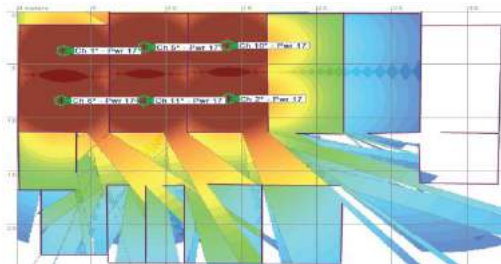
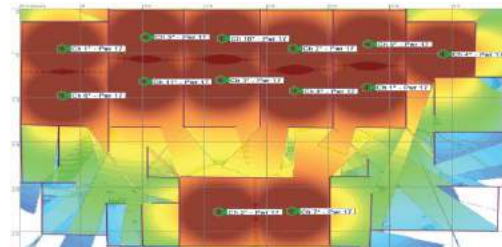


Figure 2. Library building 3rd floor (user)

- 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..

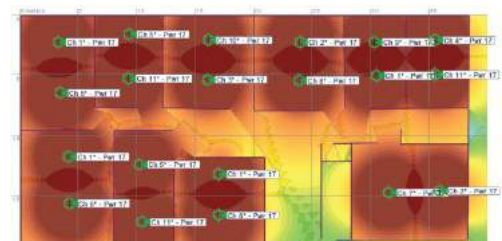


Figure 3. Library building 5th floor (user)

- 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

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.

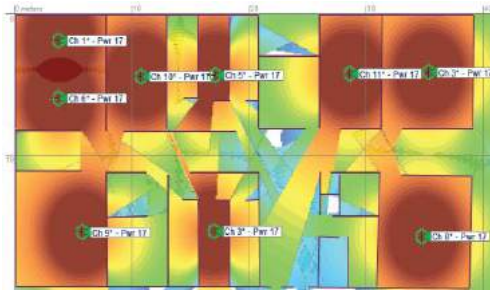


Figure 4. PTIIK-A Building 1st Floor (user)

- 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.

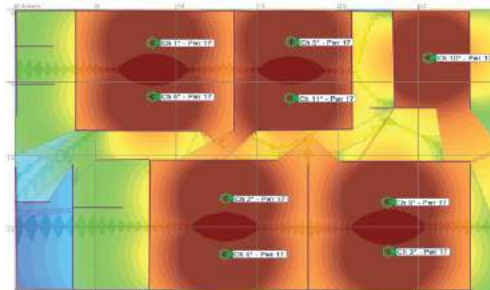


Figure 5. PTIIK-A Building 2nd Floor (user)

- PTIIK-B Building

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

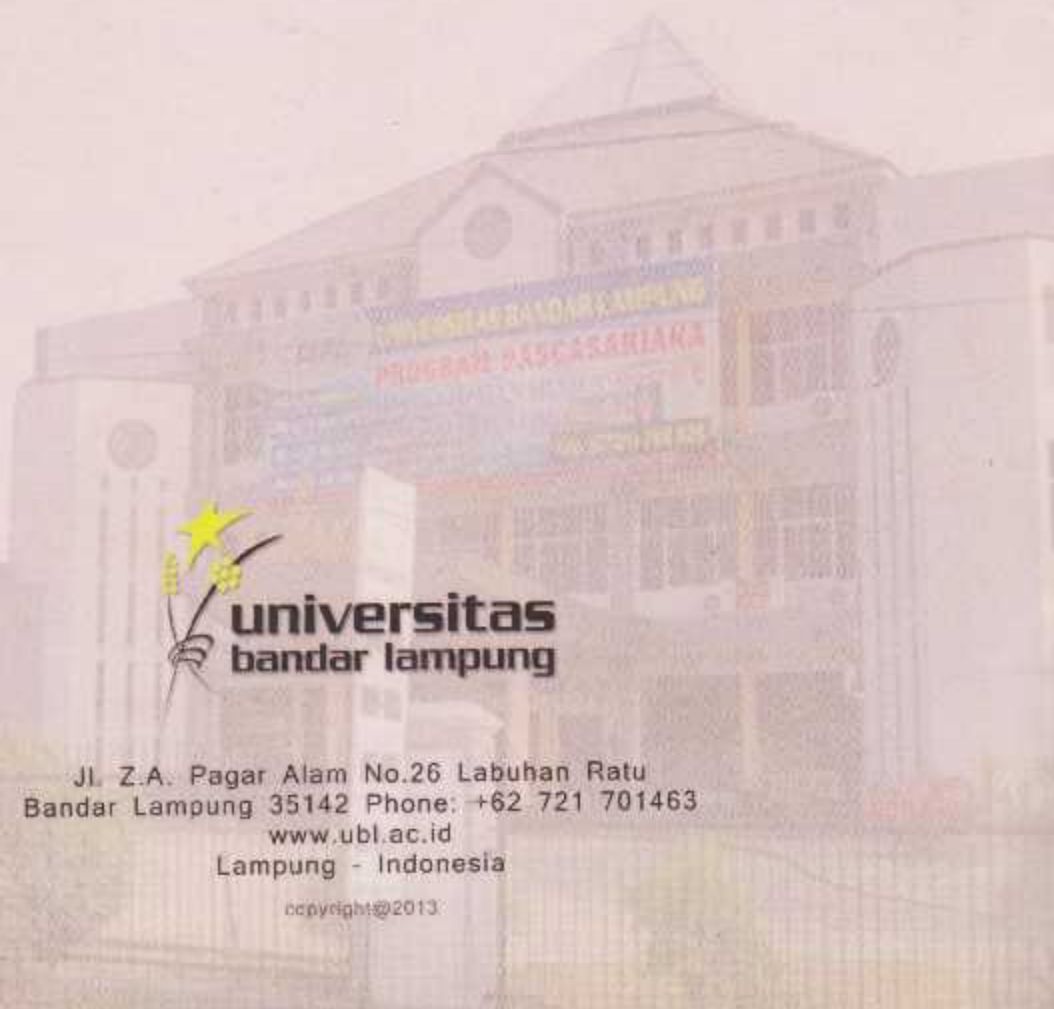
Based on the testing and analysis that has been done, it can be concluded that:

- 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.
- 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.
- 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 m² using 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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