

KAISTEE

We are pursuing research and nurturing talents in all crucial areas related to automation via intelligent agents, cyber-physical systems and Internet of Things, and cloud computing.

KAIST

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S C H O O L
O F
E L E C T R I C A L
E N G I N E E R I N G

Greetings and welcome to the EE Community of KAIST!



We are a large organization with 87 full time professors, some 500 undergraduate students and over 1000 graduate students. Our students, both undergraduates and graduates, are the cream-of-the-crop EE students selected through highly competitive admission processes. We have numerous major research programs on topics ranging from new Nano materials to brain-like AI algorithms to Big Data. The boundaries of our education and research have changed dynamically and dramatically in recent years and today we boast having faculty with widely diverse technical backgrounds including Chemistry, Physics, Material Science, Mathematics, Computer Science and Mechanical Engineering. We feel diversity is a source of creativity and would fuel ideas leading to new technological developments that can change our lives in better ways. While KAIST EE has been instrumental in the advent of Korea's semiconductor industry via breakthrough research and training of key engineering talents, we are now positioning ourselves to help the growth of high-tech companies in the critical era of fourth industrial revolution that is sweeping the world. We

are pursuing research and nurturing talents in all crucial areas related to automation via intelligent agents, cyber-physical systems and Internet of Things, and cloud computing. Our students will grow to be the very fabric of this upcoming industry. Our strong tie with the prominent major companies of Korea will remain even stronger while we will strive to cultivate new and diverse relationships with smaller forth-coming companies in fueling our industry and economy.

We pride ourselves on placing high priority on student care. We are starting a “homeroom” care system in our undergraduate program where every student belongs to a particular group of students having similar career interests, whether pursuing graduate studies, seeking corporate jobs or getting involved in start-up companies. We are also initiating a CO-OP program where students would alternate 6-month industry employment with 6-month on-campus education. The students will gain valuable real-world engineering experiences while earning competitive salaries. As for graduate students, we are working with individual professors in setting up a minimum salary guideline so that financial difficulty would not be a limiting factor in pursuing graduate study. In addition, we are putting together plans to recognize and incentivize highly productive students. We will continue to recruit excellent international students and work hard to provide environments where our international students feel right at home. A new EE international office is being set up on the first floor of the main EE building to focus on caring for our international students as well as faculty and visiting scholars.

My door is wide open to all who have questions about EE, share our visions, wish to suggest ways to improve our system or just want to chat with the Head who feels his priority is in serving the EE community and its members.

With Warm Regards,

Jaekyun Moon

Head, School of Electrical Engineering

KAIST

Electrical Engineering History



Since 1971

1971

- Registration of Establishment of Korea Advanced Institute of Science (KAIS)
- Completion of the masterplan for the establishment of Korea Advanced Institute of Science (KAIS)
- Establishment of Korea Advanced Institute of Science (KAIS)

1973

- First entrance examination
- First entrance ceremony for the master's program

1975

- First commencement for the master's program
- First entrance ceremony for the doctoral program

1990

- First commencement for the bachelor's program

1996

- Establishment of an annex high school

1997

- Establishment of Information and Communications University (ICU)

1998

- First entrance ceremony for the graduate program of ICU

1999

- First graduation ceremony for the graduate program of ICU

1990s

1980s

1981

- Establishment of Korea Advanced Institute of Science and Technology (KAIST) by merging with KIST
- First commencement for the doctoral program

1984

- Establishment of Korea Institute of Technology (KIT) starting the undergraduate program

1986

- First entrance ceremony for KIT

1989

- Merger of KAIST with KIT

2002

- First entrance ceremony for the undergraduate program of ICU

2003

- Change in official title from 'director' of KAIST to 'president'

2004

- Foundation of the National NanoFab Center (E19)

2005

- 1000th Ph.D. graduated from the Department

2009

- Merger of KAIST and ICU
- Merges with the Korea Science Academy, renaming it Korea Science Academy of KAIST

2013

- Foundation of Kim Beang-Ho Kim Sam-Youl ITC Building (N1)

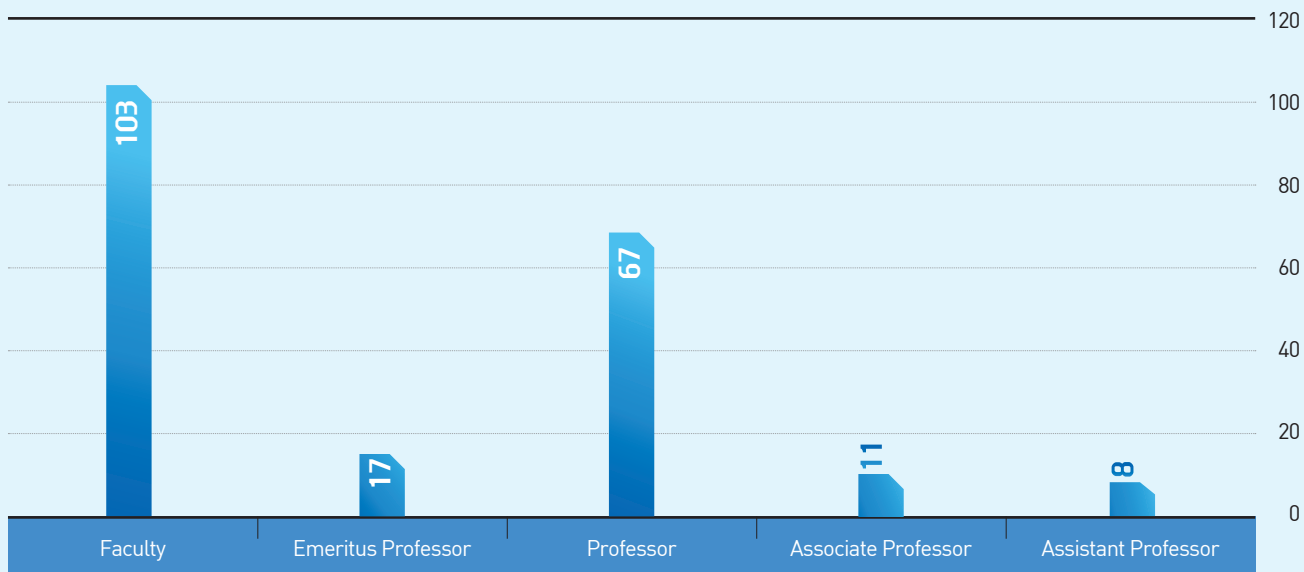
2015

- Change in official title from 'Department of Electrical Engineering' to 'School of Electrical Engineering'

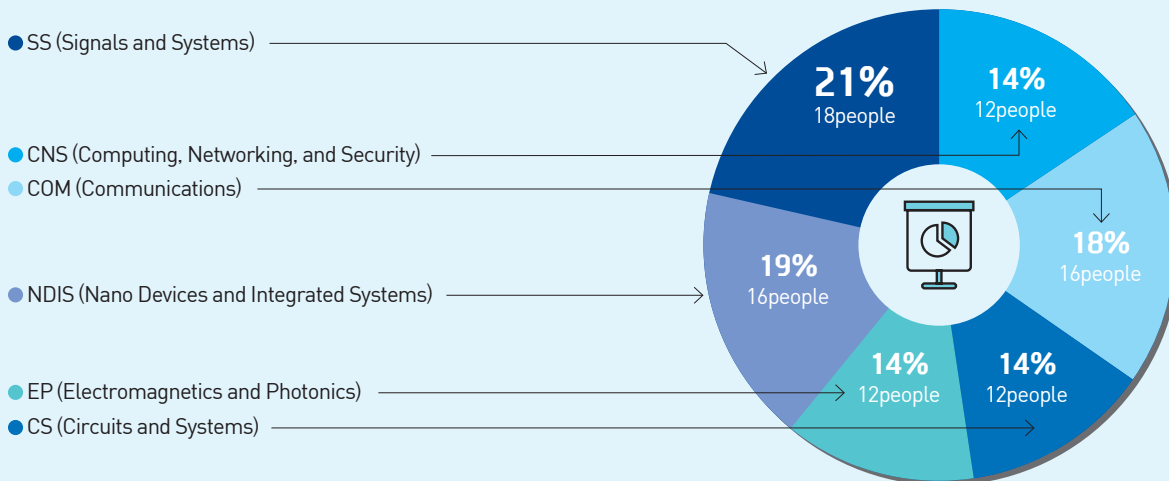
2000s

Current State of Affairs and Statistics

Faculty



Faculty by Research Fields

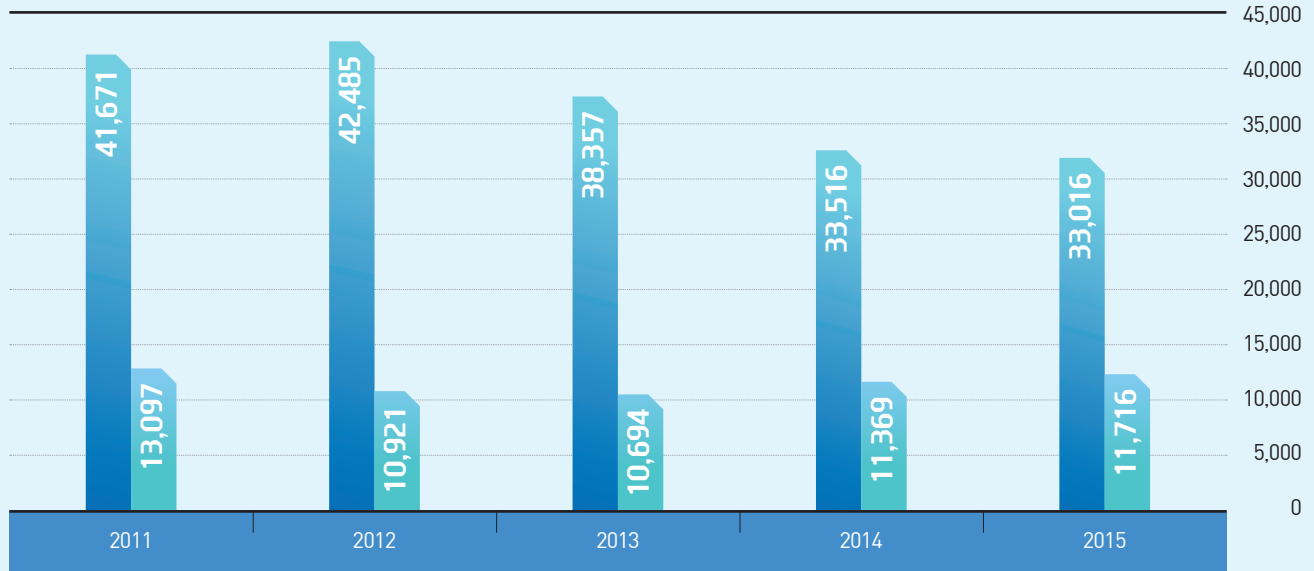




STATISTICS

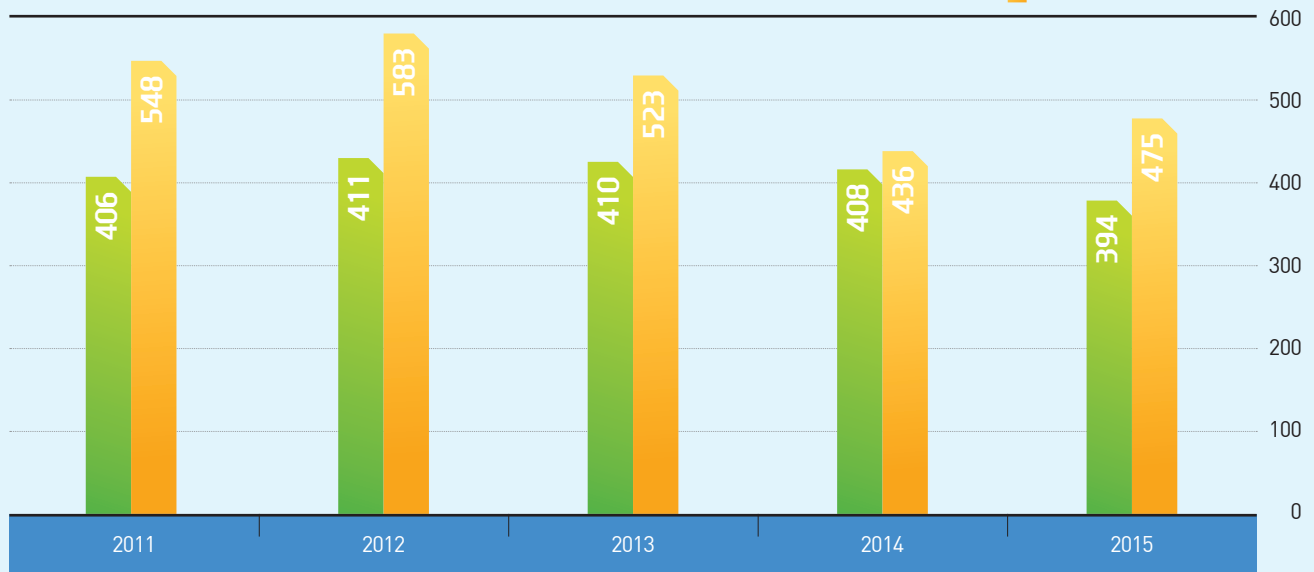
Research Funds

2011–2015 / Government Industry



International Journal and Conference

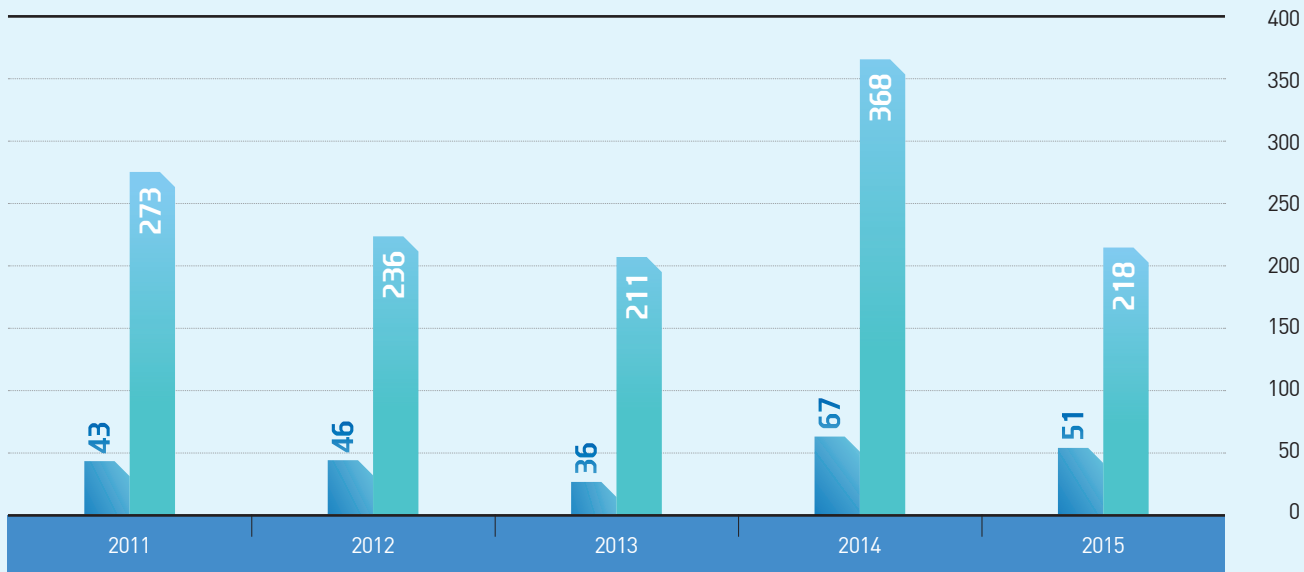
2011–2015 / International Journal International Conference



Current State of Affairs and Statistics

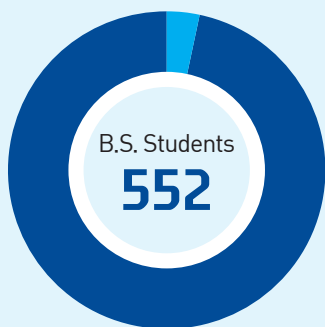
Patent Registration

2011-2015 / International Domestic

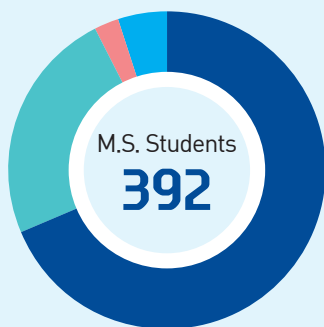


Student Enrollment

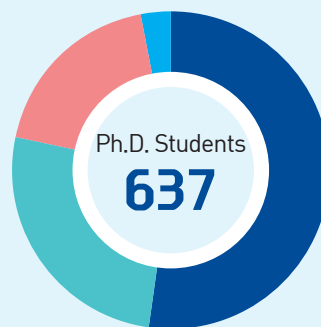
March 2016



Government Scholarship **553**
International **19**



Government Scholarship **269**
KAIST Scholarship **94**
General/Industry Scholarship **10**
International **19**



Government Scholarship **333**
KAIST Scholarship **166**
General/Industry Scholarship **119**
International **19**



STATISTICS

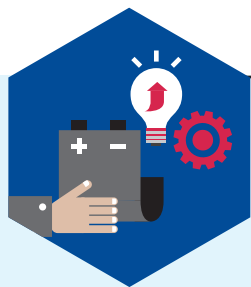
Number of Alumni



Graduated Students per Semester

March 2016 / ● B.S. ● M.S. ● Ph.D.

Semester	B.S.	M.S.	Ph.D.	Total
2006 February	65	82	45	192
2006 August	26	25	31	82
2007 February	80	92	41	213
2007 August	27	24	19	70
2008 February	86	96	34	216
2008 August	38	35	22	95
2009 February	78	103	30	211
2009 August	45	26	32	103
2010 February	87	112	49	248
2010 August	38	37	22	97
2011 February	101	145	35	281
2011 August	34	37	35	106
2012 February	104	120	46	270
2012 August	35	34	34	103
2013 February	86	123	43	252
2013 August	31	34	29	94
2014 February	76	138	57	271
2014 August	37	50	37	124
2015 February	90	133	48	271
2015 August	27	38	39	104
2016 February	91	123	56	270



Staff

ELECTRICAL ENGINEERING

Administrative Support



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Ahn, Sohyeon

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Relations, Website

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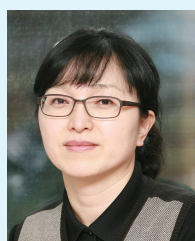


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Graduate
Admissions

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Robotics Program,
Technical Research
Personnel

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Research Funds,
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Undergraduate Affairs,
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Administrative Support



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(IT Convergence B/D)

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N5 #2358



Lee, Seungjun

Instructional Lab
Manager

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eesj@kaist.ac.kr



Yun, Guk-Young

Assets and Facilities
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(CHiPS, LG Semiconhall
and fMRI B/D)

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CHANGHO SUH

Associate Professor,
School of Electrical Engineering, KAIST
(Alumnus of School of Electrical Engineering, KAIST)



But I have a faith: There exists a mission for you. I do hope you would figure out that mission and achieve it.



Q Please introduce your research field.

A My research interests include information theory and machine learning. Information theory is one of the fundamental fields, founded by Claude Shannon, and has played a crucial role in delineating the limit on the capability to do some tasks in information-related systems that we call “information systems”. Initially the theory was developed in the process of characterize the limit on the amount of information that one can transmit in communication systems. Nowadays it plays a role in a wide variety of applications beyond communications, ranging from distributed storage systems (Facebook’s Hadoop, Google’s data center), to artificial intelligence systems (Google’s web search engine, Amazon’s recommendation systems, deep neural networks), to bio-informatics (DNA/RNA assembly, personalized medicine). For instance, in search engine, the theory can help characterize the limit on the amount of data samples required to obtain satisfactory search results, as well as can shed some lights on algorithm designs. Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. While it has evolved from the study of pattern/voice/object recognition, it has now a broader impact upon a wide spectrum of contexts: ranking systems, recommendation systems, social choice, artificial intelligence, education to name a few. A recent interesting attempt is made towards using tools of information theory to address challenging issues encountered in the field of machine learning. A typical machine learning algorithm assumes availability of a complete set of raw data. In the age of big data, however, we are faced with a challenge: the observed data is highly incomplete and inconsistent: only a small fraction of possibly noisy data sets can be accessible. To address the challenge, recent efforts have been made to develop an information-theoretic

framework which comprises two components: (1) the partial measurement component; (2) the algorithm component. Unlike conventional data analytics, the first component is newly introduced to respect the difficulty of aggregating large scale data sets, and tools of information theory are instrumental in the optimal design of the first component. Actually this approach enabled me to develop a novel ranking algorithm that requires minimal data samples and thus runs in real-time while achieving high ranking accuracy. This led to the development of a real-time search engine that speeds up Google's search engine (PageRank) in an order of magnitude. Moreover, with the approach, I am currently working on the optimal design of DNA/RNA assembly and community detection.

Q What was your motivation for coming to KAIST?

A Personally, I like a fundamental field. I wish to understand a law of the nature and/or the world. Actually that was one of the main reasons that I wanted to be a theoretical physicist in my childhood. During my undergraduate, I happened to know about information theory, and found it the perfect fit for my passion. I was fascinated by the fact that there exists the limit on the amount of information that can be transmitted no matter what we do and whatsoever. I believe KAIST pursues fundamental research. Many faculty members appreciate the fundamental research and we do have very smart and enthusiastic students who have passion for ground-breaking research. Also a low teaching load helps us focus on research. All of these factors led me to come to KAIST.

Q Do you have advice for KAIST students?

A Whenever I have a meeting with an undergraduate student, I am asked one common question: "I don't know what to do". I would like to end this interview by sharing my thoughts on this. What I recommend is three-folded. First, consider your talent. I think everyone has each his/her own mission, and I do believe that the talent is the one that is given for carrying out such a mission. There are many students who don't figure out what their talents are. Here are some ways to figure out: (1) Listening to others' advice; (2) Shrinking your wish list by excluding what you do not like. Your family or seniors can help you to make a wise decision. Sometimes they may be better (and more accurate) at figuring out your talents than you - many people are biased by their desires and environments. Of course you should rely on people who seriously take you into consideration. Also, you could find your talent easier via eliminating what you do not like. Typically people have no talent for the ones they do not like.

The second factor that I recommend you to consider is your passion. Follow what your heart wants among the ones that you are good at. Some students may want to do something that they have no talent for. My advice for those students is: "forget about it". Actually it is very difficult to be successful even for the work that you have both talent and passion for. It would be very easy to fail unless you have talent.

Lastly, consider sharing. You would definitely feel happy if what you do would contribute to many others. Also one thing to note is that the impact would be maximized when you have talent and passion.

Someone may suspect that it is almost impossible to find out their own mission considering the above three factors in that order: talent, passion, and sharing. But I have a faith: there exists a mission for you. I do hope you would figure out that mission and achieve it.

JAEHO CHOI

CEO of Drama & Company

(Alumnus of School of Electrical Engineering, KAIST)



Please keep in mind that ‘direction’ is more important than ‘speed’, and be patient about planning future.



Q Hi, Jaeho Choi. Could you please introduce yourself for those students who don't know you?

A Hi. I'm Jaeho Choi. I graduated from the school of electrical engineering at KAIST (batch 2000). Currently, I'm running an IT start-up company called Drama & Company.

Q Could you please explain about 'Drama & Company' and 'Remember'?

A 'Drama & Company' is a start-up company established in June 2013, so it's been less than 2 years. 'Remember' is a business card management service, aiming to be a Korean Linked-In. It was launched in January 2014, and it has gained good reputation in the marketplace.

Q What were the motivation and the process of starting 'Drama & Company'?

A After graduation, I worked for the international consulting firms (BCG, Deloitte) for 6 years. It was a good experience for me. But I wanted to achieve more than providing advice on business, so I started my own business.

Q Could you explain what sorts of values and vision that 'Drama & Company' pursues?

A Regarding the working 1) Do my best (not to be embarrassed by myself and colleagues). 2) Work well (like other world-leading companies) 3) Make work enjoyable (so that I'm not afraid of going to the company on Monday). Regarding the service, I plan to provide a business portal service based on the business card.

Q What's the future direction of 'Drama & Company'?

A Currently, 'Remember' is a just business card management service, but it'll be extended to a business portal service which provides personalized business information and extended social network.

Q What were your impressive moments and experiences that you had during an undergraduate at KAIST?

A I was a member of 'KangJeok' and I once worked as the club president to lead the club. I had experiences of planning concerts and doing various things for the club. Those experiences helped me a lot after graduation.

Q Nowadays, many students are interested in starting their own business. Are there any advices or tips for them?

A They should be cautious because starting a business cannot be just done from an ambiguous fantasy. Starting own business is definitely interesting and it can give you a sense of achievement. But the process of starting own business is very tough and difficult. So, I suggest that those students can first seek experiences by working in some good startup companies and then start their own business later. Or they also can start with those companies by sharing the vision.

Q Many students worry about their GPA and the future plans and they go through tough times. Could you give some advices for them?

A Unlike my friends, I served in the military, and I also had an experience of running an Internet shopping mall after graduation. Also I joined the graduate school at KAIST but I left it after 3 months. I should admit that I was a bit impatient. If I have a chance to go back to those days, I'll be more patient and try to experience many other things. Actually, there are many 30-year-old new employees in the big companies, so students in KAIST don't need to be in hurry. Please keep in mind that 'direction' is more important than 'speed', and be patient about planning future.

S C H O O L

OF

Research Groups

ELECTRICAL

ENGINEERING

CNS GROUP Computing, Networking, and Security
Group

COM GROUP Communications Group

CS GROUP Circuits and Systems Group

EP GROUP Electromagnetics and Photonics Group

NDIS GROUP Nano Devices and Integrated Systems
Group

SS GROUP Signals and Systems Group

KAIST

SCHOOL
OF ELECTRICAL
ENGINEERING

CNS GROUP



Computing, Networking and Security Group

- ① System Security (SysSec) Lab.
- ② System Modeling Simulation Lab.
- ③ Networked and Distributed Computing Systems Lab.
- ④ Multimedia Traffic Engineering Lab.
- ⑤ Communication Networks Research Lab.
- ⑥ Network and System Security Lab.
- ⑦ Algorithmic Intelligence Lab.
- ⑧ Advanced Network and Computing Lab.
- ⑨ Laboratory of Network Architecture, Design, and Analysis
- ⑩ Communications And Networking Engineering Lab.
- ⑪ CAD4X: Computer-aided design for X
- ⑫ Network Systems Lab.
- ⑬ Media Network Lab.
- ⑭ Intelligent Network Architecture and Distributed Systems Research Lab.

Yong Dae Kim
Tag Gon Kim
Kyung Soo Park

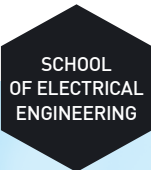
Hong Shik Park
Dan Keun Sung
Seung Won Shin
Jinwoo Shin
Chan-Hyun Youn
Yung Yi

June-Koo Kevin Rhee

Naehyuck Chang
Song Chong
Jun Kyun Choi
Dong Su Han



The Computing, Networking, and Security (CNS) group focuses its research and education efforts on the hot topics in computer systems, networking, and system security. Its goal is to lead the global research community on the recent hot issues in computing and networking technologies, and to educate the students to become global innovators in this area. Its research topics include operating systems and system software, networking theory and algorithms, networked systems design and implementation, cloud computing, big data analysis and algorithms, smart grid systems, smart mobile systems and so on.


 SCHOOL
OF ELECTRICAL
ENGINEERING

COM GROUP

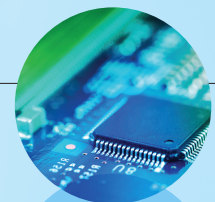


Communications Group

- ① Advanced Radio Technology Lab.
- ② Communications Signal Processing Lab.
- ③ Communications & Storage Lab.
- ④ Information Processing Systems Lab.
- ⑤ Laboratory for Information Transmission
- ⑥ Information Systems Lab.
- ⑦ Wireless Information Systems Research Lab.
- ⑧ Statistical Signal Processing Lab.
- ⑨ Digital Communications Lab.
- ⑩ Mobile Communications Lab.
- ⑪ Scientific Computing Lab.
- ⑫ Information Theory & Machine Learning Lab.
- ⑬ Ubiquitous Mobile Life Systems Lab.
- ⑭ Wireless Communication Systems Lab.
- ⑮ Coding and Communication Lab.
- ⑯ Wireless Innovative Technologies Lab.

Joonhyuk Kang
Hyung Myung Kim
Jaekyun Moon
Dong Jo Park
Hyuncheol Park
Changho Suh
Youngchul Sung
lickho Song
Yong Hoon Lee
Hwang Soo Lee
JooHwan Chun
Sae Young Chung
Dong Ho Cho
Wan Choi
Jeongseok Ha
Youngnam Han

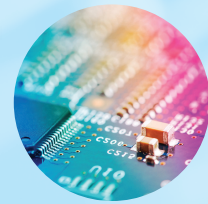
Our research interests include the design and analysis of a wide variety of communication systems such as next-generation cellular systems (e.g., 5G systems), wired networks, wireless networks, broadcasting systems, sensor networks, storage systems, and computing systems. We seek to characterize the fundamental limits of information flow for diverse networks, as well as to develop practical transmission/reception schemes that can actually achieve the limits. We are also interested in extending the principles developed in communication networks into other fields of network research. Especially we are recently doing interdisciplinary research on world-wide important topics such as the smart energy network (the so-called smart grid), the smart health-care network, and the smart environment system.



SCHOOL
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ENGINEERING

CS GROUP

Circuits and Systems Group



- ① Smart Sensor Architecture Lab.
- ② Multimedia VLSI Design Lab.
- ③ Mixed Signal Integrated Circuits Lab.
- ④ Integrated Computer Systems Lab.
- ⑤ Nanoscale Advanced Integrated Systems Lab.
- ⑥ μ -computing Lab.
- ⑦ Semiconductor System Lab.
- ⑧ Nano Integrated Circuit Expertise Lab.
- ⑨ Integrated Microsystems Powered with Advanced Circuit Technologies Lab.
- ⑩ Circuit Design and System Application Lab. (CNSL)
- ⑪ Communication Circuits & Systems Lab.

Chong Min Kyung

Lee Sup Kim

Seung Tak Ryu

In Cheol Park

Hyun Min Bae

Youngsoo Shin

Hoi Jun Yoo

Sang Gug Lee

Minkyu Je

Gyu Hyeong Cho

Seonghwan Cho

The Circuits and Systems (CS) group focuses on enhancing human life quality by the realization of state-of-the-art wired/wireless telecommunication system, bio/healthcare-related system, as well as energy-efficient green environment management system. With such vision in mind, we are striving to contribute in the research areas of digital/analog circuit designs, mixed circuit designs, platform designs, design automation/verification, wired/wireless telecommunication, healthcare, and green-energy systems.

EP GROUP

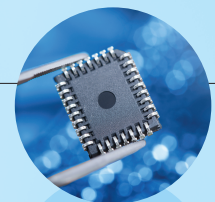
Electromagnetics and Photonics Group

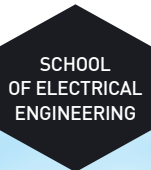
- | | |
|--|-----------------------|
| ① TeraByte Interconnection and Package Lab. | Joungho Kim |
| ② Photonics Systems Research Lab. | Hoon Kim |
| ③ Electromagnetic Theory and Technology Lab. | Noh Hoon Myung |
| ④ Microwave & Antenna Lab. | Seong Ook Park |
| ⑤ Nano Electronic and Photonic Systems Lab. | Hyo Hoon Park |
| ⑥ Convergence Optoelectronic Device Engineering Lab. | Yong Hyub Won |
| ⑦ Integrated Nanophotonics Lab. | Kyoungsik Yu |
| ⑧ Radio Frequency System Solution Lab. | Jong Won Yu |
| ⑨ Photonics Application Lab. | Man Seop Lee |
| ⑩ Photonic Networks Research Lab. | Chang Hee Lee |
| ⑪ Nano Optics Lab. | Min Seok Jang |
| ⑫ Lightwave Systems Research | Yun Chur Chung |

Electromagnetics and Photonics (EP) group research activities cover the two major areas: Applied Electromagnetics and Optics and Photonics. Applied Electromagnetics focuses on the electromagnetics scattering, diffraction, and wave propagation in such applications as RF/ microwave and millimeter-wave circuits, antennas, packages and systems. Optics and Photonics conducts

research in photonics, quantum optoelectronics, optical communication, nanoscale optical device, nanophotonics, optical sources, optical MEMS, and biophotonics. Application areas of our group include the physics, devices, and systems that use electromagnetics and photonics for various applications such as communications, display, energy, environments, imaging, health care, sensing, and security.

- Applied Electromagnetics: Electromagnetics scattering, diffraction, and radiation problems, analytical and numerical techniques of electromagnetics, analysis and design of antenna, precision antenna measurement techniques, beam forming antenna, RFID systems, radar systems, remote sensing, meta-materials, signal and power integrity in 3D ICs, Radio Frequency (RF)/microwave/ millimeter/sub-millimeter-wave's circuits and systems
- Optics and Photonics: Optical interconnection, optical switching, photonic signal processing devices, optofluidic device for 3D display, semiconductor light sources, terahertz generation and applications, nanoscale optics, Integrated photonics and optoelectronics, optical MEMS, quantum communications, micro/nano-photonics, biophotonics, optical system and network technology, and lightwave systems technology.




 SCHOOL
OF ELECTRICAL
ENGINEERING

NDIS GROUP



Nano Devices and Integrated Systems Group

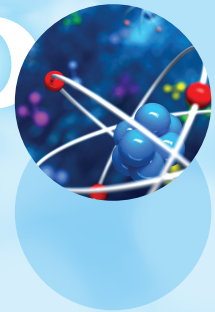


- ① Microwave Microsystems Laboratory
- ② Computational Nanoelectronics Lab.
- ③ High Speed Nanoelectronics Lab.
- ④ Integrated Organic Electronics Lab. (IOEL)
- ⑤ Communication Devices and Systems Lab.
- ⑥ Terahertz Nano System Lab. (TNSL)
- ⑦ 3D Micro–Nano Structures Lab.
- ⑧ Wireless PHYCOM Lab.
- ⑨ Biomedical Microsystems Lab.
- ⑩ Infrared Image Sensor Lab.
- ⑪ Nano Electronics & Energy Device Lab.
- ⑫ Advanced Display and Nano Convergence Lab.
- ⑬ Molecular and Nano Device Lab.
- ⑭ Nano–Oriented Bio–Electronics Lab.
- ⑮ Wave Embedded Integrated Systems Lab.

Chul Soon Park
Mincheol Shin
Kyounghoon Yang
Seunghyup Yoo
Hyung Joun Yoo
Giwan Yoon
Jun Bo Yoon
Kwyro Lee
Hyunjoo Lee
Hee Chul Lee
Byung Jin Cho
Kyung Cheol Choi
Sung Yool Choi
Yang Kyu Choi
Songcheol Hong

Nano Devices and Integrated Systems (NDIS) group focuses on improving quality of human life by the realization of state-of-the-art nano device and system technology based on the semiconductor devices and fabrication of such devices as CMOS device, MEMS device, organic device, display technology, energy harvesting device, optoelectronic device, high frequency device, bio/medical/health-care related device and system. NDIS group covers a broad range of technology from fundamental science to applied science and engineering for commercialization by employment of a novel device, a novel structure, a novel concept, new materials, and a novel fabrication technology.

SS GROUP



Signals and Systems Group

- ① Robotics and Computer Vision Lab.
- ② Brain Reverse Engineering and Imaging Lab.
- ③ Video and Image Computing Lab.
- ④ Real-Time Control Lab.
- ⑤ Visual Communications Lab.
- ⑥ Robot Intelligence Technology Lab.
- ⑦ Statistical Inference and Information Theory Lab.
- ⑧ Computational Imaging Lab.
- ⑨ Statistical Speech and Sound Computing Lab.
- ⑩ Image Systems Lab.
- ⑪ Image and Video Systems Lab.
- ⑫ KAIST Power Electronics Lab.
- ⑬ Image Computing System Lab.
- ⑭ Statistical Learning for Signal Processing Lab.
- ⑮ Computational NeuroSystems Lab.
- ⑯ Cognitive Neurorobotics Lab.
- ⑰ Smart sound systems Lab.
- ⑱ Speech and Audio Information Lab.

In So Kweon
Dae Shik Kim
Munchurl Kim
Byung Kook Kim
Seong Dae Kim
Jong Hwan Kim
Junmo Kim
Changick Kim
Hoi Rin Kim
Jong Beom Ra
Yong Man Ro
Gun Woo Moon
Hyun Wook Park
Chang Dong Yoo
Soo Young Lee
Jun Tani
Jung Woo Choi
Minsoo Hahn

processing algorithms, as well as designing and implementing systems for various applications. Its areas of research can be divided into three broad categories: machine learning, information systems and control systems. In the area of machine learning, it develops learning algorithms such as deep learning to improve task performance. In the area of information systems, the group carries out research on information and signal processing that involves voice, images, and communication. Specifically, it focuses on voice synthesis and coding, signal processing and prediction, computer vision, pattern recognition, multimedia communication, digital mobile communication, data protection, signal detection and prediction, and 3D image processing. Research related to control systems is focused mainly on robots, power electronics, and control theories used in various intelligent systems and industrial systems. Its examination of process control systems, production line automation, satellite systems, intelligent traffic control systems, power conversion systems, human-centric welfare robots, personal robots, artificial life, inter-robot collaboration, human-robot interfaces, and empathetic robots is aimed at creating an intelligent future environment for humankind.

The Signals and Systems (SS) group conducts theoretical and applied research for developing signal and information

S C H O O L

OF **10 Major Achievements
in the Year 2015**

ELECTRICAL

ENGINEERING

1. Breaking and Fixing VoLTE: Exploiting Hidden Data Channels and Mis-implementations
Prof. Yongdae Kim, Prof. Dongsu Han
2. The world's first standardization of physical layer security for distributed network
Prof. Jeongseok Ha
3. Flexible, ultra-thin polymer insulating layers and their applications to flexible electronics
Prof. Seunghyup Yoo, Prof. Byung Jin Cho
4. Vision system of DRC-HUB0+ for DARPA Robotics Challenge
Prof. In So Kweon
5. Fiber-based Polymer light emitting diodes for wearable displays
Prof. Kyung Cheol Choi
6. K-Glass2: A Gaze Activated Augmented Reality Smart Glasses
Prof. Hoi-Jun Yoo
7. Portable high spatial resolution near-infrared spectroscopy system(NIRSIT)
Prof. Hyeon Min Bae
8. Pattern polarization beam division multiple access (P2BDMA)
Prof. Dong Ho Cho
9. Micro Chained Radar System for detecting small UAVs
Prof. Seong-Ook Park, Prof. Joohwan Chun
10. FloSIS: a highly scalable network flow capture system for fast retrieval and storage efficiency
Prof. KyoungSoo Park, Prof. Yung Yi

Breaking and Fixing VoLTE: Exploiting Hidden Data Channels and Mis-implementations

Authors Prof. Yongdae Kim, Prof. Dongsu Han

Summary

Long Term Evolution (LTE) is becoming the dominant cellular networking technology, shifting the cellular network away from its circuit-switched legacy towards a packet-switched network that resembles the Internet. To support voice calls over the LTE network, operators have introduced Voice-over-LTE (VoLTE), which dramatically changes how voice calls are handled. We find that this dramatic shift opens up a number of new attack surfaces that have not been previously explored. To call attention to this matter, this paper presents a systematic security analysis. Unlike the traditional call setup, the VoLTE call setup is performed at the Application Processor (AP), using the SIP over IP. A legitimate user who has control over the AP can potentially control and exploit the call setup process to establish a VoLTE channel. This is combined with the legacy accounting policy (e.g., unlimited voice and the separation of data and voice) and eventually leads to a number of free data channels. In the process of unveiling the free data channels, we identify a number of additional vulnerabilities of early VoLTE implementations, which lead to serious exploits, such as caller spoofing, over-billing, and denial-of-service attacks.

Achievements and Expectations

A. Responsible Disclosure

- i. Report to US CERT (Vulnerability Note VU#943167)
- ii. Report to Google Security Team and patched by Google (CVE-2015-6614)
- iii. Report to 3 major Korean operators and suggest mitigations

B. Publication and invited talks

- i. Proceedings of the 22nd ACM SIGSAC Conference on Computer and Communications Security. (ACM CCS 2015)
- ii. 32nd Chaos Communication Congress (32C3, 2015)
- iii. Power of Community 2015 (PoC 2015)
- iv. A3 Workshop 2016, Research on Next Generation Internet and Network Security
- v. GSMA VoLTE/RCS Security Workshop 2016

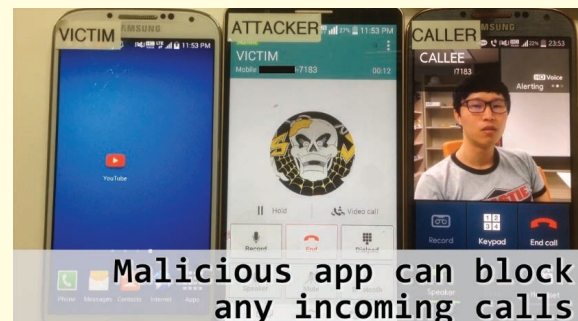
C. Media coverage (International)

- i. Nexus Security Bulletin, DSLReports, IT World, Softpedia, tom's guide, Pocketnow, FierceMobileIT, Techworm, Neowin, Network World



Executing Caller spoofing

Caller spoofing attack on VoLTE user



Malicious app can block any incoming calls

VoLTE call DoS attack on LTE device

The world's first standardization of physical layer security for distributed network

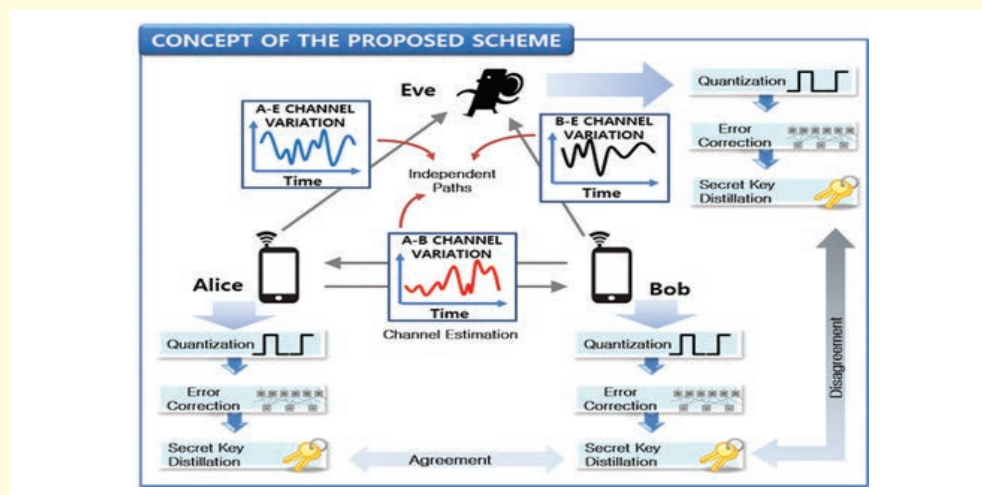
Authors Prof. Jeongseok Ha

Summary

Physical layer security is an emerging technique which aims at reinforcing communication secrecy by utilizing physical layer resources such as features of wireless channels, characteristics of hardware components, signal processing techniques, etc. Physical layer security has been considered as a promising technique for next generation distributed networks since it enables us to realize information theoretic perfect secrecy even without resorting to neither expensive computational complexity nor security infrastructure. Nonetheless, there have not been thorough studies on commercialization and standardization of physical layer security. In this research, we proposed a secret key agreement protocol for distributed networks utilizing no-cloning property of wireless channel. The protocol was the world's first physical layer security technology to be adopted in the international standard IEEE 802.15.8 PAC. This work and extensions of this work must provide an effective solution to secret key agreement in various next generation distributed networks, which will be an essential technique to make so-called IoT (Internet of Things) viable.

Achievements and Expectations

- The world's first standardization of physical layer security for distributed network (IEEE 802.15.8 PAC)
- It is expected that this work could be an effective security solution for a next generation distributed networks such as IoT which are vulnerable to security threats due to the absence of centralized infrastructures



Flexible, ultra-thin polymer insulating layers and their applications to flexible electronics

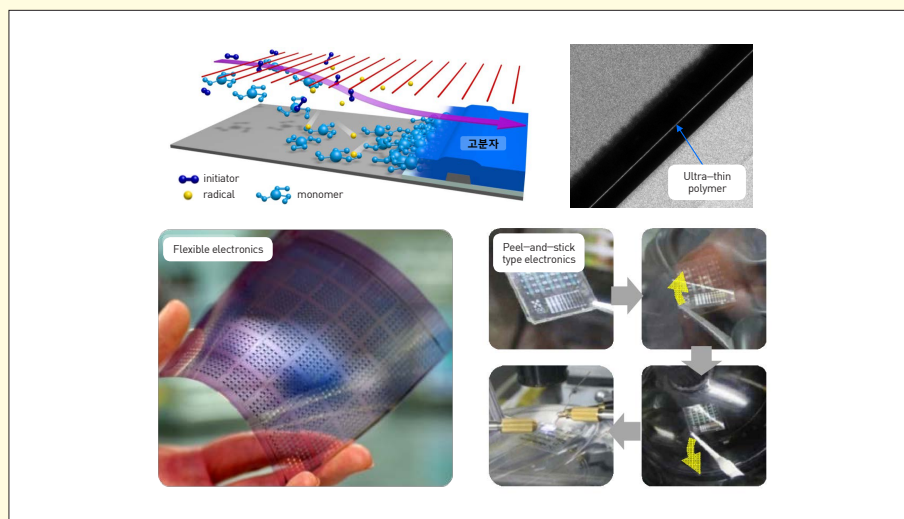
Authors Prof. Seunghyup Yoo, Prof. Byung Jin Cho

Summary

Forth-coming electronics devices are expected to have a closer interaction with human life. Flexible displays and wearable mobile healthcare devices are good examples. These devices are often desired to be even foldable, for example, to simultaneously realize a conflicting demand of large screen and ultra-portability or to cope with a very small-radius curvature of a human skin (wrinkles, etc.). In this research, we have developed, using a so-called initiated chemical vapor deposition (iCVD) technique, an ultra-thin polymer insulating layer, which has excellent insulating properties comparable to conventional inorganic insulating layers, and in addition, is four-fold more flexible than the inorganic ones. Various flexible electronic devices have been demonstrated using the proposed polymer insulating layers on plastic substrates, which typically have very low thermal budget. Organic devices fabricated on commodity cellophane tapes have also been demonstrated, raising the hope for “peel-and-stick” type electronics.

Achievements and Expectations

- World's first sub-10 nm polymeric layers that can be used for gate insulators
- Publication in Nature Materials (IF>35); world-wide exposure through science portals and Korean newspaper
- Public exhibition in National Archives Museum in 2016



Vision system of DRC–HUBO+ for DARPA Robotics Challenge

Authors Prof. In So Kweon

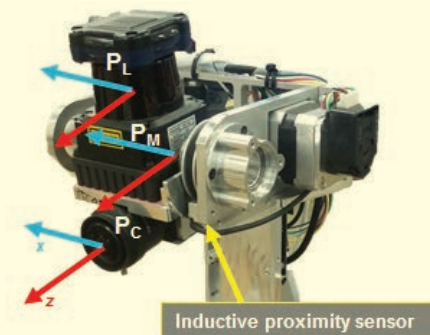
Summary

The need for robots substituting humans in hazardous environments has come to the fore since the Fukushima Daiichi nuclear on March 11, 2011. The US Defense Advanced Research Project Agency (DARPA) held the DARPA Robotics Challenge (DRC) in 2013 (trials) and 2015 (finals) for robots assisting humans in disaster response. In the challenges, a robot should carry out eight tasks with limited human–robot interaction. To perform these tasks, we developed a new sensor system, which consists of one LIDAR sensor and one color camera, and novel vision algorithms for recognizing the surrounding environment as follow:

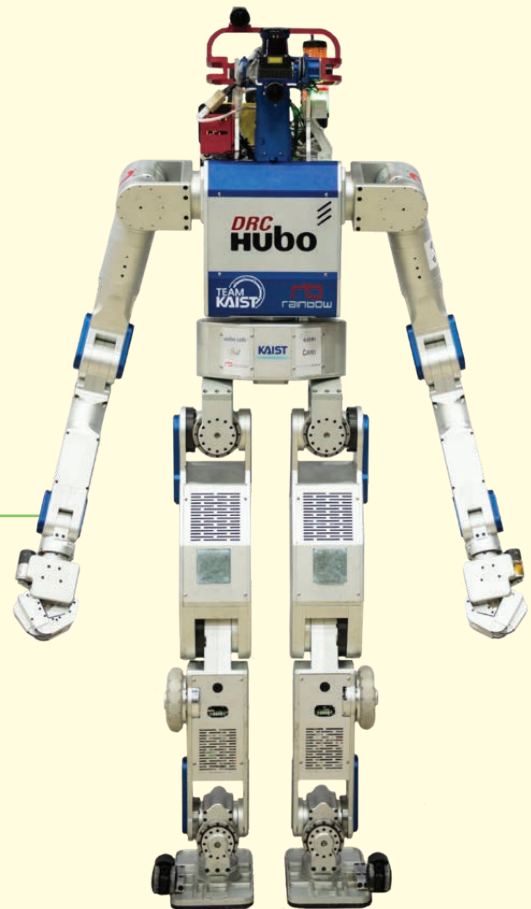
- 1) Robust auto–adjusting camera exposure method by fusing gradient and exposure;
- 2) Robust depth–map up sampling method by fusing image and depth data;
- 3) Accurate 3D object pose estimation for robot–world interaction; and
- 4) Deep–net based object recognition and localization

Achievements and Expectations

- 1st place(\$2,000,000) in DARPA Robotics Challenge Finals, June 7, 2015.
- KAIST Achievement Award of Robotics, June, 2015.
- KAIST Creativity and Challenge Award.
- Numerous international and local media coverage.
- Giving trial performances at DAVOS forum 2016 and etc.
- Good reference of vision system for Robotics field.



Sensor System of DRC–HUBO+



DRC–HUBO+

Fiber-based Polymer light emitting diodes for wearable displays

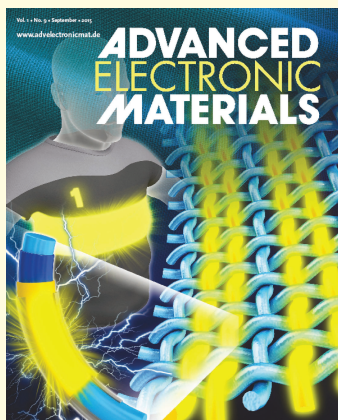
Authors Prof. Kyung Cheol Choi

Summary

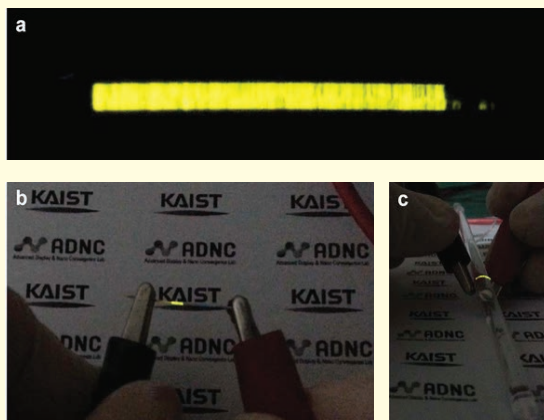
Professor Kyung Cheol Choi and his research team have developed fiber-based polymer light-emitting diodes (PLEDs), which can be applied to wearable displays. Traditional research on wearable displays developed display devices on a flat substrate which was later attached to clothes. This technique is limited with regard to application to wearable displays due to the effects on the intrinsic properties of textiles, such as their softness and comfort. To solve this problem, the research team discarded the notion of developing organic light-emitting diodes on a flat substrate via a thermal evaporation process. Instead, they focused on fibers, a component of fabrics, and developed a fiber-based PLED with the characteristics of both fabric and a display. Consequently, the fiber-based PLEDs can be directly knitted or woven to form part of the fabric of light-emitting and comfortable clothes. This research will become a core technology in the development of light-emitting diodes on fibers, which are fundamental elements of clothes. Because the core technology used here, i.e., the dip-coating process, offers low-cost mass production using roll-to-roll manufacturing, this technology will accelerate the commercialization of fiber-based wearable displays.

Achievement and Expectations

- Published in the September 15th issue of Advanced Electronic Materials and selected as an inside front cover article.
- Highlighted in dozens of domestic and foreign press releases and on TV.
- Exhibited at the Korea Electronics Show (KES) 2015.



[Inside front cover] Next-generation wearable display using fiber-based



Photographs of the fiber-based PLEDs developed with a dip-coating method

K-Glass2: A Gaze Activated Augmented Reality Smart Glasses

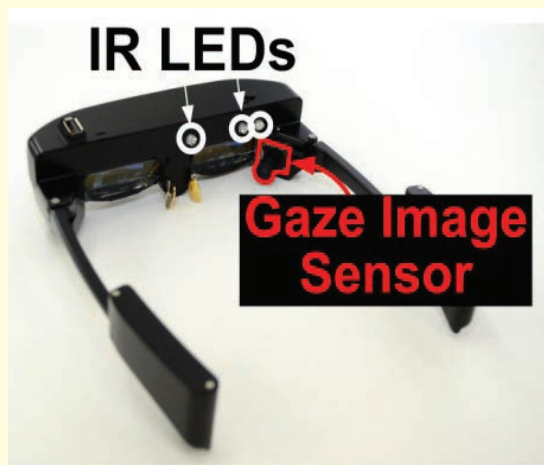
Authors Prof. Hoi-Jun Yoo

Summary

Recently, user interface for smart glasses or head mounted reality has been actively investigated. Since smart glasses have its compact platform size, it is hard to embed conventional touch user interface onto the compact smart glasses. To overcome such limitation, Google glasses use speech interface while Microsoft's Hololens use hand gesture interface. However, both methods are limited due to the following two reasons; First, they reveal user's intention not only to users, but also to public. Second, they consume large power which makes it difficult to operate in long hours with battery pack. In this work, we propose gaze tracking image sensor for intention concealed gaze user interface which can operate long operation hour with battery power. Unlike conventional image sensor for capturing image, the proposed sensor not only just captures image but also can estimate user's point of gaze on glass screen accurately. In addition, the sensor has its analog processing elements inside so that it can reduce power by 20x compared to the state of the art work. As a result, when user naturally looks at target objects on screen, the relevant recognition results of that objects are augmented on the glass. We successfully verify the chips functionality in a prototype smart glasses, K-glass 2.

Achievements and Expectations

- 2015 ISSCC Best Live Demonstration Paper
- 6 International paper (1 ISSCC, 2 VLSIC), 2 SCI Journal JSSC, 2 Korean patent
- Korean Media (KBS/MBC/SBS/YTN)



Portable high spatial resolution near-infrared spectroscopy system(NIRSIT)

Authors Prof. Hyeon Min Bae

Summary

Currently, the near-infrared spectroscopy (NIRS) device which measures cerebral blood oxygenation that is strongly coupled to neuronal brain activities holds only a small portion of the medical imaging device market. For the main reason, current available NIRS system has low spatial resolution compared to the commercial brain monitoring devices such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) even though it offers greater portability compared to fMRI and PET. However, we have implemented a high spatial resolution NIRS system, NIRSIT, by combining diffuse optical tomography method with optimum sensor arrays. Additionally, cheap optical communication lasers with a small form factor are used and application specific integrated circuit (ASIC) is developed to substitute a large size of circuitry and optical elements that are currently implemented to the commercial NIRS system. NIRSIT can measure brain oxygenation of the patients wirelessly in the hospital in real time. It can be used in various cases such as in an emergency situation, operation room, and inside an incubator measuring neonatal brain status.

Achievements and Expectations

- A Gold prize in 21st Samsung Human-Tech Paper Award 2015
- Prize of commissioner of the Korean Intellectual Property Office in 15th Korea Integrated Circuit Design Contest 2014
- Selected to Korean industry promising 100 technologies 2020 (The National Academy of Engineering of Korea 2013)
- Funded from KITE Entrepreneurship Foundation and Small and Medium Business Administration, preceding commercialization (OBELAB)
- Society for Neuroscience (SFN) 2014, 2015 Exhibition
- 6 International patent technology transfer to a venture company and pending to commercialize
- International Conference: International Solid-State Circuits Conference (ISSCC 2015) A Time-Divided Spread-Spectrum Code Based 15pW-Detectable Multi-Channel fNIRS IC for Portable Functional Brain Imaging
- A Time-Divided Spread-Spectrum Code Based 15pW-Detectable Multi-Channel fNIRS IC for Portable Functional Brain Imaging



NIRSIT



Real time mobile application

Pattern polarization beam division multiple access (P2BDMA)

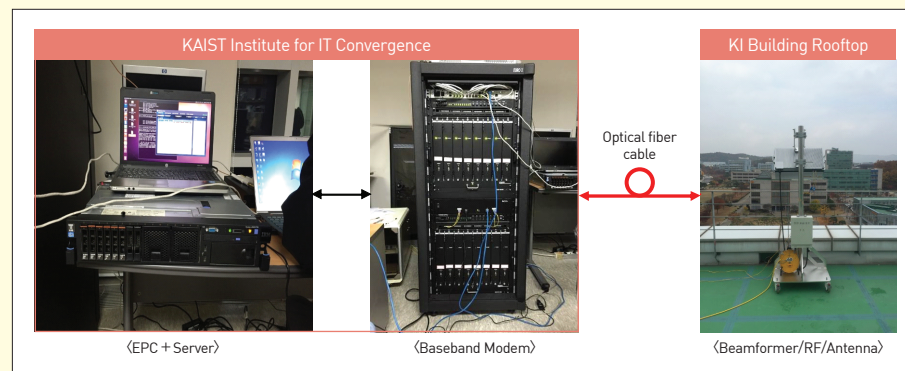
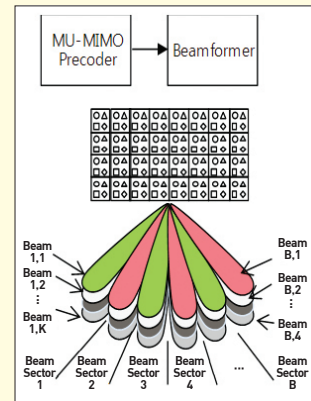
Authors Prof. Dong Ho Cho

Summary

We have developed the pattern polarization beam division multiple access (P2BDMA), a novel multiple access technique for 5G mobile communication, and verified its validity through outdoor field tests with the experimental system we have implemented. The developed P2BDMA technique is an upgraded version of the conventional spatial multiplexing technique called "BDMA"; on top of the BDMA technique in which the same frequency resource is reused spatially by use of multiple beams, the P2BDMA technique reuses the same frequency resource not only in beam domain but also in pattern polarization domain. By reusing the frequency resource in pattern polarization domain as well as beam domain, the frequency reuse rate increases by as much as the product of the number of beam sectors and the number of pattern polarization dimensions. The field test performed by using the experimental system with 64 pattern polarization antenna elements shows that the P2BDMA technique can certainly improve the base station system capacity by as much as five times compared to the conventional LTE systems.

Achievements and Expectations

- P2BDMA demonstrations to the vice-minister of Ministry of Science, ICT and Future Planning and officials of IITP (December 18th 2015)
- 16 SCI papers, 13 international patents applied, 25 domestic patents registered and 56 domestic patents applied for P2BDMA related technology



Principle of P2BDMA Technology(Left), Prototype of P2BDMA System(Right)

Micro Chained Radar System for detecting small UAVs

Authors Prof. Seong-Ook Park, Prof. JooHwan Chun

Summary

Unmanned aerial vehicles (UAVs), commonly known as drones, are difficult to detect using conventional radar systems. In this research, a precise radar system that can detect and identify small UAVs has been developed. Researchers succeeded in detecting them at ranges up to 1 km and extracting information of interest such as velocity and location. It is expected to improve technological readiness and achieve global competitiveness in the radar industry. Researchers have developed a 4-channel radar system for the detection of small UAVs with our own technologies. It can detect UAVs having little radar cross section ($\leq 0.03\text{m}^2$) whereas those of an existing radar system of the ROK army are about 2.0m^2 , which means the detection performance is improved greatly (60 times). Also, it is possible to identify UAVs using the discrepancy compared to birds and other clutters. The development of the radar system includes fabricating Ku-band antennas, designing RF circuitry and its synchronization, and implementing a tracking algorithm and real-time data processing. This system has 1 transmitter in the center and 4 receivers in the four cardinal directions to find out the exact location of the target. This optimum placement forms conical beam patterns and determines the range of air surveillance. Researchers succeeded in enhancing the overall performance of the system by utilizing digital signal processing. Not only has the stability and dynamic range of the system been improved, but also the size of the system has become smaller and the cost has also been reduced compared to analog-based systems. This radar system has a bandwidth of 150 MHz and the radial resolution is 1 m. Researchers had a number of experiments to verify its performance. During both trials, it successfully detected and tracked all eleven various drones prepared.

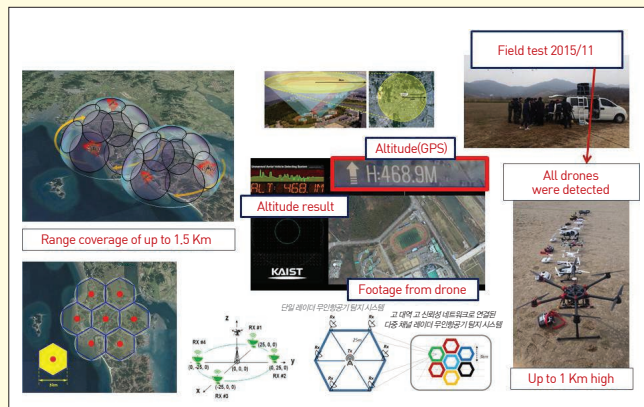
Achievements and Expectations

● Patents

- Domestic patent 10-2015-0079355, UNMANNED AERIAL VEHICLE DETECTION METHOD AND SYSTEM USING GPS LEAKAGE SIGNALS
- International patent 14931026, DETECTION METHOD FOR SMALL UAVS USING GPS LEAKAGE TECHNIQUE
- Domestic patent 10-2015-0078711, UNMANNED AERIAL VEHICLE DETECTION METHOD USING FREQUENCY-MODULATED CONTINUOUS WAVE RADAR NETWORK
- International patent 14626076, APPARATUS AND METHOD FOR MEASURING PRECIPITATION IN THE ATMOSPHERE USING K-BAND FREQUENCY-MODULATED CONTINUOUS WAVE (FMCW) WEATHER RADAR SYSTEM

● Expectations

This radar system can be used to guard the Military Demarcation Line and key national infrastructure as one of core technologies for the national security. As civil drones are increasingly being used, it is possible to apply the system for civilian demands.



Principle of Micro chained radar system for the detection of small UAVs & Field test result

FloSIS: a highly scalable network flow capture system for fast retrieval and storage efficiency

Authors Prof. KyoungSoo Park, Prof. Yung Yi

Summary

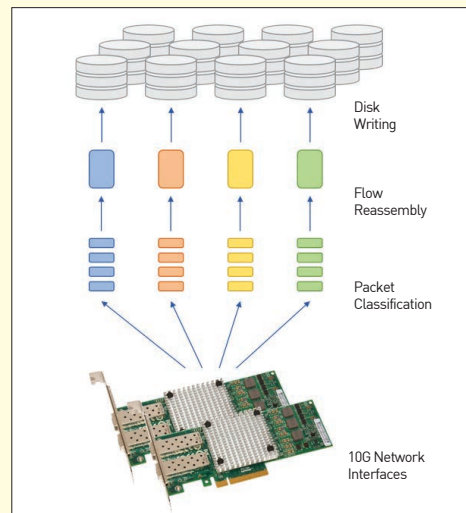
Network packet capture performs essential functions in network management such as attack analysis, network troubleshooting, and performance debugging. As the network edge bandwidth exceeds 10 Gbps, the demand for scalable packet capture and retrieval is rapidly increasing. However, existing software-based packet capture systems neither provide high performance nor support flow-level indexing for fast query response. This would either prevent important packets from being stored or make it too slow to retrieve relevant flows. In this research, we present FloSIS, a highly scalable, software-based flow storing and indexing system. FloSIS is characterized as the following three aspects. First, it exercises full parallelism in multiple CPU cores and disks at all stages of packet processing. Second, it constructs two-stage flow-level indexes, which help minimize expensive disk access for user queries. It also stores the packets in the same flow at a contiguous disk location, which maximizes disk read throughput. Third, we optimize storage usage by flow-level content deduplication at real time.

Achievements and Expectations

- September, 2015. Detect attack in real data center through traffic analysis using FloSIS.
- FloSIS is presented in USENIX Annual Technical Conference in 2015.
- July, 2015. patent application in Korea



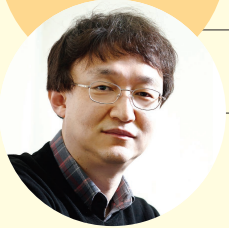
Network flow capture system



Overall architecture of FloSIS

1. Prof. Byung Jin Cho [The 2015 Commendation for Best National R&D Achievement by the Ministry of Science, ICT and Future Planning Award](#)
2. Prof. Jinwoo Shin [2015 ACM SIGMETRICS Rising Star Research Award](#)
3. Prof. Kyungsoo Park,
Prof. Song Chong,
Prof. Yung Yi [Wi-Fi Auto-Sensing Download Technology](#)
4. Prof. Sung Yool Choi [Prime Minister's Commendation at 2015 Nano Korea Awards](#)
5. Prof. Kyoungsik Yu [IT Young Engineer of the Year](#)
6. Seungkyu Oh [An undergraduate student donated 30 million KRW](#)
7. Prof. Myung Jin Chung [Appointed as the president of Gwangju Health University](#)
8. Prof. Yang Kyu Choi,
Prof. Byung Hyun Lee [Five-level Vertically Integrated Multiple Nanowire Field Effect Transistor](#)
9. Prof. Kyung Cheol Choi [Fiber-based Polymer Light-Emitting Display Technology](#)
10. Prof. Hyun Wook Park
Hyun Seok Suh [Grand Prix in HumanTech Paper Award](#)
11. Prof. Naehyuck Chang [Appointed as the Fellow of ACM](#)
12. Prof. Yang-Kyu Choi
Daewon Kim ["Producing electricity from vibration in any directions using nanopowder"](#)
13. Prof. Hoi Jun Yoo,
Prof. Seung Hyup Yoo [Measuring biological signals using the sticker attached on the body](#)
14. Dr. Jinwoo Han [The Presidential Early Career Awards from the White House](#)
15. Prof. Hoi Jun Yoo [Smart Glasses \(K-Glass 3\) for Gesture Recognition AR](#)
16. Prof. Yung Yi
Prof. Song Chong [The 2016 IEEE William R. Bennett Prize](#)

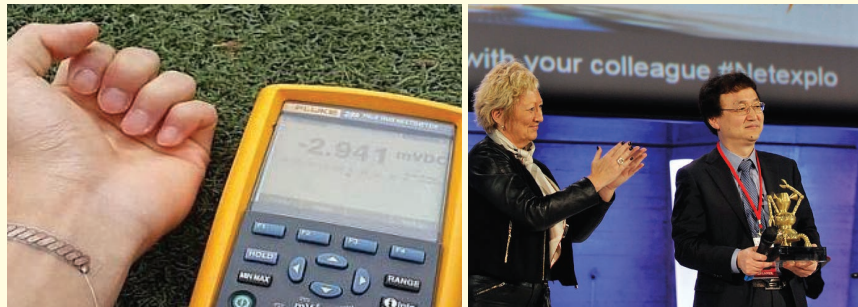
The KAIST logo is displayed in blue, bold, uppercase letters. Below the text is a horizontal blue line that tapers at both ends, resembling a stylized wave or a bridge. The logo is centered within a white circular area that is part of a larger graphic of a glowing lightbulb.

2015
02.10

BYUNG JIN CHO
PROFESSOR

The 2015 Commendation for Best National R&D Achievement by the Ministry of Science, ICT and Future Planning Award

Professor Cho's research on "Development of a wearable thermoelectric module" was awarded as 2015 the best National R&D research and he received a Ministerial Citation from the Ministry of Science, ICT and Future Planning. Among the 53,000 government-supported research projects, 110 projects received honors and 11 projects received the highest honors from 2015 National R&D Excellence Award. Only 3 researchers among the best honor recipients belong to university. For the first time in Korea, his team's research on "Wearable Thermo-Element" technology was designated one of the top ten technologies that will change the world, and won the Grand Prix 2015 of the UNESCO Netexplo Award.

2015
06.17

JINWOO SHIN
PROFESSOR

Professor Jinwoo Shin won 2015 ACM SIGMETRICS Rising Star Research Award

Professor Jinwoo Shin won 2015 ACM SIGMETRICS Rising Star Research Award. This award is given annually to 1 junior researcher (within 7 years of having attained PhD) and Professor Shin was the 8th award winner and the first recipient from Asian schools. The award was for his contribution to stochastic queueing networks and theoretical analysis in machine learning. Recently, he received the best paper awards from ACM MOBIHOC 2013 and SIGMETRICS 2009, and he was also awarded with a Bloomberg Scientific Research Award for his research on deep learning.

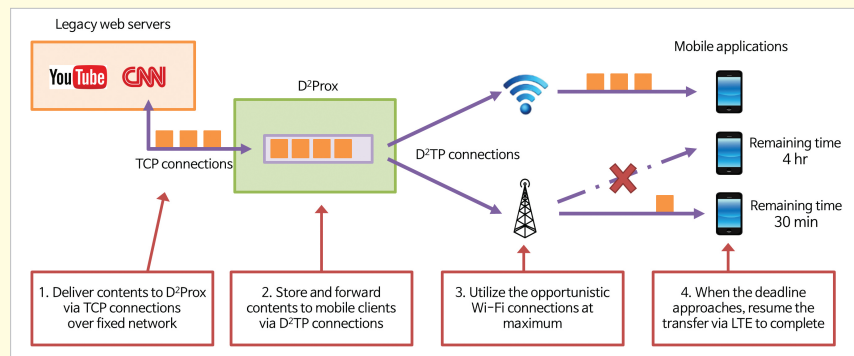
Wi-Fi Auto-Sensing Download Technology

Professor KyoungSoo Park, Professor Song Chong and Professor Yung Yi have developed the technology and systems that deliver mobile content by automatically detecting the disconnection of Wi-Fi and mobile networks.

The research team has developed a mobile network platform which automatically handles the disconnection problem and enables the Wi-Fi networks as many as possible, and the team has developed delay-tolerant ¹Wi-Fi offloading techniques as well. By scheduling the time to complete the download, the contents can be downloaded at any time with a minimum use of LTE data by adjusting LTE and Wi-Fi after calculating the remaining time and capacity.

By means of this technology, users can enjoy high-quality content at low rates, network operators can re-invest on the existing LTE network and Wi-Fi network. In addition, it is also possible to ensure the connection to more number of consumers for mobile video providers.

1) Wi-Fi offloading: use of complementary network technologies for delivering data originally targeted for cellular networks



2015
04.21



KYOUNGSOO PARK
PROFESSOR



SONG CHONG
PROFESSOR



YUNG YI
PROFESSOR

Professor Sung-Yool Choi received Prime Minister's Commendation at 2015 Nano Korea Awards

Professor Sung-Yool Choi received Prime Minister's Commendation at 2015 NANO KOREA Awards. This award was for his contribution to synthesis of graphene and two-dimensional semiconductor materials, and the achievements in the field of soft electronics. His team also has secured the core technology of non-catalytic growth of graphene for the first time in the world.

2015
07.01



SUNG-YOOL CHOI
PROFESSOR

2015
06.18**KYOUNGSIK YU**
PROFESSOR

The IEEE/IEIE's joint award "IT Young Engineer of the Year"

Professor Kyoungsik Yu received the IEEE/IEIE's joint award "IT Young Engineer of the Year"

He received PhD from Stanford, worked in KESRI, held a postdoctoral researches position in University of California, and became an associate professor at KAIST. He has conducted innovative researches on information communication, energy and image acquisition through miniaturization and integration of optoelectronic devices. He has published more than 100 papers in international journals and conferences that have been cited more than 2200 times, significantly contributing to the development of related technology and disciplines.

The award selection criteria were based on technical practicality, creativity, and contribution to society and environment. There are five countries (Chile, Ecuador, Peru, Singapore and Italy) that have joint awards with IEEE.

2015
11.24**SEUNGKYU OH**
STUDENT

An undergraduate student donated 30 million KRW

Seungkyu Oh donated 30 million KRW to the school. This is the biggest amount that has ever been donated by the enrolled students.

In 2010, Oh realized the need for metro navigation app and started to develop it. His 'Metro Navigation' app can find the shortest path between the two stations by checking the operating hours in real time.

He distributed his app in the open market. His app has been ranked at the 2nd most downloaded metro app in Google Play, and has attracted more than 5 million users. Early this year, his app was sold to KAKAO.

Appointed as the president of Gwangju Health University

Myung Jin Chung was appointed as the president of Gwangju Health University. He graduated from Gwangju high school and SNU, and received PhD in Michigan. He was a professor at the school of Electrical Engineering, KAIST. He was the chairman of the KROS (Korea Robotics Society) and the vice-chairman of the ICRS (Institute of Control, Robotics and Systems). Since 2002, he has been a board member in Gwangju Health University.

2015
10.07

MYUNG JIN CHUNG
PROFESSOR



Development of Vertically Integrated Five Nanowire Channel-based Transistor

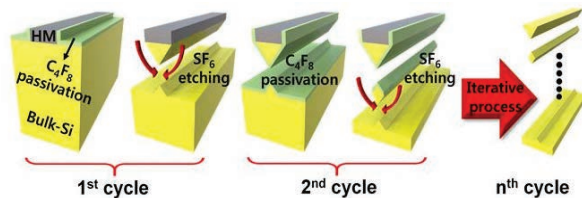
Researcher ByungHyun Lee (Advisor Yang-Kyu Choi, School of Electrical Engineering) and Dr. Min-ho Kang from National NanoFab Center (President Jaeyong Lee) developed a five-level vertically integrated multiple nanowire field effect transistor and successfully applied it to nonvolatile memory (NVM). This work was published online in the November 6th issue of "Nano Letter". Semiconductor transistor is a key component of all electronics, having a significant impact on the domestic industry and the economy. Its performance and productivity have been improved repeatedly, but there is a growing problem regarding the power consumption due to current leakage and the limitation of the production process in 10 nanometers. The team solved the problem by integrating nanowires vertically in five levels. This semiconductor transistor has showed better performance by a factor of 5 compared with a single nanowire-based transistor. Unlike the single structure, it does not require additional spaces so integration can be also enhanced. This technology is expected to contribute to commercialization greatly by reducing cost and time and also improving the performance of the semiconductor transistors. They said, "This research was supported by the excellent research environment of National NanoFab Center and excellent techniques of the other researchers including Jinsoo Kim (Research Director)."

2015
11.24

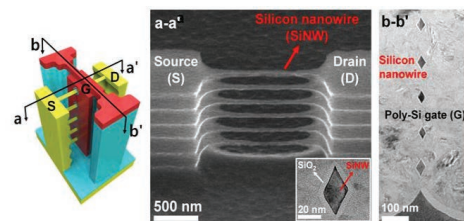
YANG-KYU CHOI
PROFESSOR



BYUNGHYUN LEE
RESEARCHER



Schematic of the one-route all-dry etching process (ORADEP) to fabricate the vertically integrated multi-stacked nanowire configuration.



Cross-sectional images of scanning electron microscope (SEM) and transmission electron microscope (TEM) along the direction of a-a' and b-b' in the schematic, respectively.

2015
08.05

KYUNG CHEOL CHOI
PROFESSOR

Fiber-based Polymer Light-Emitting Display Technology

Professor Kyung Cheol Choi and his team developed the core technology for fiber-based light emitting display which can be applied in the wearable display. This research was published online in the July 14th issue of Advanced Electronic Materials.

Traditional wearable display was limited. In other words, it was difficult to apply it to a real life situation and maintain. Professor Choi's team focused on fibers and developed the technology which functions as display while maintaining the characteristics of the fabric.

The fiber-based display would accelerate the commercialization of fiber-based wearable displays because it offers low-cost mass production using roll-to-roll processing.

Professor Choi said "This is a core technology that can develop polymer light emitting display on fibers." and "it will significantly lower the barriers of wearable displays entering the market".

2016
02.05

HYUN WOOK PARK
PROFESSOR

HyunSeok Suh (Advisor: Hyun Wook Park) received the Grand Prix in HumanTech Paper Award

Hyunseok Suh (Ph.D student, Advisor: Hyun Wook Park) received the Grand Prix in HumanTech Paper Award. This was the first Grand Prix in the history of HumanTech Award since its establishment in 1994.¹⁾

The title of his paper was 'Self-Gated Cardiac Cine MRI Using Phase Information' and it was a study on imaging techniques which enables MRI to take images even when organs are moving.

Also, KAIST won the special award and the school of Electrical Engineering at KAIST submitted 55 papers and won 15 awards, receiving the great honor of being the department with the most submissions and received awards.

1) Human Tech Paper Award' was established in 1994 by Samsung Electronics for supporting excellent researchers in the field of science and technology.



HYUNSEOK SUH
Ph.D STUDENT

Professor Naehyuck Chang was appointed as the Fellow of ACM

Professor Naehyuck Chang was appointed as the Fellow in ACM (Association for Computing Machinery) in 2015. This is the 4th case in Korea and he has been renowned for his contribution to low-power computing system and the leadership in the international computer conference.

ACM Fellow is the most prestigious membership granted to the top 1 % of ACM members for outstanding accomplishments in computing and information technology. In the field of electrical engineering, becoming the Fellow of ACM and IEEE is considered to be the best honor. Especially, professor Chang became the fellow from both ACM and IEEE which is the first case in Korea.

2015
12.10



NAEHYUCK CHANG
PROFESSOR

Professor Yang-Kyu Choi, “Producing electricity from vibration in any directions using nanopowder”

The team of professor Yang-Kyu Choi and Dr. Daewon Kim developed a nano-generator which generates electricity from vibration in any direction using polytetrafluoroethylene (PTFE) nanopowder.

Since this nano-generator uses PTFE nanopowder, it can be produced in numerous different shapes and sizes. Also it is cost-effective compared with the existing technology and is shown that it could light-up 240 LEDs simultaneously. Also, it can charge the battery for mobile phones.

Professor Choi mentioned that “this technology can exploit the existing manufacturing process and it has several advantages such as variety, cost and accessibility. It would be extended to various application areas including mobile devices”.

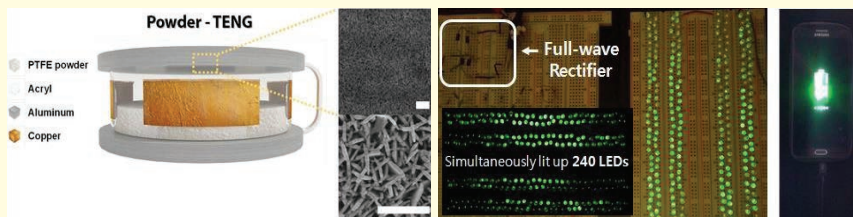
2016
01.11



YANG-KYU CHOI
PROFESSOR



DAEWON KIM
DR.



2016
02.05HOI-JUN YOO
PROFESSORSEUNGHYUP YOO
PROFESSOR

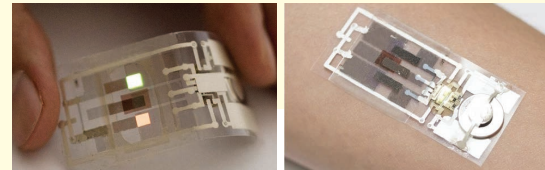
Measuring biological signals using the sticker attached on the body

The joint research team of Professor Hoi-Jun Yoo and Professor Seunghyup Yoo developed the smart sticker sensor which can be easily attached to the body and measure biological signals.

This sticker sensor is an ultra-low-power sensor which integrates the semiconductor chip and organic light-emitting diodes. This sticker sensor enables ultra low-power data communication

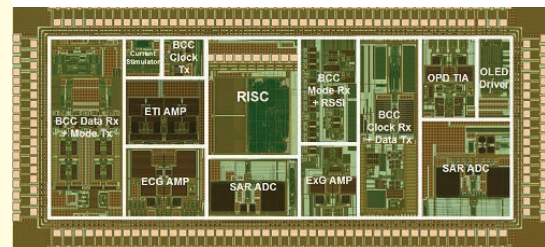
through human body communication technology and it can adjust light by automatically monitoring the amount of light in the receiver.

The researchers said “this smart sticker sensor opened new possibilities for applications of flexible OLED and organic optical sensor, and it is expected to be utilized widely in the medical and healthcare areas since it can measure ECG, EMG and oxygen saturation”.



Flexible OLED and Organic Photo Sensor used in the smart sticker

Hybrid smart sticker combining a semiconductor chip and organic light-emitting diodes



Smart sticker CMOS SoC

2016
02.19JINWOO HAN
DR.

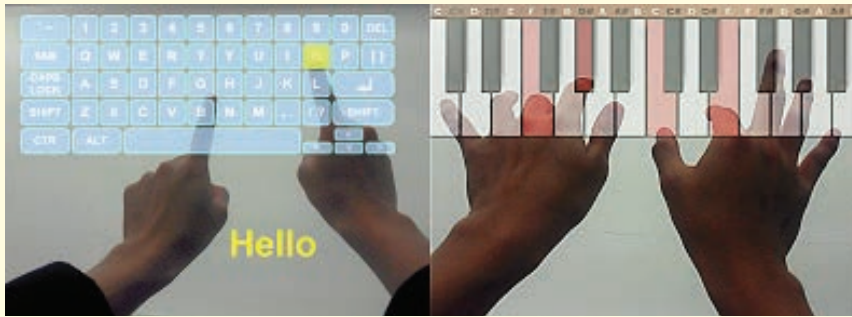
The Presidential Early Career Awards from the White House

Dr. Jinwoo Han (Alumnus of School of Electrical Engineering) was included in the list of ‘the Presidential Early Career Awards for Scientists and Engineers’, the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers. Each award winner receives funding up to five years.

He received Ph.D in KAIST in 2010 (advisor: Yang Kyu Choi), and moved to NASA Ames Research Center in the same year. Currently, he holds the researcher position there. Dr. Han and Dr. Meyyappan (chief scientist) from NASA have been renowned for developing the space radiation-resistant semiconductor element and the radiation gas sensor.

Smart Glasses (K-Glass 3) for Gesture Recognition AR

Professor Hoi-Jun Yoo and his team developed 'K-Glass 3' which is the ultra-low power smart glasses reinforced with augmented reality (AR). This is the 3rd version of the 'K Glass'. K-Glass 1 was based on AR, and K-Glass 2 was capable of detecting gaze. Moreover, K-Glass 3 is capable of recognizing human motions. The core technology of K-Glass 3 is the stereo camera system which enables the users to experience augmented reality such as typing a virtual keyboard and playing virtual keyboard.



Typing the virtual keyboard and playing piano using K-Glass 3



Photo of Actual K-Glass 3

2016
02.26



HOI-JUN YOO
PROFESSOR

The team of Professor Yung Yi and Professor Song Chong won the 2016 IEEE William R. Bennett Prize

The research teams led by Professor Yung Yi and Professor Song Chong won the 2016 IEEE William R. Bennett Prize, which is the most prestigious award in the field of communication network. This prize is awarded annually to only one research paper published in the field of communications networks within 3 years by evaluating its originality, the number of citations, impacts and the assessment from the scholars. Professor Song, Professor Yi and Vice president Injong Lee received the same prize in 2013, resulting in winning 2 prizes in 3 years. Since its establishment in 1994, this is the second time of winning 2 prizes, showing the reputation of Korean researchers in the field of communication network. They had the honor of receiving this award by their work regarding 'Mobile data offloading: How much can WiFi deliver?' which was published in 2013.

2016
04.20



YUNG YI
PROFESSOR



SONG CHONG
PROFESSOR

ELECTRIC CAR

1

Components of Electric Car

Construction

- **Battery** Supplying the electrical energy required to operate the motor
- **Battery Management System** Monitoring the status of the battery and protecting it from overcharge and over discharge.
- **Motor** It serves as the engine that produces the power to move the car
- **Motor Controller** Controlling the motor to generate a proper speed requested by the user
- **Battery Charger** Charging the battery by supplying the proper voltage for the battery.



Battery



Battery Management System



Motor



Motor Controller



Battery Charger

Advantages of Electric Car

- Cost for charging the battery is much cheaper compared to other resources such as fossil fuels
- No contaminations are made while driving
- Simpler structure makes maintenance easier
- Almost no noise

2

CAD4X Lab.

1. Building low-speed electric car and developing minimal-energy driving technique

- Research on electric car (analyzing power consumption, developing minimal-energy driving technique)
- Improving fuel efficiency by mounting the solar panels



2. Developing the electric car kit for Education purpose

- Utilizing the kit as education materials that can train the electric car professionals
- Utilizing the kit for research on electric car (developing the motor controller, battery management system, etc.)



3. Off-road electric car conversion

- Modification of the driveline from existing internal combustion engine cars to the ones in electric cars
- There is no noise and exhaust while driving
- It can make a high torque at low speed, making it suitable for off-road driving



3

KAIST Wireless Power Transfer Research Center

Research Topic

1. World's First SMFIR (Shaped Magnetic Field In Resonance) Technology

SMFIR : Shaped Magnetic Field in Resonance (SMFIR) is the technology of charging vehicles electronically through a magnetic field to generate electric charge.

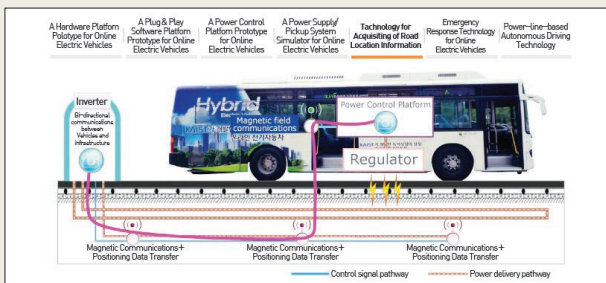
2. Development of practical technology for 20kHz wireless power transmission

It implies the potential commercialization by solving several issues, including distance, power transmission efficiency and capacity for wireless charging electric buses and electromagnetic safety issues.

3. Succeeded in the initial testing for 60kHz wireless power transmission core technology for tram, increasing utilization of wireless charging technology

Development of high-capacity, high-efficiency, low-cost 60kHz high power transfer system

4. Demonstration of 1 MW 60kHz wireless high power transfer system (Verified the applicability for the high-speed railway)



Representative Examples

1. Regular operation of the wireless charging electric buses

- Elephant train at the Seoul Grand Park, the campus shuttle at KAIST, regular operation in Gumi and Sejong

2. Renowned as world's leading technology

- "Road built-in wireless charging device", selected as the world's 50 best inventions (Time Magazine 2010)
- "Wireless charging electric buses", selected as the world's top ten emerging technologies (2013 World Economic Forum)
- "Wireless charging railways", received the Innovation Award, 2014 International Union of Railways (IUC)

3. Promoting commercialization

- Established a company for domestic commercialization, OLEV (September 2011)
- Established a company for international commercialization, OLEV TECH (March 2011)
- MOU with Medellin (the 2nd largest city in Columbia) (April 2015)

4

Personal Plug & Play DigiCar Center

1. Designing the drive system and the vehicle body

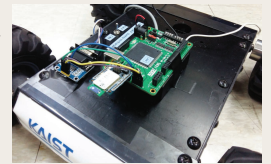
- Designing the body with consideration of the relation between wheels and drive motors, optimal chassis structure, crash safety, body rigidity and light weight.



- Study the passenger safety, indoor air conditioning, and NVH (Noise, Vibration, and Harshness) through the collision performance evaluation on the vehicle and modules.

2. Embedded computing platform

- Defining and implementing a set of API required for developing P3 DigiCar applications

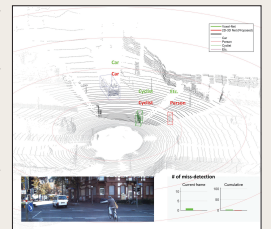


- Research on optimizing a vehicle's ECU, designing the internal blocks of the black box for P3DigiCar

- Configuring the Ethernet network by the ECU board, building integrated Ethernet IC by studying MAC and PHY level.

3. Driver assistance active safety system

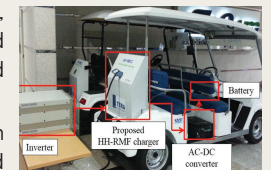
- Research on the technology for measuring and relieving driver's fatigue such as vision-based driver drowsiness detection system
- Research on image improvement technology for detecting external environment in bad weather and high-speed conditions



- Designing the rule-based situation detector that can detect the current situation such as traffic situation, and environment information from the internal and external sensors of the vehicle.
- Research on increasing the efficiency of system resource usage through hardware sharing

4. Prototyping and system integration

- Designing the vehicle's size, shape, location of each components and manufacturing each component and device modules



- Optimizing vehicle design and production through devising the platforms, and testing on durability and safety

- Development of the power supply which is an extended wireless Plug & Play concept



1995

Choong-Ki
Kim

For contributions to CCD linear image sensors and CCD technology



2005

Jaekyun
Moon

For contributions to signal processing and coding for storage



2006

Yun Chur
Chung

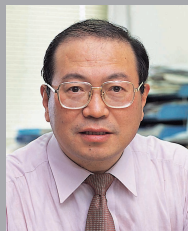
For contributions to optical network performance monitoring and passive optical network architectures



2007

Zeungnam
Bien

For contributions to development of assistive robots and human-robot interaction systems



2008

Ju-Jang
Lee

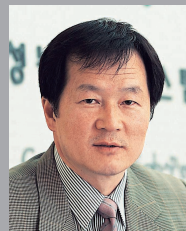
For contributions to intelligent robust control and robotics



2008

Hoi-Jun
Yoo

For contributions to low-power and high-speed VLSI design



2009

Chong-Min
Kyung

For contributions to system on chip processors





2009

Jong-Hwan
Kim

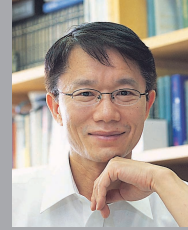
For contributions to evolutionary algorithms



2009

Iickho
Song

For application of signal detection theory to vehicular communication systems



2010

Chang-Hee
Lee

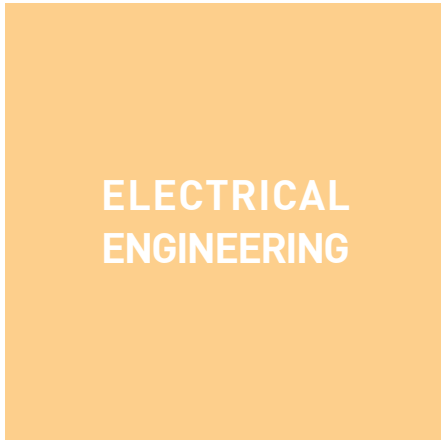
For contributions to wavelength division multiplexed-passive optical network



2012

Naehyuck
Chang

For contributions to system-level power characterization, including thermal management



ELECTRICAL
ENGINEERING



2014

Kwyro
Lee

For management and R&D leadership in semiconductor technology



2015

Dan Keun
Sung

For contributions to network resource management



2016

Gyu Hyeong
Cho

For contributions to power management circuit design



2016

Joungho
Kim

For contributions to modeling signal and power integrity in 3D integrated circuits



SCHOOL OF
ELECTRICAL
ENGINEERING



SCHOOL

OF

Student Life in EE

ELECTRIC

ENGINEERING



Student Activities

International Dual Degree

Regular Events

Student Facilities

Lee
Gwang-Hyun



Kim
Youn-Sung



2016

Students Representative Committee

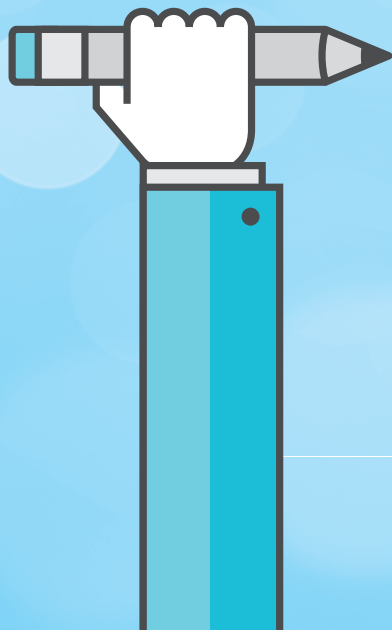
Dear fellow EE students, my name is Gwanghyun Lee. I am currently serving as the EE student president of the class of 2014. I'm very proud to be a member of EE and I decided to work as a student representative to make contributions to our department. I will do my best as the student president to make KAIST EE the best department not only in Korea, but also in the world. Thank you

Dear all, my name is Youn-Sung Kim, and I'm currently serving as the EE student manager of the class of 2015. I joined the student representative committee to have great experiences with various people. I'm also participating in a number of student clubs, such as Muse and KAIST MIDAM scholarship committee, and I enjoy listening to music of various genres, such as hip-hop and indie. I may be young, but will work harder than anyone to make contributions to EE. Thank you

Shin Dong-Hun



Hi all, this is Dong-Hun Shin, the male EE student vice president of the class of 2014. I joined the student representative committee to make contributions to the School of electrical engineering. With constant devotion, I will endeavor to make EE better for the fellow students. Thank you

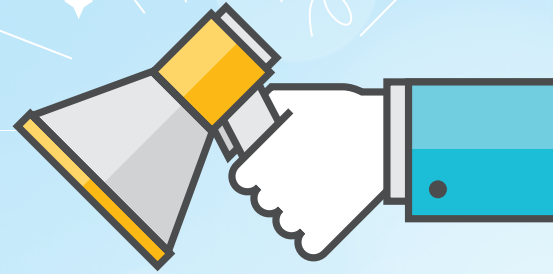


Hwang
Hyun-Jin

Dear EE students, I'm Hyun-Jin Hwang and I am the EE student president of the class of 2015. I joined the EE student representative committee to facilitate better communication among students. I will always strive to work as the student president that best serves you

Park
Ju-Hyung

Hello fellow EE student, my name is Ju-Hyung Park. I currently am the male EE student vice president of the class of 2015. As you may know, EE is one of the largest departments at KAIST, and I decided to work as a student representative to help a large number of the EE members have better campus life through communication. The student representative committee will always endeavor to seamlessly work as the medium among the students, professors, and staffs. I look forward to your kind cooperation, thank you



Shin Ji-Yun



Dear all, my name is Ji-Yun Shin, and I'm the female EE student vice president of the class of 2015. I originally applied for the vice presidency to simply make friends; however, now that I've become the EE student vice president, I would like to live up to the title and help my fellow EE students have better EE life. Thank you so much ^^

Kim Gun-Hee



Hello fellow EE students, this is Gun-Hee Kim, and I'm the EE student manager of the class of 2014. I joined the student representative committee to get acquainted with others and make friends. I will work as hard as possible to make you proud of EE. Thank you :D

Kang
Min-Kyeong

Hello, my name is Min-Kyeong Kang, and I'm the female EE student vice president of the class of 2014. I enjoy meeting new people and making new friends, which is mainly why I joined the student representative committee. I will always work hard for the fellow EE students, and if you have any questions or wish to get acquainted with me, please do not hesitate to contact me :)

Faculty Club



[Electronic Gang](#)

[EE Firebats](#)

[Madang](#)

[EE Band](#)

[KaisEEder](#)

[EE-Newsletter](#)



Electronic Gang

| Objective | We are welcoming anyone who wants to make friends in the EE department. Those who don't play futsal well are also welcome.

| Activity | We play futsal (10–12 p.m. every Friday at the north futsal field) and have semester opening and ending parties. We are always recruiting new members (Eligibility: Undergraduate/Graduate)

EE Firebats

| Objective | Learning cooperation among undergraduates and training the body through playing baseball.

| Activity | We participate in the KAIST school league every year.





Madang

| Objective | Playing card games for improving brain function, social gathering and fun.

| Activity | This club was established in 2011. We have some snacks/meals together and play card games every week (E3-4)

Not only undergraduates but also graduates also actively participate in the club activity and share some advices on school life.

We have a semester opening party every semester. Prof. Ickho Song occasionally joins the card games (once or twice)

EE BAND

| Objective | Bridging the gap between Science, Technology and Art.

| Musical Instruments | Drum, Synthesizer, Bass Guitar, Electric Guitar, Grand Piano

| Activity | First gig on 29th Oct, 2004. We play at the Taeul Song Festival and other festivals and events including the undergraduate workshop, the barbecue party, etc.



kaisEEder

| Objective | We share information about starting own business for those who are interested in having own business.

| Activity | We have periodic meetings and cooperate with various venture companies.



EE-Newsletter

| Objective | We aim to offer various knowledge about electrical engineering and the news about EE department.

| Activity |

- Established in 2001, publishing quarterly
- Introducing the labs in the EE department, venture companies, alumni, news (awards, new professor, department events, etc.)
- International association (Tsinghua University in China (2002), TUM in Germany (2003), INSA in France (2004), Reports on Domestic IT exhibition & Forum - 2004 BUSAN ITU)
- Interview with alumni for introducing life after graduation



**International Dual
Degree Program**

KAIST EE
with
GaTech & DTU



Dual B.S. Degree / Dual M.S. Degree Program

KAIST EE – GaTech ECE

ELECTRICAL ENGINEERING

Dual Degree Institutions

School of Electrical Engineering, KAIST (KAIST–EE)

School of Electrical and Computer Engineering,
Georgia Institute of Technology (GT–ECE)

HISTORY OF DUAL B.S. DEGREE PROGRAM

- 2010, Dual B.S. / M.S. Degree Program MOU was signed.
- 2011, First KAIST students were dispatched.
- 2012, First GaTech students were invited.
- August, 2015, Program was renewed to be extended.
- Fall 2016 currently, 4 students of KAIST and 2 GaTech students are studying at each other's school.



Dual M.S. Degree Program

KAIST EE – DTU

PHOTONICS ENGINEERING

Dual Degree Institutions

School of Electrical Engineering, KAIST (KAIST–EE)

Department of Photonics Engineering,
Technical University of Denmark (DTU–PE)

ELECTRICAL ENGINEERING

Dual Degree Institutions

School of Electrical Engineering, KAIST (KAIST–EE)

Department of Electrical Engineering,
Technical University of Denmark (DTU–EE)

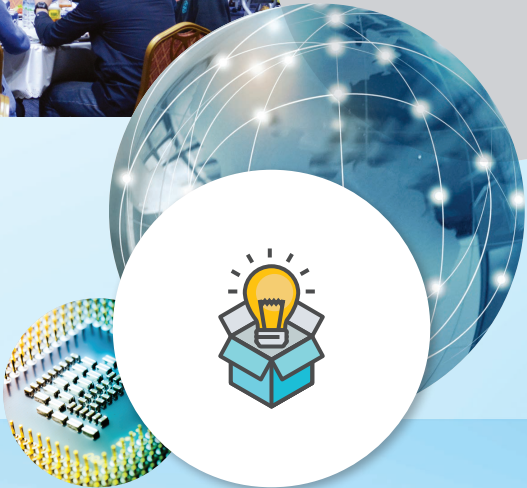


STUDENT LIFE





1. OT for new M.S. students
2. Department Fair
3. OT for new M.S. students
4. Open Lab.
5. Track-Meet
6. Sae-Teo Mission
7. OT for new EE students
8. Strawberry Party



ELECTRICAL ENGINEERING

A graphic element featuring a blue globe with white grid lines and several interlocking gears in white, red, and grey. The globe is the central focus, with the gears positioned around it.

UNDERGRADS WORKSHOP





Spring Semester Events



Semester Opening Party

The beginning of semester party is held within 1 or 2 weeks after the semester begins. This is the very first event in which the freshmen of EE can attend and at this event, the newly elected sophomore student representatives are introduced in front of the EE students and the professors.



Entering Students MT/OT

This event serves to promote friendship among the entering students. At the same time, orientation for giving information on the major courses, events, and facilities is held as well. The students get to participate in multiple games with their preassigned teammates and get acquainted with one another. This is the first event where the entering students get to make new friends.



Welcome Party for the Entering Students

This welcome party is held for the entering students of EE to give them detailed information on the current status, academic programs and major research topics of the School of electrical Engineering. After the lecture, the students get to dine with the professors and consult them on various topics.

Open Lab



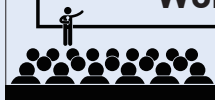
This is the event where many graduate students from different laboratories explain their research topics and life as a graduate student. Students from other departments can participate as well, and refreshments are prepared at each laboratory.

Strawberry Party

In early April, when strawberries are in season, the strawberry party is held on the lawn in front the EE building. You can sit in a circle with your friends and enjoy strawberries and other snacks. The student president emcees various games and events where the students can acquire prizes.



Workshop



Workshop is similar to MT in the sense that it is an overnight event. Nevertheless, many lectures and programs are prepared, and you can spend much time with your fellow students and professors at a resort.



Snack Event

During every exam period, we provide various snacks for the exhausted undergraduate students.



Sae-Teo Mission

Every month, in order to strengthen the solidarity, the department comes up with missions for each 'Sae-teo' group. Upon completion, the groups are provided with money for a get-together. Through these events, you can promote friendship and exchange support regarding studies.

Fall Semester Events



Track Meet



The Track Meet is participated by both the undergraduate and graduate students of EE, and it begins the finals of the soccer competition. The teams that proceed to the finals are decided through a series of preliminary contests. After the soccer competition, many games such as dodge ball are played, followed by a barbeque party and performance by EE band.



Sweatshirt, Baseball Jacket Design Contest

We hold a design contest for EE sweatshirts and baseball jackets, targeting the students from the School of electrical engineering and industrial design. We grant prize money to the students with the 1st and 2nd best designs. The 1st best design is then used to produce the sweatshirt and baseball jackets for the undergraduates.

Department Fair

In this event, the student representatives of EE give information to the freshmen who didn't choose any major. The information on the major courses, events, advantages of EE, and so forth can be helpful for the freshmen when selecting a major.

New M.S. Student Orientation

In this event, new students who enter the graduate school of electrical and engineering can learn the lifestyle of the graduate school. It is very useful time for new students of Master degree because many professors in our department will give them some information about allocation of academic adviser and other things.



Event Lecture

2015.
9.15

Torbjorn Blomdahl's Visit



From the left side, Prof. Jinwoo Shin, 'King of billiards' Torbjorn Blomdahl, and Prof. Yung YI.



Professors of EE pursuing the world best made an occasion inviting Torbjorn Blomdahl, the top billiard player in the world. Mr Blomdahl, who has been keeping his position at the top since 1985, had enjoyable moment with students and gave some advices to them as well. "The reason I could devote my whole life to one field is that it interests me. Your work should not make yourself have hard time." And he also said "While putting efforts to own job, it's necessary to do other activities like hobby sometimes forgetting what you have to do. Because this helps you refresh yourself and listen to others around you."

School of Electrical Engineering Student Welfare Facilities



SCHOOL OF ELECTRICAL ENGINEERING



1st Floor Student Lounge



2nd Floor woman lounge



2nd Floor resting lounge



Lobby lounge



Outside Lounge



Student Reading Room



IT CONVERGENCE BUILDING



Fitness Room



Lounge & Cafe



Convenience Store



SAE-NUEL DONG



Club Members' Space



Club Members' Space



Club Members' Space

KAIST CAMPUS MAP



EAST

- E1 Main Gate
- E2 Industrial Engineering & Management B/D
- E3 Information & Electronics B/D
 - ① School of Computing
 - ② School of Electrical Engineering
 - ③ Device Innovation Facility
 - ④ Saeneul Dong
- E4 KAIST Institutes B/D
- E5 Faculty Hall
- E6 Natural Science B/D
- E7 Biomedical Research Center
- E8 Sejong Hall
- E9 Main Library
- E10 Storehouse
- E11 Creative Learning B/D
- E12 Energy Plant
- E13 Satellite Technology Research Center
- E14 Main Administration B/D
- E15 Auditorium
- E16 ChungMoonSoul B/D
- E17 Stadium
- E18 Daejeon Disease-model animal Center
- E19 National Nano Fab Center
- E20 Kyeryong Hall

E21 KAIST Clinic

West

- W1 Applied Engineering B/D
- W2 Student Center-1
- W3 Galilei Hall
- W4
 - ① Yeoul Hall
 - ② Nadl Hall
 - ③ Dasom Hall
 - ④ Heemang Hall
- W5
 - ①② Married Students Housing
 - ③④⑤ International Village C
- W6 Mir Hall, Narae Hall
- W7 Nanum Hall
- W8 Educational Support B/D
- W9 Outdoor Theater
- W10 Wind Tunnel Laboratory
- W11 International Faculty Apartment
- W12 West Energy Plant
- W13 Geotechnical Centrifuge Testing Center

NORTH

- N0 East Gate
- N1 Kim Beang-Ho & Kim Sam-Youl ITC Building
- N2 Branch Administration B/D

N3 Sports Complex

- N4 School of Humanities & Social Science B/D
- N5 Basic Experiment & Research B/D
- N6 Faculty Club
- N7 Mechanical Engineering B/D
- N9 Practice B/D
- N10 Undergraduate Branch Library
- N11 Cafeteria
- N12 Student Center-2
- N13 Tae Wul Gwan
- N14 Sarang Hall
- N15 Staff accommodation
- N16 Somang Hall
- N17 Seongsil Hall
- N18 Jilli Hall
- N19 Areum Hall
- N20 Silloe Hall
- N21 Jihye Hall
- N22 Alumni Venture Hall
- N23 fMRI Center
- N24 LG Semicon Hall
- N25 Dept. of Industrial Design B/D
- N26 Center for High-Performance Integrated Systems
- N27 Eureka Hall
- N28 Energy & Environment Research Center

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