

**ISITIA
2018**



PROCEEDING

International Seminar on Intelligent Technology and Its Application 2018

August 30 – 31, 2018

Swiss-Belresort Watu Jimbar, Bali, Indonesia

IEEE Catalog Number : CFP18TIA-PRT

ISBN 978-1-5386-7652-3



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Proceeding
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IEEE Catalog Number : CFP18TIA-PRT

ISBN : 978-1-5386-7652-3

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Preface

Welcome to the 2018 International Seminar on Intelligent Systems and its Applications, or ISITIA. We are very grateful to all attendees today, including all of you who have submitted your recent research work to our conference and present your findings in this event.

In our records, the total submissions to ISITIA 2018 received 152 submissions with authors affiliated with institutions from 13 different countries. We accepted 92 papers for presentation. These papers belong to various topics such as power systems, telecommunications, electronics, control systems, biomedical engineering, and intelligent systems.

ISITIA has its roots from SITIA, or simply Seminar on Intelligent Systems and its Applications, a conference that had started 19 years ago, and have been held annually by our department ever since. We wish to provide a forum where researchers, academics, students, and industry to meet and discuss the latest development in the broad field of electrical engineering, telecommunications, and intelligent systems. In this age of the next industrial revolution, we feel that it is very important that we can extend our research to practical aspects. Hence, “Practical Prospect on New Technologies: From Theory to Industrial Challenges and Business Opportunities” becomes our conference theme this year.

This conference has received tremendous help and support, therefore we would like to thank all reviewers, mainly from three different countries, for their contributions in selecting high quality papers. We would also like to thank Toulouse INP and in particular the LAPLACE laboratory, as well as Udayana University, for their support to this conference. Our gratitude also goes to Institut Teknologi Sepuluh Nopember, Surabaya, and members of our local organizing committee for the support and help for the conference.

Lastly, please have a great time at the conference, and we wish you a very pleasant stay in Bali, Indonesia.

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TABLE OF CONTENTS

PREFACE	i
ORGANIZING COMMITTEE	ii
TABLE OF CONTENTS	v
KEYNOTE LECTURES	
Prof. Dr. Mohammad Nuh, DEA	xiv
Prof. Maurice Fadel	xv
Prof. Nathalie Raveu	xvi
Ir. Eko Yudo Pramono, M.T.	xvii
TECHNICAL PAPERS	
Radio Frequency Engineering	
Mutual Coupling Reduction & Bandwidth Enhancement Using a Simple Folded Slot-Partial Ground Plane in Dualband MIMO Antenna <i>Subuh Pramono, Budi Subagio</i>	1
New Fabry-Perot cavity antenna with Inhomogeneous Dielectric PRS <i>Sabrina Zaiter, Nathalie Raveu, Rachid Oussaid</i>	5
Planar Multiband MIMO Antenna for LTE and WLAN Applications <i>Stefanus Pratama Cahyanto, Eva Utami</i>	9
Design of a SINRD bandpass filter based on equivalent circuit method <i>Ahlem Manal Chebihi, Nathalie Raveu, Mohamed Tellache</i>	13
Design and Analysis of C-Band Parabolic Antenna Materials for Synthetic Aperture Radar On-Board Microsatellite <i>Akbar Danar Abiwardana, Gamantyo Hendratoro, Eko Setijadi, Josaphat Tetuko Sri Sumantyo</i>	17
Design of 9.4 GHz Dielectric Resonator Oscillator with One Stage Amplifier <i>Yana Taryana, Yaya Sulaeman, Teguh Praludi, Yuyu Wahyu, Arief Budi Santiko</i>	21
Telecommunications & Networking	
Raspberry Pi-Based VoIP System For Rural Area <i>Nazmia Kurniawati, Achmad Affandi, Istars Pratomo, Koichi Gyoda</i>	27
Trial and Evaluation of LoRa Performance For Smart System Multi-Client Model <i>Achmad Fauzi Rachmani, Fitri Yuli Zulkifli</i>	33

Communication System on Wireless Sensor Networks using Raspberry Pi and Arduino for Monitoring Gas of Air Pollution <i>Misbah Misbah, Rini Astutik, Eliyani Eliyani, Hendra Winarno, Andy Mukhlis, Deny Andesta</i>	39
 Power Systems	
Experimental and Numerical Analysis Design of a Lab-Scale on Horizontal Axis Wind Turbine with Winglets <i>Nyoman Ade Satwika, Ridho Hantoro, Sarwono Sarwono</i>	45
Four-leg Voltage Source Inverter for Voltage and Current Balancing of Distribution Transformer with Distributed Generations <i>Dedy Kurnia Setiawan, Mochamad Ashari, Heri Suryoatmojo</i>	51
Effect of Three Pole Auto-Reclose to Power System Transient Stability (Case Study: Jawa Timur and Bali System) <i>Yenni Tarid, Yonny Wicaksono</i>	57
Impact of Sizing in VAHT-SBC to The Channel Blockage <i>Ahmad Wildan Mahmashani, Ridho Hantoro, Erna Septyaningrum, Okky Agassy Firmansyah, Fanisa Zidna</i>	61
Energy Curtailment to Manage Power Output in Active Distribution Network <i>Latifatul Purwitosari, Ontoseno Penangsang, Rony Seto, Indri Suryawati</i>	67
Fault Location and Voltage Sag Analysis in Electric Distribution Network <i>Wildan Febrianto, Mohammad Gunartono, Ontoseno Penangsang, Rony Seto Wibowo</i>	73
Energy Consumption of Brushless DC Motor for Modern Irrigation System <i>Suwito Suwito, Mochamad Ashari, Muhammad Rivai, M. Anis Mustaghfirin</i>	79
Improving Transient Stability Assessment by Installing Super Capacitor Energy Storage using Critical Trajectory Method based on Modified Losing Synchronism <i>Talitha Puspita Sari, Ardyono Priyadi, Margo Pujiantara, Naoto Yorino, Mauridhi Hery Purnomo</i>	85
Experimental Modeling of Nano Power Generation using Thermoelectric Generator (TEG) from Incinerator Waste Heat <i>Asepta Surya Wardhana, Miftah Fauzan, Syed Islam, SM Muyeen, Soediby Soediby, Mochamad Ashari</i>	91
State Estimation for Radial Passive Distribution System using Hamiltonian Cycle Theory Based on Geographic Information System (GIS) <i>Ontoseno Penangsang, Sabila Panuntun, Vita Lystianingrum, Indri Suryawati</i>	95

CF IPP Controlling Based on AFPM by Developing Monitoring Application to Reduce Incentive Cost <i>Diana Pitaloka, Yusuf Kuncoro, Wuri Catur Prasetyo, Mohammad Jaya, Adi Purwanto, Eko Pramono</i>	101
Losing Synchronism Technique based on Critical Trajectory Method for Obtaining The CCT with Installing SCES <i>Ardyono Priyadi, Talitha Puspita Sari, Isa Hafidz, Margo Pujiantara, Naoto Yorino, Mauridhi Hery Purnomo</i>	107
Web-based Online Monitoring of Low Voltage Series Arcing with Line Impedance Analysis <i>Dimas Asfani, Daniar Fahmi, I Made Yulistya Negara, Agung Brastama, Firdaus Kurniawan, Ikhlas Ramadhan</i>	111
Study Maturity level of SCADA at Pusat Pengaturan Beban Java-Bali area using ITIL Self assessment <i>Ilham Miftha Faiz, Istas Pratomo</i>	117
Analysis of The Frequency and Voltage Changes While Load Shedding in The Multimachine System <i>Irrine Budi Sulistiawati, Aziz Nurdiansyah, Ardyono Priyadi, Ibg Manuaba, Abraham Lomi</i>	123
 High Voltage Engineering	
Study of Petersen Coil Grounding System Inductance Variation on Ferroresonance in 150 kV Transformer <i>I Gusti Satriyadi, I Made Yulistya Negara, Dimas Asfani, Daniar Fahmi, Mochammad Wahyudi, Kadek Anugrah</i>	129
Comparison of Ferroresonance Response on Three Phases Transformer with Different Core Material: M5 and ZDKH <i>I Made Yulistya Negara, I Gusti Satriyadi, Dimas Asfani, Daniar Fahmi, Mochammad Wahyudi, Reno Hidayat</i>	135
Impact of Diameter and Gap Distance on Partial Discharge Detection in Transformer Oil using RTL-SDR Method <i>Daniar Fahmi, I Made Yulistya Negara, Dimas Asfani, I Gusti Satriyadi, Mochammad Wahyudi, Hadi Al - Azmi</i>	141
 Power Electronics	
Performance of BLDC Motor Speed Control Based on Hysteresis Current Control Mechanism <i>Heri Suryoatmojo, Ronny Mardiyanto, Dedet Riawan</i>	147
Design of Interval Type-2 Fuzzy Logic Control for Voltage Controller on Buck Converter <i>Muhammad Khamim Asy'ari, Ali Musyafa'</i>	153

Design of Performance and Parameter Measurement System for Brushless Direct Current (BLDC) Motor <i>Ayuning Desanti, Indra Sidharta, Hendry Erwantono, Dimas Asfani, Heri Suryoatmojo, Mochammad Wahyudi</i>	157
Design Analysis of Axial Flux Permanent Magnet BLDC Motor 5 kW for Electric Scooter Application <i>Yoga Nugraha, Muhammad Nur Yuniarto, Herviyandi Herizal, Dimas Asfani, Dedet Riawan, Mochammad Wahyudi</i>	163
Design of Surge Test Device for Brushless DC Motor in Electric Scooter Application <i>Dimas Asfani, Dedet Riawan, I Made Yulistya Negara, Daniar Fahmi, Angga Hudaya, Dhanang Laksono</i>	169
Fuzzy Logic Based MPPT with Feedback Control for Photovoltaic Application <i>Akhmad Musafa, Peby Purnawan, Ardyono Priyadi, Margo Pujiantara, Alvin Tri Yulianto, Mauridhi Hery Purnomo</i>	175
Intelligent Systems in Power Engineering	
Islanding Detection on Grid-Connected Current Source Inverter Based on Discrete Wavelet Transformation <i>Aggie Vernandez, Dedet Riawan, Dimas Asfani</i>	181
Islanding Detection in Grid-Connected Distributed Photovoltaic Generation Using Artificial Neural Network <i>Tirta Mehang, Dedet Riawan, Vita Lystianingrum</i>	187
Wavelet Filter Selection Analysis for Air Gap Eccentricity in Three Phase Induction Motor <i>Restu Mukti Utomo, I Made Yulistya Negara, Dimas Asfani, Nur Alham</i>	193
Semi-Supervised Learning Optimization Based on Generative Models to Identify Type Of Electric Load at Low Voltage <i>Fawaati Tsabita, Vita Lystianingrum, Rosmaliati Rosmaliati, Nur Rohman Widiyanto, Mauridhi Purnomo</i>	199
Optimization of Overcurrent Relay Operation Using Artificial Intelligent on Radial Topology with Load Constraint <i>Nugraha Wibowo, Vincentius Raki Mahindara, Ardyono Priyadi, Margo Pujiantara, Mauridhi Hery Purnomo</i>	205
Obtaining The Setting of Inverse-Curve Overcurrent Relay using Serial Computing Modified Particle Swarm Optimization in Real System Applications <i>Vincentius Raki Mahindara, Muhammad Guntur Istiqlal, Margo Pujiantara, Dimas Asfani, Ardyono Priyadi, Mauridhi Hery Purnomo</i>	209

Fuzzy Logic Control Design of Mobile PV Using Bacterial Foraging Optimization <i>Dwi Nur Fitriyanah, Imam Abadi</i>	215
 Information Systems	
Adaptive Mobile Learning in the Nearby Wisdom App <i>Hardika Dwi Hermawan, Ratna Wardani, Julian Chu, Arum Darmawati, Muhammetmyrat Yarmatov</i>	221
Indonesian Question Generation Based on Bloom's Taxonomy Using Text Analysis <i>Selvia Kusuma, Daniel Siahaan, Chastine Fatichah, Rinanza Alhamri, Mohammad Naufal</i>	227
Designing a Technology-Enhanced Flipped Learning Model Using Schoology LMS <i>Zamzami Zainuddin, Habiburrahim Habiburrahim, Hardika Dwi Hermawan</i>	233
A Web-Based High School Major Decision Support System In Banten Using Tsukamoto's Fuzzy Method <i>Ana Rusmardiana, Tri Yani Akhirina, Dwi Yulistiyanti, Ulfa Pauziah</i>	239
Crowds Evacuation Simulation on Heterogeneous Agent Using Agent-Based Reciprocal Velocity Obstacle <i>Fadil Muhammad, Susi Juniastuti, Supeno Susiki, Mochamad Hariadi</i>	245
Evaluating Certificate Policy - Certification Practice Statement of Unique Government Certification Authority using Public Key Infrastructure Assessment Guidelines: Research in Progress <i>Dea Saka Kurnia Putra, Edit Prima</i>	251
Searching Cheapest Product On Three Different E-Commerce Using K-Means Algorithm <i>Vincentius Prasetyo</i>	257
Performance Evaluation of NFS-based Primary Storage with Deduplication using Windows Server and RAM-based Cache on Small-scale VMware Environment <i>Marcel Yap</i>	263
Analysis of Internet of Things (IoT) Networks Using Extrinsic Information Transfer (EXIT) Chart <i>Fransisca Pasalbessy, Khoirul Anwar</i>	269
Fuzzy Analytic Network Process-based Automatized SWOT Analysis for Optimizing Generation of Vocational School Accreditation Report <i>Veronika Arisanti, I. Sukajaya, Kadek Yota Ernanda Aryanto</i>	275

Analysis of User Acceptance Factors for Mobile Apps Browser Using Unified Theory of Acceptance and Use of Technology (UTAUT) and Task Technology Fit (TTF) on Generation Y <i>Mochamad Chandra Saputra, Niken Hendrakusma Wardani, Rahmat Trialih, Atiyyah Lia Hijriyati</i>	281
Image and Signal Processing	
Focal Length Changes Estimation on Zooming Stereo Camera using Fundamental Matrix <i>Kurnia Prima Putra, Eko Mulyanto Yuniarno, Mauridhi Hery Purnomo</i>	287
Effect of using window type on Time Scale Modification on Voice Recording Using Waveform Similarity overlap and add <i>Nanda Saputri, Yoyon Suprpto, Diah Wulandari</i>	293
Ultraviolet Rupiah Currency Image Recognition using Gabor Wavelet <i>Anggarjuna Puncak Pujiputra, Hendra Kusuma, Tri Arief Sardjono</i>	299
A Geometry-Based Underwater Acoustic Channel Model for Time Reversal Acoustic Communication <i>Yuning Widiarti, Suwadi Suwadi, Wirawan Wirawan, Titek Suryani</i>	305
Inclined Image Recognition for Aerial Mapping by Unmanned Aerial Vehicles <i>Muhammad Attamimi, Ronny Mardiyanto, Astria Nur Irfansyah</i>	311
Automatic Image Annotation using Minimum Barrier Salient Object Detection and Random Forest <i>Theresia Hendrawati, I. Sukajaya, Kadek Yota Ernanda Aryanto</i>	317
A High Capacity and Imperceptible Text Steganography Using Binary Digit Mapping on ASCII Characters <i>Alfin Naharuddin, Surya Sumpeno, Adhi D Wibawa</i>	323
Mbojo Character Recognition Using Shearlet Transform and Support Vector Machine <i>Mahathir Rizky, Ingrid Nurtanio, Intan Sari Areni</i>	329
Mango Leaf Classification with Boundary Moments of Centroid Contour Distances as Shape Features <i>Eko Prasetyo, R. Dimas Adityo, Nanik Suciati, Chastine Fatichah</i>	335
Heading Calculation from Sequence of Images Based on Corner Feature Detection and Optical Flow Algorithm <i>Daniel Haryono, Djoko Purwanto, Hendra Kusuma</i>	339
Indonesian Sign Language Recognition by Using the Static and Dynamic Features <i>Wijayanti Nurul Khotimah, Nanik Suciati, Ignatius Benedict</i>	345

Non-Linear Spatio-Temporal Input Selection for Rainfall Forecasting Using Recurrent Neural Networks <i>Ahmad Saikhu, Agus Z Arifin, Chastine Fatichah</i>	351
 Control Systems	
Study and Design of Self-Adaptive Pid-Fuzzy Control on Multistage Steam Turbine Rotation Setting <i>Rusdhianto Efendi Abdul Kadir, Eka Iskandar, Mochammad Rameli, Irfan Syuhudi</i>	357
Ladder Diagram Design Based On Huffman Method For Selection And Assembling Part On Dual Conveyor Plant <i>Eka Iskandar, Mochammad Rameli, Wildan Ramadhan</i>	363
Identification of Four Wheel Mobile Robot Based on Parametric Modelling <i>Brian Raafiu, Purwadi Darwito</i>	369
A model of reliability, average reliability, availability, maintainability and supportability for service with system dynamics approach <i>Mudjahidin Mudjahidin, Joko Buliali, Muhammad Nur Yuniarto</i>	375
Nutrient Film Technique based Hydroponic System Using Fuzzy Logic Control <i>Siti Mashumah, Muhammad Rivai, Astria Nur Irfansyah</i>	381
A practical coordinated trajectory tracking control for over actuated systems: a case study for a group of four-wheels omnidirectional mobile robots <i>Sisdarmanto Adinandra</i>	385
Automated Robotic Moisture Monitoring in Agricultural Fields <i>Senthil Palanisamy, Akila IS</i>	391
Development of Autopilot system of Unmanned Aerial Vehicle for Aerial Mapping Application <i>Ronny Mardiyanto, Heri Suryoatmojo</i>	397
 Applied Electronics	
Design and Implementation of a Piezoelectric Accelerometer Using Arduino Mega For Detection of Vibration on the 20 kV Transformer Tank <i>Tauruski Anwar, Rosmaliati Rosmaliati, Vita Lystianingrum, Ardyono Priyadi, Mauridhi Hery Purnomo, Ahmad Adila</i>	403
Milk Assessment using Potentiometric and Gas Sensors In Conjunction With Neural Network <i>Marson Ady Putra, Muhammad Rivai, Achmad Arifin</i>	409
Design of Dye-Sensitized Solar Cell Using Ultrasonic Coating Method <i>Muhammad Aulia Sembiring, Muhammad Rivai, Tri Arief Sardjono</i>	413

Implementation and Feasibility Analysis of GSM Based Smart Energy Meter for Digitalized Power Consumption with Advanced Features <i>Imtiaj Khan, Shuva Mitra, Ovishek Morshed, Abdul Ahad, Rohan Sarker, Sayeed Shafayet Chowdhury</i>	419
Smart Control of Air Conditioning System Based on Number and Activity Level of Persons <i>Fajar Budiman, Muhammad Rivai, I Gusti Bagus Prasta Raditya, Daniel Krisrenanto, Irma Zahroul Amiroh</i>	425
Smart Mobile Phone Usage Restriction by Extending Phone Circuitry- An Alternative to Jamming <i>Senthil Palanisamy, Manoharan Abitha Thangam</i>	431
Biomedical Engineering	
EEG Signal Classification Using AAR and Resilient Propagation with Emotiv EPOC Device <i>Miftah Ariyati, Ahmad Musthafa</i>	437
Segmentation of the Intracerebral Hemorrhagic Strokes (Bleeds) from Brain CT Image Based on GVF Snake <i>Muhamad Rudiansyah, Tri Sardjono, Ronny Mardiyanto</i>	443
Design of Intonation Control on Electrolarynx Using Electromyograph (EMG) <i>Mikail Widagda, Tri Arief Sardjono, Ronny Mardiyanto</i>	449
EEG features extraction during chloral hydrate-induced sedation (study case: single subject analysis between two siblings) <i>Alvin Sahroni</i>	455
Heart Rhythm Classification from Electrocardiogram Signals Using Hybrid PSO-Neural Network Method and Neural ICA <i>Miftah Ariyati, Aulia Nasution</i>	461
Carotid Artery Plaque Image Recognition Using Gabor Wavelet and Principle Component Analysis <i>Mas Afandi, Hendra Kusuma, Tri Arief Sardjono</i>	467
Microelectronics & VLSI	
Design and Validation of Asynchronous Inter FPGA Transceivers for Inter Processor Communication <i>Faizal Samman, Thagiat Andi Djiwa Putra, Fandhi Nugraha</i>	471
Instrumentation	
Design and Data Acquisition of Faraday Rotation Instrumentation System Based on Microcontroller <i>Muhammad Rizki Nurriansyah, Arief Sudarmaji, Djati Handoko, Luthfi Hadsyah, Arnold Fedriko</i>	477
Magnetic Tracker Calibration Using Polynomial Fitting <i>Joko Priambodo, Eko Mulyanto Yuniarno, Ketut Purnama</i>	481

KEYNOTE LECTURE

Biomedical Engineering

Prof. Dr. Mohammad Nuh, DEA
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"Biomedical Engineering Development in Indonesia: Challenges and Opportunity"

Indonesia will experience a new era in health services with the enacted Universal Health Coverage (UHC) for all Indonesian people. The program was implemented gradually starting January 1, 2014 for 116 million people and by 2019 will implement for all Indonesians (260 million people). The implementation of UHC is carried out by The Implementing Agency of Social Security or Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS-Kesehatan) as a mandate of the Law Number 36 of 2009 concerning Health and Law Number 24 of 2011 concerning The Implementing Agency of Social Security.

The implementation of UHC promotes the significant increase in demand of healthcare services. This includes the number of beds, doctors, nurses, medical equipments, pharmaceuticals and support services. In addition, the number of middle classes (middle income) is growing rapidly. From 130 million people (55.2%) in 2010 to 215 million people (80%) by 2020. The increasing population of middle class will improve the awareness of the importance of health. This factor could be market driven in the biomedical engineering development.

The development of science and technology, especially material technology, the Internet of Things, technological convergence, the need to improve quality of life and increased purchasing power capacity are appropriate ecosystems in developing Biomedical Engineering.

Biomedical Engineering development in Indonesia is based on point of view science and technology, market opportunity for medical equipment and healthcare system, resources availability, humanity value and the spirit of self-fulfilling in the field of healthcare services. Assistive technology, mobile healthcare, wearable technology, medical imaging, and artificial intelligence are the focus areas but not limited for developing Biomedical Engineering in Indonesia.

As the pioneering stage, the Ministry of Education and Culture in 2012 provided a mandatory assignment to Institut Teknologi Sepuluh Nopember (ITS), Institut Teknologi Bandung (ITB), Universitas Indonesia (UI), Universitas Gadjah Mada (UGM) and Universitas Airlangga (UNAIR) to establish Department and Research Center of Biomedical Engineering.

Muhammad Nuh (born 17 June 1959 in Surabaya) is the former Minister of Education and Culture of Indonesia in the Second United Indonesia Cabinet of Susilo Bambang Yudhoyono. Prof. Nuh was born on 17 June 1959 in Surabaya into a large farming family. By profession an electrical engineer, he was educated at Sepuluh Nopember Institute of Technology and Montpellier 2 University, France. More info: <https://opensciencemeeting.org/prof-dr-ir-mohammad-nuh-dea/>.

KEYNOTE LECTURE

Modeling and the control of the electric systems

Prof. Maurice Fadel
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“Some Advances of Control in Power Electronics: Predictive and Allocation Method”

Static converter based power electronic systems and electrical power conversion systems using electrical machines require high performance while preserving simple designs and easy implementations. This situation becomes critical when the processed powers increase and the converters have a large number of switches for topologies to increase power through serialization and / or paralleling. In this context it is important to develop new control approaches such as predictive control or allocation control.

The predictive control applied to static converters offers simple and often effective solutions for conventional structures. When the number of switches increases the combinatorial explosion of the controls induces a limitation especially when the operating frequency is high. For this purpose the allocation approach based on the minimization of a criterion in real time is proposed as an alternative solution allowing further reconfiguration of the system during the appearance of faults.

As for static converters, electrical machines are now associated in cooperative systems, which produces multi-machine and multi-converter systems. The design of control laws becomes more complex especially if we take into account the improvement of energy efficiency. This presentation provides an overview of recent developments in this area, drawing on examples of multilevel static converters and synchronous magnet machines alone or in cooperation for high speed aeronautical or automotive applications. Implementation procedures will also be discussed and illustrated through examples deployed on DSPACE or implemented on FPGAs.

Maurice Fadel was born in Toulouse (France). He got the PhD degree at the Institut National Polytechnique de Toulouse in 1988, in the domain of the Control in Electric Engineering. He is currently a Professor in the Ecole Nationale Supérieure d’Ingénieurs en Electrotechnique, d’Electronique, d’Informatique, d’Hydraulique et de Télécommunications of Toulouse (ENSEEIH). More info: <http://www.laplace.univ-tlse.fr/FADEL-Maurice-1464?lang=en>.

KEYNOTE LECTURE

Modeling modal method (plasma cavity, SIW circuits, transmission line)
closer to the physical, wave concept iterative
process, numerical analysis

Prof. Nathalie Raveu
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"Propagation in Waveguides with Metamaterial Walls"

With the increasing needs of communications equipment for space applications, it is important to minimize the size and mass of satellite equipment. This leads to a reduction in the launch costs of the satellites in their orbit or allows the possibility of adding equipment to the rocket. The objective is to reduce the antenna or waveguide dimensions without deteriorating their performances (directivity, cross polarization, monomode band, etc.).

It is possible to control the propagation of electromagnetic waves in horn antennas and waveguides using anisotropic walls (corrugations, metamaterials). Thus, expected propagation constants and radiation properties of electromagnetic waves differ from in classical horn antennas and waveguides using anisotropic walls in such structures: for the waveguide, cutoff frequency reduction is possible; for the horn antenna, improvement of the directivity or reduction of side lobe level.

A new design methodology based on an Expanded Modal Theory Theory (TME) is proposed to characterize waveguides with anisotropic walls in collaboration with CNES agency and the MVG Company. It makes it possible to dimension very quickly metamaterial surfaces most adapted to the required applications. A prototype waveguide was designed, manufactured and measured using this methodology. The results obtained demonstrate the interest, efficiency and general character of the proposed method for the design of guided microwave devices with anisotropic walls.

Nathalie Raveu received the M.S. degree in electronics and signal processing in 2000 and the Ph.D. degree in 2003. She is a Professor with the National Polytechnic Institute of Toulouse (INPT) and a Research Fellow with the LAPLACE—CNRS (LABoratory of Plasma and Energy Conversion). More info: <http://www.laplace.univ-tlse.fr/RAVEU-Nathalie-1119?lang=en>.

KEYNOTE LECTURE

Relay Protection, Power Transmission, Power Systems,
Transformer designers

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"Implementation of HVDC System for Improving Java Bali System"

Java Bali Grid is the largest electricity system in Indonesia, with its peak load reaching 25.880 MW on Tuesday, 08th May 2018 and total installed generating capacity of 36.211 MW. The transmission lines consist of 500 kV as the backbone with total length of 5.074 kmc. Power plants are connected to various transmission voltage, but the trend is that more bigger plants are connected to 500 kV main backbone. Currently the biggest plant unit is 815 MW, but starting on 2021 units of 1.000 MW ultra super critical coal-fired power plant will come on-line. Investment plan as stipulated in the RUPTL 2018-2027 dictates more than 12.000 MW of 1GW units will be commissioned within the next 10 years, and all will be connected to 500 kV transmission lines. Although these units will run at higher efficiency and lower generation cost, concern arises on the aspect of 500 kV system stability and capability to accommodate such amount of 1 GW units into the Java-Bali Grid. The short circuit level contribution from these plants will run significantly high above the existing breaker rating, at some point will reach more than 90 kA. Not only that, stability of the system after losing one or two 1 GW unit in contingencies also will be of concern. Therefore the study of grid impact of these 1 GW units is needed, including alternatives to improve grid stability and robustness. Possible solutions include new higher voltage of backbone such as 765 kV AC, or developing an HVDC system in Java Bali either it is DC link or HVDC back to back system. The DC system will be able to split system into several areas hence lowering the short circuit level, also isolate any fault propagating across grid therefore avoid the possibility of total black out. This will in turn increases the robustness of Java Bali grid. This lecture looks at the implementation of HVDC system to improve Java Bali grid, and proposes a distinct merit of apply HVDC technology into the grid.

Curriculum vitae:

2016 – present : General Manager Dispath Center, PT. PLN (Persero) P2B
2014 – 2016 : General Manager Transmission And Dispath Center, PT. PLN
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Searching Cheapest Product On Three Different E-Commerce Using K-Means Algorithm

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Abstract— The development of e-commerce is starting to change people's lifestyles, not least the people of Indonesia. The existence of e-commerce is very helpful user in buying and selling products. There are many e-commerce that can be found today. Some of the famous e-commerce in Indonesia are Bukalapak, Lazada, and Blibli. A large number of existing e-commerce makes users, especially buyers, have difficulty when looking for products at the cheapest price. This happens because each e-commerce offers different prices for the same product. This research aims to make the cheapest product search system in Bukalapak, Lazada, and Blibli using K-Means algorithm. The results of experiments showed that K-Means algorithm can be used to classify product data from Bukalapak, Lazada, and Blibli well. The results of the clustering process can also help for searching the cheapest products from the three e-commerce becomes faster. However, the number of clusters used will affect the effectiveness of the search process on the system.

Keywords— *e-commerce, clustering, k-means, cosine similarity, precision, recall*

I. INTRODUCTION

E-Commerce is the distribution, sales, purchasing, marketing of products, and services that rely on electronic systems, such as the Internet, television, or other computer networks. E-commerce involves the transfer of funds and electronic data exchange, management systems and data collection automatically. E-commerce is one of the most popular businesses in Indonesia because it provides a promising advantage. The advantage of e-commerce is that we can sell products or services online without having to set up shop or big office. Another advantage is the ease of communicating between the seller and the buyer. Marketing of products is also much more profitable because we do not need to spend high cost to do the promotion [1].

Bukalapak, Lazada, and Blibli are famous e-commerce in Indonesia. Based on data from Google Trends for top 5 e-commerce in Indonesia which has the highest search in 2017, Bukalapak, Lazada, and Blibli included [2]. Bukalapak was founded by Achmad Zaky in early 2010 as a digital agency division named Suitmedia located in Jakarta. Bukalapak is one of the fastest growing e-commerce in Indonesia. Starting from a safe system in the process of buying and selling, has a wide and growing community in every city in Indonesia, rapid disbursement of funds for sellers, pioneer transaction security in the world of online trading, and many more advantages Bukalapak [3]. Lazada Indonesia was established in 2012 and is one of the branches of Lazada's online retail network in Southeast Asia. Lazada Southeast Asia is a subsidiary of the Rocket Internet network, a German company. As a newcomer to the Indonesian e-commerce business, Lazada is able to grab the attention of most internet

users [4]. Blibli.com is an e-commerce that comes with the concept of an online mall in Indonesia since 2011. Blibli.com not only provide completeness of choice, but also the flexibility of payment method, delivery method, and service [5].

The number of e-commerce in Indonesia, causing competition among them, especially the selling price of products. There are often price differences across e-commerce sites even in the same stuff and the same sellers. The buyers will prefer the cheapest price on the same item. It will be difficult for the buyer because they have to check the price of an item from one e-commerce to another e-commerce. Therefore, this research aims to make a useful application to compare the price of an item sold through Bukalapak, Lazada, and Blibli. This application implements K-Means algorithm for grouping similar items.

K-means is non-hierarchical clustering method that categorize the data in the form of one or more clusters/groups. The data has same characteristics will be grouped in one cluster/group and the different characteristics will be grouped in other clusters/groups so the data has a small level of variation in one cluster/group [6].

The remaining of this paper is organized as follows. Section II discusses related works. Section III and IV explain our method and the result of experiments, respectively. Section V contains conclusions and future works.

II. RELATED WORKS

K-Means algorithm has been used in many previous kinds of research or cases. The research by Dhuhita [7] used K-Mean algorithm to determine the nutritional status of children in Indonesia. In addition, Dhuhita [7] also compares the results of grouping between by using k-means and Growth Chart First. K-Means algorithm is also used by Wardhani [8] to classify the patient's disease in Puskesmas Kajen Pekalongan. Patient's disease will be grouped into 2 main categories: "acute" and "not acute".

The research by Asroni and Adrian [9] examines the data already in the data warehouse of Muhammadiyah University of Magelang to find 5 students in Department of Informatics Engineering in order to select students who deserve to follow Cyberjawara competition. The initial phase of the system will perform grouping based on the criteria, such as the grade of Algorithm Programming, Basic Physics, Calculus, and GPA. The criteria are processed using the K-Means method.

The other related research on e-commerce, Muningsih and Kiswati [10] implement K-Means to determine the inventory on the online shop *Ragam Jogja*. The variables

used by Muningsih and Kiswati [10] are product code, transaction amount, sales volume, and average sales. The result of the research is an application that can classify products into categories of stock quantities like many, medium, and slightly based on sales transactions.

Gunawan, et al. [11] in their research compares K-Means and the Apriori method to find out the items that are often purchased on an e-commerce and also sees a faster time in analyzing sales transactions. The results of this research conclude that the k-means algorithm is faster than the apriori algorithm for determining the products often purchased by consumers.

III. RESEARCH METHODS

A. Crawling Data

The purpose of data crawling is to search and collect information about a particular product that will be used on the application. Data crawling is done using *jaunt* library. *Jaunt* is java library for web-scraping & web-automation, including JSON querying. The library provides an ultra-light headless browser. By using *Jaunt* Java programs can easily perform browser-level, document-level, and DOM-level operations. Informations obtained from the crawling process such as title, description, price, URL, and pictures taken through HTML tags from Bukalapak, Lazada, and Blibli.

Bukalapak, Lazada, and Blibli have different template URLs. These differences cause the process of data crawling to be different because the location of the required information resides in different html tags.

There are many product categories in each e-commerce. However, only a few categories will be used: mobile phones, computers, CCTV, cameras, and televisions. The results of the crawling process are stored in a file with the format *.csv*.

B. Preprocessing

Preprocessing is performed for the result of the crawling process in order to get clean data so that the process of clustering and searching product are more accurate. The preprocessing consists of several steps and is shown in Fig. 1. Steps of preprocessing are as follows:

1. Case Folding

In this step, all letters in a word are changed into lowercase.

2. Remove Stopword

This step used to eliminate words that had no effect in the process of categorization, such as: *yang, dan, atau, ke, dari*, etc.

3. Stemming

This step is a process to find the root of a word that will be implemented with Nazief Andriani algorithm (*Sastrawi 1.0.1*). The process of stemming consists of two main phase, ie: checking of the basic word and elimination of affixes, prefixes, suffixes [12].

4. Tokenization

Tokenization is a process to split a sentence into words. The results of tokenization will be saved as clean data.

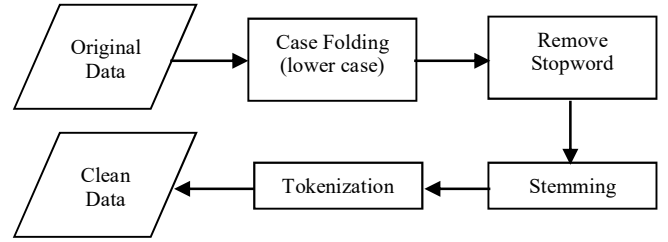


Fig. 1. Preprocessing Steps

C. Term Extraction and Term Weighting

Term extraction aims to eliminate the duplication of words contained in the preprocessing results so that will be obtained a set of unique words [12]. Term weighting will be calculated using term frequency and TF-IDF. Term frequency (TF) is the number of a term or a word that appears in a document. Term weighting with TF-IDF is calculated based on (1).

$$tf.idf_{t,d} = tf_{t,d} \times \log\left(\frac{N}{df_t}\right) \quad (1)$$

The value of $tf_{t,d}$ is the term frequency value of a term t in document d . The N value based on the number of data that are used, while df_t is the number of documents containing term t . As an example, we will show term weighting process. Examples of document that are used, as follows:

- Doc1: *samsung galaxy j2 smartphone gold*
- Doc2: *samsung galaxy note3 plus casing samsung*
- Doc3: *samsung galaxy j2 second bonus casing*

The first process is calculating the term frequency of document. For example, the appearance frequency of the term "samsung" at *Doc1* and *Doc3* is 1 and at *Doc2* is 2. After the term frequency value is obtained, the next step is calculating TF-IDF value for each term. TF-IDF value of each term in *Doc1*, *Doc2*, and *Doc3* are shown in Table I.

TABLE I. TF-IDF OF DOCUMENTS

Term	Term Frequency			df_t	TF-IDF (N=3)		
	<i>Doc1</i>	<i>Doc2</i>	<i>Doc3</i>		<i>Doc1</i>	<i>Doc2</i>	<i>Doc3</i>
samsung	1	2	1	3	0	0	0
galaxy	1	1	1	3	0	0	0
j2	1	0	1	2	0,58	0	0,58
smartphone	1	0	0	1	1,58	0	0
gold	1	0	0	1	1,58	0	0
note3	0	1	0	1	0	1,58	0
plus	0	1	0	1	0	1,58	0
casing	0	1	1	2	0	0,58	0,58
second	0	0	1	1	0	0	1,58
bonus	0	0	1	1	0	0	1,58

D. Clustering Data

Clustering is a method used to divide objects into groups based on predefined similarities. Objects will be grouped into one or more clusters so that the objects in one cluster will have a high similarity with each other [13]. One of the most commonly used algorithms for clustering is K-Means.

K-Means is a method of data clustering with unsupervised learning. This method will group data with the

partition system. K-Means aims to minimize data variations on a cluster. The main principle of this method is to compile a center of the cluster (centroid) from the dataset. Iteratively, the cluster is continually updated until convergent. Illustration of data clustering by K-Means method is shown in Fig. 2.

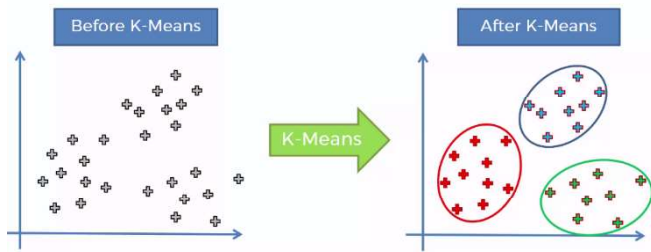


Fig. 2. Illustration of K-Means

K-Means algorithm consists of several steps which start from determining the number of clusters to group the data based on the value of similarity to the centroid. The steps of the k-means algorithm are shown in Fig. 3.

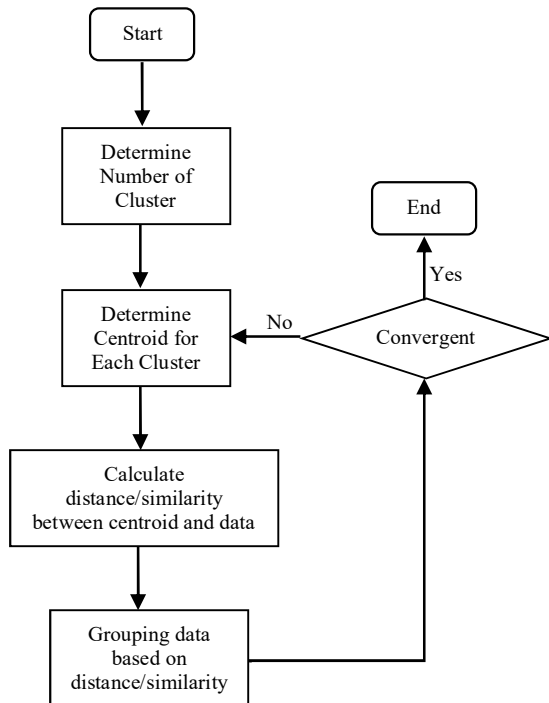


Fig. 3. K-Means Steps

At the first iteration, the centroid is determined randomly from the existing data. If clustering has not produced a convergent cluster, then to determine the centroid in the next iteration by calculating the mean of the cluster member. We can use any method to calculate distance/similarity between centroid and data, such as: Euclidean distance, Manhattan distance, cosine similarity, or Jaccard similarity. This research uses cosine similarity method for distance/similarity calculation.

Cosine similarity is a method to calculate the similarity between two objects expressed in two vectors by using keywords from a document as a measure. The formula used by cosine similarity is (2), where A_i is TF-IDF value of $Doc1$ and B_i is TF-IDF value of $Doc2$ that have similar term [14].

$$\cos \alpha = \frac{A \cdot B}{|A| |B|} = \frac{(\sum_{i=1}^n A_i \times B_i)}{\sqrt{\sum_{i=1}^n (A_i)^2 \times \sum_{i=1}^n (B_i)^2}} \quad (2)$$

When 2 documents are identical, the angle is 0° and the value of the similarity is 1, whereas when the documents and queries are not identical at all, the angle is 90° and the value of the similarity is 0. As an example, we will show K-Means clustering process. Examples of the document that are used, as in Table I. After TF-IDF value is obtained in Table I, the next step is determining the number of cluster and centroid for each cluster. For example, the number of clusters is 2 ($C1$ and $C2$), $Doc1$ as centroid $C1$, and $Doc3$ as centroid $C2$. After that, we calculate the similarity value between centroid and document, which is calculated based on Equation (2). The results of the clustering shown in Table II.

TABLE II. CLUSTERING RESULT (1ST ITERATION)

Term	Term Frequency			df _i	TF-IDF (N=3)		
	Doc1	Doc2	Doc3		Doc1	Doc2	Doc3
samsung	1	2	1	3	0	0	0
galaxy	1	1	1	3	0	0	0
j2	1	0	1	2	0,58	0	0,58
smartphone	1	0	0	1	1,58	0	0
gold	1	0	0	1	1,58	0	0
note3	0	1	0	1	0	1,58	0
plus	0	1	0	1	0	1,58	0
casing	0	1	1	2	0	0,58	0,58
second	0	0	1	1	0	0	1,58
bonus	0	0	1	1	0	0	1,58
Similarity With C1					1	0	0,06
Similarity With C2					0,06	0,03	1
Clustering Result					C1	C2	C2

Based on Table II above can be seen that $Doc1$ into the cluster 1 ($C1$) and $Doc2$ and $Doc3$ into the cluster 2 ($C2$). To ensure that the cluster is convergent, then it will be done again by clustering. The results of clustering at the second iteration shown in Table III.

TABLE III. CLUSTERING RESULT (2ND ITERATION)

Term	Cluster		TF-IDF (N=3)		
	C1	C2	Doc1	Doc2	Doc3
samsung	0	0	0	0	0
galaxy	0	0	0	0	0
j2	0,58	0,29	0,58	0	0,58
smartphone	1,58	0	1,58	0	0
gold	1,58	0	1,58	0	0
note3	0	0,79	0	1,58	0
plus	0	0,79	0	1,58	0
casing	0	0,58	0	0,58	0,58
second	0	0,79	0	0	1,58
bonus	0	0,79	0	0	1,58
Similarity With C1			1	0	0,06
Similarity With C2			0,04	0,72	0,74
Clustering Result			C1	C2	C2

The Based on Table II and III above that can be seen the cluster is already convergent. This is because $Doc1$, $Doc2$, and $Doc3$ remain on the same cluster in the first and second iterations.

IV. EXPERIMENTS AND RESULTS

A. System Testing

This section discussed the testing of the system that has been built. The purpose of this system is searching for the cheapest product from Bukalapak, Lazada, and Blibli. Before the user can search a product, crawling, term extraction, term weighting, and clustering will be run first. The crawling process will be run to get the desired data, as described in the previous section.

The number of product data that is used for testing are 2,280. The number of product data is divided into 10 titles that have been inputted previously by the user. Distribution of product data for each title is shown in Table IV.

TABLE IV. DISTRIBUTION OF PRODUCT DATA

Category	Title	Source	Number of Data
mobile phones	samsung galaxy	Blibli	72
		Bukalapak	99
		Lazada	72
	asus zenfone	Blibli	70
		Bukalapak	100
		Lazada	72
	iphone	Blibli	72
		Bukalapak	100
		Lazada	72
cameras	kamera dslr	Blibli	72
		Bukalapak	60
		Lazada	72
computers	asus notebook	Blibli	72
		Bukalapak	110
		Lazada	72
	acer notebook	Blibli	72
		Bukalapak	39
		Lazada	72
	apple macbook	Blibli	72
		Bukalapak	100
		Lazada	72
cctv	cctv	Blibli	72
		Bukalapak	100
		Lazada	72
televisions	samsung tv	Blibli	72
		Bukalapak	80
		Lazada	72
	sony tv	Blibli	66
		Bukalapak	60
		Lazada	72

The system will process the data in Table IV into preprocessing, term extraction, and term weighting before clustering. After the process is complete, clustering will be automatically run by the system. The user can input the number of clusters manually before clustering is executed. The results of clustering data with 5 clusters are shown in Fig. 4 and 10 clusters in Fig. 5.

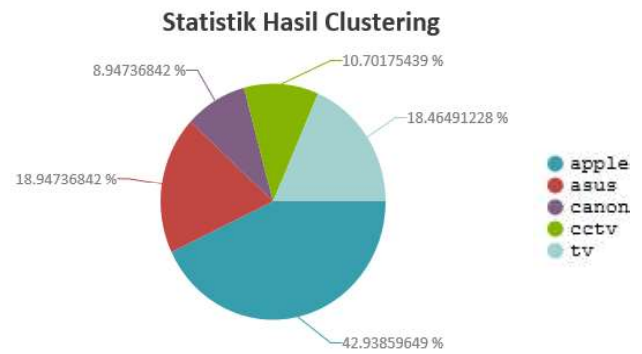


Fig. 4. Clustering With 5 Clusters

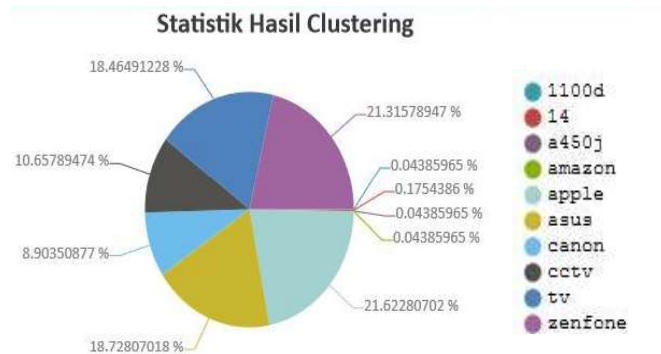


Fig. 5. Clustering With 10 Clusters

Based on Fig. 4 and Fig. 5 above can be seen that the name of each cluster is assigned automatically by the system. The name of the cluster is based on the most frequent terms in the cluster. After the system completes all the processes before, then the user can do a product search. The user will input the name, e-commerce, and category of the product, then the system will display the appropriate product data.

The system will search for product data based on the clustering results that have been done before. For example, the user inputs "apple iPhone" as the product name, "all e-commerce" as e-commerce, "all categories" as the category, and there are 5 product clusters as in Fig. 4. Based on Fig. 4, product data included in the "apple" cluster amounted to 42.94% of the total data, that means amounted to 979 data. First, the system will search on the "apple" cluster because there is "apple" word in the name of the product inputted by the user. It aims to speed up the search because the system does not have to search from all data. If the system does not find a matching word between user input and cluster name, then the system will search from all data. The display of search results performed by the user is shown in Fig. 6.

Fig. 6. The Display of Search Results

B. System Evaluation

To determine whether the system is working properly or not, it will be calculated the value of precision and recall. Precision is the level of accuracy between the information requested by the user and the answers provided by the system. While the recall is the level of success of the system in rediscovering an information. The Confusion matrix is used to facilitate the calculation of precision and recall values, as shown in Table V.

TABLE V. CONFUSION MATRIX

	Relevant	Not Relevant	Total
Retrieved	A	B	A+B
Not Retrieved	C	D	C+D
Total	A+C	B+D	A+B+C+D

The precision value is calculated from the number of relevant documents found by the system divided by the total document found by the system, whereas the recall is calculated from the number of relevant documents found by the system divided by the total of the relevant documents. Therefore, based on Table V above, it can be concluded that the precision value is $A/(A+B)$ and the recall value is $A/(A+C)$.

The system evaluation uses 10 different keywords to search the product data, while for the number of clusters used are 5 and 10. In addition, searching will be performed on all e-commerce and categories. Table VI and VII show the results of calculating precision and recall values for 5 clusters and 10 clusters.

TABLE VI. PRECISION AND RECALL FOR 5 CLUSTERS

Keyword	Precision	Recall
<i>apple iphone</i>	0,49	0,97
<i>samsung smartphone</i>	0,74	0,44
<i>canon dslr</i>	0,84	0,35
<i>led tv</i>	0,86	0,37
<i>notebook ram 4gb</i>	0,59	0,12
<i>lcd tv</i>	0,27	0,15
<i>notebook 14 inch</i>	0,65	0,81
<i>smartphone asus</i>	0,61	0,17
<i>iphone free casing</i>	0,51	0,48
<i>samsung anti gores</i>	0,49	0,33
Average	0,605	0,418

TABLE VII. PRECISION AND RECALL FOR 10 CLUSTERS

Keyword	Precision	Recall
<i>apple iphone</i>	0,60	0,51
<i>samsung smartphone</i>	0,65	0,78
<i>canon dslr</i>	0,52	0,86
<i>led tv</i>	0,70	0,78
<i>notebook ram 4gb</i>	0,91	0,57
<i>lcd tv</i>	0,52	0,57
<i>notebook 14 inch</i>	0,88	0,85
<i>smartphone asus</i>	0,98	0,84
<i>iphone free casing</i>	0,91	0,63
<i>samsung anti gores</i>	0,81	0,99
Average	0,747	0,738

A searching system has good effectiveness if it has the same or 1:1 ratio of precision and recall value. Based on Table VI and VII above, it can be seen that the ratio of precision and recall value for 10 clusters is close to 1:1. This shows that the number of clusters will affect the effectiveness level of the system. The system will search the data based on the similarity between the cluster name and the keyword before it searches from all data. If the number of clusters more and more, then the amount of data contained in the cluster will be more specific. This causes the amount of relevant data and retrieved data to increase as well.

V. CONCLUSIONS AND FUTURE WORKS

Based on the test results on section IV, it can be concluded that the K-Means algorithm can be used to classify the product data from Bukalapak, Lazada, and Blibli sufficiently. The results of the clustering process can also help to search for the cheapest products from the three e-commerce faster. However, the number of clusters used will affect the effectiveness of the search process on the system. It can be seen that the ratio of precision and recall is better on 10 clusters. The system can not be implemented in the real world scenario which usually has a lot of products for now because K-means needs a predefined number of cluster.

For the future works, the system can be developed by using other methods, such as K-Nearest Neighbors. It aims to find out which method is suitable for the system in order to work more effectively. In addition, it can also be add more training data so there will be more variations of data on a cluster.

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