The 26th East Asia Round Table Meeting

& International Symposium

Thursday, November 2, 2023

National Academy of Engineering of Korea

Chinese Academy of Engineering

Engineering Academy of Japan

Sponsored by

Ministry of Trade, Industry and Energy

Contents

Program

Program at a Glance

- Date : Thursday, November 2, 2023
- Venue : Bastille room, 3rd floor of Sofitel Ambassador Seoul
- Co-Organizers

  NAEK, National Academy of Engineering of Korea

  CAE, Chinese Academy of Engineering

  EAJ, Engineering Academy of Japan

Time	Program
09:30-15:10	International Symposium on Autonomous Driving for Future Mobility - Autonomous vehicle technologies - Autonomous driving infrastructure - Other applications of autonomous driving technologies

The 26th EA-RTM International Symposium

Autonomous Driving for Future Mobility

09.30am-3.10pm
Thursday, November 2, 2023
Bastille room, Sofitel Ambassador Seoul, Korea

Opening Address

09:30-09:45 Dr. Kinam Kim
President, National Academy of Engineering of Korea
Prof. Jianfeng Chen
Secretary-General, Chinese Academy of Engineering
Dr. Yuko Harayama
Chair, International Committee of Engineering Academy of Japan

Session 1: Autonomous vehicle technologies
Moderator: Prof. Jai-ick Yoh, Member of International Relations Committee

10:00-10:05 Session Introduction
10:05-10:20 Software-Defined Vehicle: Ultimate Compute Platform for Autonomous Vehicles
Prof. Seongsoo Hong, The Korean Society of Automotive Engineers
10:20-10:35 Vehicle-Road-Cloud Integration System: Innovative Practice of Intelligent Transportation Systems in China
Prof. Keqiang Li, Tsinghua University
10:35-10:50 Towards Realization of Automated Driving, RoAD to L4 Project in Japan
Mr. Toshio Yokoyama, National institute of advanced Industrial Science and Technology
10:50-11:10 Discussion

Session 2: Autonomous driving infrastructure
Moderator: Dr. Young Ky, Chair of Autonomous Driving Committee

11:10-11:15 Session Introduction
11:15-11:30 China's Intelligent Public Transport Infrastructure System Technology and Case Studies
Prof. Hongwen He, Beijing Institute of Technology

11:30-11:45 Automated Driving Bus Operation with V2I and Magnetic Positioning System in Kashiwa City
Prof. Yoshihiro Suda, Tokyo University

11:45-12:00 Visual and Range Sensing in Autonomous Driving
Assoc. Ayoung Kim, Seoul National University

12:00-12:20 Discussion

12:20-14:00 Lunch

Session 3: Other applications of autonomous driving technologies
Moderator: Dr. Kyung Hee Song, Member of International Relations Committee

14:00-14:05 Session Introduction

14:05-14:20 Why and How Rural Cities Lead the Deployment of Autonomous Driving Shuttles in Japan
Mr. Takuya Horikawa, BOLDLY inc

14:20-14:35 Application of Autonomous Driving Technologies in Other Industries
Dr. Jaeseung Cheon, Director of Hyundai Mobis

14:35-14:50 Exploration and Application of Autonomous Buses for Future Public Transportation in China
Dr. Gaopeng Li, Zhengzhou Yutong Group Co.,Ltd.

14:50-15:10 Discussion

Biographies

&

Abstracts

Session I

[Session 1 Speaker]

Seongsoo Hong

Chairman, The Division of Vehicle Semiconductor and System Software at the
Korean Society of Automotive Engineers
& Professor with Electrical and Computer Engineering Department
Seoul National University

Seongsoo Hong earned his B.S. and M.S. degrees in computer engineering from Seoul National University, Korea, in 1986 and 1988, respectively. He received his Ph.D. degree in computer science from the University of Maryland, College Park, in 1994. He is currently a professor in the Department of Electrical and Computer Engineering at Seoul National University. His current research interests include software-defined vehicles and cloud native computing, task scheduling and resource management in the Linux kernel, embedded and real-time systems design, real-time operating systems, software architecture for embedded and real-time systems, and cross-layer optimization of complex multi-layered software systems. He has advised numerous global companies on system software innovation, including Samsung Electronics, Hyundai Autonet, Samsung Advanced Institute of Technology, Hyundai Kefico, and Hyosung Heavy Industries. He has served on the board of directors at Hanwha Systems, Mercury Systems, and LS Automotive. He is currently a advising committee member of IEEE RTCSA. He served as a general co-chair of IEEE RTCSA 2006 and CASES 2006 and as a program committee co-chair of IEEE RTAS 2005, RTCSA 2003, IEEE ISORC 2002 and ACM LCTES 2001. He has served on numerous program committees, including IEEE RTSS and ACM OOPSLA. He is a member of the National Academy of Engineering of Korea. He is currently a senior member of the IEEE and a senior member of the ACM.

Software-Defined Vehicle: Ultimate Compute Platform for Autonomous Vehicles

Autonomous driving has been a very active research focus in both industry and academia over the past decade. Much research has been published and commercialized in the form of ADAS (advanced driver assistance system) and Level 3 autonomous driving. However, Levels 4 and 5 autonomous driving is still far from being perfected, and pilot operations in cities like San Francisco are showing many limitations. Accordingly, it is expected that fully autonomous driving will take quite a long time for it to become a revenue stream in the automotive industry.

While the revolution of autonomous driving has been slow in coming, software defined vehicles (SDVs) has emerged as the next big disruptor in the automotive industry. SDVs are vehicles whose features and functions are implemented not in mechanical and/or electronic hardware but in software. This enables vehicle servitization and creates new value addition in the automotive industry.

Unfortunately, the technology to implement SDVs is still very challenging. In this talk, I will provide a background on the emergence of SDVs and define what SDVs are. In turn, I will introduce the centralized vehicle compute platform that is required to implement SDV. The SDV's vehicle compute platform will become the ultimate computing platform for the future autonomous cars and thus expedite the realization of fully autonomous driving.

[Session 1 Speaker]

Keqiang Li

CAE Memeber & Professor at Tsinghua University

He obtained academic B.S. degree in Department of Automobile Engineering from Tsinghua University in 1985 and obtained Ph.D. degree in Mechanical Engineering from Chongqing University in 1995. He is Director of the State Key Laboratory of Intelligent & Green Vehicles and Transportation, Chief Scientist of the National Innovation Center of Intelligently Connected Vehicle. In 2021, he was elected as the Member of Chinese Academy of Engineering.

He has long been dedicated to the theoretical research and product development on the dynamic design and control for the automobile intelligent driving system. In response to the demand of technological evolution and industrialization development of the automotive intelligent technology, he made breakthroughs in three core and key technologies including “collaborative control, shared structure, integration of vehicle and cloud”. He led the development of three generations of systematic devices and their industrialized application, including “intelligent and safe driving”, “intelligent integrated driving” and “intelligent connected driving”. These achievements made major contribution to the technological development as well as the industrialization of the core technologies in the area of intelligent automobile system in China.

He has been honored with two second-class State Technological Invention Awards, one second-class State Science and Technology Progress Award, as well as the special Science and Technology Progress Award of China’s Automobile Industry. He has been granted more than 60 invention patents, has authored more than 200 high-quality papers and published three academic books.

He is one of the leading scientists in the area of intelligent automobile in China. He

brought forward the terminology of “Intelligent Connected Automobile” as well as its technical solutions in China. He is also the technical director for major National Industrialization Project. He served as Head of Specialist Group in promoting the development of intelligent connected automobile set up by China’s Ministry of Industry and Information Technology, Chief Editor of “Journal of Intelligent & Connected Vehicles” and “Journal of Automotive Safety & Energy Conservation”.

Vehicle-Road-Cloud Integration System: Innovative Practice of Intelligent Transportation Systems in China

By integrating AI, information and communication technology, and transpo rtation technology, intelligent and connected vehicles can realize safer, gre ener, and more comfortable driving. What enables the integration of vehic le, road and cloud is a new Cyber-Physical System called the Vehicle-R oad-Cloud Integration System.With respect to the systematic closed-loop c ontrol technology, the Vehicle-Road-Cloud Integration System can efficien tly optimize the roadside perception configuration, and integrate driving pl anning and traffic control in a road network to support ITS. Moreover, th e system performs integrated perception, decision and control in complex traffic scenarios while ensuring high system stability.In this speech, it hop es to show the progress of the latest works on the development of Vehi cle-Road-Cloud Integration System, and to give audience a clear picture o f the system advanced benefit that is to come.

[Session 1 Speaker]

Mr. Toshio Yokoyama

National institute of advanced Industrial Science and Technology (AIST)
Invited Senior Researcher

He joined Honda Motor Co.,Ltd. in 1979 and was transferred to Honda R&D the following year. In 2000, resided in Silicon Valley in California USA as vice president of Honda Research Americas. There, established Honda Research Institute USA in 2003 and became the first president of HRI.

In 2008, was the general manager of the Future Transportation Systems Laboratory. From 2012 to 2021, in charge of ITS and automated driving research and development as a senior chief engineer of Honda R&D Center.

After graduating from Honda at the end of March 2021, currently coordinating this project as an invited researcher at AIST.

Towards realization of automated driving, RoAD to L4 project in Japan

The Japanese government adopted a policy to realize and promote automated driving services as follows:

- Mark approximately 50 locations of deployment by FY2025.
- Acquire expertise and results to resolve problems in technology development, environmental improvement, and social acceptance by 2025 and achieve full-scale deployment by FY2027.
- The RoAD to L4 project is a five-year project which has played a leading role in achieving these goals and will continue working until FY 2025.

The progress and plans for the passenger mobility services are:

- We launched a Level 4 driverless automated driving vehicles service by remote monitoring at Eiheiji Town, Fukui Prefecture, in May of this year.
- We are working on commercializing a Level 4 automated driving bus service with safety staff at Hitachi, Ibaraki, to deploy it by the end of FY2023.
- We plan to commercialize a Level 4 automated driving bus with safety staff under mixed traffic in Kashiwa-no-ha district of Kashiwa, Chiba in 2025.
- Our final goal is to work with major stakeholders in the project to share the knowledge and how-to of previous cases and has a consensus to roll out plans and walk them through for timely deployment.

The progress and plans for the transportation of goods are as follows:

- We plan to commercialize truck logistics using automated Level 4 trucks between Tokyo and Nagoya on the Second Tomei Expressway in 2025 or later.

Session II

[Session 2 Speaker]

Hongwen He

Professor at Beijing Institute of Technology

He has long been engaged in the research on Power Transmission and Its Control for New Energy Vehicle. He built the theory of analytic modeling and state estimation for power battery and has been honored the first-class Natural Science Awards of Ministry of Education. He has been selected as global high cited author by Clarivate Analytics since 2019. He invented the method for multitask coordinated control and multiscale optimization of electronic control parameters for the dynamic system of new energy vehicles and has been honored the first-class Science and Technology Progress Award of Ministry of Education, first-class Technological Invention Award of China's Automobile Industry. He has authored more than 200 papers and has been granted over 60 invention patents, being honored two China Patent Excellence Award as the first inventor.

China's Intelligent Public Transport Infrastructure System Technology and Case Studies

Traffic congestion prevails as a salient challenge in medium to large-sized cities. Strategies involving the amalgamation of connected vehicles, infrastructure enhancements, and intelligent upgrades can notably amplify urban bus transit efficiency and optimize traffic flow.

Focused on a "Vehicle-Road-Cloud-Network" collaborative architecture, the intelligent public transit infrastructure system integrates diverse technological dimensions: smart vehicles, intelligent roads, unified networks, and astute decision-making and management via big data.

The incorporation of autonomous driving technology into bus upgrades cultivates advanced vehicle intelligence, subsequently bolstering passenger safety and comfort. A crucial stride toward enhancing intelligent public transit functionality involves the integration and enhancement of roadside perception and communication devices, facilitating intelligent road upgrades.

Orchestrated by the Beijing Institute of Technology, the National Big Data Alliance of New Energy Vehicles (NEVs) has adeptly linked over 14.2 million NEVs, erecting the world’s most extensive connected vehicle technology system for NEVs, and crucially underpinning the operational safety management of intelligent public transit.

This paper systematically analyzes the applications of intelligent public transit infrastructure technologies across various Chinese cities, prospecting future development trajectories and their supportive roles in forging intelligent cities and smart societies.

[Session 2 Speaker]

Yoshihiro Suda

Professor, Advanced Mobility Research Center, Institute of Industrial Science (IIS)
&
Director, Mobility Innovation Collaborative Research Organization (UTmobI) at University of Tokyo

Yoshihiro SUDA is Professor of Institute of Industrial Science (IIS). He graduated from The University of Tokyo, Department of Mechanical Engineering in 1982 and got Doctoral Degree in 1987. After working as Associate professor of Hosei University and Guest Associate Professor of Queen's University at Kingson, Canada, he is Professor of Institute of Industrial Science, The University of Tokyo from 2000 and Director of Mobility Innovation Collaborative Research Organization (UTmobI) from 2018. His research area is dynamics and control engineering, human-machine interface, and their applications to railway vehicle, automobile and new generation mobility. He has conducted many industry-academia collaborative projects with automobile and railway industries, and developed many practical outputs such as automated platoon truck system. He is a board member and former executive vice president of JSAE, ITS Japan and charged committee member of Japanese Governments. He hosted many international conferences.

Automated Driving Bus Operation with V2I and Magnetic Positioning System in Kashiwa City

The University of Tokyo has been conducting automated driving bus operation since November 2019 in collaboration with the Kashiwa ITS Promotion Council in Kashiwa City and many related organizations. The automated driving bus is operated by Tobu Bus Central, a local bus company, using a system developed by Advanced Smart Mobility Co., Ltd., a venture company from the University of Tokyo. This system implements an infrastructure collaborative system that utilizes a magnetic positioning system for the self-position estimation system, and also implements V2I system that uses information from traffic lights and ground sensors. In this paper the outline will be presented. In this project, we are not only conducting technical demonstrations on how to coordinate autonomous systems and V2I, but also considering building an ecosystem for social implementation. In the near future, we plan to expand to Level 4 using a Ministry of Economy, Trade and Industry project.

[Session 2 Speaker]

Ayoung Kim

Associate Professor in the department of mechanical engineering
Seoul National University

Ayoung Kim works as an associate professor in the department of mechanical engineering at Seoul National University since 2021 Sep. Before joining SNU, she was at the civil and environmental engineering, Korea Advanced Institute of Science and Technology (KAIST) from 2014 to 2021. She has B.S. and M.S. degrees in mechanical engineering from SNU in 2005 and 2007, and an M.S. degree in electrical engineering and a Ph.D. degree in mechanical engineering from the University of Michigan (UM), Ann Arbor, in 2011 and 2012. She also worked as a post-doctoral researcher in naval architecture and marine engineering, at U of M in 2013 before she worked at Electronics and Telecommunications Research Institute (ETRI) as a senior researcher.

Visual and Range Sensing in Autonomous Driving

This talk delves into the cutting-edge advancements in sensor fusion for r obust localization and mapping, with a specific focus on the integration o f LiDAR and radar technologies. The first part of the talk explores LiDA R place recognition techniques, elucidating the significance of point cloud registration, feature extraction, and matching for accurate location identific ation. Additionally, it investigates multiple LiDAR SLAM, highlighting th e benefits of data fusion and sensor calibration in creating comprehensive and precise maps of complex environments.

In the second phase, we venture into the realm of radar odometry, a pro mising approach that utilizes radar sensors for accurate motion estimation. By operating in challenging terrains and adverse weather conditions, rada r presents a compelling alternative to traditional odometry methods. More over, the talk introduces the emerging concept of radar place recognition, uncovering its unique potential in environment recognition where Lidar or visual sensors might face limitations. By synergizing these sensor modali ties, attendees will gain valuable insights into how autonomous systems a nd robotic platforms can significantly enhance their navigation capabilities, paving the way for safer and more efficient operations in various applic ations.

Session III

[Session 3 Speaker]

Takuya Horikawa

Manager, Business Development, BOLDLY Inc.

Takuya Horikawa is currently a manager at Mobility Service Section of SoftBank Corp. as well as a manager at Business Development Section of BOLDLY Inc., a SoftBank-funded startup company leading the commercial deployment of autonomous driving vehicles in Japan. Prior to joining BOLDLY/SoftBank, Horikawa worked for Yamaha Motor for 10 years in charge of sales, marketing and business development in Japan, Singapore and Canada. He received his BA in Political Science from Waseda University in 2008 and his MBA from Kellogg School of Management at Northwestern University in 2020.

Why and How Rural Cities Lead the Deployment of Autonomous Driving Shuttles in Japan

The aim of this presentation is to explain how the AV deployments have been realized facing structural issues surrounding public transportation in Japan.

The presentation covers topics such as

- Mobility related issues and customer needs in Japan
- Overview of AV deployments in town of Sakai and other cities
- BOLDLY's vision of sustainable new mobility and our current business cases

[Session 3 Speaker]

Jaeseung Cheon

Head of FTCI (Future Technology Convergence Institute)
Hyundai Mobis

Dr. Jaeseung Cheon received his B.S., M.S., and Ph.D. in mechanical engineering at the Korea Advanced Institute of Science and Technology. After spending a year as a post-doctoral research engineer he joined Hyundai Mobis in 2004. He acted as a lead engineer and team leader for various brake industry product developments from advanced research to mass production; conventional brakes, electronic brakes, electric parking brakes, regenerative braking, and brake by wire. During this period, he began serving as a full time Technical Committee Member for the SAE Brake Colloquium.

In 2018, his role shifted to become head of the Mobis Technical Center Europe based in Frankfurt. There his area of engineering engagement expanded to all chassis and safety related parts as well as in-vehicle infotainment, advanced driver assistance technologies, and e-powertrain. It was also an opportunity for him to expand his engineering and operational expertise in a global environment.

More recently, he has been leading the Future Technology Convergence Institute (FTCI, formerly known as the R&D Division) for the past few years. FTCI provides state of the art expertise in CAE, materials engineering, design, process engineering, and operations for all production engineering functions at the company. This includes activities in governance of global standards such as ASPICE, ISO26262, and cyber security. Through FTCI, his recent focus is on the development of convergence technologies for future mobility such as e-corner systems, future cockpit and exterior, mobility related bio and health systems, software defined features, modular designs, virtual design methodology, and environment friendly materials. These activities have extended to other external roles such as leader of the Technology and Service Committee at the Korea Association of Autonomous Mobility Industry (KAAMI) and a member of the Organizing Committee for EVS37.

Application of Autonomous Driving Technologies in Other Industries

With the vision of uncharted possibilities for mobility transformation in mind, the worldwide interest and rush for development of technologies for autonomous vehicles has been on-going for over a decade. However, although the achievement of technological functionality and performance has reached high levels, concerns over reliability, high cost, and other risks have slowed down the actual commercialization of fully autonomous vehicles. In this regard, the expansion of related core technologies to more widespread development in various industries can act as a springboard to bring an earlier ubiquitous autonomous reality.

Although the detailed specifications can differ, the technological foundation of object detection, perception, localization, sensors, actuators, control devices, path algorithms, interaction with infrastructure, etc. can be shared in various fields such as robotics, aviation, military, agriculture, construction, and logistics. In particular, the logistics transportation market with its wide diversity of delivery needs throughout its value chain has great potential to actively implement and innovate various autonomous driving technologies. For example, unmanned Autonomous Mobile Robots (AMR) are devices that move freely between and within manufacturing lines and warehouses to transport materials or goods. Like autonomous vehicles, these robots rely on a combination of sensors, receive information from infrastructure, and determines optimal routes for efficient and safe operation. And compared to vehicles on the road, the more controlled environment of warehouses provides a natural arena to strengthen the safety and reliability features of relevant technologies.

This is just one application example of the precision sensor based cognition-judgment-control software technology that can be implemented in the wide-ranging value chain of the logistics industry. Along with other automotive industry developments such as electrification, modular platforms, and E/E architecture, autonomous driving technologies can be a key part of cross-industry collaborative activities to bring about generational transformation for all industries.

[Session 3 Speaker]

Gaopeng Li

Dr. & Senior Engineer of Zhengzhou Yutong Group Co.,Ltd.

At present he serves as Director of the New Energy Research Institute of Yutong Group Co.,Ltd, Deputy Technical Director of Yutong Group Co., Chief Engineer of National Engineering Technology Research Center of Electronic Control and Safety for Electric Bus. He was responsible for the R&D and commercialization of new energy bus for Yutong Group Co., doing pioneer and groundbreaking work in the area of vehicle integration, power system, R&D on safety technology and the establishment of standard system for new energy bus, which contributed to its large-scale application. He was honored one Second-Class State Science and Technology Progress Award as the first investigator. In the last five years, as an expert on engineering technology for intelligent connected bus, he led the research work on automatic driving and intelligent internet connection for Yutong Bus. Under his leadership, the research team developed Yutong's autonomous driving bus "Xiaoyu", whose modelling design won the Red Dot Award. He also led the large-scale demonstration application of Xiaoyu, through which the autonomous driving technology has been continuously improved.

Exploration and Application of Autonomous Buses for Future Public Transportation in China

With the accelerated convergence of automobile, electronics, communication, artificial intelligence and other techniques, autonomous driving has become a hot topic in global automotive industry, and has also become a new trend of future travel. Bus is an important components of public transportation in the city, autonomous buses is therefore important for promoting efficient and low-carbon public transport. As an important member of bus supplier in the world, YuTong has completed many tests and verification of high-level autonomous buses. In the opinion of YuTong, urban public transportation will be undertaken by Level 3 autonomous buses, Level 4 autonomous shuttle buses will be used for branch lines. Through a collaborative control of "people-vehicle-road-network-cloud", public transportation facilities connection, quick and efficient transfer, connection between various transportation components will be achieved. Up to now, YuTong has carried out demonstration applications of Level 3 and Level 4 autonomous buses in multiple cities, massive-scale operation data has been collected. For public transportation in the future, YuTong will collaborate with global resources to explore and promote the development of autonomous buses, and provide better travel experience for all passengers.