100 TAHUN ITB & Pendidikan Tinggi Teknik di Indonesia

STEI conference series

2017 INTERNATIONAL SYMPOSIUM ON ELECTRONICS AND SMART DEVICES

IEEE Catalog Number : CFP17J03-USB
ISBN : 978-1-5386-2777-8

ISESD

YOGYAKARTA
17-19 October 2107

Pusat Mikroelektronika Institut Teknologi Bandung
STEI-ITB
Electron Devices Society
IEEE SSCS INDONESIA SECTION
PUIBWA Pusat Unggulan IPTEK Broadband Wireless Access

2017 INTERNATIONAL SYMPOSIUM ON ELECTRONICS AND SMART DEVICES

IEEE Catalog Number : CFP17J03-USB
ISBN : 978-1-5386-2777-8

ISESD

YOGYAKARTA
17-19 October 2107

COMMITTEE

ORGANIZING COMMITTEE

General Chair

Amy Hamidah Salman, *Institut Teknologi Bandung, Indonesia*

Secretary

Elvayandri Muchtar, *Institut Teknologi Bandung, Indonesia*

Suksmandhira Harimurti, *Institut Teknologi Bandung, Indonesia*

Renitia Murti Rahayu, *Institut Teknologi Bandung, Indonesia*

Finance

Mervin T. Hutabarat, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Abdhiany Rahayu, *Institut Teknologi Bandung, Indonesia*

Rina Triani, *Institut Teknologi Bandung, Indonesia*

Technical Program Committee

Muhammad Amin Sulthoni, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Akhmadi Surawijaya, *Institut Teknologi Bandung, Indonesia*

Novi Prihatiningrum, *Institut Teknologi Bandung, Indonesia*

Publication

Yusuf Kurniawan, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Publicity

Farkhad Ihsan Hariadi, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Grasia Meliolla, *Institut Teknologi Bandung, Indonesia*

Surya Ramadhan, *Institut Teknologi Bandung, Indonesia*

Prasetiyo, *Institut Teknologi Bandung, Indonesia*

Local Arrangement

Elvayandri Muchtar, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Yulian Aska, *Institut Teknologi Bandung, Indonesia*

Firmansyah Puspanegara, *Institut Teknologi Bandung, Indonesia*

Giri Achmad, *Institut Teknologi Bandung, Indonesia*

Rahmat Muttaqin, *Institut Teknologi Bandung, Indonesia*

Registration Chair

Muhammad Iqbal Arsyad, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Nopika Dewi Susilowati, *Institut Teknologi Bandung, Indonesia* ***(Secretary)***

INTERNATIONAL STEERING COMMITTEE

Trio Adiono, *Institut Teknologi Bandung, Indonesia* ***(Chair)***

Nicodimus Retdian, Shibaura Insitute of Technology*, Japan* ***(Secretary)***

Takao Onoye, *Osaka University, Japan*

Soo Young Shin, *Kumoh National Institute of Technologi, Republic of Korea*

Zulfiqar Ali Abdul Aziz, *Universiti Sains Malaysia, Malaysia*

Jamil Akhtar, *CSIR-Central Electronics Engineering Research Institute, India*

Poki Chen, *National University of Science and Technology, Taiwan*

Akinori Nishihara, *Tokyo Institute of Technology, Japan*

Basuki Endah Priyanto, *Sony Mobile Communication AB, Sweden*

Somsak Choomchuay, *King Mongkut's Institute of Technology Ladkrabang, Thailand*

Kok Sheik Wong, University of Malaya, Malaysia

Akinori Nishihara, Tokyo Insitute of Technology, Japan

Jaka Sembiring, *Institut Teknologi Bandung, Indonesia*

Adang Suwandi Ahmad, *Institut Teknologi Bandung, Indonesia*

TECHNICAL PROGRAM COMMITTEE MEMBERS

Masayuki Kurosaki, *Kyushu Institute of Technology, Japan*

Shingo Yoshizawa, *Kitami Institute of Technology, Japan*

Mahmoud Meribout,*The Petroleum Institute, Abu Dhabi, U.A.E*

Sataporn Pornpromlikit, *Khon Kaen University, Thailand*

Ucu Maksudi, *Keio University, Japan*

Danardono Antono, *Sony Corporation, Japan*

Surya Irawan Sukma, *Mitsui & Co., Japan*

Nur Ahmadi, *Imperial College London, UK*

Son Kuswadi, *Politeknik Elektronika Negeri Surabaya, Indonesia*

Setiyadi Yazid, *Universitas Indonesia, Indonesia*

Fitri Yuli Zulkifli, *Universitas Indonesia, Indonesia*

Elyas Palantei, *Universitas Hasanuddin, Indonesia*

Nico Surantha Ginting, *Binus University, Indonesia*

Nyoman Putra Sastra, *Universitas Udayana, Indonesia*

Dhany Arifianto, *Institut Teknologi Sepuluh November, Indonesia*

Gamantyo Hendrantoro, *Institut Teknologi Sepuluh November, Indonesia*

Agfianto Eko Putra, *Universitas Gadjah Mada, Indonesia*

Agus Bejo, *Universitas Gadjah Mada, Indonesia*

Estananto, *Telkom University, Indonesia*

Wahyul Amien Syafei, *Universitas Diponegoro, Indonesia*

Munawar Agus Riyadi, *Universitas Diponegoro, Indonesia*

Armein Z.R Langi, *Institut Teknologi Bandung, Indonesia*

Arif Sasongko, *Institut Teknologi Bandung, Indonesia*

Andrian Bayu Suksmono, *Institut Teknologi Bandung,* Indonesia

Achmad Munir, *Institut Teknologi Bandung, Indonesia*

Adit Kurniawan, *Institut Teknologi Bandung, Indonesia*

Adi Indrayanto, *Institut Teknologi Bandung, Indonesia*

Mervin T. Hutabarat, *Institut Teknologi Bandung, Indonesia*

Basuki Rachmatul Alam, *Institut Teknologi Bandung, Indonesia*

Yusuf Kurniawan, *Institut Teknologi Bandung, Indonesia*

Kastam Astami, *Institut Teknologi Bandung, Indonesia*

Yoannes Bandung, *Institut Teknologi Bandung, Indonesia*

Ihsan Hariadi, *Institut Teknologi Bandung, Indonesia*

Egi Hidayat, *Institut Teknologi Bandung, Indonesia*

Arif Sasongko, *Institut Teknologi Bandung, Indonesia*

Rinaldi Munir, *Institut Teknologi Bandung, Indonesia*

Habibur Muhaimin, *Institut Teknologi Bandung, Indonesia*

Waskita Adijarta, *Institut Teknologi Bandung, Indonesia*

Eniman Yunus Syamsudin, *Institut Teknologi Bandung, Indonesia*

Message from General Chair

It is with both great pleasure and honor to welcome you all at the "2017 2nd International Symposium on Electronics and Smart Devices (ISESD 2017)", here in MICC, Alana Jogjakarta Hotel & Convention Center, Jogjakarta, Indonesia.

ISESD 2017 is our second international conference which is organized by the University Center of Excellence on Microelectronics Institut Teknologi Bandung (PME ITB). This is a venue for exchange of information among researchers, academicians, and professionals through presentation of their new research ideas, innovations and development results as well as discussion of possible cooperation among the conference participants. We also hope the fruitful discussion in this conference can fulfil the gap among academia, researchers, professionals and industries that may enhance the benefit of technology for human life.

We are very pleased to have scholars and participants coming across several countries over the world with different interest and expertise. The conference has been divided into 7 regular session topics, including 5 invited speakers, along with the additional 4 special sessions. A series of the state of the art plenary presentations will be presented by 5 international renowned experts.

It has been a real honor and privilege for us to serve as the General Chairs of the Conference. It is really our hope that you can find the conference inspiring, satisfying and enjoyable. We would like to thank to all keynote speakers, authors, and participants, and wish you have pleasant experience in Jogjakarta, Indonesia.

On behalf of the organizing committee, we would like to thank to ISESD International Advisory/Steering Committee members, and all the organizing committee members for their valuable time and contribution to the excellent arrangement of this conference. This conference will not be possible without the hard work of authors, reviewers, invited speakers, session chairs to make excellent technical program of this conference.

Finally, we would like to express our sincere gratitude to the School of Electrical Engineering and Informatics, Institut Teknologi Bandung (ITB), PME ITB. And also we are so grateful for the help from our colleagues and students of Universitas Islam Indonesia (UII) and technical sponsors for their excellent supports.

General Chair

Amy Hamidah Salman
Institut Teknologi Bandung, Indonesia

Message from Dean

School of Electrical Engineering and Informatics ITB

Dear participants, guests ladies and gentlemen. Welcome to Indonesia, welcome to Jogjakarta and welcome to the 2017 2nd IEEE International Symposium on Electronics and Smart Devices (ISESD 2017).

As the Dean of the School of Electrical Engineering and Informatics, Institut Teknologi Bandung (SEEI ITB), it is my great honor to be able to welcome you to this conference.

This international conference is one of several international conferences organized by the SEEI ITB in 2017. There are various conferences that are related to our research groups in the school/faculty. The ISESD 2017 is closely related to the Electronics Engineering research group.

The topics discussed in this conference covers various subjects, such as: Devices, Circuits, and Systems, VLSI, Communication Systems, Multimedia and Systems, Signal Processing, Internet of Things, and Smart Devices. The research and development in these fields are of great importance for now and in the future.

I appreciate the participation of attendees coming from many countries such as Japan, Taiwan, Turkey, Myanmar, Thailand, China, as well as participants from other countries including Indonesia.

In this occasion, I would like to give my sincerely gratitude to my colleague, Amy Hamidah Salman, as the General Chair of ISESD 2017 and his team for all their efforts in organizing this conference.

I hope that all of you will have a fruitful conference not only during presentation, discussion and technical sessions, but also during social and interpersonal communication from each other at the breaks, lunch, dinner and so on. I hope that the gathering of ISESD 2017 participants from various countries and cultures will bring a better understanding from each other and all of you will have enjoyable time here in Jogjakarta, Indonesia.

Dean of School of Electrical Engineering and Informatics

Dr. Ir. Jaka Sembiring, M. Eng.
Institut Teknologi Bandung, Indonesia

Message from Directorate General of Institutional Affair Ministry of Research, Technology, and Higher Education Republic of Indonesia

Dear participants, guests ladies and gentlemen. It is both a great pleasure and honor to welcome you all at the 2017 2nd IEEE International Symposium on Electronics and Smart Devices (ISESD 2017), here in the Alana Yogjakarta Hotel, Yogjakarta, Indonesia.

The Directorate General of Institutional Affairs currently puts a lot of efforts to increase the level of universities in Indonesia to a World Class University level. In correspond to these efforts, we hold a national center of excellence program. This program covers topics that are essential to the development of Indonesia. As a part of the National Center of Excellence (CoE), the University Center of Excellence on Microelectronics Institut Teknologi Bandung (PME ITB) is one research center that is supported by us to be the leader in microelectronics area. In the national level, besides microelectronics center, we have other 19 CoEs. This is a prestigious and very competitive program for all univesities in Indonesia.

As a national research center, we also give them a mandate to hold an international conference. We hope that by holding such an event, they can expose their research result, can communicate with many experts from all around the world, and can contribute to the society. We also hope that this conference will be a periodical conference that involves many experts and can be held in different places in Indonesia.

Finally, we would like to express our sincere gratitude to the Institut Teknologi Bandung and PME ITB as well as all the technical sponsors for their excellent supports in this conference.

We hope that the gathering of ISESD 2017 participants from various countries and cultures will bring a better understanding from each other and all of you will have enjoyable time here in Yogjakarta, Indonesia.

Directorate General of Institutional Affairs

Dr. Ir. Patdono Suwignjo, M.Eng.Sc.
Ministry of Research, Technology and Higher Education

Message from Chairmwoman of IEEE Indonesia Section

Dear Distinguished Guests, Colleagues, researchers, professionals, ladies and gentlemen.

Good morning, a prosperous, warm, and spirited greeting.

On behalf of IEEE Indonesia section, I would like to express my sincere gratitude and welcome you to ISESD 2017: 2017 2nd International Symposium on Electronics and Smart Devices.

ISESD 2017 is organized by University Center of Excellence on Microelectronics, Institut Teknologi Bandung, sponsored by IEEE Solid-State Circuits Society Indonesia Chapter and technically co sponsored by IEEE Indonesia section. The Conference is aimed to bring researchers, academicians, scientists, students, engineers and practitioners together to participate and present their latest research finding, developments and applications related to the various aspects of electronics and smart devices for bridging future technologies, indexed by well-known publishers, especially IEEE Digital Explore.

IEEE Indonesia Section has conducted many activities over 29 years in Indonesia. In terms of collaboration, IEEE Indonesia section has a good and mutual relationship with ICT organizations, Industries, Universities as well as the government in Indonesia. IEEE Indonesia Section has contributed in about 60 different International conferences annually, and I do hope in the near future some high quality conferences will be continued and strengthened, so the result will give more benefit and positive impact to the human being, especially to Indonesian people. Cooperation with international conferences is only one activity among many other activities in IEEE Indonesia section. We hope with many activities conducted by IEEE Indonesia Section, we can help our government to decrease the digital divide in Indonesia.

In this occasion, I would also like to say welcome to Yogyakarta, one of the famous destinations in Indonesia. Yogyakarta serves beautiful heritages, culture, mountain, beach and scenery with warm, polite and friendly people, a vibrant culture and lifestyle.

Finally, we do hope all of you will have enjoyable and valuable experience. During this 3 days conference, you may share your best knowledge in your area of research and professional activities.

Thank you.
Yogyakarta, 17 October 2017
IEEE Indonesia Section Chair,
Dr. Fitri Yuli Zulkifli, ST., MSc.

PROFILES

MICROELECTRONICS CENTER

Founded in 1986, the Microelectronics Center was originally a project of Directorate General of Higher Education (DIKTI), with the World Bank. It had a mandate to be a center for academic, development, and research activities in the field of microelectronics, for university academic staff as well as researchers and trainers from Indonesian research institution and industry. Since 1997, the Microelectronics Center has been a research center under ITB coordinated by Research Institute of ITB. This reflects a new emphasis on research activities in the field of microelectronics that supports education as well as public and industrial services. The Microelectronics Center aspires to take main roles in microelectronics research and development to serve this national interest.

We have created many products ranging from wireless network sensors, 4G technologies chip, to embedded system applications.

The research labs in the Microelectronics Center ITB are as follows:

- **System and Application Laboratory,** uses the ICs to develop products and applications. In many cases, microelectronics devices, products and systems are mass products.
- **IC Design Laboratory,** develops technology for designing ICs using computer-aided design (CAD) and characterization of the component and devices.
- **Devices and Process Laboratory,** acquires and develops technology for analysis, characterization, design, developing, and processing of microelectronics components and devices to be used in integrated circuits (IC s).
- **Electronics Manufacture Laboratory,** studies and develops technology for electronics manufactures

IEEE SSCS INDONESIA CHAPTER

Founded in 1986, the Microelectronics Center was originally a project of Directorate General of Higher Education (DIKTI), with the World Bank. It had a mandate to be a center

IEEE Solid-State Circuit Society (SSCS) Indonesia Chapter was officially established in October 23, 2013 in conjunction with the IEEE International Conference on Electronics Technology and Industrial Development (ICE-ID). This chapter acts as a premier networking forum for researchers and professionals working on integrated circuits related field. Its main vision is to foster solid-state circuits research and development and support its application in the national industry.

The SSCS covers all the aspects of solid-state circuits, from the circuit theory, design, testing, to the application and device technology. In addition to focusing on scientific and industrial applications, we also focus on the activities contributing to the achievement of our goal, such as training/workshop, design contest, annual meeting, etc.

The roots of the Society go back to the launch of the International Solid-State Circuits Conference (ISSCC) in 1955, and the debut of the Journal of Solid-State Circuits (JSSC) in 1966 as an archive of major presentations from conferences, expanded into journal length papers. Soon afterward, the leadership of the ISSC and JSSC formally became a Council comprised of all IEEE societies contributing to the field of integrated circuits.

As the field grew in the 1980s, two more solid-state circuits conferences were launched — the VLSI Symposia, a sister conference with the Electron Devices Society, and the Custom Integrated Circuits Conference (CICC). In addition, the Council established a signficant relationship with the European Solid-State Device Electronics Conference and the European Solid-State Circuits Conference (ESSCIRC/ESSDERC).

To gain more control over its own work, the Council became the IEEE Solid-State Circuits Society in 1997. SSCS established the Asian Solid-Solid State Circuits Conference (ASSCC) in 2003 and the Solid-State Circuits Magazine in 2009

IEEE EDS INDONESIA CHAPTER

Founded in 1986, the Microelectronics Center was originally a project of Directorate General of Higher Education (DIKTI), with the World Bank. It had a mandate to be a center

IEEE Electron Devices Society (EDS) Indonesia Chapter was officially established on November 10, 2016. This chapter acts as a premier networking forum for researchers and professionals working on materials and devices related field. Its main vision is to foster electron devices research and development and support its application in the national industry.

The field of interest for EDS is all aspects of engineering, physics, theory, experiment and simulation of electron and ion devices involving insulators, metals, organic materials, plasmas, semiconductors, quantum-effect materials, vacuum, and emerging materials. The society is concerned with research, development, design and manufacture related to the materials, processing, technology, and applications of such devices, and scientific, technical, educational and other activities that contribute to the advancement of this field.

EDS began in 1952 as a committee of the Institute of Radio Engineers (IRE). With the merger in 1963 of the IRE and the American Institute of Radio Engineers, EDS became a technical group under the newly formed IEEE. In 1976, EDS became a society of IEEE. To respond to the more complex society structure and increased business activities, the Society established an Executive Office in 1990.

EDS provides support for 57 meetings, conferences, workshops and symposia throughout the world. For 23 of these conferences, the Society serves as either the sole financial sponsor or a co-sponsor with other technical organizations both within and outside of IEEE. For its other 34 conferences, EDS provides non-financial support in the form of 'technical co-sponsorship'.

The primary meeting for EDS members is the annual IEEE International Electron Devices Meeting (IEDM), which is held in early December in San Francisco, CA. At this meeting, the latest advancements in the field of electron devices research, development, design, manufacturing, technology and applications are presented to the international technical community.

In 2017, EDS announces the launch of the IEEE Electron Devices Technology and Manufacturing Conference (EDTM) to be held at Toyama International Conference Center, Toyama, Japan. As semiconductor technology scaling challenges continue to grow, so should the industries collaborative efforts to overcome them. EDTM is intended to serve as a forum for the electron devices community to collaborate on topics ranging from devices, materials, and tools, to create new and innovative technologies. EDTM 2017 will have a strong technical focus on devices and process technologies for advanced applications, IoE (Internet of Everything) and related low-power devices, advanced memories, sensors, actuators, MEMS, bio-chips, passive devices, and all types of (exploratory) devices related to advance applications and IoE.

ABOUT YOGYAKARTA

Yogyakarta Special Region (Daerah Istimewa Yogyakarta, DIY) is officially one of Indonesia's 32 provinces. Yogyakarta is one of the foremost cultural centers of Java. This region is located at the foot of the active Merapi volcano, Yogyakarta was in the 16th and 17th centuries the seat of the mighty Javanese empire of Mataram from which present day Yogyakarta has the best inherited of traditions. The city itself has a special charm, which seldom fails to captivate the visitor.

This province is one of the most densely populated areas of Indonesia. The city came into being in 1755, after the Mataram division into the Sultanates of Yogyakarta and Surakarta (Solo). Gamelan, classical and contemporary Javanese dances, wayang kulit (leather puppet), theater and other expressions of traditional art will keep the visitor spellbound. Local craftsmen excel in arts such batiks, silver and leather works. Next to the traditional, contemporary art has found fertile soil in Yogya's culture oriented society. ASRI, the Academy of Fine Arts is the center of arts and Yogyakarta itself has given its name to an important school of modern painting in Indonesia, perhaps best personified by the famed Indonesian impressionist, the late Affandi.

Yogyakarta is often called the main gateway to the Central Java as where it is geographically located. It stretches from Mount Merapi to the Indian Ocean. There is daily air service to Yogya from Jakarta, Surabaya and Bali as well as regular train service and easy accessibility by road. Yogyakarta is commonly considered as the modern cultural of Central Java. Although some may prefer Solo as a good runner up, Yogyakarta remains the clear front-runner for traditional dance, Wayang (traditional puppetry) and music.

Yogyakarta has more than just culture though. It is a very lively city and a shopper's delight. The main road, Malioboro Street, is always crowded and famous for its night street food-culture and street vendors. Many tourist shops and cheap hotels are concentrated along this street or in the adjoining tourist area such Sosrowijayan Street.

The key attraction of Yogyakarta is 'Kraton' (the Sultan's Palace). The Sultan's palace is the centre of Yogya's traditional life and despite the advance of modernity; it still emanates the spirit of refinement, which has been the hallmark of Yogya's art for centuries. This vast complex of decaying buildings was built in the 18th century, and is actually a walled city within the city with luxurious pavilions and in which the current Sultan still resides. Yogyakarta is also the only major city, which still has traditional 'Becak' (rickshaw-style) transport.

KEYNOTE SPEECHES

KEYNOTE SPEECH 1

Reliability and Physical Analysis Challenges in Si Nanodevices

Dr. M.K. Radhakrishnan
NanoRel LLP – Technical Consultants

Abstract — As the dimensions shrink, one of the major challenges in device technology is controlling various parameters to obtain high reliability. Device reliability is the resultant of various analyses of the design, process and product as well as understanding innumerable phenomenon to control the extension of even atomic level defects, especially when the dimensions are at nanometer level. Understanding the physical phenomenon with which devices mal-function becomes more striving in solving both the device and process problems. Difficulties arise in the area of fault localization, physical failure analysis as well as identifying the physical phenomenon and solving the related problems.

Fault localization becomes difficult as the defect dimensions are at atomic level. The tools employed to localize the defects itself pause problems such as space limitation, interaction volume, criticality in dimension, etc. Many techniques using photon, ion as well as electron have been evolved as the key tools concurrent with the technology progression. However, all these are found to have limitations at nanometer level. An overview of the trends and limitations in analysis tools for fault localization will be discussed.

One of the most important and challenging area in device is to establish very good interfaces without defects and comprehending the issues related to interfaces. Studies on interfaces of basic transistor structure have shown un-assumable problems through physical analysis which provide insights into the device reliability. Such physical analysis studies on device gate structures involving ultra-thin gate dielectrics, high K metal gates are discussed. Device physics aspects in relation to the electron conduction through various interfaces provide a deep insight in the technology progression. An overview of such studies to understand the conduction mechanisms, microstructural damages, interface interactions as well as the physical effects in the structural integrity will be discussed in this talk.

Biography

Dr. M.K. Radhakrishnan is the Founder Director of *NanoRel LLP* -Technical Consultants Singapore providing analysis based solutions to microelectronic industries for improving reliability of devices. As a researcher in the area of device failure analysis and reliability physics for more than 40 years, he worked with the Institute of Microelectronics Singapore, Philips, ST Microelectronics and ISRO. He also served as Adjunct Professor at National University of Singapore (1994-2004). Dr. Radhakrishnan is currently the IEEE EDS Vice-President of Regions & Chapters. He is an IEEE EDS distinguished Lecturer from 1997. He was an elected Member of Board of Governors of IEEE Electron Devices Society (2011-16) and the Editor-in-Chief of IEEE EDS Newsletter (2013-17). He now serves as Editor of

IEEE Journal of Electron Devices (IEEE JEDS), Editorial Board Member of Microelectronics Reliability Journal (UK). He was General Chair for IEEE conferences IPFA 1999 and IEDST 2009. Dr. Radhakrishnan has given plenary and keynote talks at numerous major international conferences around the globe, and has given more than 100 Distinguished Lectures. As a technical consultant he works with many MNCs in Asia and Europe. He has more than 60 research publications in the area of deice failure analysis, reliability and ESD. He is a Fellow of IETE, Senior Member of IEEE, Member of EDFAS and ESDA.

KEYNOTE SPEECH 2

Next Generation 3D Depth Sensing Platforms: Emerging Trends and Technological Challenges

Dr. David Stoppa

Abstract — In the past few years we have assisted to a tremendous increase of the number of applications requiring highly sophisticated electronic systems capable of taking autonomous decisions during the interaction with complex environments and scenarios. Depth sensors represent a fundamental enabling technology for such applications, allowing to reconstruct a complete 3D model of the surrounding environment, thus increasing the reliability and robustness of automatic objects classification.

Several depth-sensing technologies are available, and it is becoming more and more evident that the optimal solution relies on a clever combination and optimization of multiple techniques, through a careful optimization at system level of a multitude of parameters.

This talk provides an overview of the most interesting emerging depth-sensing applications, by addressing the main technological challenges behind each application case, and analyzing the target requirements for the development of the next generation 3D sensing systems.

Biography

David Stoppa (SM'12-M'97) received the Laurea degree in Electronics Engineering from Politecnico of Milan, Italy, in 1998, and the Ph.D. degree in Microelectronics from the University of Trento, Italy, in 2002. In 2017 he joined AMS where he is in charge of the research and development of next generation range-sensors. From 2014 to 2017 he has been the head of the Integrated Radiation and Image Sensors research unit at FBK where he has been working as a research scientist since 2002 and as group leader of the Smart Optical Sensors and Interfaces group from 2010 to 2013. From 2002 to 2012 he has been teaching at the Telecommunications Engineering faculty of the University of Trento, courses of Analogue Electronics and Microelectronics. His research interests are mainly in the field of CMOS integrated circuits design, image sensors and biosensors. He has authored or co-authored more than 120 papers in international journals and presentations at international conferences, and holds several patents in the field of image sensors. Since

2011 he served as program committee member of the 'International Solid-State Circuits Conference' (ISSCC) and the SPIE 'Videometrics, Range Imaging and Applications' conference, and was technical committee member of 'International Image Sensors Workshop' (IISW) in 2009, 2013, 2015 and 2017. He was a Guest Editor for IEEE Journal of Solid-State Circuits special issues on ISSCC'14 in 2015 and he is serving as Associate Editor since 2017. Dr. Stoppa received the 2006 European Solid-State Circuits Conference Best Paper Award.

KEYNOTE SPEECH 3

"Yes We Can" – A Short-Cut Research and Development of Miniaturized Smart Devices and Sensors through Open Facility on MEMS Integrated VLSI.

Dr. Yoshio Mita associate professor
Department of Electrical Engineering and Information Systems
The University of Tokyo

Abstract — Transistors and semiconductor sensors have born in middle of last century (1950 – 1960s). Since that time such devices have evolved in to guiding principles: one is miniaturization that means integrate more capability by making the identical component smaller and smaller, the other is integration that means integrate ability to interface other physical domain than electronic signal by combining sensors and actuators with transistors. In the mid-2010s, many successful sensors and actuators are available on the market (second principle: integration). Together with highly-capable LSI microcontrollers (first principle: miniaturization) that can nowadays embed an Operating System (OS) on one packaged device, also available on the market, it is now possible for application researchers and engineers to quickly construct an autonomous distributed sensors and / or actuator system. Such networked system is called as Internet of Things (IoT).

The important key performance indicators of such IoT devices are: (1) Autonomy, how long and how frequent the device can sense and communicate, (2) Broadness, to how large range, sensitivity and precision each device can handle, and (3) Compactness, how small and densely the devices can be integrated to put them everywhere. Commercially-available devices are developed for either existing specific applications or generic (non-optimized) one so that combination of such too-much specific and / or too-much generic device does not necessarily satisfy above-mentioned "ABC" indicators. Therefore, there are plenty rooms in R&D of next-generation IoT devices.

The classical R&D scheme has been with "integrated"; all resources including CAD design, LSI and MEMS fabrication facilities, and testing, must have been prepared in the same group (companies, research institutes, and universities). For LSI, the more "integration" it becomes along with transistor miniaturization, the more cost the facility requires. For MEMS, the more "integration" it becomes along with increase of handling physical domains, the more size the facility becomes. Therefore the size of facilities required *prior to* start such R&D of next generation IoT devices is too heavy for newcomers. For LSI, some countries such as USA (MOSIS, 1981), France (CMP and CNFM, 1981), and Japan

(VDEC, 1997) was aware of that mismatch and created an open multi-chip foundry scheme for R&D. The model is now one of the standard model in production. For MEMS, (interestingly,) some countries such as USA (NNIN 2001, NNCI 2016), France (RTB-RENATECH, 2003), and Japan (Nanotechnology Platform, 2002, 07, 12) have also been aware of that mismatch, and have started an open networked facility in micro and nanotechnology. In case of the University of Tokyo VDEC nanofabrication site, over 230 independent research groups, including 65 companies, have used the facility since 2012-2016. Each year over 150 research projects are undertaken.
As an attempt to combine dual streams on LSI and MEMS, UTokyo VDEC is developing an open CMOS-MEMS multi-chip scheme. The idea is in principle a classical post- process; an LSI wafer is made by Foundry Company through VDEC, and dedicated process is made on the LSI at VDEC's open facility in the supercleanroom in Takeda Building. A unique added feature is choice of substrates; Depending on the application, designers can order non-standard silicon bulk wafers, such as thick (9, 25, 50μm) Silicon-on-Insulator for MEMS and / or flexible devices, and or off-cut [non(001)] wafers for epitaxial growth of other materials on Silicon VLSI.
Since 2010 multi-chip run has been made once a year, and several integrated devices have been realized. The example device include post-processed on-chip high voltage photovoltaic, for an autonomous IoT node powering. Taking full advantage of the SOI substrate, the element PV cell that can merely produce 0.5V are series-connected and a high (over 60V) voltage generation have been demonstrated. Through such successful examples it can now be said that "yes we can rapidly establish research on next generation IoT device with minimum cost". In the presentation a couple of successful devices are presented to share an idea of R&D scheme for 21^{st}-century.

Biography

Dr. Yoshio Mita is an Associate Professor of the Department of Electrical Engineering and Information Systems, Graduate School of Engineering, the University of Tokyo (UTokyo). He obtained his BE (1995), ME (1997), and PhD (2000), from Departments of Electrical and Electronic Engineering, UTokyo. He served as an assistant professor of VLSI Design and Education Center (VDEC), UTokyo, and was promoted to Lecturer at the Department of Electrical Engineering in 2001 and then to Associate Professor in 2005. He also served as an associate researcher of French National Research Center (CNRS) in 1997-98, as an invited professor of French National Informatics Institute (INRIA) in 2007-08, and is serving as a visiting associate professor of Japan Aerospace Exploratory Agency (JAXA) in 2016-17. Since 2012, Dr. Mita is a manager of a Ministry of Education (MEXT)-supported National Nanotechnology Platform UTokyo open nanofabrication site, operated jointly by VDEC and Faculty of Engineering, where he is running a federal standard class 1 included, 600 m^2 super cleanroom at Takeda Building in UTokyo Hongo campus (Asano Area). He is working with over 230 independent research groups inside and outside UTokyo through his platform, including over 60 companies. Since 2002, Dr. Mita is a member of the IEEE International Conference on Microelectronic Test Structures (ICMTS) technical committee, and joined the ICMTS steering committee on March 2017. He served as technical chairman in the ICMTS 2007 and ICMTS 2016, and subsequently was a guest editor for the IEEE Transactions on Semiconductor Manufacturing on 2008 and 2017. His research interest includes CMOS and MEMS integration technology, such as a high voltage generating photovoltaic for autonomous distributed micro systems.

KEYNOTE SPEECH 4

Non- linearity consideration in the design and implementation of RF Front-end medium power amplifier for broadband 4G and 5G telecommunication

Dr. Basuki R Alam

Abstract —The ever increasing speed, throughput and bandwidth of present RF wireless communication, where the technology phase now is at the entry trial of 5G technology and rapid deployment of commercial 4G LTE worldwide, necessitates particular design and implementation procedures of the front-end part employing active devices such as the transistors of the RF amplifier. High M-ary composite modulation of the 4G advance LTE, and 5G transmission such as the WLAN IEEE 802.11ac/ax requires stringent error vector magnitude (EVM) constraint to maintain low bit-error-rate (BER) of multi-hundred Mega to Giga-bit per second throughput. Therefore, RF performance characteristics of the front-end active components should be set operating in linear range in order to suppress non-linearity spectrum products such as intermodulation distortion, harmonics and other spurious responses within the broadband signal bandwidth as well as out-of-band to the minimum level. This rigorous constraint imposes specific design-simulation and implementation of broadband front-end RF amplifier even in medium power range of the output broadband signal. Elaborate design-simulation procedures employing large signal RF model of FET or Bipolar transistor rather than a simple small signal model and S-parameters. Broadband design and simulation of RF Front-end RF medium power amplifier for broadband signal transmission comprises sequences of large signal modeling, load pulling, broadband impedance matching and two-tone / multi-tone harmonic balanced simulation for non-linearity verification as well as RF broadband signal measurement. For broadband LNA, the design procedure is much shorter with broadband impedance matching to source reflection coefficient of selected noise figure to achieve the low BER (bit-error-rate) performance. RF broadband performance were measured consisting of broadband S-parameter characteristics, gain, vector modulation constellation, EVM, OFDM error vector and signal bandwith as initial steps to verify soundness of broadband design-simulation and implementation qualitatively.

Biography

Basuki Rachmatul Alam, received a 5 year-engineering degree, Insinyur (Ir), in Electrical Engineering from Institute Technology of Bandung (ITB), Indonesia in 1983. He joined Electrical Engineering Department of Institute Technology of Bandung in 1984. During 1985 to 1987, he was involved in conception of Inter University Center of Microelectronics, especially on Device and IC Processing Laboratory of the center. He received MSc degree in 1989 in Electrical Engineering from Lehigh University, Pennsylvania, USA. He received PhD from the same university in 1993, with thesis on design and characterization of InGaAsP Double Heterojunction Bipolar Transistor (DHBT).

During his Doctoral program with Compound Semiconductor Technology Group, he was also setting up a III-V Device & IC processing facility and did completion T/R Switch MMIC based on III-V HFET and InGaAs PHEMT on GaAs wafer substrate delivered to industry patner. The MMIC work was funded by Pennsylvania Ben Franklin Eastern Tier – industrial partnership. After PhD completion, he spent two years as a Visiting Scientist in Flat-panel Display Research Laboratory at Sherman Fairchild Microelectronic Center setting up processing technology for TFT large area flat panel display. After returning to IUC Microelectronics in 1996, he assumed position as Head of Device & IC Technology Laboratory of IU Microelectronics.

From 2000 to 2002, he was head of Electronic and Component Laboratory of Electrical Engineering Department of Institute Technology Bandung. In Electrical Engineering Department, now School of Electrical Engineering and Informatics, of ITB, he is teaching some undergraduate dan graduate courses on Solid State and Electronics Physics, Device Physics, RF Microelectronic and RF IC Technology. In 2012, he did the inception and co-founded Teaching Factory of Manufacturing of Electronics (TFME) in State Polytechnics of Batam, a back-end manufacturing center of microelectronic device and IC integrated with board integration (PCB and SMT) manufacturing lines. Besides manufacturing facility, he is completing TFME with RF IC, RF component testing and 4G smartphone compliance test setup. Since October 2016, he is Chair of IEEE Electron Device Indonesia Chapter. In research and publication, he authored and co-authored some publications on RF and Microwave Device and IC in international and regional conference proceedings. He has also worked on few industrial prototypes of RF IC and component as well as power electronic and renewable energy electronics.

KEYNOTE SPEECH 5

The Design of BC3

Dr.Yusuf Kurniawan

Abstract — BC3 is the block cipher that we created some years ago. BC3 adopted some components from other cipher like AES, Camellia and DES. BC3 is designed to resistant againts many algebraic attacks like differential attack, linear attack, impossible differential attack, and slide attack. In addition, BC3 is also designed to againts side channel attacks like power analysis and timing attack. We design BC3 to be implemented efficiently at various hardware and software platforms. BC3 has 64-bit input/output and 128-bit key and feistel structure. This structure make us only need one structure to implement encryption and decryption. The keyschedule of BC3 is made as one-way function and master key is not used directly to encrypt/decrypt plaintext, so if cryptanalysts can get some (partial) subkeys, then they have to break the this function to find master key. This case is different from AES, Camellia and DES. In these ciphers, Master key is used to encrypt message directly, so if attacker can find the subkeys, they also get the master key. So, AES, DES and Camellia can be broken by differential power analysis attack. We are sure that BC3 can be secure againts that attacks. The performance of key schedule of BC3 is very fast, about three times than AES's in software. So, BC3 is the secure block cipher and fast in many platforms.

Biography

Yusuf Kurniawan received the B.Eng. degree in electrical engineering, M. Eng. degree in Telecommunication and Doctoral degree in Cryptography from Institut Teknologi Bandung, Indonesia, in 1994, 1997 and 2007, respectively. In his dissertation he received a cumlaude predicate in the field of cryptography. He is a lecturer at STEI ITB. He teachs Electronics, Digital Systems, Cryptography, computer forensic, and Microprocessor system. His research interests are computer security, hardware security, smartcard Security, e-Health Security, pre-paid meter Security, and cryptanalysis. He wrote some papers at internasional conferences & internasional journals. He has 2 patents in block cipher algorithms.

TECHNICAL PROGRAM

Instruction: click on paper ID to open the corresponding file

Special Session 1: Emerging Circuits and System

Date/time: Tuesday, 17 October 2017 / 13:00 - 14:45

SS1-1 **Automatic Layout Pattern Generator to Match Multiple-Devices with High-Order Gradient Cancellation**
Ikhwan Mohammad Iqbal, Pranata Wibawa Sanjaya and Poki Chen

SS1-2 **Dual Band Rectenna with One Rectifier**
Ding-Bing Lin, Chung-Ke Yu, Chang-Keng Lin, Yi-Hsien Lee

SS1-3 **Small-Signal Model of Flyback Converter With Peak-Current Control at Variable Switching Frequency**
Ching-Jan Chen, Ching-Hsiang Cheng, Kevin Wu, Shinn-Shyong Wang

SS1-4 **A High Performance Tracking Method for Intelligent Surveillance System**
Tsung-Han Tsai, Ching-Chin Yang, and Hong-Yi Huang.

SS1-5 **Digitally Controlled Bidirectional Testing Platform for High Power Battery Charger Systems**
Arief Noor Rahman, Chia-Min Chan, Yao-Ching Hsieh, Jing-Yuan Lin, Huang-Jen Chiu, Yao-Ching Hsieh

Special Session 2: Analog Circuits and Related Techniques

Date/time: Wednesday, 18 October 2017 / 10:00 - 12:00

SS2-1 **Parallel Sensing Operation using Octagonal MOSFET**
Tomochika Harada.

SS2-2 **Performance Improvements of On-Chip Solar Cell for Microsystem**
Daigo Zenibayashi, Takaya Sugiura, and Nobuhiko Nakano

SS2-3 **Wireless Power Transmitter Using Parallel-Tuned Class-E Power Oscillator**
Yoshimitsu Yamashita and Kazuyuki Wada

SS2-4 **Compensation Circuit Using Time-Mode Capacitance Scaling**
Nicodemus Retdian and Takeshi Shima

SS2-5 **Prototype and Measurement of Automatic Synchronous PLL System for N-path Filter for Hum Noise Reduction**
Ryouya Tanaka, Takumi Deguchi, and Nobuhiko Nakano

SS2-6 **Prediction of Element Values of OpAmp for Required Specification Utilizing Deep Learning**
Nobukazu Takai and Masafumi Fukuda

Special Session 3: RF Electronics

Date/time: Wednesday, 18 October 2017 / 13:00 - 14:45

SS3-1 **Design Power Amplifier Using Load Pull Method in WLAN 802.11 ax Access Point Application**
Aris Agung Pribadi, Vita Awalia Mardiana and Basuki Rachmatul Alam.

SS3-2 **Front-end RF Amplifier Optimum Design for S-Band Broadband transmission**
Fakhri Hidayat and Basuki Rahmatul Alam.

SS3-3 **Design and Simulation of Front-End Broadband RF Power Amplifier for LTE TDD 2.3 GHz**
Erwin Setiawan, Mukmin Maulana Latin, and Basuki Rahmatul Alam

SS3-4 **The effect of self resonance to the performance of Low Noise Amplifier (LNA) designed for WLAN IEEE 802.11n transmission in 2.4GHz**
I. S. B Firmansyah, M.T Hutabarat, B. R Alam

SS3-5 **High-Gain and Low-Power Cascaded Power Amplifier in S-Band Frequency for Airport Surveillance Radar (ASR-11)**
Bima Sahbani, Adi Candra Swastika, and Basuki Rachmatul Alam.

Special Session 4: Intelligent – Secure Systems

Date/time: Thursday, 19 October 2017 / 09:00 - 11:00

SS4-1 **Implementation of BC3 Encryption Algorithm on FPGA Zynq-7000**
Ma'muri, Yusuf Kurniawan, Sarwono Sutikno

SS4-2 **The Implementation of A3S Information Fusion Algorithm for Interpreting Dissolved Gas Analysis (DGA) based on Doernenburg Ratio**
Karel Octavianus Bachri, Arwin Datumaya WS, Bambang Anggoro S, Adang S. Ahmad

SS4-3 **Security Analysis of BC3 Algortihm for Differential Power Analysis Attack**
Septafiansyah Dwi Putra, Mario Yudhiprawira, Yusuf Kurniawan, Sarwono Sutikno, and Adang Suwandi Ahmad.

SS4-4 **NAIDS Design Using ChiMIC-KGS**
Herman RA Talompo, Adang S. Ahmad, Yudi Gondokaryono, Sarwono Sutikno

SS4-5 **Brain Inspired Cognitive Artificial Intelligence for Knowledge Extraction and Intelligent Instrumentation System**
Adang Suwandi Akhmad

Parallel Room B-1: ICT and Information System

Date/time: Tuesday, 17 October 2017 / 10:30 - 12:00

PB1-1 **[Invited] Improved Hashing and HoneyBased Stronger Password Prevention against Brute Force Attack**
Khin Su Myat Moe and Thanda Win.

PB1-2 **Design and Implementation of Video Conference System with Object Tracking for Distance Learning**
Yoanes Bandung, Kusprasapta Mutijarsa and Luki Bangun Subekti.

PB1-3 **The Use of Machine Learning in Combating Cyber Bullying in Indonesia**
Putri Sanggabuana Setiawan and Muhammad Ikhwan Jambak.

PB1-4 **Development of IoT Authentication Mechanisms for Microgrid Applications**
Resa Pramudita, Farkhad Ihsan Hariadi and Adang Suwandi Ahmad.

PB1-5 **Security Analysis of a Chaotic Ring Oscillator Based "True" Random Number Generator**
Salih Ergün.

Parallel Room B-2: IoT and Image Processing

Date/time: Tuesday, 17 October 2017 / 13:00 - 14:45

PB2-1 **Telemetry and Tele-Control of Electronic Appliances for Smart-Homesystem**

Muhammad Bagus Nurfaif, Sri Ratna Sulistiyanti, Muhamad Komarudin, and Gigih Forda Nama.

PB2-2 **Human Machine Interface on e-Shrimp as Smart Control System for Whiteleg Shrimp Pond**
Elvayandri Muchtar, Edwin Sanjaya, and Farkhad Ihsan Hariadi.

PB2-3 **Solar Energy Harvesting for Wireless Sensor Networks Node**
Octarina Nur Samijayani, Hamzah Firdaus, and Anwar Mujadin.

PB2-4 **Haar Cascade Technique to Improve Banknote Image Recognition for the Blind**
Dhany Arifianto, Kurnia Diastana Abdirandra, Nuril Hidayati, and Muhammad Ghofur Rahmatullah.

PB2-5 **Local Binary Pattern on Halftone Image**
Heri Prasetyo, Wiranto, and Winarno

Parallel Room B-3: Instrumentation and Control-1

Date/time: Tuesday, 17 October 2017 / 15:00 - 16:30

PB3-1 **Design of Deaerator Storage Tank Level Control System at Industrial Steam Power Plant with Comparison of Neural Network (NN) and Extreme Learning Machine (ELM) Method**
W. P. Mahardhika, M. Syai'in, R.Y. Adhitya, S. Wibowo, R. Kurniawan, B. Herijono, N. Rinanto, E. A. Zuliari, D. K. Setiawan, A. Soeprijanto, and B. S. Kaloko.

PB3-2 **Extreme Learning Machine and Back Propagation Neural Network Comparison for Temperature and Humidity Control of Oyster Mushroom Based on Microcontroller**
G. M. Fuady, A.H. Turoobi, M. N. Majdi, M. Syaiin, R.Y. Adhitya, Isa Rachman, F. Rachman, M. A. P. Negara, A. Soeprijanto, and R.T. Soelistijono.

PB3-3 **Development of Stationary Reflow Oven with PID Control for Laboratory Scale Surface Mounting Technology Processes**
Arnoldus Janssen Krisma Pambudi, Farkhad Ihsan Hariadi, Muhammad Iqbal Arsyad

PB3-4 **Optimization of Coefficient Power (Cp) in Variable Low Rated Speed Wind Turbine using Increamental Particle Swarm Optimization (IPSO)**
Aliy Haydlaar, Ali Musyafa', M. Syai'in, R.Y. Adhitya, G. Suhardjito, B. Herijono, N. Rinanto, H. A. Widodo, E. A. Zuliari, T. Suheta, D. K. Setiawan, and A. Soeprijanto.

PB3-5 **Analysis of Artificial Intelligence Application Using Back Propagation Neural Network and Fuzzy Logic Controller on Wall-Following Autonomous Mobile Robot**
A. Budianto, R. Pangabidin, M. Syai'in, R. Y. Adhitya, L. Subiyanto, A. Khumaidi, Isa Rachman, B. Widiawan, K. Joni, E.D. Nurcahya, I. Pratomo, A. Soeprijanto, and R.T. Soelistijono.

Parallel Room B-4: Instrumentation and Control-2

Date/time: Wednesday, 18 October 2017 / 10:00 - 12:00

PB4-1 **Comparison Of Extreme Learning Machine and Neural Network Methods On Automatic Pressure Application Of Plant Air Receiver Based On Microcontroller**
E. E. Santoso, A.C. Chafid, R. L. Siregar, M. Syaiin, R.Y. Adhitya, B. Herijono, L. Subiyanto, J. Endrasmono, S. T. Sarena, A. Soeprijanto, and B. S. Kaloko.

PB4-2 **Development of FPGA-Based Sub-Module of Three-Phase Spindle Motor Speed Controller for CNC PCB Milling and Drilling Machine**

Nopriandri, Farkhad Ihsan Hariadi and Arif Sasongko.

PB4-3 **CLC (Cellular Lightweight Concrete) Brick Making Process using Neural Network and Extreme Learning Method Based on Microcontroller and Visual Studio.Net**
D. P. Utomo, B. W. Perdana, A. Pamungkas, M. Syaiin, R.Y. Adhitya, Ii Munadhif , J. Endrasmono , A. Soeprijanto, and R.T. Soelistijono

PB4-4 **Prototype Control And Monitoring System Safety Device From Leakage Ammonia At Marine Loading Arm With Comparison Of Neural Network (NN) And Extreme Learning Machine (ELM) Method**
Oktavian Hanggara P., Mat Syai'in, Fahrizal Paradisa P., M. Zainal Arifin , Sryang T. Sarena, M. Syaiin , R.Y. Adhitya, Aliy Haydlaar, R.A. Atmoko, P. Asri, and A. Soeprijanto.

PB4-5 **Computer Vision Algorithm of Chip Mounter Machine in Smd (Surface Mount Device) Components Mounting Machine Development**
Fernandez Elian, Farkhad Ihsan Hariadi and Muhammad Iqbal Arsyad.

Parallel Room B-5: Instrumentation and Control-3

Date/time: Wednesday, 18 October 2017 / 13:00 - 14:45

PB5-1 **Design and Implementation of 3D Motion Control of Small Scale Pick and Place Surface-mount Technology Machine**
Johan Iswara Ngadimin, Farkhad Ihsan Hariadi, and Muhammad Iqbal Arsyad.

PB5-2 **Comparison of Extreme Learning Machine and Neural Network Method on Hand Typist Robot for Quadriplegic Person**
D. A. Kurniawan, M. Y. Alfani, R. A. Samudro, M. Syai'in, R.Y. Adhitya, A. Khumaidi, M. K. Hasin, M.Y. Santoso, B. Widiawan, Winarno, A. Soeprijanto, and R.T. Soelistijono.

PB5-3 **Comparison Of Neural Network (NN) and Extreme Learning Machine (ELM) on Thickness Auto Adjustment of Instant Noodle Dough on Roll Press Machine**
R. Ahsani, A. A. Wardhani, U. F. Nisa, M. Syaiin, R.Y. Adhitya, E. Setiawan, Ii munadhif, R.A. Atmoko, M. A. P. Negara, A. Soeprijanto, and R.T. Soelistijono.

PB5-4 **Development of Interface and Coordination for Control Module CNC PCB Milling and Drilling Based FPGA**
Muhammad Hidayatullah, Farkhad Ihsan Hariadi and Arif Sasongko.

PB5-5 **Applicated Neural Network and Extrame Learning Machine Methods in Prototype Dry Pads**
Fatihah Istiqomah, Rahadyan Alfian Rizqy, Aa Raja Aynelhaqq Sulhawi and Matt Syaiin.

Parallel Room B-6: Instrumentation and Control-5

Date/time: Wednesday, 18 October 2017 / 15:00 – 16:30

PB6-1 **Design and Implementation of FPGA-Based Control for Line and Circle Motion Interpolator on PCB CNC-Milling & Drilling Machine**
Febby Purnama Madrin, Farkhad Ihsan Hariadi, and Arif Sasongko.

PB6-2 **Comparison Methods of Neural Network and Extreme Learning Machine in Automatic Water Flow and Temperature Control System**
A. M. Nabawi, Mat Syaiin, R. Y. Adhitya, A. Juksia, R. H. Koespino, and N. A. Firmansyah.

PB6-3 **Control and Monitoring System Optimalization of Combustion in Furnace Boiler Prototype at Industrial Steam Power Plant with Comparison of Neural Network (NN) and Extreme Learning Machine (ELM) Method**
A. A. Rahmanda, F. Afandi, A. Muhammad, M. Syaiin, R.Y. Adhitya, B. Herijono, J. Endrasmono, A. Singgih, E. A. Zuliari, S. I. Haryudo, A. Soeprijanto, and B. S. Kaloko.

PB6-4 **Charging Supercapacitor Mechanism based-on Bidirectional DC-DC Converter for Electric ATV Motor Application**
Braham Lawas Lawu, Syifaul Fuada, Surya Ramadhan, Achmad Fajar Sabana and Arif Sasongko.

PB6-5 **Implementation of Deep-Learning based Image Classification on Single Board Computer**
Hasbi Ash Shiddieqy, Farkhad Ihsan Hariadi and Trio Adiono.

Parallel Room C-1: SoC and Digital IC

Date/time: Tuesday, 17 October 2017 / 10:30 - 12:00

PC1-1 **Implementation of Baseband Transmitter Design based on QPSK Modulation on Zynq-7000 All-Programmable System-on-Chip**
Erwin Setiawan, Vita Awalia Mardiana, Mukmin Maulana Latin and Trio Adiono.

PC1-2 **RTL Design of FM0 and Miller Encoding Architecture for RFID UHF Tag Transmitter**
Aris Agung Pribadi, Yusuf Hendrayana, Ula Grace Rosyidah, and Trio Adiono.

PC1-3 **Sine Wave Synthesis with Harmonic-Cancellation and Single-Bit Sigma-Delta Modulation**
Astria Nur Irfansyah

PC1-4 **FPGA Based Hardware Implementation of Fault Detection for Microgrid Applications**
Surya Ramadhan, Farkhad Ihsan Hariadi and Adang Suwandi Ahmad.

Parallel Room C-2: Telecommunication-1

Date/time: Tuesday, 17 October 2017 / 13:00 - 14:45

PC2-1 **[Invited] Source Coding-based Compression of Indonesia Local Languages for 5G Potential Application**
Khoirul Anwar, Rahmattio Fais Baihaqi, Yoga Julian

PC2-2 **ZigBee Transceiver Design Model under AWGN Channel Implemented on Matlab Simulink**
Vita Awalia Mardiana and Trio Adiono.

PC2-3 **On Alleviating Exposed Terminal Problem in IEEE802.11-based Ad-Hoc Network – A Review**
Farchah Hidayatul Ilma and Tutun Juhana.

PC2-4 **Synthesis of Fractional Order Reactance Matrices**
Guishu Liang, Zheng Qi, HuaYing Dong, Xiaoyan Huo, Chang Liu, and Jing Chen.

Parallel Room C-3: Signal Processing

Date/time: Tuesday, 17 October 2017 / 15:00 - 16:30

PC3-1 **Identify the accuracy of the recitation of Al-Quran reading verses with the science of tajwid with Mel-Frequency Ceptral Coefficients Method**
Efy Yosrita and Abdul Haris.

PC3-2 **Infrared System for Motion Detection and Universal Control on TV System Add-on**
Brian Parsaoran, Muhammad Luthfan Taris, Arsyi Patriannisa, and Mervin T. Hutabarat.

PC3-3 **Design of Electronics Wind Chime 2.0**
Damon Prasetyo Arso, Puspa Anindita Yurianti, Ahmad Yusya Sadali and Mervin Tangguar Hutabarat.

PC3-4 **Smart Card Reader APDU Simulation Using Zybo**
Reynhart Isaac Malingkas, Adi Candra Swastika and Trio Adiono.

PC3-5 **Implementations Fault Detection Phasor Measurement Unit using Zybo SoC**
Hasbi Ash Shiddieqy, Surya Ramadhan and Trio Adiono.

Parallel Room C-4: Telecommunication-2

Date/time: Wednesday, 18 October 2017 / 10:00 - 12:00

PC4-1 **[Invited] Channel Selectivity Schemes for Retransmission Diversity in Industrial Wireless System**
A. Maria K., N. Sutisna, Y. Nagao, L. Lanante, Jr., M. Kurosaki, B. Sai, and H. Ochi.

PC4-2 **Study on Capacitor-based Recongurable FSS and Its Characterization**
Achmad Munir and Arif Jauhari.

PC4-3 **Characteristic of L Band Erbium Doped Fiber Amplifier under Forward Pumping Scheme**
Ary Syahriar, Anwar Mujadin, Yanti Susanti, and Sasono Rahardjo.

PC4-4 **Passivity assessment of Fractional Circuits basic model for Smart Device in W-domain**
Guishu Liang and Chang Liu.

PC4-5 **Bowtie-Shaped DGS for Reducing Coupling Between Elements of Planar Array Antenna**
Mochamad Yunus, Trio Johan Sinaga, Iskandar Fitri, Evyta Wismiana, and Achmad Munir.

Parallel Room C-5: Instrumentation and Control-4

Date/time: Wednesday, 18 October 2017 / 13:00 - 14:45

PC5-1 **[Invited] Ground Glass Opacity (GGO) Nodules Detection from Lung CT Scans**
May Phu Paing and Somsak Choomchuay.

PC5-2 **Design A Noninvasive Digital Blood Pressure Meter Using High Sensitivity Pressure Gauge MPX5050GP**
Anwar Mujadin and Putra Wijaya Kusuma.

PC5-3 **Automatic Gain Control Circuit for Mobility Visible Light Communication System using LM13700**
Syifaul Fuada, Rosmianto Aji Saputro and Trio Adiono.

PC5-4 **High Precession Resistive Touch Screen Driver Circuitry for Ball On Plate Balancing Systems**
Anwar Mujadin and Aulia Ashari Pratama.

PC5-5 **The Positive-Reality and Regularity of Fractional-Order Biquadratic Impedance Functions**
Guishu Liang, Xiaoyan Huo, Huaying Dong, Zheng Qi, and Chang Liu.

Parallel Room C-6: Device Modeling and Simulation

Date/time: Wednesday, 18 October 2017 / 15:00 – 16:30

PC6-1 **[Invited] A Review of Tunneling Current in High-κ-based MOS Capacitors : Effects of Transverse-Longitudinal Energy Coupling**
Fatimah A. Noor, Euis Sustini, Mikrajuddin Abdullah, and Khairurrijal.

PC6-2 **Study of Tunneling Gate Oxide and Floating Gate Thickness Variation Effects to the Performance of Split Gate Flash Memory**
Grasia Meliolla, Akhmadi Surawijaya, Muhammad Amin Sulthoni, Trio Adiono

PC6-3 **Study of Optical Absorption in Hexagonal Silicon Nanowire Arrays with Radial Schottky Junction**
Akhmadi Surawijaya, Muhammad Amin Sulthoni and Irman Idris.

PC6-4 **Effect Of L_{SG}/L_{FG} Ratio Variation to The IV Curve Of Split-Gate 1st Generation Superflash**
Gilang Mardian Kartiwa, Yusuf Hendrayana, Novi Prihatiningrum, M. Amien Sulthoni and Akhmadi Surawijaya.

TELEMETRY AND TELE-CONTROL OF ELECTRONIC APPLIANCES FOR SMART-HOME-SYSTEM

Muhammad Bagus Nurfaif[#1], Sri Ratna Sulistiyanti[#2], M. Komarudin[#3], Gigih Forda Nama[#4]
[1,2]Department of Electrical Engineering, [3,4]Department of Informatics Engineering
[#]University of Lampung, Lampung-Indonesia
muhammad.bagus@students.unila.ac.id, sr_sulistiyanti@eng.unila.ac.id, m.komarudin@eng.unila.ac.id, gigih@eng.unila.ac.id

***Abstract*— The utilization of household electronic appliances is influenced by every user's necessities. The high demand upon the usage of electronic appliances in one house will trigger excessive power consumption which in further level can lead to electrical-short-circuit problem and end with conflagration. This will put customer's safety and comfort in danger. As the demand toward a comfortable home system rises up, technology plays great role to meet people's need. One solution it offers is by establishing a smart-home-system. This system is aimed to help customers on controlling electronic appliances, monitoring the power use and the power blackout occurrences. The result of this implementation will decrease the tendency for an electrical-short-circuit problem to occur.**

Keywords*— Smart Home; Internet; Control; Monitoring; Power; Raspberry Pi; Arduino; Android.

I. INTRODUCTION

The demand upon the utilization of household electronic appliances in one house depends on each family's necessities. When the demand is going higher, the limitation of the power usage is no longer noticed. This power limitation in every house might be different. According to the data from The Ministry of Energy and Mineral Resources) Directorate General of Electricity, in 2016 two common power limitations for household are 450 VA with 23,144,262 customers, and 900 VA with 23,044,534 customers[1].

The consequence of the excessive power usage is the electrical-short-circuit problem which then will cause conflagration. Based on the data from The Indonesian National Board for Disaster Management, from 2012 until 2015, 646 conflagration cases caused by short-circuit-problem occurred. Therefore, the management system for power usage is urgently required[2].

Nowadays, due to the high demand and modern lifestyle, the household electronic appliances are varied in its kinds and functions. However, nearly all tools use similar system in which when it is connected to the electrical circuit, the common electricity controls used are the switch and the red-infra. The easiest examples are lamp which is controlled by switch and AC (Air Conditioner) which uses red-infra.

Networking can help simplify the utility of remote-controller feature when people are inside or outside home. It can be used to control the switch-control-based and red-infra-control-based electronic appliances, to manage the household total power usage as well as to anticipate unwilling condition when blackout occurs.

Smart-home-system is an integrated concept of several services at home which uses similar communication system and keeps securing the customers' safety and comfort smartly[3]. Smart-home-system combines the communication network connected to the household appliances which enables to be controlled, observed and accessed from distance[4].

Meanwhile, data acquisition system is a system used to take, collect, prepare and process the data based on the users' wishes[5]. Monitoring activity involves the activities to collect, review, report and any activities toward an information related to the implemented process[6].

The controlling system is a composition of several physical components which are connected and bond in such a way that it can instruct, direct or manage its own system as well as others[7]. Controlling system consists of sub-system and process arranged to produce certain output or services wished in accordance with the input[8].

A software engineering is a science which produces zero-error-software and it enables the in-time-delivery which satisfies the customers[9]. Software engineering is a process that creates and utilizes the engineering skill principles aimed to produce economical, qualified and efficient software when applied to the real machine[10].

The Smart-Home-System enables customers to control any electrical appliances, manage the power usage and anticipate when the blackout accidents occur by simply utilizing the android application connected to internet.

 978-1-5386-2778-5/17/$31.00 ©2017 IEEE

II. Configuration Of Smart-Home-System

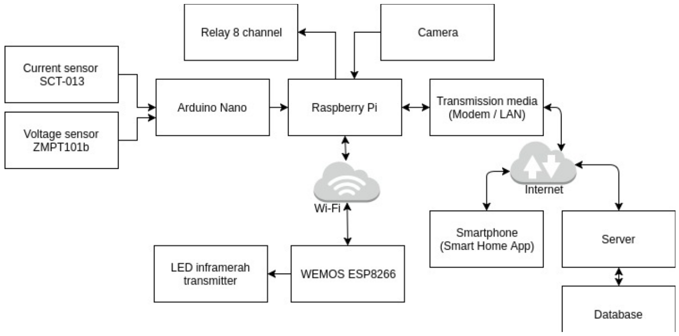

Fig. 2.1 Hardware design

Figure 2.1 shows the system process of this research. The current censor block SCT-013 measures the total current and the voltage censor ZMPT101b measures the AC (alternating current) voltage. Both of these censors work in the main cable of a house. They produce parameter in the form of ADC 10 bytes which then is processed by Nano Arduino. Hence, both of the current and voltage number being processed will result as total power use. The accumulation of current, voltage and total power use parameter by Arduino will then be sent to Raspberry pi through UART (Universal Asynchronous Receiver Transmitter) communication lane.

The Raspberry pi records the data by using python language program. This program also records 8 active relay statuses on GPIO (General Purpose Input Output) pin on Raspberry Pi connected to the switch-based-electrical appliances implemented on lamp. Next this data is transferred to the cloud storage via internet. Raspberry Pi activates the access point wireless feature while WEMOS is applied to control the red-infra-based-electrical appliances implemented on AC which is connected to Raspberry Pi through Wi-Fi. This system is accessed through a link from the server which runs the program.

Raspberry Pi uses GSM transmission modem to connect to internet so that it can implement the Remote Control and Management System as well as being used as the data transmission device from Raspberry Pi to the cloud storage on server.

III. The Hardware and the Software Architecture of the Smart-Home-System

A. *The Hardware*

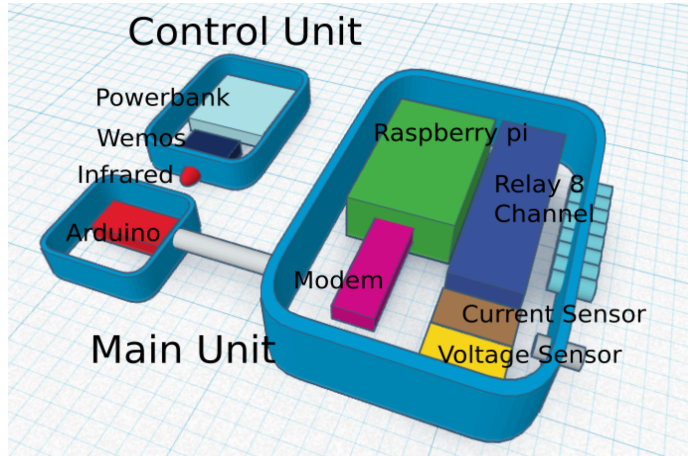

Fig. 3.1. Hardware design

1) The main unit design

The main unit is the unit functions to process, collect, manage, send and control the data. It consists of nearly all devices abovementioned except those in the control unit. Its cubical form which sized 20cm length, 13 cm width and 3.5 cm height is wrapped in a plastic container. Figure 3.1 shows the main unit design completely.

2) The red-infra-control-baser unit design

The control unit is the unit functions to control the red-infra-control-based appliances such as AC (air conditioner). It turns on and off the appliances and sets the temperature as it is wished so. One control unit can only be used for the AC with similar brand. Therefore this unit type must be made specifically. Figure 3.1 shows the control design unit.

B. *The Software*

1) Software Raspberry Pi

 978-1-5386-2778-5/17/$31.00 ©2017 IEEE

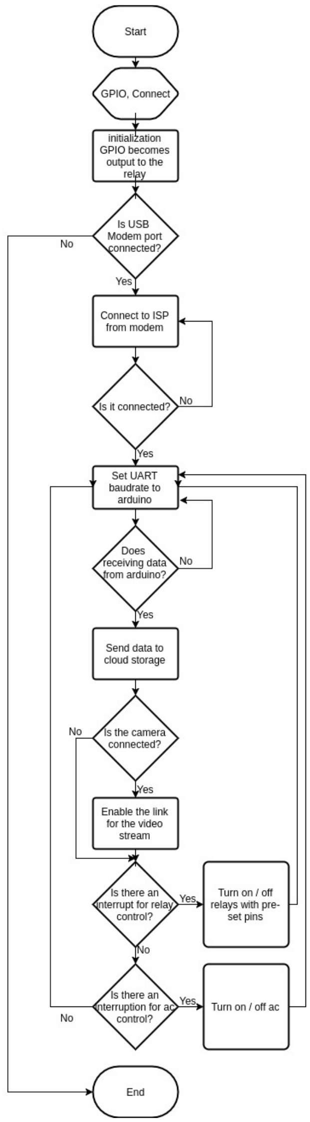

Fig. 3.2. Raspberry-pi's Flowchart

Figure 3.2 describes the flow diagram of Raspberry Pi program design. When Raspberry Pi is activated, it will also initialize the GPIO pin on Raspberry Pi and transfer it to be an output on relay. Therefore, when modem is connected to Raspberry Pi, it will connect to ISP (Internet Service Provider) as well. After being connected, it manages the communication channel series with certain baud rates. After that, some repetitions are done to accept data from Arduino and pass it to the cloud storage, to check the camera to activate video stream link, to check interruptions on relay connected to lamp and to AC.

2) Arduino Nano Software

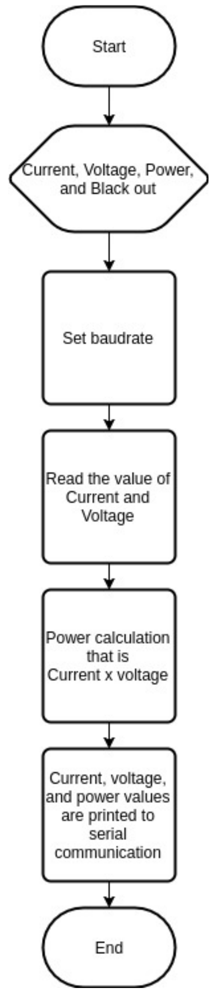

Fig. 3.3. Arduino's Flowchart

Figure 3.3 explains the flow diagram of Aduino Nano program. It works by using UART with certain baud rates. It will read the number on the flow and voltage censor which then will be processed to be the parameter scores of flow, voltage power and blackout condition. Then, Arduino sends those data to Raspberry Pi by using serial communication.

3) Software WEMOS

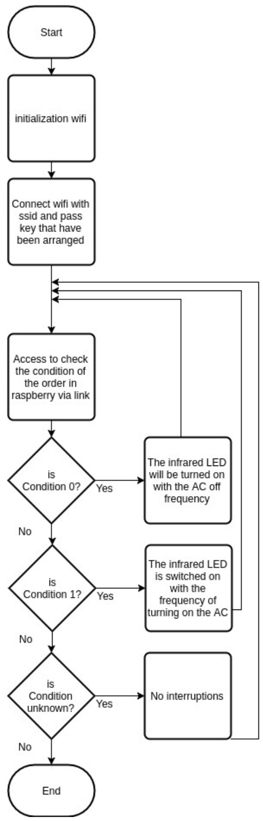

Fig. 3.4. Wemos's Flowchart

Figure 3.4 illustrates the flow diagram of WEMOS program design. It connects to Raspberry Pi through Wi-Fi. It will access the link on Raspberry to search for the command given. Zero (0) indicates a command to turn the AC off and One (1) implies the command to turn it on with certain degrees of temperature. And the unknown condition means no command given.

4) The Android Apps RCKD Software

Figure 3.6 defines the flow diagram of application design on the android operation system. This application connects to internet and gets data from the cloud storage. After that, the data is viewed on the application. It then gives interruption options; to view the video streams opened on browser or to control AC and lamp.

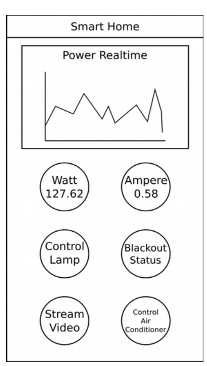

Fig. 3.5. Android Software Design

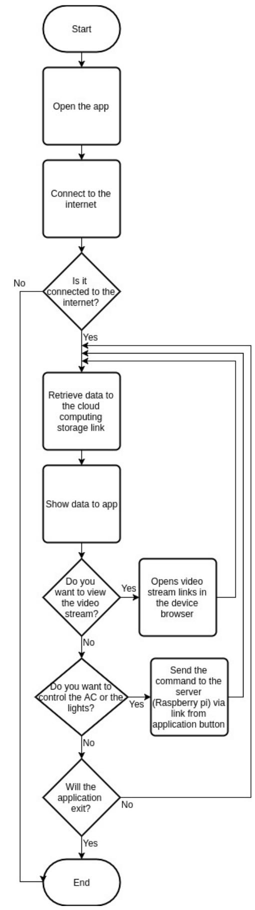

Fig. 3.6. Android App's Flowchart

IV. The Features of The Smart-Home-System Implementation

The test results of the Smart-Home-System features are described as follows:

Table 4.1 Smart Home Implemented

No	Conditions Tested	Expected results	Success / Failed (√/x)
Device			
Test Goal: Smart House System			
1	Connected to the internet	Connected to GSM modem	√
		Connected to LAN	√
2	Get sensor data	Get power value	√
		Get voltage value	√
		Get power outage condition	√
3	Get the status of the switch	Get the status value on the switch	√
4	Change the conditions on the switch	Change the switch condition to on or off	√
5	Change the conditions on the infrared	Change the conditions on the AC becomes on or off	√
6	Sending video over the internet	Displays videos over the internet	√

User			
Test Goal: Smart Home App			
1	User's main dashboard	Displays the main dashboard	√
2	Get sensor data	Displays power graph	√
		Displays power values	√
		Displays voltage values	√
		Displays status of power outage	√
3	Get status data on the switch	Switch status no.1	√
		Switch status no.2	√
		Switch status no.3	√
		Switch status no.4	√
		Switch status no.5	√
		Switch status no.6	√
		Switch status no.7	√
		Switch status no.8	√
4	Sending switch condition changes	Switch on / off no.1	√
		Switch on / off no.2	√
		Switch on / off no.3	√
		Switch on / off no.4	√
		Switch on / off no.5	√
		Switch on / off no.6	√
		Switch on / off no.7	√
		Switch on / off no.8	√
5	Sending infrared condition changes	On/Off AC	√
6	Get video streaming on camera	Displays live video conditions on the Camera	√

V. The Implementation of The Smart-Home-System

Here are the implementations of the Smart-Home-System:

1) The Smart-home-system implementation

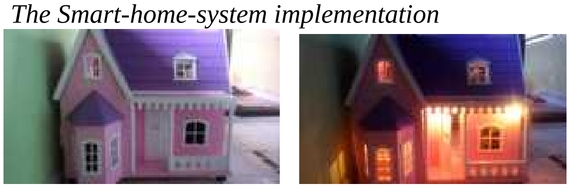

Fig. 5.1. Smart-home-system implementation

It is implemented on the house miniatures with lamps on all rooms.

2) The Smart-home-system application

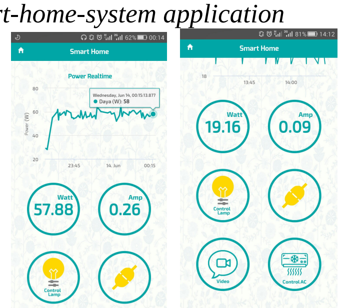

Fig. 5.2. Smart-home-system application

The features to control power, switch for lamps, red-infra for AC and house condition via video streaming are already given.

3) The Telemetry power-control implementation

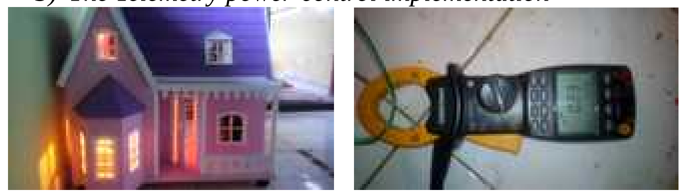

Fig. 5.3. Power-control implementation

Fig. 5.4. Power control graph

On this point, the test upon the accuracy of power calculation of the active lamp (1) and the inactive one (0) has been conducted. It was administered by comparing the value measured on the power scale of the Smart-Home-System.

Table 5.1 The result of comparison test of calculation value on smart home and power measurements tools.

No	*Power Outage*	*Switch*								*Current (Calc) Ampere*	*Current (Meas) Ampere*	*Power (Calc) Watt*	*Power (Meas) Watt*	*Error (%)*
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*					
1	0	0	0	0	0	0	0	0	0	0.1	0.09	22	19.8	11.1
2	0	1	0	0	0	0	0	0	0	0.1	0.09	22	19.8	11.1
3	0	1	1	0	0	0	0	0	0	0.12	0.12	26.4	26.4	0.0
4	0	1	1	1	0	0	0	0	0	0.23	0.23	50.6	50.6	0.0
5	0	1	1	1	1	0	0	0	0	0.29	0.3	63.8	66	3.3
6	0	1	1	1	1	1	0	0	0	0.35	0.35	77	77	0.0
7	0	1	1	1	1	1	1	0	0	0.35	0.36	77	79.2	2.8
8	0	1	1	1	1	1	1	1	0	0.4	0.43	88	94.6	7.0
9	0	1	1	1	1	1	1	1	1	0.51	0.55	112.2	121	7.3
10	1	0	0	0	0	0	0	0	0	0	0	0	0	0.0
													Percent	4.3

Calc : Calculation
Meas : Measurement

 978-1-5386-2778-5/17/$31.00 ©2017 IEEE

4) The Switch-Telecontrol implementation

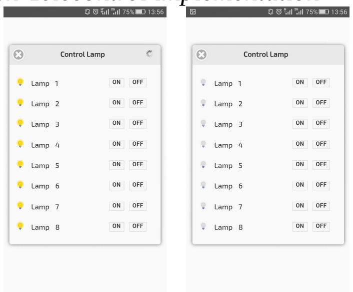

Fig. 5.5. Switch-Telecontrol Implementation

To check this implementation, several trials have been conducted by turning on and off the lamps set in the miniature.

5) The Red-Infra-Telecontrol implementation

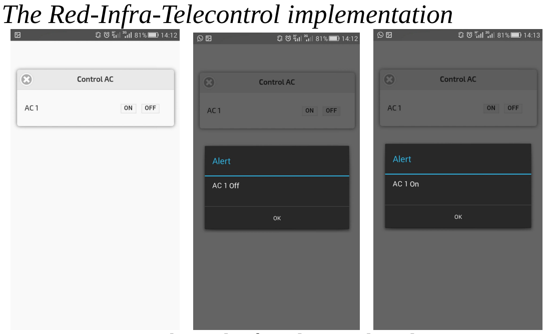

Fig. 5.6. The Red-infra-telecontrol implementation

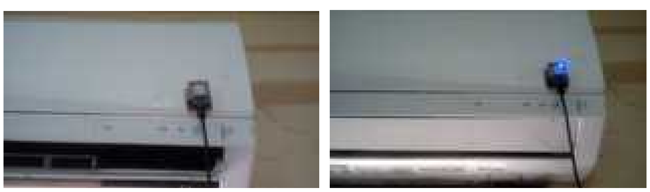

Fig. 5.7. The Red-infra-telecontrol implementation on AC

Meanwhile to implement it, several tests toward AC have been administered by turning it on and off

6) The implementation of Video Streaming

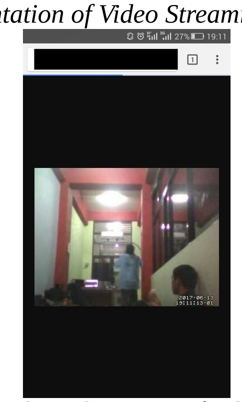

Fig. 5.8. The implementation of Video Streaming

For this implementation, some trials have been administered by using network and LAN modem for transferring the video.

VI. CONCLUSION

This research represented the utilization of the Internet if Thing in a system named the Smart-Home-System. It was conducted by administering Raspberry Pi, arduino nano, etc. this system enables to send data to the users from distance and is accessible via internet so that customers not only can control but also watch his house condition through video streaming. Therefore, the excessive power use can be minimized and the power control is more efficient since it can be done from distance.

ACKNOWLEDGMENT

This research is supported by PPUPIK (*Program Pengembangan Usaha Produk Intelektual Kampus*) from The Directorate of research and community service (DRPM), Ministry of Research and Technology for Higher Education, Republic of Indonesia.

REFERENCE

[1] The Ministry of Energy and Mineral Resources Directorate General of Electricity, Republic of Indonesia. (2016). Penerapan Subsidi Listrik Tepat Sasaran Bagi Konsumen R-1/900 VA. Jakarta Selatan

[2] The Indonesian National Board for Disaster Management, Republic of Indonesia. (2015). Data Kejadian Bencana Kebakaran Permukiman. Jakarta Pusat

[3] Lutolf R. (1992). Smart Home concept and the integration of energy meters into a home based system, hal 277-278

[4] King, N (2004). Smart Home – A Definition, Intertek research & Testing Centre, United Kingdom

[5] Batubara, F (2015). Sistem Akuisisi Data, page 1-4, Teknik Elektro ENSIKOM

[6] Mercy Corps (2005). Design, monitoring, and evaluation guidebook.

[7] DiStefano, Joseph., Stubberud, Allen., Williams, Ivan. (2011). Schaum's Outline of Feedback and Control Systems, 2nd Edition, McGraw-Hill,

[8] Nise, Norman S. (2010). Control Systems Engineering, International Student Version, 6th Edition, , John Wiley & Sons, Inc.

[9] Stephen R. Schach (2004). Introduction to Object Oriented Analys and Desaign with UML and The Unified, The McGraw Companies, New York

[10] Pressman, Roger S (2005). Software Engineering : A Practioner's Approach Sixth Edition, Mc Graw Hill, New York