

Final Program & Digest

2017 Changwon International Conference on Intelligent Robot and Convergence Industry (CICIRO 2017)

**November 30(Thursday) ~ December 1(Friday), 2017
CECO, Changwon, Korea**

Hosted by

**Province of GyeongSangnam-do
Changwon City**

Organized by

**Robotics Research Center for Robot Intelligent Technology,
Kyungnam university, Korea**

Technically Co-sponsored by

**The Korean Society of Industry Convergence (KSIC)
Institute of Control, Robotics and Systems (ICROS)
The Korean Society of Manufacturing Technology Engineers (KSMTE)
Korea Association of Robot Industry (KAR)
Gyeongnam Robot Industry Association (GRIA)
Gyeongnam Robot Land Foundation (GRF)
Artificial Life and Robotics (AROB)
Gyeongnam Convention & Visitors Bureau (GNCVB)**

I. Welcome Messages

■□ Invitation Text □■



Sung-Hyun Han, Ph.D
General Chair of CICIRO 2017

Dear distinguished scholars, ladies and gentlemen, I feel very honored and privileged to welcome all the participants to Changwon city, Korea, for the 2017 international Conference on intelligent robot and convergence industry(CICIRO 2017). As the General Chair of the conference, I am very happy and honored to open the CICIRO2017 here in Changwon.

The CICIRO2017 will bring together academicians and professionals from around the world to exchange ideas, discuss novel findings and new methods, reacquaint with colleagues, and broaden their knowledge. This conference covers a wide range of fields from robotics and intelligent control technology to convergence industry. Especially, many research papers on artificial intelligence, advanced mechatronics, smart factories, as well as technical fields such as intelligent robots, IT and NT, which are the core fields of the fourth industrial revolution, are presented in the 2017 Changwon International Intelligent Robotics Conference. This will greatly contribute to the establishment of policies to foster the nation's future new growth engine industry and local specialized industries.

It is our great honor to have world-class scholars as plenary and Invited lectures in CICIRO2017. They are Prof. Balan Pillai(Helsinki Univ. Finland), Prof. Sung-Wan Kim(Seoul Nat'l Univ. Korea), Prof. Fumitoshi Matsuno(Kyoto Univ., Japan), Prof. Guoying Gu(Shanghai Jiao Univ., China), Prof. Ih-huck Song(Texas state Univ.,U.S.A) and Prof. Nguyen Chi hung(Hanoi Univ.,Vietnam). They will share their new theoretical results and thoughts on the fields of intelligent robotics, and convergence industry technology.

In addition, the 2017 International Intelligent Robotics Conference will provide a more efficient international industry-university cooperation network, and play a pivotal role in the development of the future new industry through international technology information exchange for advanced convergence industry.

Finally, I hope all of you who have visited the 2017 International Intelligent Robotics Conference will have good and rewarding time with the presentation of academic papers in Changwon. We sincerely hope that all the participants benefit from and have a fruitful time at CICIRO 2017 in Changwon city Korea.

Thank you very much.

■ Welcoming Address ■



Welcome to the 2017 Changwon International Conference on Intelligent Robot and Convergence Industry (CICIRO). It is no coincidence that this conference is being held here, in the city of Changwon, the cradle of Korea's largest high-tech manufacturing industry. I warmly welcome all the specialists in the field, and leaders of industry, who have come from around the country and around the world to attend this event.

As you all know, we are on the brink of a Fourth Industrial Revolution. Its scope and complexity are all-embracing. This revolution is disruptive, transformative, and moving at immeasurable speed. It is pushing us all to innovate. The challenges and possibilities this revolution brings are immense. In response, global competition and collaboration are intensifying, with an undeniable trend toward development of advanced IT convergence technology.

In this light, this international conference seeks to provide vision and direction for new growth engines by introducing and discussing new technologies that can create new demand in robotics, convergence technologies, and high-tech manufacturing industries. This conference also seeks to promote more efficient network of international industry-university cooperation, as well as play a pivotal role in the development of future industries through international information exchange for the advancement of advanced manufacturing technology.

During this two-day event we will hear from many experts who will enlighten us on what is happening in the fields of artificial intelligence, advanced machines, mechatronics, and smart factories. Some will share their research on intelligent robots, IT, and network technology. These areas are all core to and drivers of the Fourth Industrial Revolution. We hope their contributions to this conference can assist in the establishment of policies that help foster new growth engines and local specialized industries.

Over these two days we have much to look forward to. And so, I hope you find your participation at CICIRO 2017, and your time in Changwon City, a rewarding and enjoyable experience.

The best to you all!

Thank you.

Park, Jae Kyu, Ph.D.

President, Kyungnam University

II. Conference Organization

A. Organizing Committee

General Chair :	Sung-Hyun Han, Kyungnam Univ., Korea
General Co-Chairs :	Ju-Jang Lee, KAIST, Korea Fumitoshi Matsuno, Kyoto Univ., Japan Sung-Wan Kim, Seoul Nat'l Univ., Korea J.M. Lee, Pusan Nat'l Univ., Korea
Organizing Co-Chairs :	In-Hyeok Song, Texas State Univ., USA Guoying Gu, Shanghai Jiao Tong Univ., China Young-Hoon Park, ADD, Korea Hee-Hyeol Lee, Waseda Univ., Japan Balan Pillai, Helsingki Univ., Finland Nguyen Chi Hung, Hanoi Univ., Vietnam
Program Co-Chairs :	Kang-Hyun Jo, Ulsan Univ., Korea Min-Cheol Lee, Pusan Nat'l Univ., Korea Kyung-Soo Kim, KAIST, Korea Jae-Sil Kim, Changwon Nat'l Univ. Korea Soo-hee Han, Postech, Korea Young-Im Cho, Gachon Univ., Korea
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Regional Program Co-chair :	Jang-sik Park, Kyungsung Univ., Korea Won-gu Lee, Kyunghee Univ., Korea Sung-jun Park, chonnam Nat'l Univ., Korea Dang Bao Lam, Hanoi Univ., Vietnam Seok-Jo Go, Dongeui Institute of Technology, Korea
Publicity Chair :	Ha-Young Kim, Pusan National Univ., Korea Yang-Keun Jung, Shinla tech Co., Ltd., Korea
Finance Chair :	Young-Hwa Jeong, Daeho Tec., Korea Kyu-Hyun Jung, SEYOUNG INDUSTRY Co., Ltd., Korea
General secretary :	Chul-Kyu Jin, kyungnam Univ., Korea

B. International Organizing Committee

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Malachy Eaton, Univ. of Limerick, Ireland	Toshio Fukuda, Nagoya Univ., Japan
Joshua M. Epstein, The Johns Hopkins Univ., United States	Furong Gao, Hong Kong Univ. of Sci. and Tech., Hong Kong
Takayasu Fuchida, Kagoshima Univ., Japan	Luis Gomes, Univ. Nova Lisbon, Portugal
Adam Grzech, Wroclaw Univ. of Technology, Poland	Jerzy Świątek, Wroclaw Univ. of Technology, Poland
Maki K. Habib, The American Univ. in Cairo, Egypt	Yuichiro Taira, Sojo Univ., Japan
Yoshiteru Ishida, Toyohashi Univ. of Technology, Japan	Charles E. Taylor, Univ. of California-Los Angeles, United States
David John Glyndwyr James, Coventry Univ., United Kingdom	Marion Oswald, Vienna Univ. of Technology, Austria
Takashi Kohno, The Univ. of Tokyo, Japan	Steen Rasmussen, Univ. of Southern Denmark, Denmark
Man Hyung Lee, Pusan National Univ., Korea	Thomas S. Ray, Univ. of Oklahoma, United States
Kenneth James Mackin, Tokyo Univ. of Information Sciences, Japan	Shinichi Sagara, Kyushu Institute of Technology, Japan
Fumitoshi Matsuno, Kyoto Univ., Japan	Katsunori Shimohara, Doshisha Univ., Japan
Kaoru Mogushi, Juntendo Univ., Japan	Hideyuki Suzuki, The Univ. of Tokyo, Japan
Fusaomi Nagata, Tokyo Univ. of Science, Yamaguchi, Japan	Reiji Suzuki, Nagoya Univ., Japan
Ken Naitoh, Waseda Univ., Japan	Jian Chen, City Univ. of Hong Kong, Hong Kong
Masatoshi Nakamura, Research Institute of Systems Control, Japan	Kwang-Hyun Cho, KAIST, Korea
Kazushi Nakano, The Univ. of Electro-Communications, Japan	Kyoungrae Cho, Dong Seoul College, Korea
Masanori Nishibori, International Univ. of Health and Welfare, Japan	Toshio Tsuji, Hiroshima Univ., Japan
Nobuhiro Okada, The Univ. of Kitakyushu, Japan	Masafumi Uchida, The Univ. of Electro-Communications, Japan
Chintae Choi, RIST, Korea	Fumio Uchikoba, Nihon Univ., Japan
Hyeongsik Choi, Korea Maritime Univ., Korea	Shinjiro Umezu, Waseda Univ., Japan
Jae Weon Choi, Pusan Nat'l Univ., Korea	Keigo Kunihiro Yamamori, Univ. of Miyazaki, Japan
Kwan-ho Chun, Chungnam Univ., Korea	Kazuko Yamasaki, Tokyo Univ. of Information Sciences, Japan
Carl Crane, Univ. of Florida, USA	Masao Yokota, Fukuoka Institute of Technology, Japan
Baocang Ding, Jiaotong Univ., China	Changshui Zhang, Tsinghua Univ., China
Junping Du, Beijing Univ. of Sci. and Tech., China	Kyung-Seok Byun, Mokpo Nat'l Univ., Korea

C. International Program Committee

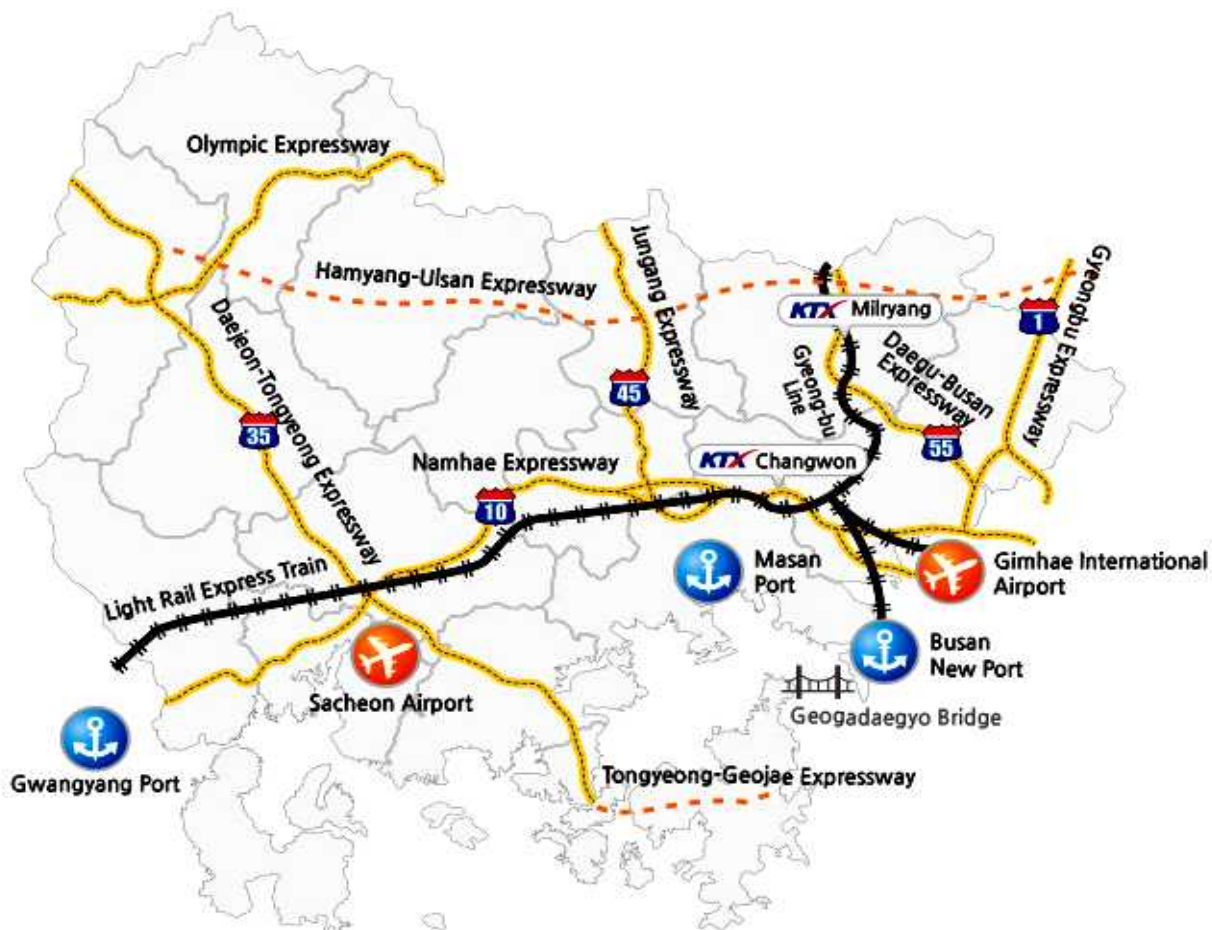
Shyi-Ming Chen, National Taiwan Univ. of Science and Technology, Taiwan	Mutsumi Watanabe, Kagoshima Univ., Japan
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Hiroshi Kinjo, Univ. of the Ryukyus, Japan	Ikuo Yoshihara, Univ. of Miyazaki, Japan
Kentarou Kurashige, Muroran Institute Technology, Japan	Yong Yu, Kagoshima Univ., Japan
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Mikhail Svinin, Kyushu Univ., Japan	Young Im Cho, The Univ. of Suwon, Korea
Ivan Tanev, Doshisha Univ., Japan	Mo-Yuen Chow, North Carolina State Univ., United States
Hiroshi Umeo, Osaka Electro-Communication Univ., Japan	Yueyue Fan, Univ. of California-Davis, United States
Katsuji Uosaki, Fukui Univ. of Technology, Japan	Rintaro Haraguchi, Mitsubishi Electric Corporation, Advanced Technology R&D Center, Japan
	Noriyasu Homma, Tohoku Univ., Japan
	Dong Hyuk Cha, Korea Polytechnic Univ., Korea
	Chwan Hsen Chen, Yuan Ze Univ., Taiwan

III. Local Information

A. Host Province, GyeongSangnam-do

The Best Investment location

Realize your dream in **Gyeongsangnam-do** where the perfect infrastructure awaits you!



Airport

Gimhae International Airport and Sacheon Airport



Traffic Network

7 stations in expressway and 2 stations in KTX (Korea Train eXpress)



Economic Zone

2 Free Economic Zones, 2 Foreign Investment Zones, and 1 Free Trade Zone



Port

International ports (Busan Port, Gwangyang Port, and Masan Port)



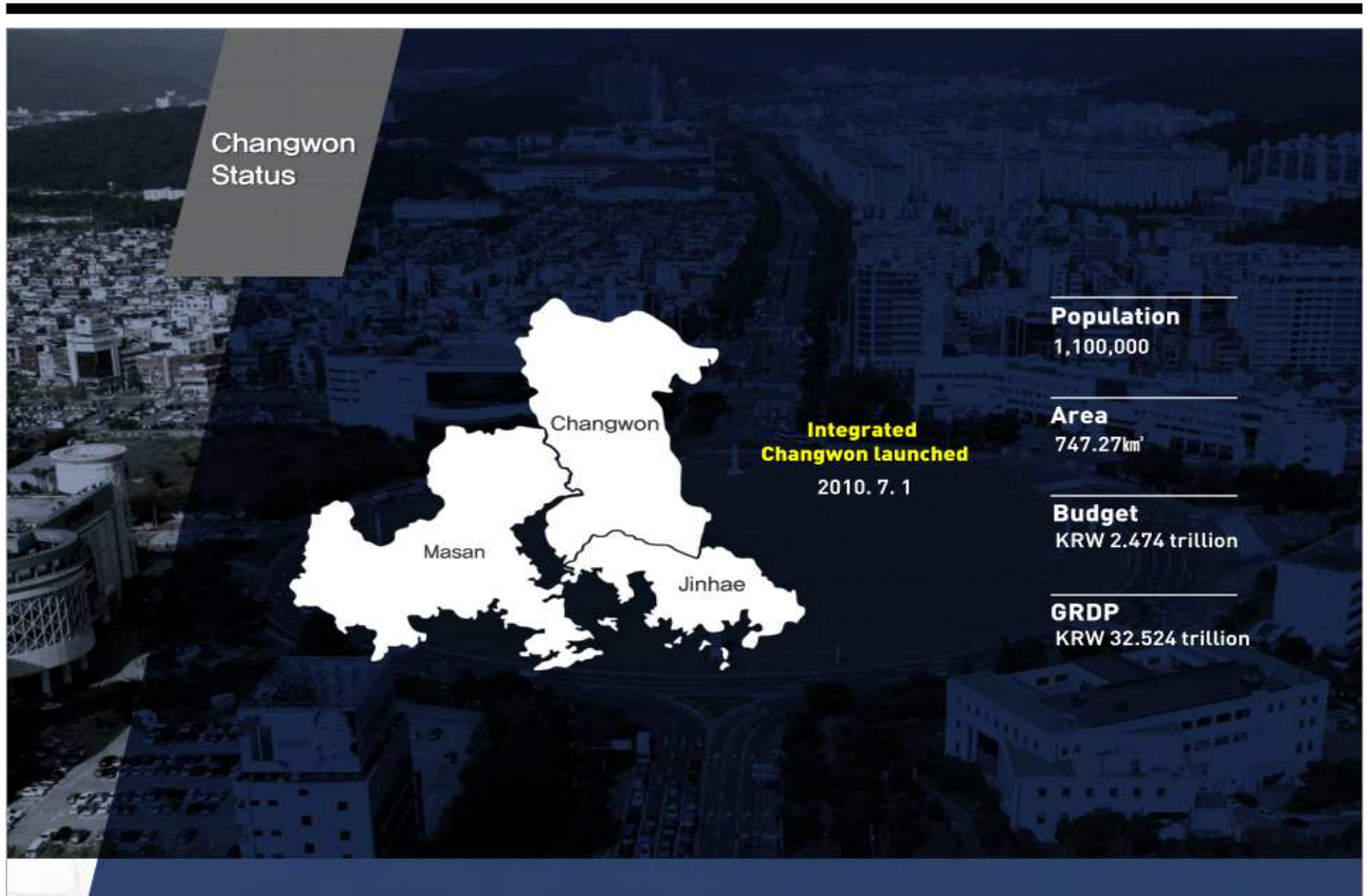
Industrial Complex

4,874 companies residing in 7 national industrial complexes and 158 General industrial complexes

Population	3.334 million (As of December 2013) ※ Number of foreigners registered: 69,126
Area	10,535km ² (10.6% of Republic of Korea)
GRDP (Gross Regional Domestic Product)	KRW 95 trillion and 634.5 billion (the 3rd highest GRDP among all provinces of the Republic of Korea)
GRDP per capital	USD 26,134 (the 6th highest rate among all provinces of the Republic of Korea)
Economically active population	1.653 million (6.4% of entire economically active population in the Republic of Korea)
Total Enterprises / Number of Employees	242,123 Enterprises / 1,250,462 Employees
Trade Balance	Export: USD 51.9 billion (9.3% of entire export of the Republic of Korea) Import: USD 28.5 billion (5.5% of the entire import of the Republic of Korea)
Foreign-Invested Company	200 Companies Number of Employees: 28,762 / Production: USD 34.991 million Export: 20,724 million



B. Host City, Changwon City



Tourism environment

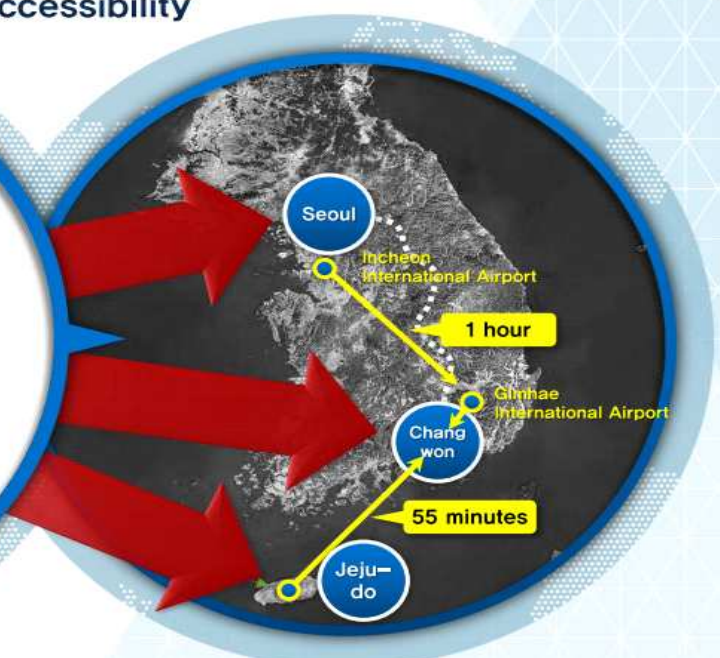
Easy accessibility

[Incheon International Airport → Changwon]

- Incheon Airport Limousine Bus
 - ▶ Changwon (approx. 4 hours)
- Incheon Airport KTX Station
 - ▶ Changwon Station (approx. 3 hours and 20 minutes)

[Gimhae International Airport → Changwon]

- Gimhae Airport Limousine Bus
 - ▶ Changwon (approx. 40 minutes)



2 hours to 3 hours and 30 minutes from major cities in China to Incheon, Busan and Jeju Island

Status of tourism in Changwon City



Tourism environment

A multitude of transportation modes

City Tour Bus

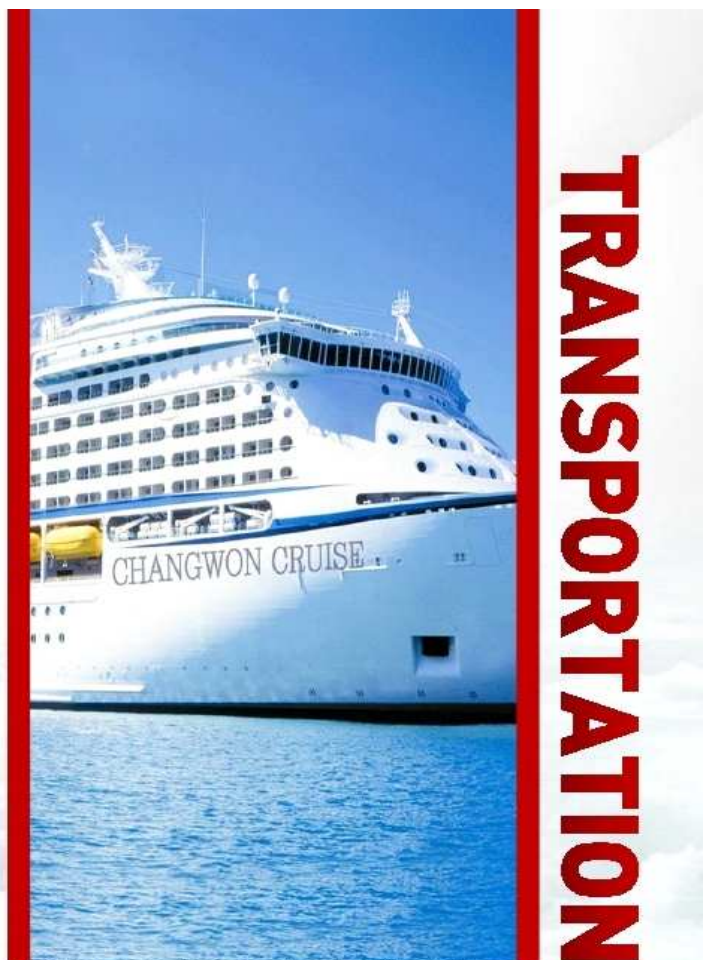
The City Tour Bus takes the tourists to major attractions of the city on circular courses and 12 selective courses. Throughout the courses, all of the city tour buses will be accompanied by a guide to provide stories about major tourist spots

Nubija Bikes

Changwon, an active advocate of eco-friendly transportation, has introduced the bike lending program to promote the use of bikes. Tourists can get a one-day pass to use Nubija bikes.

Coastal Cruise

The Coastal Cruise departs from Masan Port Cruise Terminal (Pier 2) and sails to Dotseom Islet, Machang Bridge, Makgaedo Island, Namdo Island, Modo Island and back to Machang Bridge, providing panoramic sea views along the voyage



C. Changwon Exhibition Convention Center(CECO)

1. Superior Industrial Infrastructure



- The production base for global companies in high value-added industries including machinery, heavy industry, shipbuilding, aerospace, and robotics
- Arrangement for technical tour programs to companies that are relevant to conventions

2. EcoCity & Fantastic Tourist Resources



- Successfully holding prestigious environment conventions, RAMSAR COP 10
- A scenic and natural location
- UNESCO World Cultural Heritage(The Tripitaka Koreana)

3. Convention All-Inclusive Service



- State-of-the-art convention facilities
- Convention multi-functional complex (Hotel, Shopping&Entertainment facilities)
- Customizable menu and global level of service

4. Solid and Professional Support

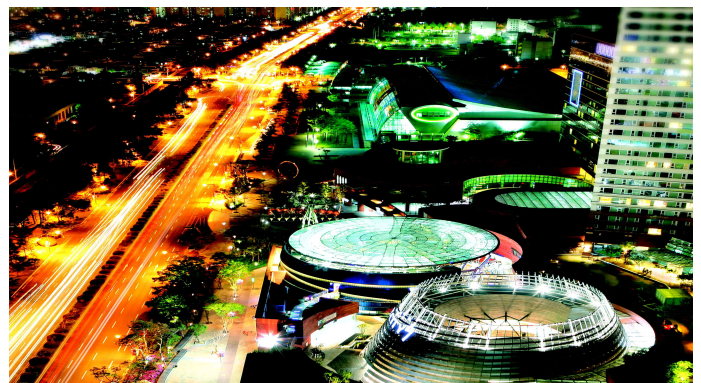


- Thorough support from beginning to end
- Experienced professionals
- Arranging systematic financial support program with Gyeongnam Convention Bureau

5. Easy Access & Various Accommodations



- 30 minutes(by car) from Gimhae Int'l Airport
- Regular operation of KTX, high speed train, between Seoul and Changwon
- More than 10,000 rooms from luxurious hotels within 30 minutes from CECO



D. Transportation



1. Air Transportation

Incheon Int'l Airport → Kimhae(Busan) Airport (50min.)	There are about 5 flights per day.
Kimhae(Busan) Airport → CECO (30~40 min.)	
Kimpo Int'l Airport → Kimhae(Busan) Airport (50min.)	There are about 30 flights per day with 1 hour intervals.
Kimhae(Busan) Airport → CECO (30~40 min.)	

Incheon Int'l Airport	http://www.airport.kr/eng/
Kimpo Int'l Airport	http://www.airport.co.kr/mbs/gimpoeng/
Kimhae Int'l Airport	http://www.airport.co.kr/mbs/gimhaeeng/

2. Train(KTX : High Speed Train)

Seoul → Changwon : 2 Hours 50 Minutes
Station : Chanwon, Changwon Central, Masan(Within 15 Minutes from CECO)

KORAIL website	http://www.letskorail.com/ebizbf/EbizBfIndex_eng.do
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3. Express Bus

Seoul(Gangnam Express Terminal or East Seoul Bus Terminal) → Changwon(5 hr)
Busan → Changwon(45 min.~1 hr)
(20 minute intervals from Sasang, Haeundae terminals)

IV. Program Schedule & Session Timetable

A. Program Schedule

☐ **NOVEMBER 30th(THU.), 2017**

13:00 ~ 14:00	Registration		
14:00 ~ 14:30	Opening Ceremony		
14:30 ~ 15:20	< Room 302 >	< Room 301 >	
	Keynote Speech Prof. BALAN PILLAI Helsinki University, Finland	Oral Session (I)	
15:20 ~ 16:10	< Room 302 >	< Room 301 >	
	Invited Lecture (T-I) Prof. Ju-Jang Lee KAIST, Korea	Oral Session (II)	
16:10 ~ 16:30	Coffee Break Time		
16:30 ~ 17:20	< Room 302 >	< Room 301 >	
	Invited Lecture(T-II) Prof. Han-Sung Kim Kyungnam University, Korea	Oral Session (III)	
17:20 ~ 18:00	< Room 302 >	< Room 301 >	
	Young Outstanding Reseacher Prof. Moon-Hee Lee Dong-Eui Institute of Technology, Korea	Poster Session (I)	Poster Session (II)
18:00 ~ 20:00	Welcome Reception		

□ **DECEMBER 1st(FRI.), 2017**

9:00 ~ 9:50	Preparation and Registration				
9:50 ~ 10:30	< Room 302 >	< Room 301 >			
	Invited Lecture(F-I) Prof. DANG BAO LAM Hanoi univ. of Science and Technology, Vietnam	Invited Lecture(F-II) Prof. Kang-Hyun Jo University of Ulsan, Korea			
10:30 ~ 11:10	< Room 302 >	< Room 301 >			
	Invited Lecture(F-III) Prof. Jang-Myung Lee Pusan National Univ., Korea	Invited Lecture(F-IV) Prof. Young Jin Moon Asan Medical Center, Korea			
11:10 ~ 11:50	< Room 302 >	< Room 301 >	< Room 600A >		
	Invited Lecture(F-V) Prof. Soo-Hee Han Pohang Univ. of Science and Technology, Korea	Oral Session (I)	Oral Session (II)		
11:50 ~ 13:20	Lunch Time				
13:20 ~ 13:30	Opening Ceremony & Plenary Lecture				
13:30 ~ 14:10	< Room 302 >	< Room 301 >		< Room 600A >	
	Plenary Lecture(F-I) Prof. Sung-Wan Kim Seoul National Univ., Korea	Oral Session (III)	Oral Session (IV)	Oral Session (V)	Oral Session (VI)
14:10 ~ 14:50	< Room 302 >				
	Plenary Lecture(F-II) Prof. Fumitoshi Matsuno Kyoto Univ., Japan				
15:00 ~ 15:40	< Room 302 >	< Room 301 >			
	Plenary Lecture(F-III) Prof. Guoying Gu Shanghai Jiao Tong Univ., China	Poster Session (I)	Poster Session (II)	Poster Session (III)	
15:40 ~ 16:20	< Room 302 >	< Room 301 >			
	Plenary Lecture(F-IV) Prof. In-Hyok Song Texas State Univ.. USA	Poster Session (IV)	Poster Session (V)	Poster Session (VI)	
16:20 ~ 17:00	< Room 302 >	< Room 301 >			
	Invite Lecture(F-VI) Prof. Young-Im Cho Gachon University, Korea	Poster Session (VII)	Poster Session (VIII)	Poster Session (IX)	
17:00 ~ 18:30	< Intelligent Robot Forum > Topic : Fourth Industrial Revoution and Intelligent Robot (Prof. Sung-Hyun Han)				
	<Pannel Discussion> Pannel: Prof. Balan Pillai, Prof. Ju-Jang Lee, Prof. Dang Bao Lam, Prof. Jang-Myung Lee, Prof. Soo-Hee Han, Prof. Fumitoshi Matsuno, Prof. Guoying Gu, Prof. In-Hyok Song, Prof. Sung-Hyun Han, Prof. Young-Im Cho, Prof. Young Jin Moon				
18:30 ~ 20:30	Banquit				

V. Keynote Speech

A. Keynote Speech I



November 30(THU) 14:30 ~ 15:20

[Chair : Ju-Jang Lee]

Professor BALAN PILLAI

Affiliation: Helsingki University, Finland

Title : ALGORITHM BASED SEMANTIC SYSTEM
SET-UP FOR INTERNET

Abstract : The technological change can definitely put up an impact quickly; it always happens incrementally. The Uber and its concept - disrupted the taxi business overnight; though it wasn't likely before the Internet, high-speed mobile communications, Cloud computing, Big Data, distributed Storage and advanced Data Analytics enabled its platform. KPMG is investing a lot in cognitive technologies; counting IBM Watson to supercharge the audit capabilities. Are these all idiosyncrasies - not really! In the millennium, the telecommunications industry; is abuzz with megabits per minutes, gigabits, terabits and so. Those working in the forefront of the technologies involved; are getting used to the power of exponents, as major advances are happening in silicon, routing, switching, radio frequencies, and fiber optics.

Identified that the payer needs to know, no matter what has done at the Internet as communication to the public? The outcome of this spending on the Internet, at all, has to be massively sighted, smartly analyzed, synchronized, and evaluated. It should also cleverly rout with pragmatic impacts? This paper thereby process and address as to how that works seamlessly. There are several of them every second on the Net. An analyzing method is formed and called as Web Analytic. This tool is not any more new or narrative. However, this paper would show here; a new form of identification and interpretation in using the Semantic Infrastructure attached to it with Lambda Computer Modeling, then it becomes as novel diffusion. Most of the Web Analytic is associated with the Big Data players in the field, such as IBM, Google, Microsoft and few others. We may not go into details here. There are plenty of spaces to play a story rule. A genius process we have created as a novel proposition.

The doctrine is a thread to exigency. What is discussed here is bit dissimilar. Present concept is put under a patent-pending form. Fundamentally, a drive propels the system at the net in a flow-pattern. This is an all inclusive grid platform. The system would run from here yet again back-and-forth securely and between the systems-to-systems at the clouds.

Keywords : Idiosyncrasy, web analytic, grid platform, security, system, semantic infrastructure, ontology, clouds

VI. Plenary Lecture

A. Plenary Lecture I



December 1(FRI) 13:30 ~ 14:10

[Chair : Ju-Jang Lee]

Professor Sungwan Kim

Affiliation: Dept. of Biomedical Engineering Seoul
National University College of Medicine
Seoul, South Korea

Title : From Aerospace Engineering to BioMedical
Engineering with Emphasis on Medical Robots

Abstract : Recent Research & Development (R&D) efforts on Medical Robots at Seoul National University (SNU) College of Medicine and SNU Hospital are presented. For surgical robot, two innovative ideas motivated from Aerospace technology are addressed. Those ideas are patented in the United States as well as South Korea. The several proto-types have been developed to demonstrate those feasibilities and those are getting surgeon's attention now. Further, research outcomes are documented as journal articles. Then, rehabilitation robot is explained and the first proto-type, named as SNUExo, is described followed by mirror robot as well as Brain Machine Interface (BMI) based rehab robot. Various other robot- & aerospace- based technologies are also covered in this presentation.

B. Plenary Lecture II

December 1(FRI) 14:10 ~ 14:50

[Chair : Jang-Myung Lee]

Professor Fumitoshi Matsuno

Affiliation: Kyoto University, Japan

Title : Bio inspired robotic and its application to rescue
and recovery

Abstract : Our ILaboratory has been engaged in two broad and connected areas of research that relate to each other and the human surroundings; ""bBio-inspired Rrobotics"" and ""Rrescue Rrobotics."" Living things creatures have been survived and been optimized by natural selection. An uUnderstanding of the functions of living things is very useful toin createing a new artificial robots. In our lab,. we are interested in analysis ofzing the beautiful skills and behaviors of living things, and we are trying to find solutions forto the following questions, among others: Why can a living snakes move without legs?, Why do quadrupedlegged living things change their gaitte patterns (for example, Walkwalk, Trottrtrot,

Gallop gallop for a horse) due to depending on their moving speed of movement?, What is the mechanism of the flocking mechanism of huge number behaviors of birds and fishes?, How can small ants build produce a big anthill?, Why can human beings can walk with two legs?, etc. Based on their understanding of these phenomena, we can apply our knowledge to create of robots and to solve industrial problems in industry.

We believe that rescue robot systems are another important application of robotic technology. When I was with During my time as an employee at Kobe University, I missed a one of my masters' student, Mr. Motohiro Kiso, was killed by in the Great Hanshin-Awaji Earthquake on January 17, 1995. After Since this tragic event, I have been putting my heart into the development of useful rescue robot systems and creation of rescue engineering. When In the Great East Japan Earthquake occurred in 2011, we dispatched and utilized grand the rescue robots KOHGA3 to inspection of damaged buildings in at Hachinohe and Aomori, and we dispatched underwater robots for to searching for bodies in at Minamisanriku, Miyagi, and Rikuzentakata in Iwate. My dream is to establish an international rescue robot team, like the popular TV show "Thunderbirds," with using advanced robotic technologies. If we can dispatch rescue robots from Japan to disaster sites everywhere in the world for disaster response and recovery, it will be is a strong contribution to the world.

In this keynote speech I would like to introduce our research activities.

Biography : Fumitoshi Matsuno received the Dr. Eng. degree from Osaka University in 1986. In 1986 he joined the Department of Control Engineering, Osaka University. He became a Lecturer in 1991 and an Associate Professor in 1992, in the Department of Systems Engineering, Kobe University. In 1996 he joined the Department of Computational Intelligence and Systems Science, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology as an Associate Professor. In 2003 he became a Professor in the Department of Mechanical Engineering and Intelligent Systems, University of Electro-Communications, Tokyo. Since 2009, he has been a Professor in the Department of Mechanical Engineering and Science, Kyoto University. He holds also posts of the Vice-President of the Institute of Systems, Control and Information Engineers (ISCIE) and the Vice-President of NPO International Rescue System Institute (IRS). His current research interests lie in robotics, swarm intelligence, control of distributed parameter system and nonlinear system, and rescue support system in disaster. Dr. Matsuno received many awards including the Outstanding Paper Award in 2001, 2006 and 2017, Takeda Memorial Prize in 2001 and Tomoda Memorial Prize in 2017 from the Society of Instrument and Control Engineers (SICE), the Prize for Academic Achievement from Japan Society of Mechanical Engineers (JSME) in 2009, and the Best Paper Award in 2013 from Information Processing Society of Japan. He is a Fellow member of the SICE, the JSME, the Robotics Society of Japan (RSJ) and a member of the IEEE among other organizations. He served as a co-chair of IEEE RAS Technical Committee on Safety, Security, and Rescue Robotics (SSRR), an Editor-in-Chief of Journal of RSJ, an Editor of Journal of Intelligent and Robotic Systems, a chair of Steering Committee of SICE Annual Conference, a General Chair of IEEE SSRR2011 and IEEE/SICE SII2011, SWARM2015, SWARM2017 etc. He is

an Editor of Journal of Robotics, an Associate Editor of Advanced Robotics, International Journal of Control, Automation, and Systems, etc. and on the Conf. Editorial Board of IEEE CSS.

C. Plenary Lecture III



December 1(FRI) 15:00 ~ 15:40

[Chair : Sung-Wan Kim]

Professor Guoying Gu

Affiliation: Institute of Robotics, School of Mechanical Engineering Shanghai Jiao Tong University

Title : Recent development of soft material robotics at SJTU

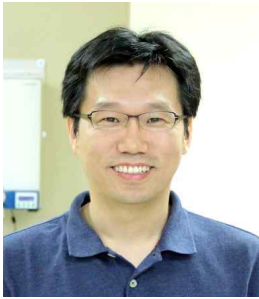
Abstract : Soft robotics based on soft functional materials is an emerging technology in the field of robotics, which makes the design, fabrication and control approaches for traditional rigid robots not applicable. In this talk, I will firstly introduce the state-of-the-art of soft robotics, and mainly present the recent achievements in our lab at SJTU, emphasizing the key points of working principle, key components and preliminary prototypes of different soft robots. Lastly, I will summarize the challenges and opportunities for the further studies in terms of mechanism design, manufacturing, dynamics modeling and control.

Brief CV : Guoying Gu received the Ph.D. degree in Mechatronic Engineering from Shanghai Jiao Tong University (SJTU), Shanghai, China, in 2006 and 2012, respectively.

He was a Visiting Scholar at Concordia University, Montreal, Canada, and National University of Singapore, Singapore. Supported by the Alexander von Humboldt Foundation, he was as a Humboldt Fellow at University of Oldenburg, Oldenburg, Germany. Since October 2012, he has worked at SJTU, where he is currently appointed as an Associate Professor. His research interests include soft robotics and high-precision motion control. He is the author or co-author of over 60 publications (including more than 40 SCI-indexed papers), which have appeared in journals, as book chapters and in conference proceedings.

Dr. Gu is a member of the IEEE and ASME. Now he serves as Associate Editor of International Journal of Advanced Robotic Systems. He has also served for several international conferences as Associate Editor or a program committee member.

D. Plenary Lecture IV



December 1(FRI) 15:40 ~ 16:20

[Chair : Kang-Hyun Jo]

Professor In-Hyounk Song

Affiliation: Texas State University, USA

Title : Vertically Movable Gate Field Effect Transistor for
Low-frequency Vibration Monitoring System

Abstract : The demand of MEMS products has gradually increased and replaced traditional sensors due to size, cost and integration convenience compared to traditional sensors. MEMS based sensors and actuators have been used in many applications including automobiles, display, and life science. As developing microfabrication technology, a variety of materials, such as polymer, metal, poly-silicon, etc., have been studied and employed for forming functioning devices. Among them, silicon (Si) wafer is still dominant in MEMS due to convenience of integration with electronics and excellent mechanical and electrical properties. The use of a Si microcomponent not only enables the integration of thousands of functioning electrical devices onto a single chip but also provides a means of interconnecting it with micromechanical components in an inexpensive manner. As an active sensing element, a suspended gate FET called a vertically movable gate field effect transistor (VMGFET), whose gate move in vertical direction to the plane of substrate, is presented. The gate structure of the VMGFET is formed with single crystalline silicon using a device layer of SOI wafer. In the presentation, the principle of VMGFET is introduced and the fabrication processes are discussed with the advantages of employment of SOI wafer. The electrical and mechanical characterizations of the fabricated VMGFET are presented for low-frequency vibration monitoring application.

Biography : Dr. In-Hyounk Song is an associate professor in Department of Engineering Technology at the Texas State Dallas. He received the M.S. and Ph.D. degrees in electrical engineering from Louisiana State University, Baton Rouge, in 2002 and in 2005, respectively. He had worked at National Research Council of Canada (CNRC – NRC) before joining Texas State University in 2010. His current research interests include MEMS sensors and actuators, including accelerometer, ultrasonic transducer, electrostatic actuators, and polymer based bio/chemical sensors.

VI. Invited Lecture

A. Invited Lecture I



November 30(THU) 15:20 ~ 16:10

[Chair : Kang-Hyun Jo]

Professor Ju-Jang Lee

Affiliation: Dept. of Electrical Engineering, KAIST

Title : Robust Fault-Tolerant Control for Underactuated Robot Manipulators

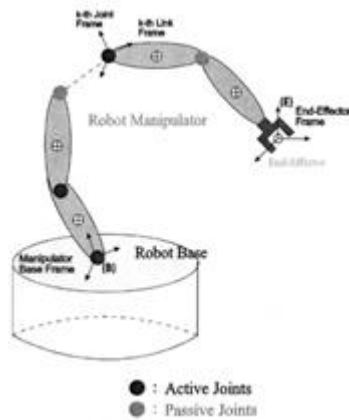
Abstract: This article addresses a robust fault-tolerant control for underactuated robot manipulators faced with actuator failures and uncertainties. This paper deals with two control issues in manipulator control fields, namely, the joint space control and Cartesian space control. For the joint space control of underactuated robot manipulators, a robust adaptive control scheme with fault tolerance is proposed using the brakes equipped at passive joints, in the presence of parametric uncertainty and external disturbances. The proposed joint control scheme has two control modes with a passive joint control and active joint control, and one braking mode to lock all passive joints at their desired set-points. In this case it is assumed that the passive joints do not have actuators but are equipped with brakes. For the Cartesian space control of robot manipulators with free-swining passive joints, a robust adaptive control scheme with fault tolerance is also proposed. This scheme is suitable for some joints with failed actuators and/or brakes as well as passive joints without actuators or brakes. In order to overcome the dynamic singularity problem for a nominal decoupling matrix (input matrix of the controller) used in the presented Cartesian controller, a singularity-free Cartesian path planning is achieved via a computer simulation. The proposed joint and Cartesian space control schemes do not need a priori knowledge of the accurate dynamic parameters and the exact uncertainty bounds. To illustrate the feasibility and robustness of the proposed control schemes, simulation studies are performed for a three-link planar robot manipulator with a passive joint, under parametric uncertainty and external disturbances.

◆ **Control of *nonholonomic underactuated* robot systems**

- Growing attention in recent years, and it has many practical application fields.

◆ **What is an Underactuated Robot Manipulator ?**

- Number of joint actuators < Number of total joints



- Total joints (n) = Active joints (r) + Passive joints (p)
- Feature : 2nd-order nonholonomic constraints due to passive joints
- *Active joints* or *Actuated joints* (r) :
 - have their own actuators
- *Passive joints* or *Unactuated joints* (p) :
 - do *Not* have their own actuators

B. Invited Lecture II



November 30(THU) 16:30 ~ 17:20

[Chair : Kang-Hyun Jo]

Professor Han Sung Kim

Affiliation: School of Mechanical Engineering

Kyungnam University, Korea

Title : Parallel Robot Technology and Applications

Abstract: Parallel robot manipulator has a moving platform connected to a fixed base by at least two serial kinematic chains called legs, comparing serial robot manipulator with a single kinematic chain. Since heavy actuators locate near or at the fixed base, a parallel robot has much smaller moving inertia than that of a serial robot counterpart and has high speed and high acceleration capabilities. Also, since external force and moment at the moving platform is supported by several legs, a parallel robot has large payload and high stiffness/mass ratio. Finally, since errors in actuators and parts are not accumulated and are distributed to several legs, a parallel robot has high accuracy. Perhaps best known is the six degrees-of-freedom Gough-Stewart platform with linear actuators and links that are only under tension and compression. It has the disadvantages of complex forward kinematics, a small workspace, and many components. Parallel manipulators with less than 6 DOF can alleviate these shortcomings. They typically cost less and are appropriate for various specific applications. The most common geometries provide 4-DOF (3 translational and 1 rotational DOF) such as a Delta parallel robot.

This plenary lecture is organized as follows. First, the characteristics of a parallel robot is explained comparing that of a serial robot. Second, main applications of parallel robots are introduced, which can maximize the advantages, such as high payload, high speed, high acceleration, high payload, high reliability, and high accuracy. Third, brief introductions to forward/inverse kinematics, Jacobian analysis, singularity analysis, dynamics analysis, and optimal design are given using the example of a Delta robot. Finally, several parallel robot

mechanisms developed at Robotics & Mechanism Design Lab in Kyungnam University are presented.

Biography: Han Sung Kim received the M.S. and Ph.D. degrees in Mechanical Engineering from Yonsei University, Korea in 1996 and 2000, respectively. Since March 2004, he has been working in School of Mechanical Engineering of Kyungnam University, Korea. Since his research interests include mechanism design, kinematics, parallel robot applications, and collaborative robots.

C. Invited Lecture III



December 1(FRI) 09:50 ~ 14:20

[Chair : Soo-Hee Han]

DANG BAO LAM

Affiliation: Hanoi university of Science and Technology
(HUST)

Title : Robotics in Vietnam: brief review and a case
study from HUST



NGUYEN CHI HUNG

Affiliation: Hanoi university of Science and Technology
(HUST)

Abstract:

- Overview of research, application and manufacture of robots in Vietnam in the beginning of 21st century
- SWOT analysis and growth forecast of robotics market in Vietnam to 2020
- Policies and solutions to develop robotics industry in Vietnam in the period up to 2020.
- VIEbot: a humanoid robot from cooperation between Hanoi university of Science and Technology and Vietnam Institute of Electronics, Informatics and Automation.

D. Invited Lecture IV



December 1(FRI) 09:50 ~ 14:20

[Chair : Young-Jin Moon]

Professor Kang Hyun Jo

Affiliation: University of Ulsan, Korea

Title : Vision based Intelligent Systems for Human
Supportive Technology

Abstract : Computer vision technology has been investigated for decades to search out the theoretical and application topics. Therefore it is widely challenged to use in the different fields as the real application solutions nowadays. In the presentation, it is outlined and considered the status of Vision based Intelligent Systems research and its some application widely tackled in the ICT(information communication technology) fields. While the IoT based technology is widely spoken recently, the computer vision-based technology still is major technology to lead the hot issues in the artificial intelligence and its application because of its straight forward and intuitive understanding in the predefined domains and its neighboring coverage. Here these belonging contents will be discussed and shown with some examples like intelligent surveillance system, vision application to autonomous driving car systems and robotic application for human supportive technology. In the presentation, some of the current research topics are also introduced with the real application.

Biography : Kanghyun Jo received the BS degree from Busan National University and MS and Ph.D from Osaka University, in 1989, 1993, 1997, respectively. He worked in ETRI (Electro-Telecommunication Research Center) as a Post-Doc. Research Fellow during 1997-1998. Since March of 1998, he has been with University of Ulsan, as a Faculty member, now as a Professor, in charging of an Intelligent Systems Lab.

He had served as the vice dean of e-Vehicle Graduate Institute during 2007-2009 and continuously the vice dean of College of Engineering during 2009-2011. He experienced as visiting Professor/Researcher Kyushu University and KIST during 2005-2006 and also in Oregon State University during 2008-2009 and UC Riverside during 2013-2014.

He has been also serving as a director of many societies, like ICROS (Institute of Control, Robotics and Systems), KMMS (Korean Multimedia Society), SICE (Society of Instrumentation and Control Engineers, Japan), as well as IEEE IES. He is currently contributing as an editorial member for a few renowned international journals, such as IJCAS(International Journal of Control, Automation and Systems) and TCCI (Transactions on Computational Collective Intelligence) or a guest editor of IEEE TII(Transactions on Industrial Informatics).

By now he has made a variety of contributions for organizing conferences and other academic gatherings, ICIC (International Conference on Intelligent Computing, since 2006),

ICCAS (International Conference on Control, Automation and Systems, since 2008), and ICCCI (International Conference on Computational Collective Intelligence, since 2010) as a steering member. He is currently serving as an AdCom member IEEE IES and managing IES Ulsan Chapter. He has published more than 200 peer-reviewed technical papers in the renowned journals, such as Springer Neurocomputing, IJCAS, IEEE Trans. Industrial Informatics and Trans. Industrial Electronics.

E. Invited Lecture V



December 1(FRI) 10:30 ~ 11:10

[Chair : Balan Pillai]

Professor Jang Myung Lee

Affiliation: Department of Electronics Engineering, Pusan
National University, Korea

Title : Startup Time for Robots

Abstract: With the immerging technology of 4th industry innovation, it is time to make start up using the results of the robotics researches. It is definitely necessary to review several very successful robots in terms of technology and market to understand how the robotics has been changed with the current development of IT technologies. For this understanding, the basic components of the intelligent robots have been discussed to see how they have been changed and in which direction they are required to be developed further, which may show the possible items for the start up. The robots are classified into five generations: 1.Industrial Robot, 2.Sensor-based Robot, 3.Intelligent Robot, 4.Self-energized Robot, and 5.Super-connected Robot. Currently, the 3rd generation robots are mostly mentioned and developed in the market. With the completion or success of the 3rd generation robots, the robotics industry will grow so rapidly that it pursues the 4th and 5th generation robots.

Bibliography: He is a Professor of Department of Electronics Engineering,Pusan National University, Koreasince 1992.Director for SPENALO National Robotics Research Center since 2009. Head of Division of Electrical &Electronics Engineering(2007 ~ 2010). The Ph.D. degree (1990) in ComputerEngineering from the University of Southern California, Los AngelesUSA. The MS and BS degrees from Seoul National University in Korea (1982, 1980). He served as a president of Korean Robotics Society in 2010, and served several years as a vice-president of ICROS, IEIE. Now he is serving as a CRB of Korea Research Foundation.

Research areas: His research interestsinclude Design of Robotic Control System, Factory Automation System Design,Sensor Integrated Manufacturing, Computer Communication, Robotics, Integrated Manufacturing Systems,Intelligent Control, Localization. He haspublished

101papers in international journals, such as IEEE Transcation on Industrial Electronics, Image and Vision Computing, IEEE/ASME Transactions on Mechatronics, etc(SCIindexed).

F. Invited Lecture VI

December 1(FRI) 10:30 ~ 11:10

[Chair : Young-Im Cho]



Professor Young Jin Moon

Affiliation: Department of Anesthesiology and Pain Medicine,
Laboratory for Cardiovascular Dynamics, Asan Medical Center,
University of Ulsan College of Medicine, Seoul, Korea.

Title : Hospital-initiated development of medical robots:
Intervention and rehabilitation robots in Asan
Medical Center

Abstract: In current development of medical robots, the role of clinicians and tight collaboration of clinicians and engineers have been considered very important. As such examples, four medical robots developed or being developed by Biomedical Engineering Research Center, Asan Institute for Life Sciences, Asan Medical Center (AMC) are presented. Firstly, an image-based needle insertion intervention robot has been developed in accordance with clinical unmet needs found by radiologists. The robot focuses on complete biopsy procedure including the task of tissue sampling, which is totally different from the existing needle insertion robots that handle only one needle. The second is robotic catheterization system used in cardiovascular interventions. To overcome limitation of the commercialized products for robotic arrhythmia ablation, AMC's research consortium has attempted to use information and big data such as ablation trajectories recorded by a mapping system and to give variable stiffness to robotic sheath that guides steering of a catheter. The two others are rehabilitation robots: one is a rehabilitation robot based on bio-signal such as electromyography and electrocardiography, and the other is an attempt to apply artificial intelligence to lower-limb rehabilitation. For the later, clinical big data is being collected from clinical trials performed by seven clinical institutions. As the examples in AMC have shown, clinicians' participation in development of medical robots is expected to be expanded more and more.

G. Invited Lecture VII



December 1(FRI) 11:10 ~ 11:50

[Chair : Young-Im Cho]

Professor Soo Hee Han

Affiliation: Department of Creative IT Engineering
Pohang University of Science and Technology,
Korea

Title : 3D mapping for localization of drones

Abstract : Drones are growing in popularity for their wide-ranging potential applications. The global drone market is expected to reach 5.5 billion dollar by 2020. While drones are popular and applied to a variety of areas, they have some rooms for improvement. Since drones are flown by operators and their batteries are also replaced or charged manually, it is a laborious and troublesome work to operate drones by hand for a long time. Additionally, we need to resolve some safety issues arising from communication interruption between an operator and a drone, and obstacle collision. In this regard, now is the time when an autonomous drone control system should be developed. In order to develop the autonomous drone control system, it is most important to achieve precise localization through 3 D perception technology. In this talk, we discuss how to construct high precision 3D maps for indoor and outdoor uses through LiDAR, composite sensors, and omnidirectional cameras. Indoor and outdoor localization systems based on composite 3D maps will be introduced together with real-time algorithms for aligning positions and directions among sensors, and estimating and compensating errors within sensors, with high precision GPS/INS integration technologies.

Biography : Soohee Han received his B.S. degree in electrical engineering from Seoul National University (SNU), Seoul, Korea in 1998. He received the M.S. and Ph.D. degrees in School of electrical engineering and computer science from Seoul National University, Seoul, Korea, in 2000 and 2003, respectively. From 2003 to 2007, he was a researcher at the Engineering Research Center for Advanced Control and Instrumentation of SNU. In 2008, he was a senior researcher at the robot S/W research center. From 2009 to 2014, he was with the Department of Electrical Engineering, Konkuk University, Seoul, Korea. Since 2014, he has been with the Department of Creative IT Engineering, POSTECH, Pohang, Korea. He is an associative editor of International Journal of Control, Automation, and Systems. He is a Senior Member of IEEE Control Society and has been serving as a member of IFAC TC 6.3(Power and Energy Systems). Dr. Han has published more than 150 international journal/proceeding papers. He has also authored 5 technical books. His main research interests are in the areas of autonomous vehicles, smart grid systems, electric vehicles, cyber physical energy systems, computer aided control system design, distributed control system, time delay system, and stochastic signal processing.

H. Invited Lecture IX



December 1(FRI) 16:20 ~ 17:00

[Chair : Soo-Hee Han]

Professor Young Im Cho

Affiliation: Faculty of Computer Engineering, Gachon University,
South Korea

Title : Research of Intelligent IoT-Smart City Platforms

Abstract : Smart City platform have been developed in the city and national level. From Smart City, IoT is an important means to resolve current issues. Technical elements of the IoT is sensing, wired and wireless communications, network, service interfaces, big data, security etc.

Usually, Machine-to-Machine communications (M2M) is a phenomenon that has been proceeding quietly in the background. Current international standard was presented as a reference model in One M2M which is leading IoT. The four areas are IoT service-centric platform, data-centric platform, connectivity-centric platform, and device platform.

To avoid creation of competing M2M standards the 7 standards developing organizations, that publish telecom standards: TTC, ARIB (Japan), ATIS, TIA (USA), TTA (Korea) CCSA (China), ETSI (Europe) started the OneM2M Global Initiative to develop one globally agreed M2M Specification with initial focus on Service Layer. OneM2M aims to consolidate current M2M Service Layer standards activities such as ETSI TC M2M (Europe), TIA TR-50 (USA) and CCSA TC 10 (China), and to reduce standardization overlap and confusion and provide ongoing standards support to enhance interoperability, reduce market fragmentation, and improve security and reliability. (Ref: <http://www.eclipse.org/proposals/technology.om2m/>).

However, there is no international standardized IoT platform including data, service, connectivity and device, what is more there is no clear national standardized platform satisfy the reference model that is presented by oneM2M institute which is a leading organization to establish an international IoT standardized platform.

In this seminar, I am going to talk about some topics like following: IoT and Smart City basic, IoT International platform focusing on OneM2M reference model, components and model description for IoT platform. Thank you.

Biography: Professor Young Im Cho got bachelor's, master's, and doctoral degrees in Computer Science from Korea University in South Korea. She got Post-Doc. Degree at University of Massachusetts at 2000 in USA. Now she is Chiefs of AI and Smart City Laboratory at Gachon University, Korea-Kazakhstan ICT Cooperation Center and Intelligent Service Robot Automation System Society. She will be a Chief of Korea Intelligent and System Society from 2018. She was ex-committee member of National Information Strategy

Council under Korea President, and worked as a senior research at Samsung Electronics. She is a member of e-Government committee member in Korea Government. She was a visiting professor at Purdue University in USA from 2013 to 2014. She has published more than 300 publications including Journals, conferences. Also she has 13 text and reference books. She received a big medal from Korea Government at 2013, and 15 academic awards from academic societies. She is a member of more than 15 editorial boards of international journals and conferences. She is IEEE member, too. Her interesting areas are Artificial Intelligence, Smart City, Big data, Cloud Robot and e-Government and etc.

V. Young Outstanding Researcher

A. Young Outstanding Researcher



November 30(THU) 17:20 ~ 18:00

[Chair : Seok-Jo Go]

Professor Moon Hee Lee

Affiliation: Dong-Eui Institute of Technology, Korea

Title : Development and Application of Advanced Composite Materials

The development of composite materials has been accompanied by the development of metals, plastics and ceramics. Composite materials, which are materials to expand or replace existing materials, have been developed in the form of particle, fiber reinforcing or lamination structures, and are being applied to several industrial fields.

In the aerospace industry, the replacement of conventional aluminum and titanium alloys to carbon fiber-reinforced plastic composites (CFRRP) has been progressed to secure weight-saving with excellent mechanical property. This has been possible with decades of advancement in the mechanical properties of carbon fibers and cost-saving manufacturing processes of composite materials. In recent years, General Electrics (GE) Aviation has been expanding the application of composite materials to the development of a LEAP engine that uses a ceramic matrix composites (CMCs) instead of the conventional nickel-based superalloy as engine turbine components.

The application of composite materials in the energy field is also actively under consideration. In the design of International Thermonuclear Experimental Reactor (ITER), the application of silicon carbide fiber reinforced silicon carbide composites (SiCf/SiC) with excellent nuclear properties has been studied for the future fusion energy sources. On the other hand, after the earthquake in Fukushima, OECD / National energy agency (NEA) has been emphasizing the safety of nuclear facilities and countermeasure against the accident scenarios such as station-blackout (SBO) and loss-of-coolant-accidents (LOCAs). As part of the development of accident tolerant fuel (ATF), the studies on application of SiCf/SiC composite materials instead of conventional Zirconium alloys to nuclear fuel cladding materials are under review.

In the fields of electric/electronic components, the integration technology and high power electronic components in LED, hybrid/electric vehicle has a problem of heat generation during operation causes degradation of system efficiency and performance. In order to solve this problem, the design and material research for high performance electronic packaging has been under consideration of heat dissipation. In the materials field, metal matrix composites (MMCs) has being actively researched for high performance heat-sink. MMCs that can enhance not only the thermal conductivity but also coefficient of thermal expansion

matching to the electronic substrate have been developed by reinforcing diamond powder, high thermal conductivity carbon fibers and carbon nanotubes in the conventional high thermal conductive copper or aluminum.

In the field of engine piston for automobiles, research on MMSs has also been actively carried out in order to improve the performance of conventional aluminum alloys. In order to achieve low density, high modulus and strength and suitable thermal expansion matching, attempts have been made to compose silicon carbide fibers, carbon nanotubes, or other ceramic fibers with conventional aluminum alloys.

In the recent development of the Industry 4.0, the role of the robotic system is much emphasized. In order to improve the performance of the robot system, such as weight- or energy-saving and operation in harsh environment, it is necessary to apply the materials based on the knowledge of various composites.

VII. Program Table

NOVEMBER 30th(THU.), 2017 [Oral Session]

Oral Session I [14:30 ~ 15:20] : Room 301

☐ Oral Session I		Chair : Ehn-Joo Nah
14:30~14:40	A Study on Autonomous Travelling Control of Direct Driving Robot with Two Driving Min-Seong Kim ¹ , Hyun-Woo Song ² , Ehn-Joo Nah ³ , Sung-Hyun Han ³	
14:40~14:50	A Precise Control of Robot Manipulator with Eight D.O.F Based on Digital Signal Process Hyun-Woo Song ¹ , Jae-Hyung Kim ² , Min-Seong Kim ³ , Woo-Song Lee ⁴ , Yeon-Guk Noh ⁵	
14:50~15:00	A Study on Robust Motion Control of Robot Arm Based on Neurel Network Jae-Hyung Kim ¹ , Min-Seong Kim ² , Hyun-Min Kim ³ , Se-Han Lee ⁴ , Uhn-Joo Nah ⁴ , Sung-Hyun Han ⁴	
15:00~15:10	A Flexible Control of Robot Hand Fingers with Six Joints Dong-Hwa Jeong ¹ , Min-Seong Kim ² , Gi-Su Shin ³ , Se-Han Lee ⁴	
15:10~15:20	A Stable Walking Motion Control of Humanoid Robot with 24 Joints Hyun-Min Kim ¹ , Min-Seong Kim ² , Hyun-Woo Song ³ , Yang-Keun Jung ⁴	

Oral Session II [15:20 ~ 16:10] : Room 301

☐ Oral Session II		Chair : Won-Sik Choi
15:20~15:30	Surface type broaching machine forced vibration analysis under normal cutting operation condition based on finite element method Pandu Sandi Pratama ¹ , Destiani Supeno ² , Jae-Young Byun ² , Joong Soon Lee ³ , Jeong Hwan Jeong ³ , Won-Sik Choi ^{2,#}	
15:30~15:40	The Characteristics of 4Mhz NDT Ultrasonic Transducer for Weld Quality Inspection of Spot Welding Robot Eon Uck Kang ¹ , Pandu Sandi Pratama ² , Jae Young Byun ¹ , Eun Suk Lee ¹ , Sung Won Chung ¹ , Won Sik Choi ^{1,#}	
15:40~15:50	The red ginseng vinegar fermentation manufacturing using "Uinkin" Se Ran Hwang, Destiani Supeno, Kwo Soon Hong, Chung Sung Won, Kwon Soon Goo, Park Jong Min, Kim Jong Soon, Won Sik Choi	
15:50~16:00	Improvement of the Life of the Electric Vehicle Carrier Reducer by the Finite Element Method Jae Young Byun ¹ , Pandu Sandi Pratama ² , Eun Suk Lee ¹ , Chun Suk Park ³ , Sung Won Chung ¹ , Won Sik Choi ^{1,#}	
16:00~16:10	Characteristics of Jujube Cherry Tomato Fermentation Destiani Supeno, Kwo Soon Hong, Chung Sung Won, Kwon Soon Goo, Park Jong Min, Kim Jong Soon, Won-Sik Choi	

Oral Session III [16:30 ~ 17:20] : Room 301

□ Oral Session III		Chair : Pandu Sandi Pratama
16:30~16:42	A Study on the tool for collecting insect pests from fruits trees Ji-Hee Woo ¹ , Destiani supeno ¹ , Keefe Dimas haris sean ¹ , En-Suk Lee ¹ , Mi-kyung Nam ¹ , Can-yeol Cha ² , Yeong-jo Moon ² , Won-Sik Choi ^{1*}	
16:42~16:56	Charactrtistics of Separation with Tofu and Tofu Container according to Water Temperature Eun Suk Lee ¹ , Jae Young Byeon, Mi Kyung Nam , Ji Hee Woo ¹ , Na Kyung Kim ² , Kang Sam Lee ³ , Won Sik Choi ¹ ,	
16:56~17:08	Fermentation system and characteristics of natural fermented vinegar using lotus and stems Mi Kyung Nam ¹ , Eun-Suk Lee ¹ , Ji Hee Woo ¹ , Jae-Young Byeon ¹ , Won-Sik Choi ^{1*}	
17:08~16:20	The change of plant and fluorescent lamp temperature in closed system cultivation Dimas Harris Sean Keefe ¹ , Jaeyoung Byun ¹ , Pandu Sandi Pratama ² , Jeongyeol Cho ³ , Wonsik Choi ^{1,#}	

Poster Session I [17:20 ~ 18:00] : Room 301

☐ Poster Session I		Chair : In-Man Park
Poster 1	A Orientation Control of Vertical Articulated Robot Manipulator Based on Servoing Feedback in Working Space Hee-Jin Kim ¹ , Woo-Song Lee ² , Min-Seong Kim ³ , In-Man Park ⁴ and Sung-Hyun Han ⁵	
Poster 2	A Precise Position and Velocity Control of Vertical Type Robot Arm with Seven D.O.F Min-Seong Kim ¹ , Min-Hyuck Choi ² , Jeong-Suk Kang ³ , Nam-Il Yoon ³ , Jong-Bum Won ³ , Sung-Hyun Han ⁴	
Poster 3	A Stable Path Control of Robot Manipulator with 6 Joints for Forging Trimming Automation Min-Seong Kim ¹ , Jong-Hun Kim ¹ , Sung-Hun Noh ² , Gi-Su Shin ³ , Jeong-Suk Kang ⁴ , Jong-Bum Won ⁴ and Sung-Hyun Han ⁵	
Poster 4	A Study on Intelligent Control of Biped Robot for Smart Factory Un-Tae Ha ¹ , Min-Seong Kim ² , Byung-Suk Yoon ³ , Jung-Eup Gye ⁴ , Jong-Gyo Jung ⁵ and Sung-Hyun Han ⁶	
Poster 5	A Study on Intelligent Motion Control of Humanoid Robot for Smart Factory Min-Seong Kim ¹ , In-Man Park ² , Young-Hwa Jeong ³ , Sung-Hyun Han ⁴	

Poster Session II [17:20 ~ 18:00] : Room 301

☐ Poster Session II		Chair : Yang-Geun Jeong
Poster 1	A Study on Motion Control of Humanoid Robot for Human-Robot Interaction Min-Seong Kim ¹ , Byeong-Gap Moon ² , Kyu-Hyun Jung ³ , Myeong-Hwan Park ⁴ , Ju-Jang Lee ⁵ and Sung-Hyun Han ⁶	
Poster 2	A Study on Motion Control of Two Wheel Driving Mobile Robot by Voice Command for Smart Factory Gi-Hyun Kim ¹ , Ho-Young Bae ² , Woo-Song Lee ³ and Sung-Hyun Han ⁴	
Poster 3	A Study on Precise Control of Mobile Robot with Dual-Arm Woo-Song Lee ¹ Ki-Young Ko ² , Ho-Young Bae ³ , Mun-Keun Cho ⁴ , Ki-Hyun Kim ⁵ , and Sung-Hyun Han ⁶	
Poster 4	A study on Robust Control for Working of Humanoid Robot Min-Seong Kim ¹ , Woo-Song Lee ² , Hyun-Suk Sim ³ , Ho-Young Bae ⁴ , Sung-Hyun Han ⁵	
Poster 5	A Study on walking Control of Biped Robot by Voice Command for FA Yang-Geun Jeong ¹ , Min-Seong Kim ² , Yeon-Guk Noh ³ , and Sung-Hyun Han ⁴	

Oral Session III [13:30 ~ 14:50] : Room 301

☐ Oral Session III		Chair : Jang-myung Lee
13:30~13:46	6 DOF Manipulator Technology in ROS Environment Dong-eon Kim ¹ , Dong-ju Park ¹ , Ki-seo Kim ¹ , Jin-hyun Park ¹ and Jang-myung Lee ^{1*}	
13:46~14:02	Edge Simplification Method for Stereo Images Eun Kyeong Kim ¹ , Hyunhak Cho ² Jongeun Park ¹ and Sungshin Kim ^{1*}	
14:02~14:18	Inverse Kinematic Analysis of 5 DOF Manipulator using Numerical method Jin Gon Yoon ¹ , Sun Oh Park ¹ , Min Gyu Jung ¹ and Min Cheol Lee ^{1*}	
14:18~14:34	Sliding Mode Control Of 2 Link Robotic Manipulator Saad Jamshed ¹ , Karam Dad ¹ and Min Cheol Lee ^{1*}	
14:34~14:50	Utilizing air pressure sensor for detecting of object Jin-hyun Park ¹ , Tae-eon Kim ¹ , Ki-seo Kim ¹ , Dong-eon Kim ¹ , and Jang-myung Lee ^{1*}	

Oral Session V [13:30 ~ 14:50] : Room 600A

☐ Oral Session V		Chair : Kang-Hyun Jo
13:30~13:50	Analysis of Traffic Sign Classification using Multiple Image Preprocessing Methods Qing Tang ¹ and Kang-Hyun Jo ²	
13:50~14:10	Exploiting Different Shape Features for Fall Action Classification Sowmya Kasturi ¹ and Kang-Hyun Jo ²	
14:10~14:30	Vehicle Contour Segmentation Using 3D Point Cloud Yang Yu ¹ , Laksono Kurnianggoro ¹ , Kang-Hyun Jo ²	
14:30~14:50	Human Pose Estimation from Images Using Convolution Neural Networks Hoang Van Thanh ¹ and Kang-Hyun Jo ²	

Oral Session VI [15:00 ~ 16:20] : Room 301

☐ Oral Session V		Chair : Jang-Sik Park
15:00~15:20	Video Based People Counting with Pedestrian Detection and Tracking Husnu Baris Baydargil, Jangsik Park and Keumyoung Son	
15:20~15:40	Features of Joint Relative Distance Based Gait Analysis on Human Identification in 3D Environment Omer Faruk Ince ¹ , Ibrahim Furkan Ince ¹ , Jang Sik Park ^{1*} , Jong Kwan Song ¹	
15:40~16:00		
16:00~16:20		

Poster Session I [15:00 ~ 15:40] : Room 301

☐ Poster Session I		Chair : Woo-Song Lee
Poster 1	A Study on the Path Planning and Control of Robot Manipulator with Six Joint for Molding and Forging Process Automation Min-Seong Kim ¹ , Geo-Seung Choi ² , Byung-Seuk Yoon ³ , Jong-Bum Won ⁴ , Sung-Hyun Han ⁵	
Poster 2	Intelligent Control of Mobile-Manipulator Robot by Voice Command for Smart Factory Yang-Keun Jeong 1* , Min-Seong Kim 2 , Hui-Jin Kim 3 , Woo-Song Lee 4 , Yeon-Guk Noh 5 , Geo-Seung Choi 6 , In-Man Park 7 Jang-Sik Park 8 and Sung-Hyun Han 9	
Poster 3	A Study on Robust Control of Robot Gripper Based on Pressure Sensors for Marking Automation Process Min-Seong Kim 1 , Jeong-Seok Kang 2 , Jong-Dae Won 3 ,Sung-Hyun Han 4 ,Han-Sung Kim 4	
Poster 4	A Study on Accurate Motion Control of Mobile Robot with Dual-Arm Yang-Geun Jeong 1 , Gi-Su Shin 2 , Min-Seong Kim 2 , In-Man Park 3, Sung-Hyun Han 4	

Poster Session I [15:00 ~ 15:40] : Room 301

☐ Poster Session II		Chair : Hyun-Suk Sim
Poster 1	A Real-Time Control for Precise Walking of Biped Robot Jeong-Chul Moon 1 , In-Man Park 2 ,Sung-Hyun Han 3	
Poster 2	A Robust Neural Network Control of Robot Manipulator for Industrial Application Eun-Taek Ju 1 , Woo-Song Lee 2,Sung-Hyun Han 3	
Poster 3	A Study on Grasping Control of Hand Fingers 12 Joints Jae-Jong Kim 1 , In-Man Park 2 , Hyun-Suk Sim 3, Sung-Hyun Han 4	
Poster 4	A Study on Intelligent Control of Bipped Robot by Voice Command Chang-Keun Oh 1 , Woo-Song Lee 2, Sung-Hyun Han 3	

Poster Session II [15:00 ~ 15:40] : Room 301

☐ Poster Session III		Chair : Eun-Tae Ha
Poster 1	A Study on Real-Time Control of Intelligent Robot with Three Wheel Moon-Kuen Cho 1 , In-Man Park 2, Sung-Hyun Han 3	
Poster 2	A Study on Robust Control of Robot Manipulator for Industrial Application In-Kyun Yoon 1 ,Woo-Song Lee 2, Sung-Hyun Han 3	
Poster 3	A Study on Robust Motion Control of Humanoid Type Robot for Cooperative Working Ki-Young Ko 1 , Eun-Tae Ha 2, Sung-Hyun Han 3	
Poster 4	A Study on Stable Control of Intelligent Robot with Dual Arm for Cooperation working Ho-Young Bae 1 , Yang-Keun Jeong 2 , Woo-Song Lee 3 , In-Man Park 4, Sung-Hyun Han 5	

Poster Session III [15:00 ~ 15:40] : Room 301

☐ Poster Session IV		Chair : Yang-Geun Jeong
Poster 1	A Study on Travelling Control of Humanoid Type Mobile Robot with Three Wheel Se-Bin Park1, In-Man Park 2and Sung-Hyun Han3	
Poster 2	A Travelling Control of Mobile Robot Based on Sonar Sensors Jae-Sang Kim1 Yang-Keun Jeong2 Jong Bum Won3 and Sung-Hyun Han4	
Poster 3	A Precise Position Control of Robot Manipulator with Eight Joints Taek-Jong Nam1 Yang-Keun Jeong2, Jong Bum Won3, Hyun-Cheol Lee4 and Sung-Hyun Han5	
Poster 4	A Stable Control of Legged Robot Based on Ultrasonic Sensor Seong-Gyu Park1, Eun-Tae Ha2 and Sung-Hyun Han3	

Poster Session IV [15:40 ~ 16:20] : Room 301

☐ Poster Session V

Chair : In-Man Park

Poster 1	A Study on Grasping Control of Robot Hand with 12 Joints Chang-Young Lee ¹ , Yang-Keun Jeong ² and Sung-Hyun Han ³
Poster 2	A Study on Intelligent Control of Humanoid Robot with Voice recognition Min-Hwan Lee ¹ , Woo-Song Lee ² and Sung-Hyun Han ³
Poster 3	A Study on Robust Control of Articulated Robot Arm with Seven Joints Hee-Jin Kim ¹ , Sung-Cheol Jang ² , and Sung-Hyun Han ³
Poster 4	A Study on Robust Control of Robotic Hand with 14 Joints for cooperate Working Young-Tae Back ¹ , Yang-Keun Jeong ² and Sung-Hyun Han ³

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Poster Session IV [15:40 ~ 16:20] : Room 301

☐ Poster Session VI

Chair : Woo-Song Lee

Poster 1	A Study on Robust Voice Control of Biped Robot for Cooperate working Seong-Ju Choi ¹ , Jong-Dae Won ² , Woo-Song Lee ³ , and Sung-Hyun Han ⁴
Poster 2	A Study on Stable Walking Control of Mobile Robot with Dual Arm Hyung-Tae Lee ¹ , Yang-Keun Jeong ² , Woo-Song Lee ³ , In-Man Park ⁴ , and Sung-Hyun Han ⁵
Poster 3	A Study on Visual Feedback Control of Articulated Robot Arm with Seven Joints Ki-Hyun Kim ¹ , Hyun-Suk Sim ² and Sung-Hyun Han ³