LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : PROSIDING

Judul Karya Ilmiah   : Design of Smart Open Parking Using Background Subtraction in the IoT Architecture
Jumlah Penulis   : 6 orang
Status Pengusul   : Penulis Utama
Identitas Prosiding   : a. Judul Prosiding   : **2018 2nd International Conference on Electrical Engineering and Informatics (Icon EEI 2018 Batam - Indonesia, 16th-17th October 2018**

         b. ISBN/ISSN   : 978-1-5386-6000-3, Hal : 7 - 11
         c. Thn Terbit, Tempat Pelaks. : Batam, 16-17 Oktober 2018
         d. Penerbit/Organiser   : IEEE Xplore digital library
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(beri ✓pada kategori yang tepat) ☐ *Prosiding* Forum Ilmiah Nasional

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	Reviewer I	**Reviewer II**	
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b. Ruang lingkup dan kedalaman pembahasan (30%)	7,00	7,50	7,25
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,00	7,00	7,00
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	7,50	7,00	7,25
Total = (100%)	**24,00**	**24,00**	**24,00**

Semarang,

Reviewer 2

Dr. Wahyudi, S.T., M.T.
NIP. 196906121994031001
Unit Kerja : Teknik Elektro FT UNDIP

Reviewer 1

Dr. Eng. Wahyul Amien Syafei, ST, MT
NIP. 197112181995121001
Unit Kerja : Teknik Elektro FT UNDIP

Judul Karya Ilmiah	:	Design of Smart Open Parking Using Background Subtraction in the IoT Architecture	
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b. Ruang lingkup dan kedalaman pembahasan (30%)	7,50		7,00
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,50		7,00
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	7,50		7,50
Total = (100%)	25,00		24,00

Catatan Penilaian Paper oleh Reviewer :

1. **Kesesuaian dan kelengkapan unsur isi paper:** Makalah ditulis sesuai dengan petunjuk IEEE conference. Penulisan makalah berisi abstract, introduction, methodology, testing and results, dan conclusion, serta references.

2. **Ruang lingkup dan kedalaman pembahasan:** Ruang lingkup makalah cukup fokus dengan pembahasan detil dari teori hingga implementasi smart open parking di dalam arsitektur IoT.

3. **Kecukupan dan kemutakhiran data/informasi dan metodologi:** Referensi berasal dari paper-paper yang mutahir. Hanya 1 dari 11 referensi berasal di luar dari 5 tahun terakhir.

4. **Kelengkapan unsur dan kualitas terbitan:** Makalah telah memenuhi unsur kelengkapan untuk diterbitkan dalam proceeding international conference (IconEEI2018)

Semarang,
Reviewer 1

Dr. Eng. Wahyul Amien Syafei, ST, MT
NIP. 197112181995121001
Unit Kerja : Teknik Elektro FT UNDIP

LEMBAR
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Komponen Yang Dinilai	Nilai Maksimal Prosiding		Nilai Akhir Yang Diperoleh
	Internasional [ ]	Nasional [ ]	
a. Kelengkapan unsur isi prosiding (10%)	2,50		2,50
b. Ruang lingkup dan kedalaman pembahasan (30%)	7,50		7,50
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,50		7,00
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	7,50		7,00
Total = (100%)	25,00		24,00

Catatan Penilaian Paper oleh Reviewer :

a) **Kesesuaian dan kelengkapan unsur isi paper:** Makalah yang disajikan sesuai dengan kebutuhan, pendahuluan, metoda, pembahasan, kesimpulan, dan daftar pustaka

b) **Ruang lingkup dan kedalaman pembahasan:** ruang lingkup pembahasan cukup lengkap dan cukup mendalam terkait materi yang disajikan

c) **Kecukupan dan kemutakhiran data/informasi dan metodologi:** Metoda yang disajikan sudah biasa dipakai, referensi data cukup mutahir, kurang dari 10 tahun

d) **Kelengkapan unsur dan kualitas terbitan:** Kelengkapan unsur makalah terpenuhi dan diterbitkan pada prosiding konferensi internasional dan terindeks Scopus

Semarang,
Reviewer 2

Dr. Wahyudi, S.T., M.T.
NIP. 196906121994031001
Unit Kerja : Teknik Elektro FT UNDIP

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2nd International Conference on Electrical Engineering and Informatics, ICon EEI 2018; Nagoya
Hill HotelJl. Teuku Umar, Superblok Nagoya Hill Batam, Kepulauan RiauBatam; Indonesia; 16
October 2018 through 17 October 2018; Category numberCFP18RPC-ART; Code 150474

Design of smart open parking using background subtraction in the IoT architecture (Conference Paper)

Sofwan, A. ⊠, Hariyanto, M.S. ⊠, Hidayatno, A. ⊠, Handoyo, E. ⊠, Arfan, M. ⊠, Somantri, M. ⊠

⊞⊙ Save all to author list

Department of Electrical Engineering, Diponegoro University, Semarang, Indonesia

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Abstract   ⌄ View references (11)

The Internet of Things (IoT) has evolved and penetrated to our live since the end of the last century. Nowadays, many devices for any purpose are connected through the Internet. A smart node, in smart campus environment, can detect an availability of an open parking space by calculating the vehicle that enters or outs from the space. The node applies a background subtraction method, which is deployed in IoT architecture. The Gaussian Mixture Model (GMM) is utilized to determine foreground and background image, in order to detect a moving object at an open area. Furthermore, the node can discriminate the type of vehicle with a high accuracy. The result of vehicle type classification is transmitted by the node through the Internet, and then it is saved to the data server. We observe the designed system succeeds delivering a good performance in terms of average accuracy determining car and motorcycle are 93.47% and 91.73%, respectively. © 2018 IEEE.

SciVal Topic Prominence ⓘ

Topic: Parking | Traffic congestion | Parking supply

Prominence percentile: 96.391   ⓘ

Author keywords

(Background subtraction) (Gaussian Mixture Model) (Internet of Things) (Smart campus)

Indexed keywords

Engineering   (Electric power systems) (Gaussian distribution) (Object detection) (Vehicles)
controlled terms:

Engineering   (Background image) (Background subtraction) (Background subtraction method)
uncontrolled terms (Gaussian Mixture Model) (Internet of thing (IOT)) (Iot architectures) (Moving objects)
(Smart campus)

Engineering main   (Internet of things)
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M.
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Conference on Information and
Communication Technology,
ICoICT 2018

Energy and delay aware massive
access management in machine-
to-machine communications

Tagarian, Z. , Shahgholi
Ghahfarokhi, B.
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Green Machine-To-Machine
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Li, M. , Yu, F.R. , Si, P.
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   ISBN: 978-150904083-4
   doi: 10.1109/ICDMAI.2017.8073523

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11 Sofwan, A., Surur, F.A., Arfan, M., Handoyo, E., Yosua Alvin, A.S., Somantri, M., Enda, W.S.

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   of Things (IoT) architecture**

   (2018) *2018 6th International Conference on Information and Communication Technology, ICoICT 2018*, art.
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16th – 17th Ocober 2018 (Tuesday)

Venue : Nagoya Hill Hotel

Date	Time	Program		
16-Oct-18	07:30-08:20	Registration		
	08:20-08:50	Opening & Welcome Ceremony (Convention Hall)		
	08:50-09.00	Photo Session		
	09:00-09:50	Keynote Speech 1 (Convention Hall)		
		Prof. Dr. Ir. Mohd Wazir Mustafa		
	09:50-10:40	Keynote Speech 2 (Convention Hall)		
		Prof. Dr. Ir. Riri Fitri Sari, M.Sc, M.M		
	10:40-11:30	Keynote Speech 3 (Convention Hall)		
		Assoc. Prof. Dr. Razali Bin Ngah		
	11:30-12.00	Question & Answer		
	12:00-13:00	Lunch Break		
	13:00-17:00	**Parallel Sessions**		
		Convention Hall	**Bintan**	**Natuna**
	13:00-15:00	Track 3	Track 2	Track 1
	15:00-15:15	**COFFEE BREAK**		
	15:15-17:00	Track 3	Track 2 & 3	Track 1 & 3
	18:30-21:30	**Gala Dinner**		
17-Oct-18	07:00-18:00	Singapore day trip for those who have registered to travel agency		

Keynote Speech 1

The Utility and Grid of the Future Electrical Power System: Challenges, Needs, Trends and Key Issues

Prof. Dr. Ir. Mohd Wazir Mustafa

Universiti Teknologi Malaysia

Abstract

Digital economy, national security, and sustainable living are highly dependent on reliable, safe, abundant, affordable, and secure electricity. Electric power systems through-out many parts of the world face challenges brought on by new technology trends, environmental concerns, a multiplicity of consumer needs, and regulatory requirements. These factors have partially accelerated global demand for low carbon power system and stimulated new technology trends. The vision for future power system is to transition away from carbon-based fuels toward increased penetration of renewable DERs and use of energy storage and electric transportation. Far-reaching change is transforming the electric power sector in the form of: government and regulatory action to address climate change concerns; increasingly empowered and demanding customers; proliferation of distributed generation, including solar and wind; digitization of the grid and information and operational technologies integration; increased risk of cyber-attacks on grid systems and infrastructure and energy reform as markets open to new forms of competition. Future electric power system is also expected to improve cost efficiency, service quality, and safety, offer reliability and withstand external threats such as superstorms and cyber threats, as well as flexibility respond in real time to fluctuations in demand and supply during major weather or security events. On the other hand, managing and optimizing the system will become increasingly challenging due to the complexities in system balancing between the load and the integrated RES generation, as a result of increased levels of system variability and uncertainty.

ISI Journal

1. S.N. Syed Nasir, J.J. Jamian, M.W. Mustafa, (2018) "Minimization Of Harmonic Distortion Impact Due To Large-Scale Fast Charging Station Using Modified Lightning Search Algorithm And Pareto-Fuzzy Synergistic Approach", IEEJ Transactions on Electrical & Electronic Engineering, Institute of Electrical Engineers of Japan. Volume 13, Issue 6 June 2018, pp 815-822 **(ISI Indexed), IF 0.723 (Q4).**

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12. Beenish Sultana, MW Mustafa, U Sultana, Abdul Rauf Bhatti (2016). "*Review on reliability improvement and power loss reduction in distribution system via network reconfiguration.*" Renewable & Sustainable Energy Reviews. **(ISI Indexed), IF: 6.798 (Q1).**

13. S saeh, MW Mustafa, YS Mohammed, M Almaktar (2016). "*Static security classification and evaluation classifier design in electric power grid with presence of PV power plants*

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14. Mohammad Reza Miveha, Mohd Fadli Rahmat, Ali Asghar Ghadimib, Mohd Wazir Mustafa (2016). "*Control techniques for three-phase four-leg voltage source inverters in autonomus microgrids: A review*." Renewable & Sustainable Energy Reviews. **(ISI Indexed), IF: 6.798 (Q1).**

Area of Interest

Smart Grid, Distributed Generation, Sustainable Energy, Regulated & Deregulated Power System, Renewable Energy, Power System Analysis, Power System Devices and Apparatus, Power Quality, Protection.

Project Leader/Project Member

i) Project Member, Non-Intrusive Load Monitoring and Management of Residential Electrical Appliances Using Steady-State Load Signatures. PY/2017/01321. Budget approved RM 40,500. (01/02/2018- 31/01/2020).

ii) Project Leader, Enhanced Power Quality Controller in An Autonomous Microgrid Using Whales Optimization Algorithm, PY/2017/00612, Budget approved RM 40,000. (01/07/2017 - 30/09/2018).

iii) Project Member, Passive Filter Size Optimization for Reducing the Harmonic Distortion Due to Electrical Vehicle Charging Station. PY/2016/06734. Budget approved RM 40,000. (01/10/2016- 31/07/2018).

iv) Project Leader, Flexibility Constrained Unit Commitment Problem for Enhanced Operation of Low Carbon Power Systems by an Enhanced Priority List Based Particle Swarm Optimization Technique. PY/2016/06747. Budget approved RM 40,000. (01/07/2016- 30/06/2018).

v) Project Leader, Enhancing Power System Oscillation Stability with Facts Devices using Fuzzy Logic and Bees Algorithm. Budget approved RM 50,000.00. (01/05/2015- 31/12/2016).

vi) Project Member, Flexible Feed in Tariff Scheme for Photovoltaic in Residential Area Based on Artificial Neural Network Projection. Budget approved RM 20,000.00. (01/05/2015- 31/07/2016).

vii) Project Leader, Coordinated and Robust Design of Power System Stabilizers using Bees Algorithm, Budget approved RM 88,000.00. (01/07/2014- 30/09/2016).

viii) Project Leader, A Self-Configuring Methodology Of Future Smart Power Grid (A Solution Towards Future Potential Challenges) Budget approved RM 80,688.79. (01/04/2014- 31/03/2016).

Keynote Speech 2

Preparing Engineers for the Internet of Things Network for Circular Economy and Sustainable Building Management

Prof. Dr. Ir. Riri Fitri Sari, MM MSc, DTM, SMIEEE

Universitas Indonesia

Abstract

The Internet of Things (IoT) in the disruption era has come towards its peak time which includes smart cities, smart buildings, smart homes, smart kitchens, smart appliances, security, smart home, smart health, smart factories, smart machines, smart supply chain, smart transportation, smart manufacturing, autonomous vehicles, smart consumer devices, etc. All infrastructure and its management will be based on the smart systems which have sensors and crowdsourcing as information sources.

At the university of Indonesia, we have been using NS-2 and NS3 as the de facto open source network simulator in which we can contribute to the development and performance evaluation of different protocols, and contribute new ideas by providing C and tcl codes. As the result of the open source approach we can experiment with different protocol such as congestion control mechanism, adhoc network, vanet, and other 802.11 series protocols. Students could quickly experience how to collaborate to upgrade our Internet Protocol to advancement, from Adhoc Network to Blockchain Architecture. Our latest work on the Lorawan, NB-IOT and Blockchain based in NS-3 have shown that the issue of infrastructure development will not only dictated by proprietary software approaches but also worldwide collaboration in which we can train the next information infrastructure engineers.

During all the 30 years of the development of Internet Protocol through Internet Engineering Task Force (IETF) and 3GPP we have witnessed that Internet engineer are collaborating all over the world towards the advancement of our information super highway. The trace can be found from the website of contributed code of ns-2 of Lawrence Berkeley laboratory in which engineers shows their simulator code, introduce their new ideas, writing the Internet Draft, while at the same time companies such as Huawei, ZTE, and Mediatech quickly turn that in to manufacturing products that lower the cost with improved quality.

We have witnessed how open source language such as Java, PHP, and C have flourished and support the development of open source operating system such as Linux and its derivation. Lately it becomes Android based devices which currently immensely used worldwide to support us in daily activity decision making processes based on connected information.

All of the advancement of computer and communication technology in Silicon Valleys of the US, China, Taiwan, Singapore, etc would not happen this fast without tools that could provide the current surrounding environment that should be extended. Therefore, lecturers and senior researchers plays an important role in making sure that the new students could go directly to the problem as soon as possible without reinventing the wheel, using problem based learning. The short time to the product development life cycle pushed all of us to collaborate to reach win-win consensus through standardization.

This talk will discuss some state of approaches in training the IoT Network engineers to solve the problem found to achieve balanced circular economy and sustainable building management. We will some example learned from different approaches used across the globe to overcome challenges such as resource constraint, scalability, heterogeneity, mobility and security for wireless monitoring system. We will also discuss the role of engineers to provide applications and communication mechanism for indoor and outdoor purposes for sustainability purposes.

Biography

Riri Fitri Sari received a Ph.D. from the School of Computing, University of Leeds, UK, with specialization in Multimedia Network in 2004. From 2006-2014, she was the IT Director of the University of Indonesia. In 2009, she has become a Full Professor of Computer Engineering at the Faculty of Engineering, University of Indonesia. She has written more than 60 journal papers, 130 conference articles,10 books. She has also worked in different teams and granted with 11 patents/copyrights, and supervised more than 20 doctoral students. She is a Senior member of the IEEE and a Professional Engineers from PII.

She has focused on Protocol Engineering, Multimedia Network, Vehicular Area Network, Internet of Things, and IT for Sustainability Development Goals. She was the recipient of the IEEE Region 10 WIE Most Inspiring Engineer Award 2012 in Kalkuta India. She is awarded as an Honorary Professor at the Kazakh National Agrarian University, Almaty Kazakhistan, in June 2017. She has been using the power of Information Technology and Social Media to develop the UI GreenMetric Rankings of World Universities which have been widely used in more than 516 universities in 75 countries as a voluntary standard for improving their sustainable and green campus programs. Under her leadership, the UI GreenMetric University Network has conducted workshops organized in more than 20 countries, making UI GreenMetric as a reference for infrastructure development of smart sustainable campus.

Recent Publication

1. M Salman, R Yugitama, Amiruddin, RF Sari KAMIES: Security Optimization of KASUMI Algorithm by Increasing Diffusion Level, Internasional Journal of Security and its Application 12(3), 29-46, 2018.

2. Y Shirota, T Hashimoto, RF Sari, Visualization of time series statistical data by shape analysis (GDP ratio changes among Asia countries), Journal of Physics: Conference Series 971 (1), 012013, 2018.

3. M Misbahuddin, AA Ratna, RF Sari, Dynamic Multi-hop Routing Protocol Based on Fuzzy-Firefly Algorithm for Data Similarity Aware Node Clustering in WSNs., International Journal of Computers, Communications & Control 13 (1), 2018

4. Ruki Harwahyu, Alfan Presekal, Riri Fitri Sari, Performance Evaluation with Optimized Configuration, International Journal of Future Generation Communication & Networking, Vol.11, No. 4(2018), pp51-68, http://dx.doi.org/10.14257/ijfgcn.2018.11.4.05, http://www.sersc.org/journals/IJFGCN/vol11_no4/5.pdf

5. Misbahuddin, M.; Ratna, A. A. Putri; Sari, R. F, International Journal of Computers, Communications & Control, Feb2018, Vol. 13 Issue 1, p99-116. 18p. Dynamic Multi-hop Routing Protocol Based on Fuzzy-Firefly Algorithm for Data Similarity Aware Node Clustering in WSNs., International Journal of Computers, Communications & Control. Feb 2018, Vol. 13 Issue 1, p99-116. 18p. (SJR Q2, H Indeks 19)

6. R. Harwahyu , R. Cheng, C. Wei, RF Sari., Optimization of Random Access Channel in NB-IoT, IEEE Internet of Things Journal, 5 (1), 391-402. Januari 2018. (SJR Q1, H Indeks 22)

7. RN Ode, D Perdana, RF Sari, Performance Evaluation of AODV, AODV-UU, and AODV with Malicious Attack Mode on Vehicular Ad-Hoc Network, Advanced Science Letters 23 (5), 3990-3994, 2017, (SJR Q4, H indeks 21, 2017/5/1)

8. I Sutandi, RF Sari, Performance Analysis of Different Push Notification Services Implementation on Vehicle Sharing Application, Advanced Science Letters 23 (4), 3644-3648, 2017, (SJR Q4, H indeks 21, 2017/4/1)

9. RF Sari, AF Rochim, E Tangkudung, A Tan, T Marciano, Location-Based Mobile Application Software Development: Review of Waze and Other Apps, Advanced Science Letters 23 (3), 2028-2032, 2017(SJR Q4, H indeks 21, 2017/3/1)

10. D Perdana, RG Cheng, RF Sari, Analytical Study of the Impact of the Mobility Node on the Multi-channel MAC Coordination Scheme of the IEEE 1609.4 Standard, KSII Transactions on Internet and Information Systems (TIIS) 11 (1), 61-77, (SJR Q3, H indeks 15 2017/1/1)

Recent Research Activities

- Principal Investigator, Hibah Kolaborasi Riset dan Publikasi Internasional (International Joint Research and Publications with Prof. Ray Guang-Cheng, NTUST, Taiwan, "Development of an Optimize New Technique Algorithm of Variable CCH Interval (VCI) with QoS Implementation using EDCA and Markov chain approach in IEEE 1609.4/802.11p standard, Kemendiknas, Feb 2014-2016.

- Principal Investigator, Hibah Cluster UI, "Location-based Distributed Data Mining for Vehicle Sharing in Green Transportation System," UI, Feb 2014-Dec 2014.

- Principal Investigator, Hibah PUPT, "Pengembangan Algoritma Terinspirasi Proses Alami untuk Optimasi Solusi Jaringan Sensor Nirkabel dan IoT," PUPT 2016, UI, 1173/UN2.R12/HKP.05.00/2016, 17 Feb 2016-10 Nov 2016.

- Principal Investigator, Hibah Cluster UI, "Location-based Distributed Data Mining for Vehicle Sharing in Green Transportation System," UI, Feb 2016-Dec 2016.

- Principal Investigator, Hibah PUPT, "Pengembangan Algoritma Terinspirasi Proses Alami untuk Optimasi Solusi Jaringan Sensor Nirkabel dan IoT," PUPT 2016, UI, No: 1173/UN2.R12/HKP.05.00/2016, 17 Feb 2016-10 Nov 2016.

- Principal Investigator, Hibah PUPT, "Dampak Masa Depan Media Web pada Ekosistem Sitasi Akademik (Future Impact of Media for Worldwide Academic Citation Ecosystem) " PUPT 2017, UI, Adian, 2756/UN2.R3.1/HKP05.00/2017, 4 April 2017-30 Nov 2017. 002/ADD/SP2H/LT/DRPM/VIII/2017.

- Principal Investigator, Insentif Riset Sistem Inovasi Tahun Skema Insinas Riset Pratama Individu,"Pengembangan Teknologi Utama untuk Layanan IoTpada Jaringan 5G/IMT-2020,   Insinas   2017   UI,   Ruki   Harwahyu,   Alfan   Presekal, 3497/UN2.R3.1/HKP.05.00/2017, 13 Juli 2017-30 Nov 2017.

- Principal Investigator, TA Dok, "Indeks RA sebagai alternatif untuk mengukur dampak peneliti yang adil dan optimal berdasarkan metode Lotka dan Jain's Fairness Indeks", Adian Fatchur Rochim, 1661/UN2.R3.1/PPM.0001/2018.

- Principal Investigator, PDUPT, "Dampak Masa Depan Media Web pada Ekosistem Citasi Akademik", 419/UN2.R3.1/HKP05.00/2018.

- Principal Investigator, PTUPT, "Mekanisme Keamanan Berbasis Onetime Pad Teracak untuk Gateway Multiprotokol dalam Mendukung Kinerja dan Kompatibilitas teknologi dalam IoT", 505/UN2.R3.1/HKP05.00/2018.

- Principal Investigator, Hibah World Class Professor 2018.Principal Investigator, Hibah USAID Shera 2018.

Keynote Speech 3

D2D Challenges and Opportunities

Assoc. Prof. Dr. Razali Ngah

Universiti Teknologi Malaysia

Abstract

Device-to-Device (D2D) communication, which alludes to direct transmission between two devices without passing through the base station. It has been broadly anticipated to be an essential cornerstone to enhance system performance and bolster new amenities beyond 2020 in future fifth generation (5G) systems [1]. In 5G networks, it is anticipated that controlled D2D communication offers the open door for short distance communication, local management and permits the isolation of local activity from the global activity, for example locally data offloading. D2D communication evacuates the data traffic heap load on the backhaul and center systems and decreases the vital exertion for managing data traffic at the center system. Due to proximity services, D2D communication viewed as a promising remedy for enhancing communication accomplishment and system capacity of long term evolution-advanced (LTE-A) network. The potential enhancements in proximity services that can be provided by D2D are not entirely exploited yet. In the 5G network, such confinement does not exist any longer, and it is anticipated that D2D operation in the in-band cellular network will be locally incorporated as a component without any bounds in the 5G network. There are also many more challenges to implement D2D communication such as discovery (location and position) of the devices with ensured accuracy and efficiency, signaling techniques need to be amended with signaling overhead evaluation, network integration, and local support in future 5G systems.

Biography

Razali Ngah received the Ph.D. degree from the University of Northumbria, United Kingdom, in 2005. Since 1989, he has been with the Faculty of Electrical Engineering, Universiti Teknologi Malaysia (UTM), where he is currently a Associate Professor. He is also the Deputy Director of Wireless Communication Centre in UTM. His research interests include antennas and propagation for communications, device-to-device communication, UWB communication, radio over fiber and photonic networks.

Recent Publication

1. O. Hayat, R. Ngah and Yasser Zahedi, Device discovery for D2D communication in in-band cellular networks using sphere decoder like (SDL) algorithm, EURASIP Journal on Wireless Communications and Networking (2018) 2018:74, Q2 (IF: 1.951)

2. Bushra Naeema, Razali Ngah, and Siti Z. Mohd Hashim, Reduction of Ping-pong effect in Heterogeneous Networks Using Fuzzy Logic, Journal of Soft Computing (Springer), 2018, Q1 (IF: 2.472)

3. Hayat, O. Ngah, R., Zahedi, Y. "Cooperative Device-to-Device Discovery Model for Multiuser and OFDMA Network Base Neighbour Discovery in In-Band 5G Cellular Networks", Wireless Personal Communications, In Press. . Q4 (IF: 0.951)

4. Muhamad, W.A.W.,Ngah, R., Jamlos, M.F., Soh, P.J., Ali, M.T., "High-Gain Dipole Antenna Using Polydimethylsiloxane–Glass Microsphere (PDMS-GM) Substrate for 5G Applications", Applied Physics A: Materials Science and Processing, Vol.123 (1), article no: 102, 2017. Q3 (IF: 1.455)

5. Muhamad, W.A.W., Ngah, R., Jamlos, M.F., Soh, P.J., Ali, M.T., Narbudowicz, A., "Bandwidth Enhancement of a Multilayered Polymeric Comb Array Antenna for Millimeter-Wave Applications", Applied Physics A: Materials Science and Processing Vol.123 (1), article no: 105 , 2017. Q3 (IF: 1.455)

6. Muhamad, W.A.W., Ngah, R., Jamlos, M.F., Soh, P.J., Ali, M.T., "Bandwidth Enhancement using Polymeric Grid Array Antenna for Millimeter-wave Application", Applied Physics A: Materials Science and Processing, Vol.123 (1), article no: 69 ,2017 . Q3 (IF: 1.455)

7. Zahedi, Y. , Ngah, R., Nunoo, S., Mokayef, M., Alavi, S.E., Amiri, I.S., "Experimental measurement and statistical analysis of the RMS delay spread in time-varying ultra-wideband communication channel" , Measurement: Journal of the International Measurement ConfederationVol.89, pp 179-188.2016 IF : Q2 (1.742)

8. W.A.W.Muhamad,R.Ngah,M.F.Jamlos,P.J.Soh, H.Logo, " Antenna Array Bandwidth Enhancement Using Polymeric Nanocomposite Substrate", Applied Physic A (Material Science & Processing) 2016, 122, pp 426- 435, 2016. Q2 (IF: 1.704)

9. Yasser Zahedi, Razali Ngah, Mastaneh Mokayef, Khalid Zahedi, "Stationarity Regions for Ultrawideband Channels", IEEE Antennas And Wireless Propagation Letters, Vol. 15, pp 139- 142, 2016. Q2 (IF: 1.579)

10. Zahedi, Yasser; Ngah, Razali; Abdulrahman, A. Y; Mokayef, Mastaneh; Alavi, S. E; Zahedi, Khalid; Arrifin, S. H. S " Experimental Measurement and Analysis of Electromagnetic Communications in Underwater Wireless Sensor Network", Journal of Computational and Theoretical Nanoscience", 12(12), pp. 6069-6076(8), 2015. Q2 (IF: 1.666)

Recent Research Activities

- Antenna design for 5G communication system

- D2D communication

- UWB coummunication

Parallel Session

Room : Natuna (3rd Floor)

No	Title	Authors	Time	Track
	Invited Talk 1 : High Voltage Plasma Generator from Dielectric Barrier Discharge	Dr. Eng Fri Murdiya	13:05-13:15	
1	Analysis of Peltier Characteristic and Cold Side Treatment for Thermoelectric Generator Module at Brick Kiln Furnace	Missyamsu Algusri	13:15-13:30	Track 1
2	Short Term Load Forecasting for Electrical Dispatcher of Baghdad City Based on SVM-PSO Method	Aqeel S. Jaber	13:30-13:45	Track 1
3	The Effect of Pressure and Gap Distance to AC Breakdown Behavior of SF_6/N_2 Gas Mixtures	Nur Farhani Ambo; Hidayat Zainuddin; Muhammad Saufi Kamarudin; Jamaludin Mohd Wari; Ayuamira Zahari	13:45-14:00	Track 1
4	Optimum Torque Control of Stand Alone Wind Turbine Generator System Fed Single Phase Boost Inverter	Muldi Yuhendri; Aslimeri MT; Mukhlidi Muskhir	14:00-14:15	Track 1
5	Comparison of MPPT Fuzzy Logic Controller Based on Perturb and Observe (P&O) and Incremental Conductance (Inc) Algorithm	Azmi Saleh	14:15-14:30	Track 1
6	Characteristics of Positive Lightning as Observed in Temperate and Tropic Regions: A Review	Nor Asrina Ramlee; Noor Azlinda Ahmad	14:30-14:45	Track 1
7	Design and Analysis of Variable-Reluctance Stepping Motor as Actuator Element of New Type Automatic Transfer Switch	Budhi Anto; Yangly Refli; Fri Murdiya; Eddy Hamdani; Suwitno Suwitno; Amir Hamzah	14:45-15:00	Track 1
	COFFEE BREAK		**15.00-15.15**	
8	Application of Molecular Dynamics Study and Homo Lumo Calculation on the Ionized Air for High Voltage Engineering	Fri Murdiya; Neni Frimayanti; Marzieh Yaeghoobi	15:15-15:30	Track 1
9	Barrier Discharge in Magnetic Field: The Effect of Magnet Position Induced Discharge in The Gap	Fri Murdiya; Budhi Anto; Eddy Hamdani; Suwitno Suwitno; Edy Ervianto; Amun Amri	15:30-15:45	Track 1

10	Web Based Wind Energy Conversion System Monitoring	Amir Hamzah; Bayu Chaniago; Suwitno Suwitno; Iswadi Hasyim Rosma; Haji Gussyafri; Iwan Kurniawan	15:45-16:00	Track 1
11	The Implementation and Analysis of Dual Axis Sun Tracker System to Increase Energy Gain of Solar Photovoltaic	Iswadi Hasyim Rosma; Jamarrintan Asmawi; Syukri Darmawan; Barri Anand; Nurhalim Dani Ali; Budhi Anto	16:00-16:15	Track 1
12	Analysis of Single Axis Sun Tracker System to Increase Solar Photovoltaic Energy Production in the Tropics	Iswadi Hasyim Rosma; Ichsan Maulana Putra; Dian Yayan Sukma; Ery Safrianti; Azriyenni Azhari Zakri; Abubakar Abdulkarim	16:15-16:30	Track 1
13	Extract Fault Signal via DWT and Penetration of SVM for Fault Classification at Power System Transmission	Azriyenni Azhari Zakri; Syukri Darmawan; Iswadi Hasyim Rosma; Jafaru Usman; Boy Ihsan	16:30-16:45	Track 1

Room : Bintan (2nd Floor)

No	Title	Authors	Time	Track
	Invited Talk 2: Challenges on 5G MIMO Antenna Design	**Dr. Yusnita Rahayu**	13:05-13:15	
1	Measurement Design of Sensor Node for Landslide Disaster Early Warning System	Aghus Sofwan; Sumardi Sumardi; Muhammad Reynaldi	13:15-13:30	Track 2
2	Performance Analysis of a Dielectric Resonator Antenna with Different Feeding Technique for 5G Communication	Abinash Gaya; Mohd Haizal Jamaluddin; Muhammad Ramlee Kamarudin; Raghuraman Selvaraju; Irfan Ali	13:30-13:45	Track 2
3	FEXT Analysis and Its Mitigation Using Double-slit Complementary Split-Ring Resonators	Azhagumurugan R	13:45-14:00	Track 2
4	Android-based Touch Screen Projector Design Using a 3D Camera	Mochamad Susantok; Susi Rubiyati; Muhammad Saputra; Muhammad Diono	14:00-14:15	Track 2
5	Early Warning Systems Using Fire Sensors, Wireless and SMS Technology	Ari Sandhyavitri; Rahyul Amri	14:15-14:30	Track 2
6	New Design of High-Gain Beam-Steerable Dipole Antenna Array for 5G Smartphone Applications	Yusnita Rahayu; Hikmah Putra; Ahmad Romadan; Adit Kurniawan	14:30-14:45	Track 2
7	Microstrip Antenna Design H-Shaped Planar Array 4 Elements Using Circular Slot for Fixed WiMAX Network 3.5 GHz Frequency	Ery Safrianti; Yoga Yusfarino; Feranita Jalil; Linna Sari	14:45-15:00	Track 2
	COFFEE BREAK		**15.00-15.15**	
8	A Survey on Medium Access Control (MAC) for Clustering Wireless Sensor Network	Anhar Anhar; Rajagopal Nilavalan; Febrizal Ujang	15:15-15:30	Track 2
9	A Single DD-MZM for Generating Vestigial Sideband Modulation Scheme in Radio over Fiber Systems	Febrizal Ujang; Gunawan Wibisono	15:30-15:45	Track 2

Room : Convention Hall (2nd Floor)

No	Title	Authors	Time	Track
1	Performance Evaluation of Automatic Dependant Surveillance Broadcast Data Distribution Using Named Data Networking	Muhammad Raka Perbawa; Riri Fitri Sari	13:00-13:15	Track 3
2	Design of Smart Open Parking Using Background Subtraction in the IoT Architecture	Aghus Sofwan; Eko Handoyo; Achmad Hidayatno; M Arfan; Maman Somantri; Monica Sari Hariyanto	13:15-13:30	Track 3
3	Using Bayesian Network to Determining the Recipient of Zakat (Case Study: BAZNAS Pekanbaru)	Rahmad Kurniawan; Akbarizan Akbarizan; Sri Murhayati; Nurcahaya Nurcahaya; Mohd Zakree Ahmad Nazri; Siti Norul Huda Sheikh Abdullah	13:30-13:45	Track 3
4	Intelligent Decision Support System Using Certainty Factor Method for Selection Student Career	Yenny Desnelita; Kasman Rukun; Syahril, Dewi Nasien; Gustientiedina; Vitriani	13:45-14:00	Track 3
5	Social Media Sentiment Analysis Using K-Means and Naïve Bayes Algorithm	Muhammad Ihsan Zul; Feoni Yulia; Dini Nurmalasari	14:00-14:15	Track 3
6	A Review of Firefly Algorithms for Path Planning, Vehicle Routing and Traveling Salesman Problems	T. Brenda Chandrawati; Riri Fitri Sari	14:15-14:30	Track 3
7	An Analysis of ID and Evaluation of Physics Learning Media of Three Dimensional Animation Using Blender Application	Muhammad Nasir; Rizo Prastowo; Riwayani Riwayani	14:30-14:45	Track 3
8	The Effect of Class Imbalance Against LVQ Classification	Rahmad Abdillah; Iis Afrianty; Suwanto Sanjaya	14:45-15:00	Track 3
	COFFEE BREAK		**15.00-15.15**	
9	Determining of Adolescent Learning Styles by Comparing the Effectiveness Between Certainty Factor and Demster-Shafer	Wita Yulianti; Diki Arisandi; Auliya Syaf	15:15-15:30	Track 3
10	Virtual World Environment Design for Vidyanusa e-Learning System	Rahmat Rizal; Dewi Nasien; Linna Oktaviana Sari	15:30-15:45	Track 3
11	Building Domain Ontology from Semi-formal Modelling Language: BPMN	Amarilis Yanuarifiani, Yanuar Firdaus Arie Wibowo and Kusuma	15:45-16:00	Track 3

		Ayu Laksitowening		
12	Web-based Expert System to Diagnose Tropical Diseases Using Certainty Factor	Rahmad Kurniawan, Novi Yanti, Mohd Zakree Ahmad Nazri, Siti Norul Huda Sheikh Abdullah, Wilda Hunafa, Mardhiyah Kharismayanda	16:00-16:15	Track 3
13	New Feature Vector from Freeman Chain Code for Handwritten Roman Character Recognition	Dewi Nasien; Deni Yulianti; Omar Fakhrul Syakirin; M. Hasmil Adiya; Yenny Desnelita	16:15-16:30	Track 3
14	Off-line Handwritten Korean Letter Using Principle Component Analysis and Back Propagation Neural Network	Dewi Nasien; Feri Candra; Delsavonita Delsavonita; Deni Yulianti; M. Hasmil Adiya	16:30-16:45	Track 3

Short Term Load Forecasting for Electrical Dispatcher of Baghdad City Based on SVM-PSO Method

1st Aqeel S. Jaber
department of electriacl power enginerring techniques
Al-mamon university colage
Iraq
aqe77el@yahoo.com

2nd Koay A. Satar
department of electriacl power enginerring techniques
Al-mamon university colage
Iraq
kosaysm@yahoo.com

3rd Nadheer A. Shalash
department of electriacl power enginerring techniques
Al-mamon university colage
Iraq
eng_n_a_msc@yahoo.com

Abstract—**The short-term of power forecasting represents as one of the substantial roles in the safe and economic uses of the power system. The climate consideration is the main challenge which is facing the improvement of the load forecasting accuracy. In this paper hybrid PSO and SVM methods used to forecast non-linear load data was proposed. First, description of the detail of a hybrid method between PSO and support vector machines learning method. Secondly; applying this method for forecasting the load in Bagdad city. Finally, the proposed method implemented by MATLAB and compared with classical support vector machines method. The results show that the proposed method was very clear in the accuracy of the forecasting depends on terms of absolute proportional error (MAPE).**

Index Terms— *Load Forecasting, PSO, SVM.*

I. INTRODUCTION

The optimization by adaptive intelligent methods with PSO was very common terms in power system studies in last ten years [1]. Since PSO has been proposed by Kennedy and Eberhart; the method was used to solve many problems of power system [2]. Also, the support vector machines learning method was faced many challenges in the accuracy of the power system forecasting [3],[4]. The power system operators and engineering are relying on the short and long time forecasting to give a high quality of services. Many works have been done to get that quantity of knowledge in power system data behavior especially after the term of DGs was come out. A clustering method based on a short time Load predation depends on (SVM) was introduced by Jain, and Satish [5]. Xing et al. have been proposed multi prediction methods based on multiple support vector machine (SVM); such as least squares support vector machine (LSSVM) [6]. Hybrid intelligent approaches of load forecasting field methods have increased their importance last years[7]. Different statistical techniques include regression analysis, Kalman filtering method weighted exponential method, and Box-Jenkis's autoregressive internal moving average methods have been suggested in grid prediction field [8]. A load forecasting using ANNs was applied to procure the power demand for short time, and PSO was optimized SDC parameters to increase the stability [9]. However, Bagdad data consist of a special-event or non-linearity behavior. So, the previous prediction models gave a few promising results. Qi Wu was introduced a hybrid method between PSO and SVM to predict the demand but without taking on the effect of climate[6].

In this work, a short time forecasting of power system load has been proposed using PSO- SVM intelligent technique. The study has done starting from the mathematical analysis of PSO, SVM, and the forecasting, ending to the simulation of the proposed method and the comparison of the results. The results comparison was depended on the error calculation concept to validate the system using MATLAB. The prediction results proved that PSO- SVM strategy is more accurate concerning with the classical support vector machines method.

II. RELATED WORK

Support Vector Machines (SVM) is a set of assortment techniques, which was introduced by Vladimir N. Vapnik in the end of the decade of the last century [3],[10]. The classification or regression, was the main topic of SVM applications [10].

For m of dimension of input vector, the SVM optimization equations can be showed as in [3]:-

$$\min J = \frac{1}{2}\|\omega\|^2 + \frac{1}{2}C\sum_{i=1}^{l}e_i^2 - \sum_{i=1}^{l}\alpha_i(\omega^T\varphi(x_i) + b + e_i - y_i) \quad (1)$$

Where e_i is initial error, $e \in R^{l \times 1}$ is the vector error, C is the regularization parameter. α is the Lagrange multipliers, $\alpha \in R^{l \times 1}$. Also the nonlinear forecasting power $P(t)$ can be expression in terms of x_i (the input vector) and temperature $T(t)$ by (2) [9]:-

$$P_{i+1} = \sum_{i=1}^{m}\alpha_i K(x_i, x) + b \qquad i = 1,\dots,m \qquad (2)$$

Where the natural illumination $L(t)$; X - coordinates of the center of the scattering vector; α_i, b - linear coefficients;

$K(x_i, x)$ - Kernel function, which performs a nonlinear mapping the input space of input data.

At the same decade of SVM introducing, Particle Swarm Optimization was proposed by [11]. A birds swarm was simulate as random particles to search of maximum food place after some of iterations [12].

The Effect of Pressure and Gap Distance to AC Breakdown Behavior of SF$_6$/N$_2$ Gas Mixtures

N. F. Ambo
Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka
Melaka, Malaysia
Email: m011620009@student.utem.edu.my

H. Zainuddin
Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka
Melaka, Malaysia
Email: hidayat@utem.edu.my

M. S. Kamarudin
Faculty of Electrical and Electronic Engineering
Universiti Tun Hussein Onn Malaysia
Johor, Malaysia
Email: saufi@uthm.edu.my

J. M. Wari
Indkom Engineering Sdn. Bhd.
Selangor, Malaysia
Email: jamalwari@indkom.com.my

A. Zahari
Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka
Melaka, Malaysia
Email: m011520010@student.utem.edu.my

Abstract— To date, sulphur hexafluoride (SF$_6$) gas has been the predominant insulation medium in high voltage applications which mainly due to its exceptional physical and electrical properties. However, environmental concerns arise since SF$_6$ is a potent greenhouse gas. In this study, the breakdown behavior of SF$_6$/N$_2$ gas mixtures under non-uniform field is investigated. A breakdown voltage test on SF$_6$/N$_2$ gas mixtures which subjected to AC voltage was conducted inside a pressure vessel. The gas mixture ratio was fixed to 10/90, while the total gas pressure was varied between 0.11 MPa to 0.15 MPa with 0.01 MPa intervals. Meanwhile, R6-Plane electrode configuration was used to produce a non-uniform field where the electrodes gap distance was varied between 5 mm to 30 mm. The results show that the breakdown voltage of SF$_6$/N$_2$ (10/90) gas mixtures increases linearly with the increase of gas pressure and electrodes gap distance. However, it is found that the effect of electrode gaps distance is more dominant to cause the breakdown voltage of SF$_6$/N$_2$ gas mixtures to increase, as compared to the effect of small range of pressure levels.

Keywords—gas insulation, SF$_6$ gas mixtures, AC breakdown voltage, non-uniform field

I. INTRODUCTION

Gaseous insulation serves a vital role in high voltage applications; as an insulating medium and/or arc quencher (current interrupter). Due to its superior properties in both functions aforementioned, sulphur hexafluoride (SF$_6$) gas has been widely used in gas-insulated equipment such as circuit breaker, switchgear, and transmission line [1–3]. SF$_6$ is a strong electronegative gas which has the ability to capture free electron and forming itself a low mobility negative ion, hence prevents the electron avalanche that leads to breakdown [4].

Despite of its advantages, SF$_6$ has been identified as a strong greenhouse gas that gives adverse effect to the environment [5–6]. In Kyoto Protocol 1997, SF$_6$ gas was listed as one of the greenhouse gas that being restricted its emission and usage [7]. Although SF$_6$ is non-toxic in its pure state, an electrical discharge or arc event causes the SF$_6$ molecule to decompose and forms highly toxic and corrosive byproducts (e.g. S$_2$F$_{10}$, SOF$_2$). In addition, its chemical inertness properties makes the SF$_6$ gas last longer in the atmosphere once released [3].

Since 1970s, the researches on SF$_6$ gas mixtures have gained much attention to minimize the usage of SF$_6$ in high voltage apparatus, instead of completely replace the SF$_6$ gas. Until now, one of the mostly studied gas mixtures is SF$_6$/N$_2$ (i.e. sulphur hexafluoride and nitrogen). This is because N$_2$ has low cost, indefinite resources, and environmental friendly. By focusing on SF$_6$/N$_2$ gas mixtures, various studies have shown a positive synergistic effect where the breakdown voltage of pure N$_2$ is obviously improved by adding a small amount of SF$_6$ [8–11].

A recent work done by Guo et. al [8] is shown in Fig.1. Under non-uniform field condition, the addition of 10 % SF$_6$ (i.e. gas pressure ratio of SF$_6$/N$_2$ is 10/90) improves the AC breakdown voltage of N$_2$ by 49 % and it is about 64 % of pure SF$_6$ (i.e. at 0.1 MPa, and gap distances of 33 mm). However, it can be seen that there is not much difference in the breakdown voltage values at low pressure of 0.1 MPa as the SF$_6$ is increased above 10 %. This result is in agreement with Sun et. al [10].
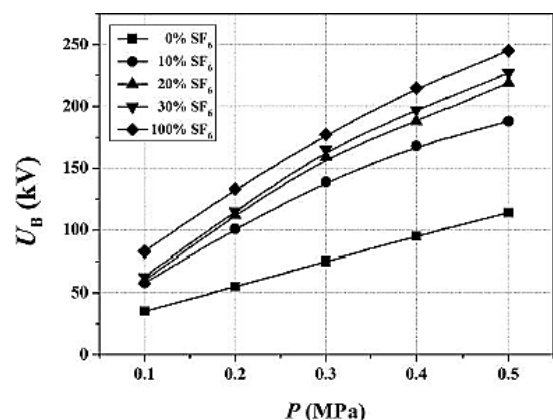

Fig. 1. AC Breakdown voltage of SF$_6$/N$_2$ as a function of gas pressure under R8-plane configurations [8].

Analysis of Single Axis Sun Tracker System to Increase Solar Photovoltaic Energy Production in the Tropics

Iswadi Hasyim Rosma, *Ichsan Maulana* Putra
Dian Yayan Sukma, *Ery* Safrianti, *Azriyenni* Azhari Zakri
Department of Electrical Engineering
Faculty of Engineering, Universitas Riau
Pekanbaru, Indonesia

iswadi.hr@lecturer.unri.ac.id;
ichsanmaulanaputra09@gmail.com;
dianyayan.sukma@eng.unri.ac.id; erysafrianti@yahoo.co.id;
azriyenni@eng.unri.ac.id

Abubakar Abdulkarim
Department of Electrical and Electronics Engineering
Faculty of Engineering and Technology, University of Ilorin
Ilorin, Nigeria

abdulkarim.a@unilorin.edu.ng

Abstract — *The utilization of Solar Photovoltaic (SPV) generation system is generally installed at some certain tilted angles, therefore it does not obtain the optimum solar radiation from the sun. In order to overcome this weakness, the SPV generation system that is equipped with a single axis sun tracker was designed and analyzed in this paper. The sun tracker system has two LDR sensors to estimate the position of the sun. Arduino Uno 3 was implemented as a controller system. The Arduino Uno 3 instructs a servo motor to drive SPV panel from the east to the west to track the movement of the sun in a similar direction. In order to understand the energy gain of single axis sun tracker, it has been compared with SPV generation system installed at the certain number of tilted angles. It can be noted from the results that the SPV generation system with single axis sun tracker has a significant increase in energy production than without tracker where its energy gain is up to 22%. Therefore, it can be concluded that there is a promising potential increase in energy when the SPV panel is equipped with the single axis sun tracker generally in tropical regions.*

Keywords — *Solar Photovoltaic, Sun Tracker, Data Logger Shield, LDR, Servo Motor*

I. INTRODUCTION

The availability of electrical energy is one of the most important issues in the world, especially in Indonesia. Indonesia is still relying on fossil fuel energy sources. When the supply of fossil fuels is low, then it may be the energy crisis that could lead to problems in other sectors in Indonesia. Therefore, efforts are needed to find and develop renewable energy that exists around the country, such as solar energy. Geographically, Indonesia is a region located around the equatorial belt. Therefore, the country has a tropical climate which is blessed with the sun shines more than 6 hours a day or more than 2,400 hours in a year with the solar intensity of 600-700 watt/m^2 [1], [2].

When using the Solar Photovoltaic (SPV) generation system on a stand-alone mode, the SPV panels are usually installed on a rooftop or mechanical structure with a certain titled angle. This type of installation has its own weakness because of the incident angle of solar radiation is not perpendicular to SPV panels surface. Therefore the energy production is not optimal and affects the energy production of SPV generation system [3]. On the other hand, the SPV panels equipped with sun tracking system maximize the solar radiation received by the panels and drive the panel towards sunshine [4].

This paper aims to design and implement a single axis sun tracker and analyze energy gain. Single axis sun tracker is working based on active tracking techniques. This type of tracker designed in this paper is a horizontal single axis sun tracker (HSAT). The HSAT type is suitable for use in tropical region like Indonesia [5].

The designed single axis sun tracker is considered as a control system that uses two LDR, namely LDR1 and LDR2. LDR 1 serves to detect the position of the sun on the east side, while LDR 2 is placed on the west side to detect the position of the sun while in the west region of the city. The feedback of the control system is coming from different output voltage values between LDR 1 (East) and LDR 2 (West). This voltage difference is used by Arduino microcontroller to give command to the servo motor to drive the SPV panel to follow the movement of the sun from East to West.

The organization of the rest of the paper can be summarized as follows. In Section II, the sun tracking system is described. The author's design of single axis sun tracker is presented briefly in section III. Section IV and section V provide the experimental demo and the analysis of the designed system while conclusion of the work and the future work are discussed in section VI.

II. REVIEW OF SUN TRACKING SYSTEM

Generally, sun tracking system can be divided into single axis and double axis system. The single axis sun tracker is classified into two types, namely: Horizontal Single Axis Tracker (HSAT) and Vertical Single Axis Tracker (VSAT). The focus of this paper is to design the HSAT and analyze the energy gain achieved when compare with the SPV generation system installed at the certain tilted angle [4]. The use of the HSAT is considered to be appropriate for the location around the equator belt area such as Pekanbaru City Indonesia where the sun's path is above the observer. On the other hand, the VSAT is suitable to be applied in sub-tropical region where

FEXT Analysis and its Mitigation Using Double-slit Complementary Split-Ring Resonators

R. Azhagumurugan

Department of Electrical and Electronics Engineering,
Sri Sairam Engineering College,
Chennai, India.
azhagumurugan.eee@sairam.edu.in

Abstract — The operating speed of a digital signal and systems are in several GHz range to initiate faster response. Due to this high frequency and operating speed of the signals more and more signal integrity related issues may arise and these issues has to be solved for the better performance of the system. Now a day's integration and miniaturization of digital devices of printed circuit boards (PCBs) are the key features in high speed technology. The printed circuit boards traces are crowded in the design and creates magnetic coupling interference between them. These traces are considered as transmission lines which carrying signal and power between two more points. When current flows through the traces a magnetic field is always set up and interact with the neighboring conductor due to close proximity. The magnetic coupling is mutual and not possible to avoid it. In the result the signal gets affected which degrades the performance of the system to great extent. So, it is necessary to reduce the effect of mutual coupling to improve the performance of the system for its better signal integrity. The mitigation of mutual coupling effect is analyzed and suppression is achieved using metamaterial based complementary split-ring resonators. A new design of double-slit CSRR is used to reduce the crosstalk which is due to coupling. The FEXT analysis is carried out for the frequency range of 5 GHz to 10 GHz.

Keywords — Crosstalk, NEXT, FEXT, metamaterials, electromagnetic coupling.

I. INTRODUCTION

In this digital world the digital systems are operating at very high frequency and this creates frequency dependent issues. Now-a-days, the integration of digital devices and miniaturization in physical sizes of printed circuit boards are the key features in the design. The electromagnetic crosstalk due to coupling of signals is a major concern in the high-speed systems and need to be reduced. It is mainly due to radiation coupling of lines when the lines are in close proximity and degrades the quality of the signal, in turn causing signal integrity issues. Now-a-days, the crosstalk is a major concern and mitigation of crosstalk is the fundamental topic of interest.

Two types of crosstalk are far-end crosstalk (FEXT) and near-end crosstalk (NEXT) which are due to the electromagnetic coupling of signals between the traces of the PCB. The FEXT is due to the forward crosstalk behavior of mutual capacitance and inductance in the victim trace and the NEXT is due to the backward crosstalk of mutual capacitance and inductance. The parallel routing of traces are closer to each other which are unavoidable in case of a PCBs. Hence, crosstalk is unavoidable and minimization of crosstalk can be achieved by proper design topologies.

This article focuses on the crosstalk and the impact of crosstalk on signal integrity in PCBs. The mitigation of crosstalk is achieved by metamaterials based complementary split-ring resonators in the ground plane. The unit cell of CSRRs is etched in the ground plane and the resulting designs are simulated to obtain frequency domain S-parameters.

A conventional guard trace, grounded guard trace and trace are designed with serpentine form in between the microstrip parallel lines to reduce the magnetic coupling and hence the far-end crosstalk [1]. In the conventional guard method, a bare conductor terminated at both ends and equal to the width of the line is inserted between the PCB traces. In the via stitch guard method, the transmission line with grounded vias are placed between the lines and makes the crosstalk potential to zero.

To reduce the crosstalk in the high density printed circuit board by placing a composite magnetic material made up of Fe-Si-B-Cr amorphous particle with a mean diameter of 6 micrometer in between the signal lines [2]. With a volume of 51% of amorphous composite material, a 20dB of crosstalk reduction is achieved. A guard trace with open stub is inserted in between the lines of a PCB trace to reduce the crosstalk [3].

The FEXT in the stripline structure can be eliminated under homogeneous environment. The idea of complementary split-ring resonators structure for the reduction of electromagnetic interference in the low frequency and radio frequency signals in analog circuits are discussed [4]. The interference effect is suppressed by the CSRRs in combination with analog printed circuit boards' layout. The concept of artificial magnetism from a non-conducting material, where the split ring resonators are one of its kind to produce artificial dielectrics [5]. In this paper, the author proved that periodic microstructures built from non-magnetic conducting sheets exhibit an effective permeability in which the μ can be tuned to such a value which is not available in the naturally occurring materials.

CERTIFICATE

International Conference on Electrical Engineering and Informatics

2nd ICon EEI 2018

2018 2nd International Conference on Electrical Engineering and Informatics

October 16th - 17th 2018 at Nagoya Hill Hotel, Batam, Indonesia

Hereby acknowledges the participation and contribution of:

Aghus Sofwan

as Presenter

Dr. Iswadi Hasyim Rosma
General Chair of ICon EEI 2018

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