

ICECOS 2018 CONFERENCE

PROVINCE OF BANGKA-BELITUNG
INDONESIA



9 781538 657195

Proceeding of 2018 International Conference on Electrical Engineering and Computer Science (ICECOS)

ISBN : 978-1-5386-5719-5

ICECOS

2018

INTERNATIONAL CONFERENCE
ON ELECTRICAL ENGINEERING
AND COMPUTER SCIENCE

PROCEEDING

ICECOS 2018 CONFERENCE

**“Future energy brings the quality of human life through
applied techniques and ICT Innovations”**

October 02-04, 2018
Province of Bangka-Belitung
Indonesia

Organized by :



Co-Organized by :



Partner :



Technical Co-Sponsored by :



[2018 International Conference on Electrical Engineering and Computer Science \(ICECOS\)](#) took place October 2-4, 2018 in Pangkal Pinang, Indonesia.

ISBN: 978-1-5386-5720-1

Copyright and Reprint Permission: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved. Copyright © 2018 by IEEE.

**INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING
AND COMPUTER SCIENCE (ICECOS) 2018**

Organizing Committee

International Advisory Committee

Gopakumar, Indian University of Science Bangalore, (Power Electronics) IEEE fellow
Haitham Abu-Rub texas A&M University, Qatar
Z. Y. Dong, University of Sidney
Akhtar Kalam, Victoria University, Melbourne, Australia
Azha binti Mohamed, Universiti Kebangsaan Malaysia
Nasrudin bin Abd Rahim, Universiti Malaya

Steering Committee

Yanuarsyah Haroen, Institut Teknologi Bandung
Zainal Salam (UTM) Malaysia
Zainuddin Nawawi, Universitas Sriwijaya
Suwarno, Institut Teknologi Bandung
Hussein Ahmad, (UTHM) Malaysia
Anton Satria Prabuwono, King Abdulaziz University

General Chair

Siti Nurmaini, Universitas Sriwijaya, Indonesia

General co-Chairs

Hiroyuki Iida, Japan Advanced Institute of Science and Technology
Muhammad Abu Bakar, Universitas Sriwijaya, Indonesia
Rahmat Budiarto, Al-baha University, Saudi Arabia
Zolkafle Buntat, Universiti Teknologi Malaysia, Malaysia

Publication Chairs

Deris Stiawan, Universitas Sriwijaya, Indonesia
Firdaus, Universitas Sriwijaya, Indonesia
Tole Sutikno, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Finance Chairs & Treasurer

Rizda Fitri Kurnia, Universitas Sriwijaya, Indonesia
Caroline, Universitas Sriwijaya, Indonesia

Public Relation Chairs

Muhammad Irfan Jambak, Universitas Sriwijaya, Indonesia
Mochammad Facta, Universitas Diponegoro, Semarang, Indonesia
Teguh Bharata Aji, Universitas Gadjah Mada, Indonesia
Zulfatman, Universitas Muhammadiyah Malang, Malang, Indonesia
Noor Akhmad Setiawan, Universitas Gadjah Mada, Indonesia
Muhammad Syafrullah, Universitas Budi Luhur, Jakarta, Indonesia
Anton Yudhana, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Endra Pitowarno, Politeknik Elektronika Negeri Surabaya – PENS, Indonesia
Rudi Kurianto, Universitas Tanjungpura, Indonesia

Technical Program Chairs

Reza Firsandaya Malik, Universitas Sriwijaya, Indonesia
Mohd. Riduan Ahmad, Universiti Teknikal Malaysia Melaka, Malaysia
Munawar A. Riyadi, Universitas Diponegoro, Semarang, Indonesia
Herlina Wahab Universitas Sriwijaya, Indonesia
Imam Much Ibnu Subroto, Universitas Islam Sultan Agung, Semarang, Indonesia

International Scientific Committee

Brian Kurkoski, School of Information Science Japan Advanced Institute of Science and
Technology (JAIST), Japan
Dejan Gjorgjevikj, SS Cyril and Methodius University, Skopje, Macedonia
Ion Tutanescu, University of Pitesti, Romania
Ahmad Hoirul Basori, King Abdulaziz University, Saudi Arabia
Germano Lambert-Torres, Universidade Federal de Itajuba, Brazil
Serhat Şeker, Istanbul Technical University, Turkey
Ildar Z Batyrshin, Mexican Petroleum Institute, Mexico
Wazir Mustafa, Universiti Teknologi Malaysia
Mohammed Yahia Alzahrani, Al-baha University, Saudi Arabia
Ahmed Alahmadi, Al-baha University, Saudi Arabia
Gorakanage Arosha Chandima Gomes (UPM) Malaysia
Montserrat Ros (Wolongong University) Australia
Malik Elbuluk (The University Of Akron) USA
Rudi Heriansyah (Umm Al-Qura University) Saudi Arabia
Vernon Coray (Uppsala University) Sweden
Mike Inggs, South Africa
Ilhan Kocaarslan (Istanbul University)
Gamal Abdel Fadeel Khalaf, Faculty of Engineering, Helwan University, Cairo, Egypt
Dana Prochazkova. PhD., DrSc, Czech Technical University, Czech Republic
Serdar Ethem Hamamci, Inonu University, Turkey
Gökhan Gökmen, Marmara University, Turkey
Mohd. Yazid Idris, Universiti Teknologi Malaysia
Audrius Senulis, Klaipeda University, Lithuania
Peng Peng, Sr. Development Engineer at Seagate Technology, United States
Kamal Bechkoum, School of Science and Technology, Northampton, United Kingdom
Simon Xu, Algoma University College, Canada
Aydin Nusret Güçlü, METU, Ankara, Turkey
Sultan Noman Qasem, Al- Imam Muhammad Ibn Saud Islamic University, Saudi Arabia
Tahir M. Lazimov, Azerbaijan Technical University, Azerbaijan
Tahir Cetin Akinci, Kirklareli University, Turkey
Siti Zaiton Mohd Hashim, Universiti Teknologi Malaysia, Malaysia

Local Chairs

Bhakti Yudho Suprpto, Universitas Sriwijaya, Indonesia
Djulil Amri, Universitas Sriwijaya, Indonesia
Irmawan, Universitas Sriwijaya, Indonesia
Abdul Haris Dalimunthe, Universitas Sriwijaya, Indonesia
Dessy Windiasari, Universitas Sriwijaya, Indonesia
Hera Hikmarika, Universitas Sriwijaya, Indonesia
Hermawati, Universitas Sriwijaya, Indonesia
Rahmawati, Universitas Sriwijaya, Indonesia
Suci Dwi Jayanti, Universitas Sriwijaya, Indonesia
Saparudin, Universitas Sriwijaya, Indonesia
Ermatita, Universitas Sriwijaya, Indonesia
Hadi Purnawan Satria, Universitas Sriwijaya, Indonesia
Ade Silvia, Polytechnic State of Sriwijaya, Indonesia
Nyanyu Latifah Husni, Polytechnic State of Sriwijaya, Indonesia
Syarifah Fitria, Universitas Sriwijaya, Indonesia
Dina Yunika, Universitas Sriwijaya, Indonesia
Sarifah Putri Raflesia, Universitas Sriwijaya, Indonesia
Samsuryadi, Universitas Sriwijaya, Indonesia
Rosi Pasarella, Universitas Sriwijaya, Indonesia
Sutarno, Universitas Sriwijaya, Indonesia
Sukemi, Universitas Sriwijaya, Indonesia
Ahmad Heryanto, Universitas Sriwijaya, Indonesia
Alfarisi, Universitas Sriwijaya, Indonesia
Pacu Putra, Universitas Sriwijaya, Indonesia

2018 International Conference on Electrical Engineering and Computer Science (ICECOS)

Table of Content

RFI Suppression Based on Time-Frequency Spectrogram for FMCW Radar	1
<i>Oktanto Dedi Winarko (Labs247); Andrian Andaya Lestari (Labs247, Indonesia)</i>	1
Performance Consideration in Signal Acquisition for High Dynamic Application in Tropical Environment	7
<i>Syed Mohd Fairuz Syed Mohd Dardin and Akram Abdul Azid (Universiti Pertahanan Nasional Malaysia, Malaysia); Zuhairi Abdul Rashid (Universiti Pertahanan Nasional Malaysia ; Engineering Faculty, Malaysia); Asnor Mazuan Ishak and Ahmad Shukri Abu Hasim (Universiti Pertahanan Nasional Malaysia, Malaysia)</i>	7
Benchmarking Low Latency Kernel and Xenomai for a Network Gateway Encryption Application	13
<i>Mastura Diana Marieska (Sriwijaya University, Indonesia); Achmad Imam Kistijantoro (Bandung Institute of Technology, Indonesia)</i>	13
Dual Circular-Polarized Slot Antenna Design for Wireless MIMO System at 2.4 GHz	19
<i>Nornikman Hassan and Badrul Hisham Ahmad (Universiti Teknikal Malaysia Melaka, Malaysia); Mohamad Zoinol Abidin Bin Abd Aziz (Universiti Teknikal Malaysia Melaka ; Hang Tuah Jaya, Malaysia); Mohd Riduan Ahmad, Zahriladha Zakaria and Chew Siang (Universiti Teknikal Malaysia Melaka, Malaysia); Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia)</i>	19
Application of WSNs for Detection Land and Forest Fire in Riau Province Indonesia	25
<i>Evizal Abdul Kadir, Sri Listia Rosa and Ana Yulianti (Universitas Islam Riau, Indonesia)</i>	25
Optimization of Coffee Bean Drying Using Hybrid Solar Systems and Wi-Fi Data Communication	29
<i>Devita Ayu Larasati and Ike Fibiriani (University of Jember, Indonesia); Dedy Wahyu Herdiyanto and Guido Kalandro (Universitas Jember, Indonesia); Widyono Hadi and Catur Suko Sarwono (University of Jember, Indonesia)</i>	29
Fabrication of Integrated Power Divider and Filter for X Band Radar Applications	33
<i>Folin Oktafiani (Indonesian Institute of Sciences (LIPI), Indonesia); Yuyu Wahyu (Indonesia Institute of Science LIPI, Indonesia); Yussi Saputera (Indonesian Institute of Sciences, Indonesia)</i>	33
Object Position Estimation Using Naive Bayes Classifier Algorithm	39
<i>Reza Firsandaya Malik (University of Sriwijaya ; Faculty of Computer Science, Indonesia); Eko Pratama, Huda Ubaya and Rido Zulfahmi (Universitas Sriwijaya, Indonesia); Deris Stiawan (University of Sriwijaya, Indonesia); Kemahyanto Exaudi (Universitas Sriwijaya, Indonesia)</i>	39
Optimal Route Driving for Leader-Follower Using Dynamic Particle Swarm Optimization	45
<i>Bambang Tutuko (Sriwijaya University, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Putri Sahayu (Intelligent System Research Group, Universitas Sriwijaya, Indonesia)</i>	45

Electronic Transaction Device Based on Contact Smart Card Using Programmable System-on-Chip	51
<i>Trio Adiono (Institut Teknologi Bandung, Indonesia); Reynhart Malingkas and Adi Candra Swastika (Bandung Institute of Technology, Indonesia); Syifaul Fuada (Institut Teknologi Bandung, Indonesia)</i>	
	51
Visual Servoing Design and Control for Agriculture Robot; a Review	57
<i>Tresna Dewi (Politeknik Negeri Sriwijaya, Indonesia); Pola Risma (Sriwijaya Polytechnic, Indonesia); Yurni Oktarina (Polytechnic Sriwijaya Palembang-Indonesia, Indonesia); Selamat Muslimin (State Polytechnic of Sriwijaya, Indonesia)</i>	
	57
Design and Implementation of Analog Transceiver Circuit for Patient Monitoring System Based on OWC	63
<i>Trio Adiono and Radhian Fereh Armansyah (Institut Teknologi Bandung, Indonesia); Amy Hamidah Salman (Institut Teknologi Bandung, Korea); Syifaul Fuada (Institut Teknologi Bandung, Indonesia)</i>	
	63
Multistage Scanning Method on 64-Channels ECVT Sensor	69
<i>Arbai Yusuf (Universitas Indonesia ; C-Tech Labs Edwar Technology, Indonesia); Agus Santoso Tamsir, Dodi Sudiana and Harry Sudibyo (Universitas Indonesia, Indonesia)</i>	
	69
Enhancement of the Fuzzy Control Response with Particle Swarm Optimization in Mobile Robot System	73
<i>Siti Nurmaini (University of Sriwijaya, Indonesia); Febrina Setianingsih (Universitas Sriwijaya, Indonesia)</i>	
	73
A Comparison of Back Propagation Neural Network and Elman Recurrent Neural Network Algorithms on Altitude Control of Heavy-lift Hexacopter Based on Direct Inverse Control	79
<i>Bhakti Yudho Suprpto (University of Sriwijaya, Indonesia); Benyamin Kusumoputro (Universitas Indonesia, Indonesia)</i>	
	79
Multisensors System for Real Time Detection of Length, Weight, and Heartbeat of Premature Baby in the Incubator	85
<i>Sri Purwiyanti (Unila, Indonesia); Sri Ratna Sulistiyanti and Arinto Setyawan (University of Lampung, Indonesia); Helmy Fitriawan, Billy Wibisono and Ketut Atmaja (Lampung University, Indonesia)</i>	
	85
Using Pressure Sensors Towards Pipeline Leakage Detection	89
<i>Kemahyanto Exaudi, Rossi Passarella, Rendyansyah Rendyansyah and Rido Zulfahmi (Universitas Sriwijaya, Indonesia)</i>	
	89
Different Types of Fuzzy Logic in Obstacles Avoidance of Mobile Robot	93
<i>Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Andry Meylani (Politeknik Negeri Sriwijaya, Indonesia); Ciksadan Dansadan (State of Polytechnic Sriwijaya, Indonesia); Nyayu Latifah Husni (Politeknik Negeri Sriwijaya, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Irsyadi Yani (Universitas Sriwijaya, Indonesia); Carlos Sitompul (Politeknik Negeri Sriwijaya, Indonesia)</i>	
	93
Development of Computational Intelligence-based Control System Using Backpropagation Neural Network for Wheeled Robot	101

<i>Karlisa Priandana, Iqbal Abiyoga, Wulandari Wulandari, Sri Wahjuni, Medria Hardhienata and Agus Buono (Bogor Agricultural University, Indonesia)</i>	101
Optimal Kernel Classifier in Mobile Robots for Determining Gases Type	107
<i>Nyayu Latifah Husni and Muhammad Muhaajir (Politeknik Negeri Sriwijaya, Indonesia); Ekawati Prihatini (State Polytechnic of Sriwijaya, Indonesia); Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Irsyadi Yani (Universitas Sriwijaya, Indonesia)</i>	107
Optimal Gas Sensors Arrangement in Odor Searching Robot	111
<i>Nyayu Latifah Husni (Politeknik Negeri Sriwijaya, Indonesia); Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Irsyadi Yani (Universitas Sriwijaya, Indonesia)</i>	111
Smart Parking Using Wireless Sensor Network System	117
<i>Anggi Sahfutri (State Polytechnic of Sriwijaya, Indonesia); Nyayu Latifah Husni (Politeknik Negeri Sriwijaya, Indonesia); Muhammad Nawawi, Iskandar Lutfi and Evelina Ginting (State Polytechnic of Sriwijaya, Indonesia); Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Ekawati Prihatini (State Polytechnic of Sriwijaya, Indonesia)</i>	117
Safety Communicational System Using Shifting Cryptography in Smart Parking	123
<i>Wulan Dari (State Polytechnic of Sriwijaya, Indonesia); Nyayu Latifah Husni (Politeknik Negeri Sriwijaya, Indonesia); Evelina Ginting, Iskandar Lutfi and Muhammad Nawawi (State Polytechnic of Sriwijaya, Indonesia); Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Dewi Permata Sari (State Polytechnic of Sriwijaya, Indonesia); Adella Rialita (Politeknik Negeri Sriwijaya, Indonesia)</i>	123
Analyzing of Different Features Using Haar Cascade Classifier	129
<i>Ratna Yustiwati (State Polytechnic Of Sriwijaya, Indonesia); Nyayu Latifah Husni (Politeknik Negeri Sriwijaya, Indonesia); Evelina Ginting (State Polytechnic of Sriwijaya, Indonesia); Sabilal Rasyad (State Polytechnic Of Sriwijaya, Indonesia); Iskandar Lutfi (State Polytechnic of Sriwijaya, Indonesia); Ade Handayani, ASH (Politeknik Negeri Sriwijaya ; Engineering Electrical, Indonesia); Niksen Alfarizal (State Polytechnic Of Sriwijaya, Indonesia); Adella Rialita (Politeknik Negeri Sriwijaya, Indonesia)</i>	129
Power Consumption Optimization in Cooling System Using Knowledge Base Temperature System	135
<i>Andi Adriansyah, Akhmad Wahyu Dani and Krisna Brotoatmodjo (Universitas Mercu Buana, Indonesia)</i>	135
A Secure Voice Channel Using Chaotic Cryptography Algorithm	141
<i>Munawar A Riyadi, M Reza Khafid, Natanael Pandapotan and Teguh Prakoso (Diponegoro University, Indonesia)</i>	141
Image Steganography Using Combine of Discrete Wavelet Transform and Singular Value Decomposition for More Robustness and Higher Peak Signal Noise Ratio	147
<i>Adam Nevriyanto and Erwin E (Universitas Sriwijaya, Indonesia); Sutarno Sutarno (University of Sriwijaya, Indonesia); Sri Desy Siswanti (Universitas Sriwijaya, Indonesia)</i>	147

Game Complexity Factor: A Collaborative Study of LeBlanc Taxonomy and Function Points Method	153
<i>Renny Sari Dewi (Universitas Internasional Semen Indonesia, Indonesia); Sholiq Sholiq and Apol Pribadi Subriadi (Institut Teknologi Sepuluh Nopember, Indonesia)</i>	
	153
Removal of Modulo as Hashing Modification Process in Essay Scoring System Using Rabin-Karp	159
<i>Errissya Rasywir (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia); Yovi Pratama (Stikom Dinamika Bangsa, Indonesia); Hendrawan Hendrawan and Marrylinteri Istoningtyas (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia)</i>	
	159
Real Time Detection on Face Side Image with Ear Biometric Imaging Using Integral Image and Haar-Like Feature	165
<i>Fachruddin Fachruddin (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia); Yovi Pratama (Stikom Dinamika Bangsa, Indonesia); Errissya Rasywir, Desi Kisbianty, Hendrawan Hendrawan and Maria Borroek (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia)</i>	
	165
Automatic Cost Estimation Analysis on Datawarehouse Project with Modified Analogy Based Method	171
<i>Yovi Pratama (Stikom Dinamika Bangsa, Indonesia); Errissya Rasywir (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia)</i>	
	171
Analysis on Knowledge Layer Application for Knowledge Based System	177
<i>Maria Borroek and Errissya Rasywir (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia); Yovi Pratama (Stikom Dinamika Bangsa, Indonesia); Fachruddin Fachruddin and Marrylinteri Istoningtyas (Sekolah Tinggi Ilmu Komputer Dinamika Bangsa Jambi, Indonesia)</i>	
	177
Fast Fourier Transform (FFT) Data Sampling Using Hamming and Blackman Method for Radar	183
<i>Sulis Tyaningsih (Indonesian Institute of Science (LIPI), Indonesia); Prasetyo Putranto, Winy Desvasari and Pamungkas Daud (Indonesian Institute of Sciences, Indonesia)</i>	
	183
Radar Software Development for the Surveillance of Indonesian Aerospace Sovereignty	189
<i>Yussi Saputera (Indonesian Institute of Sciences, Indonesia); Sulis Tyaningsih (Indonesian Institute of Science (LIPI), Indonesia); Topik Teguh Estu (PPET LIPI, Indonesia); Mashury Wahab (PPET-LIPI, Indonesia)</i>	
	189
Quality Assessment Level of Quality of Cocoa Beans Export Quality Using Hybrid Adaptive Neuro - Fuzzy Inference System (ANFIS) and Genetic Algorithm	195
<i>Gayatri Dwi Santika, Diah Ayu Wulandari, DARW and Fitriyana Dewi (Jember University, Indonesia)</i>	
	195
Automated Examination Timetabling Optimization Using Greedy-Late Acceptance-Hyperheuristic Algorithm	201
<i>Ahmad Muklason, Putri C Bwananesia and Sasmi Hidayatul Y T (Institut Teknologi Sepuluh Nopember, Indonesia); Nisa Angresti (Sepuluh Nopember Institute of Technology, Indonesia); Vicha Azthanty Supoyo (Institut Teknologi Sepuluh Nopember, Indonesia)</i>	
	201

Artificial Neural Network for Health Data Forecasting, Case Study: Number of Dengue Hemorrhagic Fever Cases in Malang Regency, Indonesia	207
<i>Wiwik Anggraeni, Graha Pramudita and Edwin Riksakomara (Institut Teknologi Sepuluh Nopember, Indonesia); Radityo Prasetyanto Wibowo (Institut Teknologi Sepuluh Nopember, Indonesia); Febriliyan Samopa (Institut Teknologi Sepuluh Nopember, Indonesia); Puji Adi (Ministry of Health, Indonesia); Renny Sari Dewi (Universitas Internasional Semen Indonesia, Indonesia)</i>	
	207
Using Metadata in Detection Spam Email with Pornography Content	213
<i>Dewi Wardani (Universitas Sebelas Maret, Indonesia); Retisa Siwi (Badan Pemeriksa Keuangan, Indonesia); Bambang Harjito (Sebelas Maret University, Indonesia); Maysa Marshallia (Universitas Sebelas Maret, Indonesia)</i>	
	213
Automatic Features Extraction Using Autoencoder in Intrusion Detection System	219
<i>Yesi Novaria Kunang (Universitas Sriwijaya, Indonesia); Siti Nurmaini and Deris Stiawan (University of Sriwijaya, Indonesia); Ahmad Zarkasi and Firdaus Firdaus (Universitas Sriwijaya, Indonesia); Jasmir Jasmir (STIKOM Dinamika Bangsa Jambi, Indonesia)</i>	
	219
Emotional Design on User Experience-based Development System	225
<i>Andhika Giri Persada (Universitas Islam Indonesia, Indonesia)</i>	
	225
Review of Automatic Emotion Recognition Through Facial Expression Analysis	231
<i>Dewi Yanti Liliana (Universitas Indonesia ; State Polytechnic of Jakarta, Indonesia); Chan Basaruddin (Universitas Indonesia, Indonesia)</i>	
	231
Breast Cancer Classification Using Deep Learning	237
<i>Jasmir Jasmir (STIKOM Dinamika Bangsa Jambi, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Reza Firsandaya Malik (University of Sriwijaya ; Faculty of Computer Science, Indonesia); Dodo Abidin (STIKOM Dinamika Bangsa Jambi, Indonesia); Ahmad Zarkasi, Yesi Novaria Kunang and Firdaus Firdaus (Universitas Sriwijaya, Indonesia)</i>	
	237
Techno-Economic Analysis of Sea Floating PV/Diesel Hybrid Power Plant with Battery Arrangement Scheme for Residential Load at Remote Area in Indonesia (Case Study: Small Kei Island, South East Moluccas)	243
<i>Achmad Tofani and Iwa Garniwa (University of Indonesia, Indonesia); Fidel Rezki Fajry (Universitas Indonesia, Indonesia)</i>	
	243
A 250 kW Three Phase Induction Motor Design for Electric Bow Thruster	247
<i>Asep Andi Suryandi (BPPT ; ITB, Indonesia); Cuk Supriyadi Ali Nandar (Agency for the Assessment and Application of Technology, Indonesia); Dewi Rianti Mandasari and Katri Yulianto (BPPT, Indonesia)</i>	
	247
Comparative Analysis of Applications Off-Grid PV System and On-Grid PV System for Households in Indonesia	253
<i>Aryulius Jasuan (University of Sriwijaya, Indonesia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Hazairin Samaulah (Universitas Tridianti Palembang, Indonesia)</i>	
	253
Techniques for Analysis of Chaotic Pulse Trains Generated by Lightning: A Review	259

<i>Chin-Leong Wooi (Universiti Malaysia Perlis, Malaysia); Zulkurnain Abdul-Malek (UTM, Malaysia); M. N. K. H. Rohani (University Malaysia Perlis ; UNIMAP, Malaysia); Syahrudin Nizam Md Arshad Hashim (Universiti Malaysia Perlis, Malaysia); Ahmad Muhiddin Bin Yusof (Faculty of Engineering Technology, Universiti Malaysia Perlis (Unimap), Malaysia)</i>	259
Comparative Study; Different Types of PWM Control Scheme in Three-Phase Four-Wire Shunt Active Power Filter (APF) Topology	265
<i>Ahmad Shukri Abu Hasim (Universiti Pertahanan Nasional Malaysia, Malaysia); Zulkiflie Bin Ibrahim (Universiti Teknikal Malaysia Melaka, Malaysia); Syed Mohd Fairuz Syed Mohd Dardin, Akram Abdul Aziz and Asnor Mazuan Ishak (Universiti Pertahanan Nasional Malaysia, Malaysia)</i>	265
An Improved Circuit-Based Grounding Electrode Considering Frequency Dependence of Soil Parameters	271
<i>Ruqayyah Othman (Universiti Teknologi Malaysia ; Faculty of Electrical Engineering, Malaysia); Zulkurnain Abdul-Malek (University Technology Malaysia, Malaysia)</i>	271
Selection of Single-tuned Filter and High Pass Damped Filter with Changes of Inverter Type to Reduce Harmonics on Microgrid AC-DC	275
<i>Rudy Setiabudy (Universitas Indonesia (UI), Indonesia); Guru Wibowo (Universitas Indonesia, Indonesia); Herlina Wahab (Sriwijaya University ; University of Indonesia, Indonesia)</i>	275
Distance Effect on Lightning Electromagnetic Pulse over Lossy Ground	281
<i>Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Mohammed Imran Mousa and Zulkurnain Abdul-Malek (University Technology Malaysia, Malaysia); Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia)</i>	281
Power Generation from Wave Energy Using Floating Device	287
<i>Asnor Mazuan Ishak, Ahmad Shukri Abu Hasim, Syed Mohd Fairuz Syed Mohd Dardin and Akram Abdul Aziz (Universiti Pertahanan Nasional Malaysia, Malaysia)</i>	287
Electricity Demand Forecasting of Household Sector in Papua Province 2050	291
<i>Yosef Lefaan and Rinaldy Dalimi (Universitas Indonesia, Indonesia)</i>	291
Wavelet Analysis of the Onset of VHF and Microwave Radiation Emitted by Lightning	297
<i>Shamsul Ammar Shamsul Baharin, Mohd Riduan Ahmad, Dinesh Periannan, Muhammad Haziq Mohammad Sabri and Seah Boon York (Universiti Teknikal Malaysia Melaka, Malaysia); Mohamad Zoinol Abidin Bin Abd Aziz (Universiti Teknikal Malaysia Melaka ; Hang Tuah Jaya, Malaysia); Mohd Muzafar Ismail (University Tecnical Malaysia Melaka, Malaysia); Mona Riza Mohd Esa and Sulaiman Ali Mohammad (Universiti Teknologi Malaysia, Malaysia); Zulkurnain Abdul-Malek (UTM, Malaysia); Norbayah Yusop (Utem, Malaysia); Vernon Cooray (Uppsala University, Sweden); Gaopeng Lu (Chinese Academy of Sciences ; Institute of Atmospheric Physics, P.R. China)</i>	297
VHF Emissions Prior to the Onset of Initial Electric Field Changes of Intracloud Flashes	301
<i>Muhammad Haziq Mohammad Sabri, Mohd Riduan Ahmad, Dinesh Periannan and Seah Boon York (Universiti Teknikal Malaysia Melaka, Malaysia); Mohamad Zoinol Abidin Bin Abd Aziz (Universiti Teknikal Malaysia Melaka ; Hang Tuah Jaya, Malaysia); Mohd Muzafar Ismail (University Tecnical Malaysia Melaka,</i>	

<i>Malaysia); Mona Riza Mohd Esa and Sulaiman Ali Mohammad (Universiti Teknologi Malaysia, Malaysia); Zulkurnain Abdul-Malek (UTM, Malaysia); Norbayah Yusop (Utem, Malaysia); Vernon Cooray (Uppsala University, Sweden); Gaopeng Lu (Chinese Academy of Sciences ; Institute of Atmospheric Physics, P.R. China)</i>	301
Performance Analysis of Stacked Capacitive Antenna for Lightning Remote Sensing	305
<i>Jin Ying Ong and Mohd Riduan Ahmad (Universiti Teknikal Malaysia Melaka, Malaysia); Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia); Muhammad Haziq Mohammad Sabri, Dinesh Periannan and Seah Boon York (Universiti Teknikal Malaysia Melaka, Malaysia); Sulaiman Ali Mohammad (Universiti Teknologi Malaysia, Malaysia); Gaopeng Lu (Chinese Academy of Sciences ; Institute of Atmospheric Physics, P.R. China); Norbayah Yusop (Utem, Malaysia); Mohd Muzafar Ismail (University Tecnical Malaysia Melaka, Malaysia); Vernon Cooray (Uppsala University, Sweden); Mohamad Zoinol Abidin Bin Abd Aziz (Universiti Teknikal Malaysia Melaka ; Hang Tuah Jaya, Malaysia); Zulkurnain Abdul-Malek (UTM, Malaysia)</i>	305
Shaft Mechanical Design of 250 kW Electric Motor	309
<i>Budi Fadjrin and Harry Purnama (BPPT, Indonesia); Muhammad Adhynugraha (The Agency for the Assessment and Application of Technology, Indonesia); Cuk Supriyadi Ali Nandar (Agency for the Assessment and Application of Technology, Indonesia)</i>	309
Development and Validation of Rogowski Coil with Commercial High Frequency Current Transformer for Partial Discharge Detection	315
<i>Chaganti Lakshmana Geetha Pavan Kumar, Nur Hazirah Abdul Khalid and Mohd Hafizi Ahmad (Universiti Teknologi Malaysia, Malaysia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Eka Waldi (Andalas University, Indonesia); Aulia Aulia (Universitas Andalas, Indonesia); Rizda Kurnia (University of Sriwijaya, Indonesia)</i>	315
The Effect of Surface Mounted Device (SMD) Configuration Array on Light Distribution on LED Lamp	321
<i>Herlina Wahab (Sriwijaya University ; University of Indonesia, Indonesia); Rudy Setiabudy (Universitas Indonesia (UI), Indonesia); Muhammad Rully Syahputra (Universitas Indonesia, Indonesia)</i>	321
Power Transistor 2N3055 as a Solar Cell Device	327
<i>Yohandri Bow, Tresna Dewi, Ahmad Taqwa, Rusdianasari Rusdianasari and Zulkarnain Zulkarnain (Politeknik Negeri Sriwijaya, Indonesia)</i>	327
Face Movement Detection Using Template Matching	333
<i>Ahmad Zarkasi (Universitas Sriwijaya, Indonesia); Siti Nurmaini and Deris Stiawan (University of Sriwijaya, Indonesia); Firdaus Firdaus and Huda Ubaya (Universitas Sriwijaya, Indonesia); Yogie Sanjaya (Institut Teknologi Bandung, Indonesia); Yesi Novaria Kunang (Universitas Sriwijaya, Indonesia)</i>	333
Measurement of Component Performance (Sensor) on Internet of Thing (IoT)	339
<i>Sharipuddin Sharipuddin and Kurniabudi Kurniabudi (STIKOM Dinamika Bangsa, Indonesia); Benni Purnama (STIKOM Dinamika Bangsa Jambi ; STIKOM Dinamika Bangsa Jambi, Indonesia); Deris Stiawan (University of Sriwijaya, Indonesia); Darmawijoyo Hanapi (Sriwijaya University, Indonesia); Rahmat Budiarto (Al Baha University, Saudi Arabia); Dimas Wahyudi, Fepiliana Fepiliana and Sri Suryani (Universitas Sriwijaya, Indonesia)</i>	339

Preprocessing and Framework for Unsupervised Anomaly Detection in IoT: Work on Progress	345
<i>Kurniabudi Kurniabudi (STIKOM Dinamika Bangsa, Indonesia); Benni Purnama (STIKOM Dinamika Bangsa Jambi ; STIKOM Dinamika Bangsa Jambi, Indonesia); Sharipuddin Sharipuddin (STIKOM Dinamika Bangsa, Indonesia); Deris Stiawan (University of Sriwijaya, Indonesia); Darmawijoyo Hanapi (Sriwijaya University, Indonesia); Rahmat Budiarto (Al Baha University, Saudi Arabia)</i>	
Monitoring Connectivity of Internet of Things Device on Zigbee Protocol	351
<i>Benni Purnama (STIKOM Dinamika Bangsa Jambi ; STIKOM Dinamika Bangsa Jambi, Indonesia); Sharipuddin Sharipuddin and Kurniabudi Kurniabudi (STIKOM Dinamika Bangsa, Indonesia); Deris Stiawan (University of Sriwijaya, Indonesia); Darmawijoyo Hanapi (Sriwijaya University, Indonesia); Rahmat Budiarto (Al Baha University, Saudi Arabia)</i>	
An Analysis of Points System of Hotel Loyalty Program Based on the Return on Investment	357
<i>Long Zuo and Hiroyuki Iida (Japan Advanced Institute of Science and Technology, Japan); Shuo Xiong (Huazhong University of Science and Technology, P.R. China)</i>	
MSME Recommendation Application Using Collaborative Filtering Method and Realtime Database (Case Study: Salatiga City)	361
<i>Radius Tanone and Yoga Adi Dharma (Satya Wacana Christian University, Indonesia)</i>	
Function Points Method in Game Casual Context	367
<i>Renny Sari Dewi and Trias Andari (Universitas Internasional Semen Indonesia, Indonesia); Apol Pribadi Subriadi and Sholiq Sholiq (Institut Teknologi Sepuluh Nopember, Indonesia)</i>	
Analysis of Counter-Strike: Global Offensive	373
<i>Muhammad Nazhif Rizani and Hiroyuki Iida (Japan Advanced Institute of Science and Technology, Japan)</i>	
An Integrated Child Safety Using Geo-fencing Information on Mobile Devices	379
<i>Dinda Lestarini (Sriwijaya University, Indonesia); Sarifah Putri Raflesia (Universitas Sriwijaya ; Institut Teknologi Bandung, Indonesia); Firdaus Firdaus (Universitas Sriwijaya, Indonesia)</i>	
Web Scraping Techniques to Collect Weather Data in South Sumatera	385
<i>Fatmasari Asmuni (Universitas Binadarma, Indonesia); Yesi Novaria Kunang (Universitas Sriwijaya, Indonesia); Susan Purnamasari (Universitas Bina Darma, Indonesia)</i>	
Modified Logistic Maps for Discrete Time Chaos Based Random Number Generator	391
<i>Magfirawaty Magfirawaty (Universitas Indonesia, Indonesia); Andriani Adi Lestari (Sekolah Tinggi Sandi Negara, Indonesia); Suryadi Suryadi and Kalamullah Ramli (Universitas Indonesia, Indonesia)</i>	
Conceptual Modeling for Intelligent Knowledge-Based System in Agriculture: Case Study of Indonesia	397
<i>Sarifah Putri Raflesia (Universitas Sriwijaya ; Institut Teknologi Bandung, Indonesia); Dinda Lestarini (Sriwijaya University, Indonesia); Firdaus Firdaus (Universitas Sriwijaya, Indonesia); Siti Nurmaini (University of Sriwijaya, Indonesia); Anugrah Pamosoaji (Universitas Atma Jaya Yogyakarta, Indonesia)</i>	

Measuring Customer Satisfaction Using CRM Scorecard in Canteen FASILKOM UNSRI	403
<i>Ali Ibrahim (Sriwijaya University, Indonesia); Aris Pratiwi, Devi Indra Meytri, Madri Madri, Muhammad Aziz Kurniawan and Nadia Yuniarti (Universitas Sriwijaya, Indonesia)</i>	
	403
Identification of the Reproductive Apparatus of Tarantula Genus Brachypelma Using Linear Discriminant Analysis Method	409
<i>Apriandy Angdresey and Meylan Wongkar (De La Salle Catholic University, Indonesia)</i>	
	409
Acoustic Partial Discharge Detection Using Low-cost Pre-amplified Piezoelectric Transducer and Coated Optical Fiber Sensor	415
<i>Chaganti Lakshmana Geetha Pavan Kumar, Izzul Hilmi Arizu and Mohd Hafizi Ahmad (Universiti Teknologi Malaysia, Malaysia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Rizda Kurnia (University of Sriwijaya, Indonesia); Muhammad Yusof Mohd Noor (Universiti Teknologi Malaysia, Malaysia); Asrul Izam Azmi (Universiti Teknologi Malaysia ; The University of New South Wales, Malaysia); Eka Waldi (Andalas University, Indonesia); Aulia Aulia (Universitas Andalas, Indonesia)</i>	
	415
Comparison Double Dielectric Barrier Using Perforated Aluminium for Ozone Generation	419
<i>Syarifa Fitria and Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Dwirina Yuniarti (Universitas Sriwijaya, Indonesia); Rizda Kurnia (University of Sriwijaya, Indonesia); Zolkafle Buntat (Universiti Teknologi Malaysia, Malaysia)</i>	
	419
Evaluation of the Existence of Initial Breakdown Process for Cloud-to-Ground Flashes	425
<i>Mohd Riduan Ahmad (Universiti Teknikal Malaysia Melaka, Malaysia); Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Muhammad Zikri (Universitas Sriwijaya, Indonesia); Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia); Muhammad Haziq Mohammad Sabri and Dinesh Periannan (Universiti Teknikal Malaysia Melaka, Malaysia); Gaopeng Lu (Chinese Academy of Sciences ; Institute of Atmospheric Physics, P.R. China); Zhang Hongbo (Institute of Atmospheric Physics, Chinese Academy of Sciences, P.R. China)</i>	
	425
Enhancement of Cogging Torque Reduction on Inset Permanent Magnet Generator by Using Magnet Edge Shaping Method	429
<i>Tajuddin Nur (Atma Jaya Catholic University, Indonesia); Herlina Wahab (Sriwijaya University ; University of Indonesia, Indonesia)</i>	
	429
Variation of Pattern and Cavity Diameter of Aluminium Perforated with Single Glass Dielectric Barrier for Ozone Generation	435
<i>Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Akhbar Wista Arum and Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Rizda Kurnia (University of Sriwijaya, Indonesia); Zolkafle Buntat (Universiti Teknologi Malaysia, Malaysia); Syarifa Fitria (Universitas Sriwijaya, Indonesia)</i>	
	435
Effects of Cold Plasma Treatment on the Growth Rate of Corn and Eggplant	441

Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Zolkafle Buntat (Universiti Teknologi Malaysia, Malaysia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Yahya Buntat and Fatin Musa (Universiti Teknologi Malaysia, Malaysia) 441

Non-thermal Plasma for Removal of NO_x from Diesel Engine Vehicle: A Simulation Study 447

Muhammad Abu Bakar Sidik (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Indonesia); Zolkafle Buntat (Universiti Teknologi Malaysia, Malaysia); Zainuddin Nawawi (Universitas Sriwijaya, Indonesia); Muhammad Irfan Jambak (Faculty of Engineering, Universitas Sriwijaya Ogan Ilir, Malaysia); Hafezaidi Mat Saman and Fatin Musa (Universiti Teknologi Malaysia, Malaysia) 447

Design of a Solar Micro Power Plant for Home Lighting 453

Julie Rante, Lianly Rompis and Alexander Patras (Universitas Katolik De La Salle Manado, Indonesia) 453

The Performance Evaluation of Capacitive Antenna with Various Structures and Permittivity Values 454

Seah Boon York and Mohd Riduan Ahmad (Universiti Teknikal Malaysia Melaka, Malaysia); Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia); Dinesh Periannan and Muhammad Haziq Mohammad Sabri (Universiti Teknikal Malaysia Melaka, Malaysia); Sulaiman Ali Mohammad (Universiti Teknologi Malaysia, Malaysia); Gaopeng Lu (Chinese Academy of Sciences ; Institute of Atmospheric Physics, P.R. China); Mohamad Zoinol Abidin Bin Abd Aziz (Universiti Teknikal Malaysia Melaka ; Hang Tuah Jaya, Malaysia); Norbayah Yusop (Utem, Malaysia); Mohd Muzafar Ismail (University Tecnical Malaysia Melaka, Malaysia); Vernon Cooray (Uppsala University, Sweden); Zulkurnain Abdul-Malek (UTM, Malaysia); Noor Azwan Shairi (Universiti Teknikal Malaysia Melaka, Malaysia) 454

Power Transistor 2N3055 as a Solar Cell Device

Yohandri Bow
Chemical Engineering Department
Politeknik Negeri Sriwijaya
 Palembang, Indonesia
 yohandriBow@polsri.ac.id

Tresna Dewi, Ahmad Taqwa
Electrical Engineering Department
Politeknik Negeri Sriwijaya
 Palembang, Indonesia
 tresna_dewi@polsri.ac.id
 a_taqwa@yahoo.com

Rusdianasari, Zulkarnain
Chemical Engineering Department
Politeknik Negeri Sriwijaya
 Palembang, Indonesia
 rusdianasari@polsri.ac.id
 zulkarnain@polsri.ac.id

Abstract— The abundance power radiated by the sun can be converted into alternative electric energy. The proposed method in this paper is by utilizing the transistor waste type 2N3055. The transistor contains photocell that can convert energy radiated by the sun into electricity. The 2N3055 type of transistor composed by Aluminum (Al) 45.55%, Carbon (C) 32.40 %, Nb (Niobium) 13.42 %, Zr (Zirconium) 7.02 %, and O (Oxygen) 1,61 %, this data is provided by SEM-EDX analysis. The experiment was conducted at 10.00 AM, 12.00 PM and 02.00 PM. The experimental results show that the maximum energy is acquired at 12.00 PM since at 12.00 PM the position of the sun and the earth are at the smallest angle. The maximum power conversion is obtained when the sun is perpendicular to the earth position at 12.00 PM. The maximum power acquired is 3.55 watt during the radiation intensity of 51729 lux.

Keywords—solar cell, transistor, efficiency, intensity

I. INTRODUCTION

The decreasing availability of conventional fossil fuel has insisted researchers to find the energy alternative to substitute fossil fuel. Solar energy from the sun is one of the best alternatives for Indonesia, however, the installation of solar panels are still too expensive. The alternative material for solar cells can come from electronics waste, such as the 2N3055 transistor. This type of transistor can be found in many electronics wastes since a transistor is semiconductor device has a wide range of function such as gain, circuit breaker, switching, voltage stabilizer, signal modulation, etc [1,2].

In electronics application, transistor consumes electricity, however, in this research 2N3055 transistors are designed to produce energy by converting the sun ray's to be electricity. The 2N3055 transistors used doesn't have to be the new ones, they can be acquired from electronics waste, therefore, this research also aims to recycle the electronics waste that has become a problem too [3-5].

Researchers conducted research entitled "Research Prospect" and Application of Photovoltaics as Alternative Energy Sources in Indonesia". This research showed the simplest solar cells were made of two type of semiconductor, P and N. Semiconductor material is crucial in determining the efficiency of energy conversion, therefore, it is necessary to select the material with energy bandgap less than valance band energy. Arranging semiconductor material in tandem also helps in increasing the efficiency of energy conversion [6,7].

A research entitled "Making Solar Cell Using NPN Type 2N3055 Transistor to Produce 12 volt Voltage" was conducted.

The experiment was conducted in 3 days, from 10.00 AM – 01.00 PM with the highest energy intensity at 3rd days, 19261 lux. The highest output voltage produced was 14.16 volt, the highest current was 0.21 mA, and therefore, the maximum power was 2.9736 Watt [8-10].

II. EXPERIMENTAL

The solar panel is very important the conversion process from solar energy to electricity. The main factor is the size of the installed solar panels, and the numbers of transistor used. The working principle of this experiment is by exposing solar panel directly under the sun, connects the solar panel to control panel, and turns both panels on. The conversion process is automatically as the sunlight is absorbed by transistor photocell, then it is converted into electricity. The converted electricity is saved in an accumulator and experiment process was design by connecting the panels in series and parallel.

The materials and equipment used in this 2N3055 transistors electronics waste solar panels are below:

1. 2N3055 transistors as the main material for solar panel.
2. PCB as the medium to connect 2N3055 transistors.
3. Socket and jack to connect between solar modules.
4. Digital multimeter to measure the voltage and current.
5. Mini voltmeter to measure voltage in control panel
6. Ampere meter to measure current in the control panel.
7. 3 volt AC lamp, USB socket and switch as the load.
8. Cables as connectors.
9. Transformator to step up and down voltage.
10. Inverter to convert DC current to AC.
11. 12 volt battery to accumulate the electricity produced by the solar panel.
12. Thermo-couple as temperature sensor at solar panel.

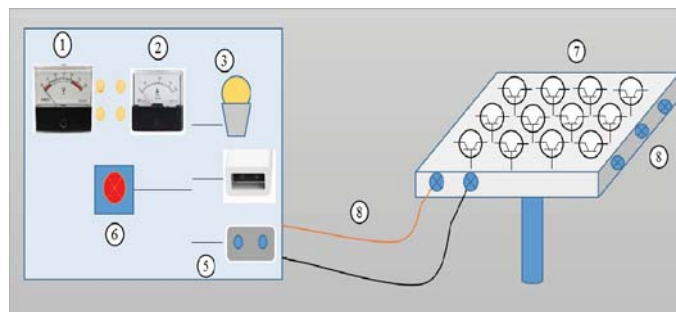


Figure 1. 2N3055 transistors solar panel design

Note:

1. Volt meter DC
2. Ampere meter Dc
3. DC 12 Volt lamp
4. USB
5. 6 – 12 Volt DC Motor
6. Transformator
7. 2N3055 transistors
8. Cables



Figure 2. The 2N3055 Transistor based solar panel design

Experimental procedures of this research are listed below:

1. Expose solar panels directly under the sun.
2. Connect solar panel to control panel using connector cable.
3. Turn on both solar panel and control panel.
4. Expose the solar panel for 1 hour before measuring data.
5. Take the note of the output shown in current and voltage display.
6. When the experiment is finished, turn off both solar panel and control panel.
7. The data is measured every hour from 10.00 AM to 13.00 PM.
8. Analyse the optimum condition from the measured data

III. RESULTS AND DISCUSSION

A. 2N3055 Transistors Characteristic

The material in designing the solar panel is 2N3055 transistors composed of semiconductor and conductor functioning as the main material for solar cell. To find out the composition material of 2N3055 transistors, the SEM-EDX analysis was conducted.

The result of SEM-EDX is required to obtain the characteristic of solar panel material based on the forming structure on the surface of panel area, and information of the pores on the surface functioning as solar absorber is achieved.

Table 1 shows the result of SEM-EDX analysis of 2N3055 transistors.

Table 1. The result of SEM-EDX analysis of 2N3055 transistors

El	AN	Series	unn. C [wt. %]	norm. C [wt. %]	Atom. C [at. %]	Error (1 Sigma) [wt. %]
Al	13	K-series	46.55	45.55	35.87	2.16
C	6	K-series	33.10	32.40	57.30	6.07
Nb	41	L-series	13.71	13.42	3.07	0.61
Zr	40	L-series	7.18	7.02	1.64	0.37
O	8	K-series	1.64	1.61	2.13	0.62
Total:			102.18	100.00	100.00	

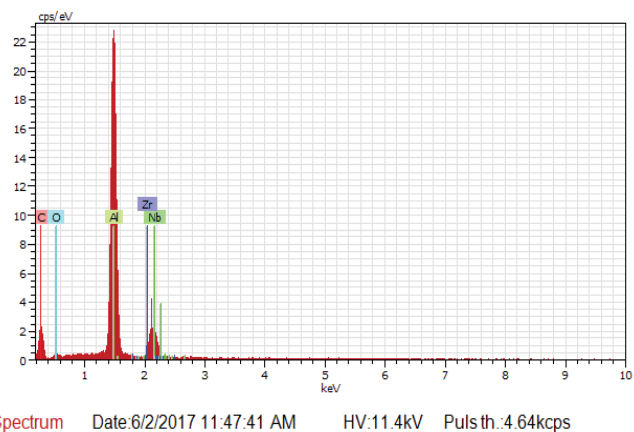
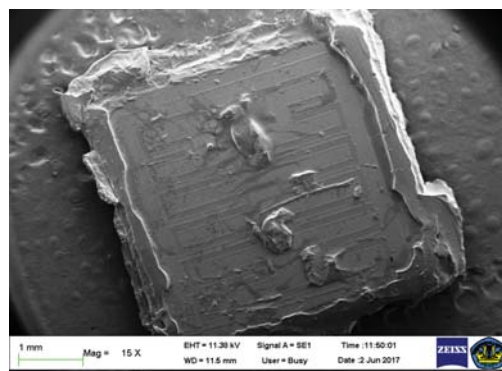
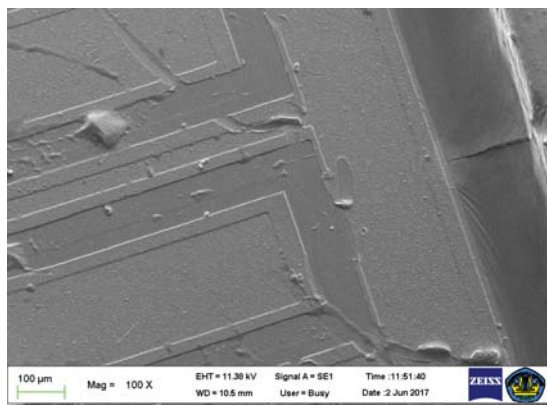


Figure 3. The SEM-EDX analysis result of 2N3055 transistors

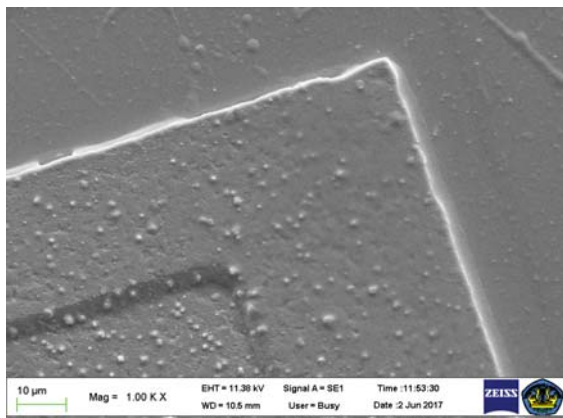
The analysis result shows the dominant elements of 2N3055 transistors are Al (Aluminum) with the percentage of 45.55 % as the conductor and C (Carbon) with the percentage of 32.40% as the semiconductor. In the periodic table, Al is in IIIA group, with the characteristic of very light, one-quarter of bronze, white-silver color, melting point at 657°C, and the boiling point at 1800°C. As the conductor, the purity of Al is up to 99.5% and other 0.5% consists of ferrous, silicon, bronze, and the remelted Al can contain zinc too. Al is the material having 237 W/m².K thermal conductivity and 0.78 W/m² thermal resistance at the average temperature of 30°C where thermal conductivity exhibits a heat-dissipating capability whereas electrically conductive conductivity conduct electricity at $3.8 \times 10^7 \Omega \cdot m$ and resistivity $2.75 \times 10^{-8} \Omega \cdot m$.



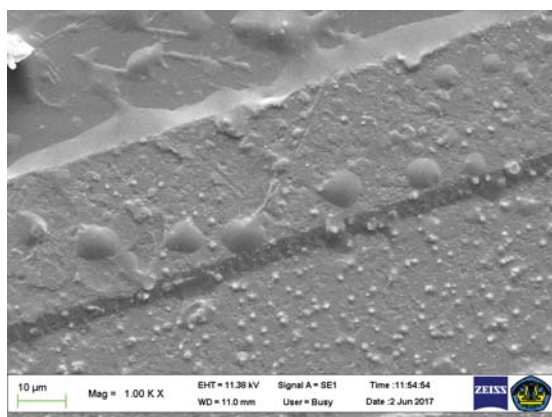
a



b



c



d

Figure 4. Photocell transistor topography with
 (a) Transistor *Photocell* 15× enlargement
 (b) Transistor *Photocell* 100 ×enlargement
 (c) Transistor *Photocell* 1,00K ×enlargement (WD 10,5 mm)
 (d) Transistor *Photocell* 1,00K ×enlargement (WD 11,0 mm)

Fig. 4 shows the SEM test results in the form of enlarged photocell surface. The enlargements were conducted 4 times, where at the last enlargement photo shows the uneven surface of the photocell. The uneven surface caused by the element of photocell which is not mixed completely.

B. Solar Panel efficiency analysis

The solar panel is the main component of the solar energy conversion system. The designed panel has the length of 53.5 cm, width 45.2, and cross-sectional area of 2418 cm² or 0.24m² wherein there are 8 PCB, and each PCB contains 12 transistors, therefore the total transistors used are 96 pieces. The transistor circuit used is the base-collector in the jumper (+) emitter output (-), the connection is selected since basically the base terminal in the transistor is prone to break and this circuit is able to produce higher current.

The estimation of temperature and humidity in June based on Climatology Station data is shown in Figure 5 [11].

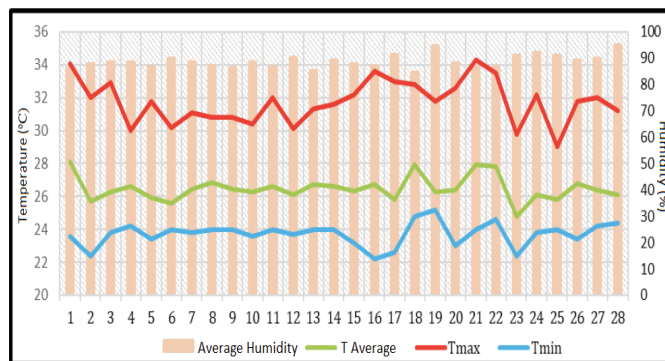


Figure 5. Temperature and humidity forecast

The solar panel was conducted on June 2-10, 2017, with local temperature forecast is 30-32 °C.

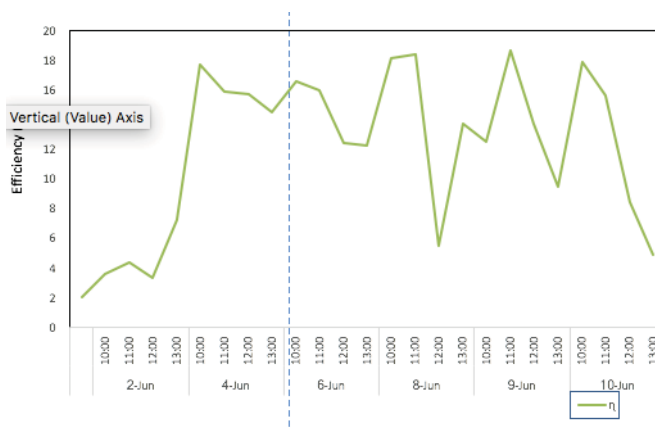


Figure 6. Solar panel efficiency fluctuation

The efficiency is obtained by defining the ratio of output power and input power, where the input power is the converted irradiance into the intensity of solar radiation.

$$P_{input} = I_r \times A \quad \dots(1)$$

$$P_{out} = V_{max} \times I_{max} \quad \dots(2)$$

Therefore the solar panel efficiency (η) is given by

$$\eta = \frac{P_{out}}{P_{in}} \times 100 \% \quad \dots(3)$$

The experiment was conducted from June 2 to 10, 2017. It can be seen in Fig. 5, the lowest efficiency is on June 2 at 12 PM, e.g. 2.4% and the highest on June 9 at 11 AM e.g. 18.6%. The fluctuation of solar cell panel efficiency is influenced by several factors, namely solar cell temperature, solar intensity, shading and electrical resistance. The electricity generated by the solar panel is not always stable due to the intensity of sunlight. The ideal time when the sun position is perpendicular to the earth, and the day is sunny without a cloud, the solar panel performance is maximized. However, in the morning or a cloudy day, the solar panel electricity production decreases.

C. The effect of Solar Panel Surface Temperature on Power

Solar panel temperature is one of the factors that affect the performance of solar cells panel. Ideally, solar panels work in standard temperature 25-35°C, however, in the real condition, solar panels are exposed to more than standard temperature. Indonesian temperature is around 25°C – 35°C that can cause the reduction of solar panel's electricity production or power for every temperature's increment.

Temperature effect to power production is shown in Fig. 6 where on 10.00-11.00 AM with temperature of 28°C - 29°C, the electricity production is 1.70 – 2.00 watt compare to 12.00 AM – 01.00 PM with temperature 30.3°C – 31°C, the electricity production is 1.50 – 1.58 watt.

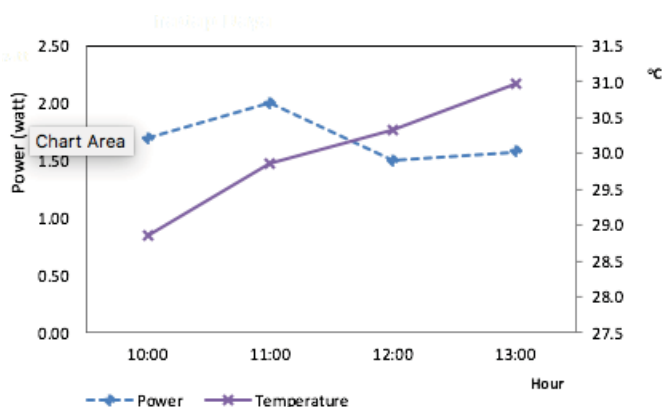


Figure 7. Solar panel surface temperature effect on electricity production

The effect of the surface temperature of the solar panel is very influential to the power produced, this shows that the surface of the transistor panel used gives a response that corresponds to the panel surface temperature range at 25°C - 35°C.

D. Effect of Sunlight Intensity of Electricity Production

The intensity of the sun or the intensity of solar radiation is the size of the angle of sunlight coming on the surface of the

earth. The amount received is directly proportional to the angular magnitude of the incident angle.

Efficiency and effectivity of this research is in the range of 3.33-18.60% and depending to solar radiance fluctuation. This result is still below the efficiency of commercial solar panel, 19.7% with output power of 330 watt for solar panel type HIT N330 produced by Panasonic [12].

The relationship of solar radiation intensity to the performance of solar cell or power produced is the greater the intensity of solar irradiance, the higher the power generated (proportional) as shown in fig. 8. The experiment results show that the intensity and the resulting power is directly proportional, except on June 2 where at an intensity of 22645 Lux or 33.16 W/m² the produced power is 0.4 watt due to the cloudy day condition. Fig. 8 also shows that that the highest intensity during the test that is on June 8 with the intensity of 39326 Lux or 57.58 W/m² produce 2 watts of power.

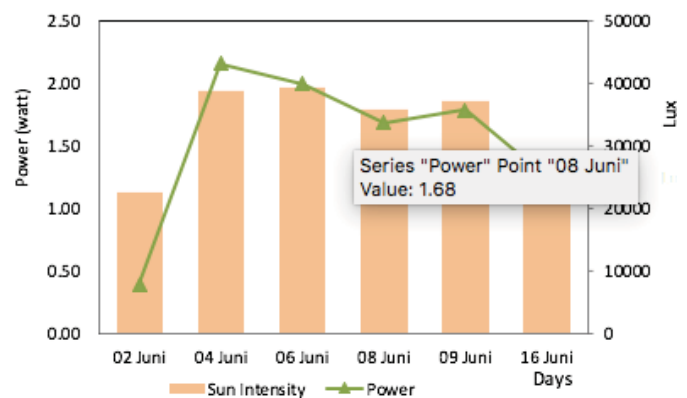


Figure 8. Effect of Sunlight Intensity of Electricity Production

E. Exposure time effect on Power Production

The electric power generated from the solar panel is influenced by the factors below:

- The distance of the sun, every change of the distance between the earth and the sun changes the incident recipient on earth.
- The intensity of sun radiation indicated by the angle of incident coming to the earth surface.
- Sun duration, the time from sunrise to sunset.
- Atmosphere effect, the sunlight comes through the atmosphere will be partially absorbed by gas, dust, and water vapor, reflected back, emitted and the rest forwarded to the earth's surface.

There are 3 types of solar radiation coming to the surface of the earth,

- Beam/Direct Radiation is the radiation that reaches the earth without changes in direction or radiation received by the earth in the parallel to the direction of the coming rays
- Diffuse Radiation, the radiation of the sun that comes to the surface of the earth after reflected or scattered by the atmosphere.

3. Global Radiation is the sum of direct radiation and diffuse radiation. However, the factors affecting global radiation are not limited only to direct and diffuse radiation.

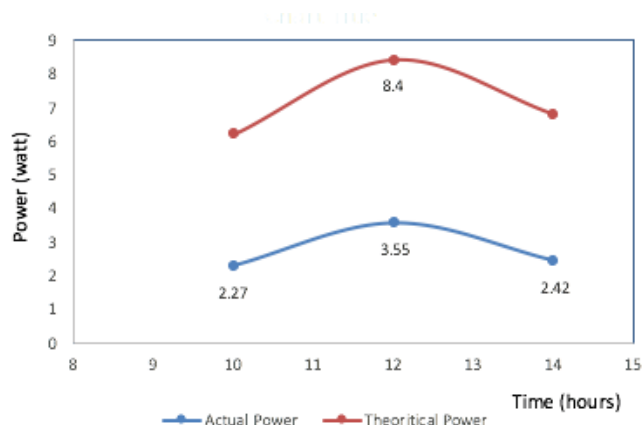


Figure 9. The affect of time exposure to the generated power

Fig. 9 shows that maximum power absorbed by solar cells are obtained at 12.00 PM due to the perpendicular position of the sun. If the angle between the sun ray and the earth are bigger, therefore, the absorbed energy is smaller. This condition occurs during the morning and late afternoon. Otherwise, the smaller the angle between the sunray and the earth, the intensity of global radiation increases and more energy absorbed and converted into electricity due to the perpendicular position of the surface of solar cells, this occurs in the daytime at 12.00 PM with power produced is 3.55 watts with an intensity of 51729 lux.

IV. CONCLUSION

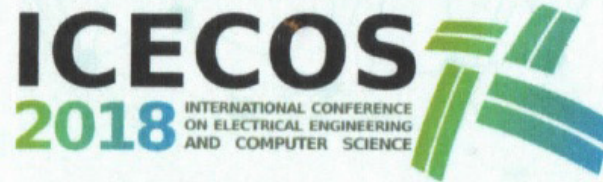
This research used the 2N3055 transistor as the main material to design a solar panel. Based on SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-Ray) analysis test on the 2N3055 transistor, it contains the Al 45.55 % and C 32.40 %.

The maximum solar energy absorbed by the solar panel is based on the intensity of solar radiation. The angle of the

sunray's and the surface of the earth affect the absorbed solar energy. If the angle between the sunray and the earth are bigger, therefore, the absorbed energy is smaller. This condition occurs during the morning and late afternoon. Otherwise, the smaller the angle between the sunray and the earth, the intensity of global radiation increases and more energy absorbed and converted into electricity due to the perpendicular position of the surface of solar cells, this occurs in the daytime at 12.00 PM with power produced is 3.55 watts with an intensity of 51729 lux.

REFERENCES

- [1] Uhuegbu C.C. and Ayara. W.A., "Power transistor and photodiode as a solar cell device", International Journal of Engineering Science and Technology (IJEST), Vol. 3, No. 2, pp. 1693-1074, Februari 2011.
- [2] I. Masyah, B. Trisno and Hasbullah, "The utilization of solar power using the design of solar panel transistor 2N3055 and thermoelectric cooler", Electrans, Vol. 12, No. 2, pp. 89-96, September 2013.
- [3] H. M. Yudha, T. Dewi, P. Risma, and Y. Oktarina, "Life cycle analysis for the feasibility of photovoltaic system application in Indonesia", IOP Conf. Ser: Earth Environ. Sci. 124 012005, 2018.
- [4] T. Dewi, P. Risma, Y. Otkatina, M.T. Roseno, H.H. Yudha, A.D. Handayani, and Y. Wijamako, "A survey on solar cell; The role of solar cell in robotics and robotic application in solar cell industry", orceeding Forum in Research, Science, and Technology (FIRST), 2016.
- [5] D. Suhandi, "Prototype solar cell made from copper oxide and zinc oxide with dielectric sulfuric acid", Jurnal Gama, Vol 9, No. 1, pp. 130136, September 2013.
- [6] Sariadi and M. Syukri, "Planning an integrated solar power plant using PVSYST software on residential in Bnada Aceh", Jurnal Rekayasa Elektrik, Vol. 9, No. 2, pp. 77-80, Oktober 2010.
- [7] Christian Honsberg and Stuart Bowden, "Photovoltaic devices, System and Application, PVCDDROM 1,0, Australia, 1999.
- [8] Donal A. Naemen, "Semiconductor physic and device basic principles, 3rd edition, pp. 634-649.
- [9] Tsung F. sun et al, "Kwarsa glass insulation in long time operation", IEEE Trans. On PWRD, Vol. 6 no.4, pp. 571, January/February 2009.
- [10] Gutierrez, F and Mendez, F, "Generation minimization of a thermoelectric cooler", The Open Thermoelectric Journal No. 2, pp. 79-80.
- [11] Stasiun Klimatologi Kelas I, "Analisis perkiraan Hujan Sumatera Selatan", 2017.
- [12] Janaloka, "Efisiensi Panel Surya Tertinggi dari Panasonic", 2016.



**INTERNATIONAL CONFERENCE
ON ELECTRICAL ENGINEERING AND COMPUTER SCIENCE 2018**

October 02-04, 2018
Province of Bangka-Belitung
Indonesia

CERTIFICATE OF APPRECIATION

present to

Ahmad Taqwa

In recognition and appreciation of your contribution as

Co-Author

For paper entitled

Power Transistor 2N3055 as a Solar Cell Device



Prof. Dr. Ir. Anis Saggaff. MSCE
Rector of Universitas Sriwijaya



Prof. Dr. Ir. Siti Nurmaini
Chair of ICECOS 2018

Organized by :



Co-Organized by :



Partner :



Technical Co-Sponsored by :

