Jin Hyun Kim

Curriculum Vitae

Contact Info

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Research and Professional Interests

- AI Safety and Security: Formal Verification and Validation
- Medical Artificial Intelligence: Diagnostic Modeling and Clinical Decision Support
- Large Language Models (LLMs): Domain-Specific Adaptation and Trustworthy AI
- Cyber-Physical Systems (CPS): Medical Devices and Autonomous Driving Systems
- Real-Time Systems and Operating System Design and Analysis

Goal

- Formal Assurance and AI-driven Software Architecture for Trustworthy Cyber-Physical and Autonomous Systems, pursuing enhanced AI safety, reliability, and security for a trustworthy and human-centered AI society.

Education

2001–2011 **Ph.D**, *Korea University*, Seoul, South Korea, GPA 4.18/4.5 .
Title TRoS : Formal Specification and Verification for Platform-constrained Embedded Software
Supervisors Professor Jin-Young Choi
Area of Study Formal methods and engineering for real-time embedded software

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1999–2001 **Master**, *Korea University*, Seoul, South Korea, GPA 4.1/4.5.
Title Design and Verification of Shut-down Embedded Software based on Esterel
Supervisors Professor Jin-Young Choi
Area of Study Formal methods and engineering for real-time embedded software

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1991–1999 **Bachelor**, *Hankook University of Foreign Languages*, Gyung-gi, South Korea, GPA 3.27/4.5.

Academic Appointments

Dec 2019–Present Associate Professor, Gyeongsang National University, Jinju, Republic of Korea
Research Areas: AI Safety and Trustworthiness in Medical Artificial Intelligence, Autonomous Driving Systems, and Large Language Models

Dec 2015-Feb 2019 Post-doctor, University of Pennsylvania, Philadelphia, USA; Supervisor: Insup Lee

Model checking and formal analysis of cyber-physical systems, *connected vehicle systems* and *medical devices*. Developing optimization techniques for *hierarchical real-time systems*.

Dec 2014-Dec 2015 Researcher, INRIA/IRISA, Rennes, France

Supervisor: Axel Legay

Developed model checking techniques for hierarchical real-time systems based on component-based compositional approaches. Developed a model checking framework for vehicle ECU systems. Developed a model checking technique for *Software Product Line Engineering (SPLE)*.

Dec 2012-Dec-2014 Post-doctor, Center for Embedded Software and System, Aalborg University, Denmark; Supervisor: Kim G Larsen

Development model checking framework to timing analysis of vehicle systems using component-based approach. Developed a model checking framework for hierarchical real-time systems using Uppaal model checking.

Mar 2011-Dec 2012 Post-doctor, Software architecture lab. KAIST (Korea Advanced Institute of Science and Technologies), South Korea; Supervisor: Sung-Won Kang (Software architecture, Software product line)

Formal approaches to AUTOSAR designs and analysis, Formal modeling and analysis methods for heterogeneous resource-constrained CPS.

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Publications

International Journals

Soomin Cho, Inhye Kang, and **Kim, Jin Hyun**. From timed automata to go: Formally verified code generation and runtime monitoring for cyber-physical systems. *IEEE Access*, 13:161729–161749, 2025.

Kim, Jin Hyun et al. Low-cost and fast epiretinal membrane detection and quantification based on sd-oct. *IEEE Access*, 2025. Accepted for publication, 2025.

Kim, Jin Hyun et al. Noise-robust markerless video gait anomaly detection via two-stage acquisition and lstm autoencoders. *Scientific Reports*, 2025. Accepted for publication, 2025.

Kim, Jin Hyun et al. Ophtimus-v2-tx: A compact domain-specific llm for ophthalmic diagnosis and treatment planning. *Scientific Reports*, 2025. Accepted for publication, 2025.

Kim, Jin Hyun et al. Development of oculomics artificial intelligence for cardiovascular risk factors: A case study in fundus oculomics for hba1c assessment and clinically relevant considerations for clinicians. *Asia-Pacific Journal of Ophthalmology*, 13(4), July 2024. Affiliation correction in progress as of 2024-11-01.

Kim, Jin Hyun et al. Estimation of best corrected visual acuity based on deep neural network. *Scientific Reports*, 12(1), October 2022.

Jin Hyun Kim et al. Machine learning-based optimization of pre-symptomatic covid-19 detection through smartwatch. *Scientific Reports*, 12(1), May 2022.

Kim, Jin Hyun et al. Asymmetry between right and left fundus images identified using convolutional neural networks. *Scientific Reports*, 12(1), April 2022. Corrigendum noted 2022-10-25.

Jin Hyun Kim et al. A deep learning ensemble method to visual acuity measurement using fundus images. *Applied Sciences*, 12(6), March 2022.

Kim, Jin Hyun et al. Development of fully automated anterior chamber cell analysis based on image software. *Scientific Reports*, 11(1), May 2021.

Kim, Jin Hyun et al. Model checking resiliency and sustainability of in-vehicle network for real-time authenticity. *Applied Sciences*, 11(3), February 2021.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim G. Larsen, Marius Mikucionis, Ulrik Nyman, and Arne Skou. Statistical and exact schedulability analysis of hierarchical scheduling systems. *Sci. Comput. Program.*, 127:103–130, 2016. **SCI(E), Impact Factor: 1.064**.

Jin Hyun Kim and Axel Legay, Louis-Marie Traonouez, Abdeldjalil Boudjadar, Ulrik Nyman, Kim G. Larsen, Insup Lee, and Jin-Young Choi. Optimizing the resource requirements of hierarchical scheduling systems. *SIGBED Review*, 13(3):41–48, 2016.

Kim, Jin Hyun, Inhye Kang, Sungwon Kang, and Abdeldjalil Boudjadar. A process algebraic approach to resource-parameterized timing analysis of automotive software architectures. *IEEE Transactions on Industrial Informatics*, 12(2):655–671, 2016. SCI(E), Impact Factor: 4.708.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim G. Larsen, Marius Mikucionis, Ulrik Nyman, and Arne Skou. A reconfigurable framework for compositional schedulability

and power analysis of hierarchical scheduling systems with frequency scaling. *Sci. Comput. Program.*, 113(P3):236–260, December 2015. **SCI(E), Impact Factor:1.064**.

Kim, Jin Hyun, Inhye Kang, Jin-Young Choi, Insup Lee, and Sungwon Kang. Formal synthesis of application and platform behaviors of embedded software systems. *Software & Systems Modeling*, pages 839–859, 2015. **SCI(E), Impact Factor:1.654**.

Kim, Jin Hyun, Jin-Young Choi, Inhye Kang, and Insup Lee. Generating composite behavior of embedded software components based on uml behavioral model and process algebra. *SIGSOFT Softw. Eng. Notes*, 36(1):1–9, January 2011.

Jin Hyun Kim, Inhye Kang, Jin-Young Choi, and Insup Lee. Timed and resource-oriented statecharts for embedded software. *Industrial Informatics, IEEE Transactions on*, 6(4):568–578, Nov 2010. **SCI(E), Impact Factor:4.708**.

Jin Hyun Kim, Jin-Young Choi, Inhye Kang, and Insup Lee. Uml behavior models of real-time embedded software for model-driven architecture. *Journal of Universal Computer Science*, 16(17):2415–2434, sep 2010. **SCI(E), Impact Factor:0.762**.

Jin Hyun Kim, Jae-Hwan Sim, and Jin-Young Choi. Resource-oriented design framework for embedded system components. *Electr. Notes Theor. Comput. Sci.*, 215:171–189, 2008.

Jin Hyun Kim, Na Young Lee, and Jin-Young Choi. Formal specification and verification of plc for certification. *SIGBED Review, Special Issues on Workshop on Innovative Techniques for Certification of Embedded Systems*, 3(4), Oct 2006.

International Conferences

Seung Ju Baek, Kuk Jin Jang, Sooyong Jang, Hyonyoung Choi, Minwook Kwon, Yong Seop Han, Seongjin Lee, **Kim, Jin Hyun**, and Insup Lee. Ophtimus-llm: Development of a specialized large language model for ophthalmology. In *Proceedings of the AAAI 2025 Workshop on Generative AI for Health (GenAI4Health)*, March 2025. Poster; GenAI4Health (AAAI 2025 Workshop); Submission No. 72; Published: 2025-03-08; Last modified: 2025-03-25; License: CC BY 4.0.

Sooyong Jang, Kuk Jin Jang, Hyonyoung Choi, Yong-Seop Han, Seongjin Lee, **Kim, Jin-Hyun**, and Insup Lee. Fundus image-based visual acuity assessment with pac-guarantees. In *Proceedings of the 4th Machine Learning for Health Symposium (ML4H 2025)*, volume 259 of *Proceedings of Machine Learning Research*, pages 535–549. PMLR, 2025. Presented at ML4H 2025.

Jin Hyun Kim, Deepak Gangadharan, Oleg Sokolosky, Axel Legay, and Insup Lee. Extensible energy planning framework for preemptive tasks. In *20th IEEE INTERNATIONAL SYMPOSIUM ON REAL-TIME COMPUTING*, 2017. May.

Jalil Boudjadar, **Jin Hyun Kim**, and Simin Nadjm-Tehrani. Performance-aware scheduling of multicore time-critical systems. In *2016 ACM/IEEE International Conference on Formal Methods and Models for System Design, MEMOCODE 2016, Kanpur, India, November 18-20, 2016*, pages 105–114. IEEE, 2016.

Mounir Chadli, **Jin Hyun Kim**, Axel Legay, Louis-Marie Traonouez, Stefan Naujokat, Bernhard Steffen, and Kim Guldstrand Larsen. A model-based framework for the specification and analysis of hierarchical scheduling systems. volume 9933 of *Lecture Notes in Computer Science*, pages 133–141. Springer, 2016.

Deepak Gangadharan, **Jin Hyun Kim**, Oleg Sokolsky, BaekGyu Kim, Chung-Wei Lin, Shinichi Shiraishi, and Insup Lee. Platform-based plug and play of automotive safety

features: Challenges and directions (invited paper). In *22nd IEEE International Conference on Embedded and Real-Time Computing Systems and Applications, RTCSA 2016, Daegu, South Korea, August 17-19, 2016*, pages 76–84. IEEE Computer Society, 2016.

Jin Hyun Kim, Axel Legay, Louis-Marie Traonouez, Mathieu Acher, and Sungwon Kang. A formal modeling and analysis framework for software product line of preemptive real-time systems. In Sascha Ossowski, editor, *Proceedings of the 31st Annual ACM Symposium on Applied Computing, Pisa, Italy, April 4-8, 2016*, pages 1562–1565. ACM, 2016.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim G. Larsen, Marius Mikučionis, Ulrik Nyman, Arne Skou, Linh Thi Xuan Phan, and Insup Lee. Flexible framework for statistical schedulability analysis of probabilistic sporadic tasks. In *Proceeding of 18th IEEE International Symposium On Real-Time Computing (ISORC)*, 2015.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim G. Larsen, Marius Mikučioni sand Ulrik Nyman, Arne Skou Linh Thi Xuan Phan, and Insup Lee. Quantitative schedulability analysis of continuous probability tasks in a hierarchical context. In *Proceeding of 18th International ACM Sigsoft Symposium on Component-Based Software Engineering (CBSE 2015)*, 2015.

Abdeldjalil Boudjadar, Juergen Dingel, Boris Madzar, and **Jin Hyun Kim**. Compositional predictability analysis of mixed critical real time systems. In Cyrille Artho and Peter Csaba Ölveczky, editors, *Formal Techniques for Safety-Critical Systems - Fourth International Workshop, FTSCS 2015, Paris, France, November 6-7, 2015. Revised Selected Papers*, volume 596 of *Communications in Computer and Information Science*, pages 69–84. Springer, 2015.

Jin Hyun Kim, Kim G. Larsen, Petur Olsen, Brian Nielsen, and Marius Mikučionis. Formal analysis and testing of real-time automotive systems using uppaal tools. In *Proceeding of 20th International Workshop on Formal Methods for Industrial Critical Systems (FMICS' 15)*, 2015.

Jin Hyun Kim, Axel Legay, Louis-Marie Traonouez, Abdeldjalil Boudjadar, Ulrik Nyman, Kim G. Larsen, Insup Lee, and Jin-Young Choi. Optimizing the resource requirements of hierarchical scheduling systems. In *Proceeding of 8th International Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS 2015)*, 2015.

Jin Hyun Kim, Brian Nielsen, Kim G. Larsen, Marius Mikucionis, and Axel Legay. Resource-parameterized timing analysis of real-time systems. In *Proceeding of 11th Haifa Verification Conference (HVC' 15)*, 2015.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim. G. Larsen, Marius Mikučionis, Ulrik Nyman, and Arne Skou. Schedulability and energy efficiency for multi-core hierarchical scheduling systems. In *Proceeding of International Congress on Embedded Real-Time Software and Systems (ERTSS)*, 2014.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim Guldstrand Larsen, Marius Mikucionis, Ulrik Nyman, and Arne Skou. Widening the schedulability of hierarchical scheduling systems. In Ivan Lanese and Eric Madelaine, editors, *Formal Aspects of Component Software - 11th International Symposium, FACS 2014, Bertinoro, Italy, September 10-12, 2014, Revised Selected Papers*, volume 8997 of *Lecture Notes in Computer Science*, pages 209–227. Springer, 2014.

Abdeldjalil Boudjadar, **Jin Hyun Kim**, Kim. G. Larsen, and Ulrik Nyman. Model checking process algebra of communicating resources for real-time system. In *Proceeding of the 26th Euromicro Conference on Real-Time Systems (ECRTS)*, 2014.

A.jalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim G. Larsen, Marius Mikucionis, Ulrik Nyman, and Arne Skou. Degree of schedulability of mixed-criticality real-time systems with probabilistic sporadic tasks. In *2014 Theoretical Aspects of Software Engineering Conference, TASE 2014, Changsha, China, September 1-3, 2014*, pages 126–130. IEEE, 2014.

A.Jalil Boudjadar, **Jin Hyun Kim**, Ulrik Nyman, and Kim Guldstrand Larsen. Compositional schedulability analysis of an avionics system using uppaal. In *Proceeding of International Conference on Advanced Aspects of Software Engineering (ICASSE)*, 2014.

Abdeldjalil Boudjadar, Alexandre David, **Jin Hyun Kim**, Kim Guldstrand Larsen, Marius Mikucionis, Ulrik Nyman, and Arne Skou. Hierarchical scheduling framework based on compositional analysis using uppaal. In José Luiz Fiadeiro, Zhiming Liu, and Jinyun Xue, editors, *Formal Aspects of Component Software - 10th International Symposium, FACS 2013, Nanchang, China, October 27-29, 2013, Revised Selected Papers*, volume 8348 of *Lecture Notes in Computer Science*, pages 61–78. Springer, 2013.

Younghun Han, Sungwon Kang, and **Jinhyun Kim**. Excharon: Improved modeling language for cyber-physical systems based on charon. In *Proceeding of IEEE 16th International Conference on Computational Science and Engineering*, pages 734–741, Los Alamitos, CA, USA, 2013. IEEE Computer Society.

Jin Hyun Kim and Sungwon Kang. A schedulability analysis framework for real-time infrastructure systems managing heterogeneous resources. In *Proceeding of International Workshop on Real-Time and Distributed Computing in Emerging Applications (REACTION)*, Dec 2012.

Jin Hyun Kim and Inhye Kang, Jin-Young Cand, and Insup Lee. Generating composite behavior of embedded software components based on uml behavioral model and process algebra. In *Proceeding of UML&FM*, Dec 2010.

Jin Hyun Kim, Jae-Hwan Sim, Chang-Jin Kim, Jin-Young Kim, and Jin-Young Choi. Formal embedded operating system model based on resource-based design framework. In *Proceeding of Quality Software, 2007 (QSIC). Seventh International Conference on*, pages 244–249, Oct 2007.

Jin Hyun Kim and Jin-Young Choi. Embedded system modeling based on resource-oriented model. In *Proceeding of Engineering of Computer-Based Systems (ECBS). 14th Annual IEEE International Conference and Workshops on the*, pages 203–212, March 2007.

Jin Hyun Kim and Jin-Young Choi. A framework for modeling and analysis of real-time system operating system. In *Proceeding of International Symposium on Automated Technology for Verification and Analysis (ATVA)*, Dec 2003.

Young-Ho Kim, **Jin Hyun Kim**, Ji-Young Kim, Jee-In Kim, Jin-Young Choi, and Chang Woo Pyo. A visual component based tool for developing embedded application software. In *Proceeding of International Conference on Human-Computer Interaction*, pages 180–184, 2000.

Domestic Journals

Jin Hyun Kim et al. Real-time requirements analysis of ros-based path planning systems. *Journal of KIISE: Computing Practices*, 31(3):128, March 2025. Korean Title: ROS 기반 경로계획 시스템의 실시간 요구 사항 분석.

Jin Hyun Kim et al. A machine learning model for toothbrush position tracking using a low-cost 6-axis imu sensor. *Transactions of the Korean Institute of Electrical Engineers*,

73(2):367, February 2024. Korean Title : 저비용 6축 IMU센서를 이용한 양치구역 추정을 위한 기계학습 모델 개발.

Jin Hyun Kim et al. Prediction of toothbrushing position based on gyro sensor data and its validation using unsupervised learning-based clustering. *Journal of KIISE*, 50(12):1152, December 2023. Korean Title : 자이로 센서 데이터를 활용한 양치 위치 추정 및 비지도 학습 클러스터링을 통한 검증.

Jin Hyun Kim et al. A performance comparison of anomaly detection techniques for smartwatch-based covid-19 pre-symptomatic detection. *Journal of KIISE: Computing Practices*, 28(7):379, July 2022. Korean Title : 스마트워치 기반 COVID-19 전조 증상 탐지를 위한 이상탐지 기술의 성능 비교.

Jin Hyun Kim et al. Covid-19 detection using disease monitoring systems based on vital-signs from smartwatch. *Transactions of the Korean Institute of Electrical Engineers*, 70(8):1207, August 2021.

Jin Hyun Kim et al. Automated one-hot eye diseases diagnostic framework using deep-learning techniques. *Transactions of the Korean Institute of Electrical Engineers*, 70(7):1043, July 2021.

Jin Hyun Kim et al. Analysis of limits in applying ap-qos-based wi-fi slicing for real-time systems. *Journal of KIISE*, 48(6):734, June 2021. Korean Title : AP-QoS 기반 Wi-Fi 슬라이싱의 실시간 시스템 적용의 한계 분석.

Jin Hyun Kim et al. Ilp-based schedule synthesis of time-sensitive networking. *Journal of KIISE*, 48(6):603, June 2021.

Jin Hyun Kim et al. Cell quantization tool for anterior chamber oct images. *Transactions of the Korean Institute of Electrical Engineers*, 69(7), July 2020. Title (KR): 전방 OCT 이미지를 위한 세포정량화 도구.

Dae Yan Hwang, Jin Hyun Kim, and Jin-Young Choi. Statechart/acsr: Combining acsr and statechart for formal specification. *Journal of the Korean Institute of Information Scientists and Engineers: Computing Practices and Letters (in Korean)*, 18(2), Jan 2012.

Jin Hyun Kim, Inhye Kang, Pyung su Kim, and Sungwon Kang. Verification of timing properties for software behaviors on autosar architecture using process algebra. *Journal of KIISE: Software and Applications (in Korean)*, 38(11), Nov 2011. **2012 Good Paper Award of KISSE**.

Jeanho Lee, Daeyon Hwang, **Jin Hyun Kim**, Junkil Park, and Jin-Young Choi. Development of the formal requirements specification of the safety-critical railway systems. *Journal of KIISE: Software and Applications (in Korean)*, 35(12):0731–0740, Dec 2008.

Na-Young Lee, **Jin Hyun Kim**, Ah-Young Sung, Yong-Ah Ahn, Jin-Young Choi, Byung-Ju Choi, and Jang-Su Lee. Development of nuclear power plant i/c embedded software using formal verification and testing. *Journal of KIISE (in Korean)*, 2(06), June 2004.

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Professional Experience

Project Experience

Mar 2023–Feb 2027 **Mathematical Quantification of Medical Diseases and Predictive Modeling for Clinical Treatment in Advanced Medical AI**, National Research Foundation of Korea (NRF), Principal Investigator.

Mid-Career Researcher Support Program funded by the Ministry of Science and ICT / National Research Foundation of Korea (NRF).

Affiliation: Cyber Safety Lab, Gyeongsang National University (through Defense Industry Technology Convergence Research Institute).

Project No.: RS-2023-NR076798613821165300003.

Total Duration: Mar 1, 2023 – Feb 28, 2027 (Current phase: Mar 1, 2025 – Feb 28, 2026).

Total Budget: ₩366,988,000 (Current Year: ₩91,747,000).

Legal Classification: National R&D Program (Innovation Act applicable), Security Level: Non-classified.

Research Goal: Advancement of **medical AI** through mathematical quantification of disease characteristics and predictive modeling for clinical treatment planning.

Key Approaches: Integration of statistical modeling, data-driven learning, and AI-based decision frameworks to improve diagnostic accuracy and treatment outcome prediction.

May 2023–Dec 2023 **AI-based Toothbrushing Guidance Algorithm for Microcurrent Toothbrushes**, Leaders in INdustry-university Cooperation (LINC 3.0) Program, National Research Foundation of Korea (NRF) / Ministry of Education, Principal Investigator.

University–Industry Collaborative R&D Project supported under the LINC 3.0 Program.

Affiliation: Office of Leaders in Industry–University Cooperation, Gyeongsang National University.

Project Duration: May 1, 2023 – Dec 31, 2023 (Completed).

Total Budget: ₩78,000,000.

Legal Classification: Non-National R&D (Innovation Act applicable), Non-classified.

Research Goal: To develop an artificial intelligence–based personalized brushing guidance system optimized for microcurrent toothbrushes.

Key Outcomes: Designed and validated a deep-learning algorithm that analyzes user brushing motion and current feedback to provide adaptive, real-time brushing recommendations for oral health improvement.

Sep 2022–Jan 2023 **AI-based Toothbrushing Habit Improvement Algorithm Development**, Leaders in INdustry-university Cooperation (LINC 3.0) Program, National Research Foundation of Korea (NRF) / Ministry of Education, Principal Investigator.

University–Industry Collaborative R&D Project supported under the LINC 3.0 Program.

Affiliation: Office of Leaders in Industry–University Cooperation, Gyeongsang National University.

Project Duration: Sep 19, 2022 – Jan 31, 2023 (Completed).

Total Budget: ₩26,000,000.

Legal Classification: Non-National R&D (Innovation Act applicable), Non-classified.

Research Goal: To develop an artificial intelligence algorithm that analyzes individual brushing patterns to encourage effective oral hygiene habits.

Key Outcomes: Implemented a machine learning–based behavioral analysis model utilizing sensor data to identify brushing inefficiencies and provide adaptive feedback for user habit improvement.

Mar 2020–Feb 2023 **Dynamic Time-Sensitive Networking (TSN) and Network Slicing for Edge-to-Edge Handover in Autonomous Vehicles**, National Research Foundation of Korea (NRF), Principal Investigator.

Funded by the Ministry of Science and ICT (MSIT) through the NRF Mid-Career Research Program.

Affiliation: Gyeongsang National University, Institute of Marine Industry.

Project No.: 2020R1A2C101485511.

Project Duration: Mar 1, 2020 – Feb 28, 2023 (Completed: Nov 16, 2021).

Total Budget: ₩150,000,000 (Current Year: ₩50,000,000).

Management Office: Center for Marine Industry Research, Gyeongsang National University.

Legal Classification: National R&D Program, Non-classified (Innovation Act not applicable).

Research Goal: Development of a dynamic Time-Sensitive Networking (TSN) and network slicing framework to ensure seamless communication handover between autonomous vehicle edges.

Key Outcomes: Proposed adaptive TSN scheduling and slicing techniques for reliable and low-latency inter-edge communication in real-time vehicular networks.

Mar 2020–Feb 2023 **Dynamic Time-Sensitive Networking (TSN) and Network Slicing for Edge-to-Edge Handover in Autonomous Vehicles**, National Research Foundation of Korea (NRF), Ministry of Science and ICT (MSIT), Principal Investigator.

Funded by the National Research Foundation of Korea (NRF) under the Mid-Career Researcher Program.

Affiliation: Institute of Marine Industry, Gyeongsang National University.

Project No.: 2020R1A2C101485511.

Project Duration: Mar 1, 2020 – Feb 28, 2023 (Completed: Nov 16, 2021).

Total Budget: ₩150,000,000 (Current Year: ₩50,000,000).

Management Office: Center for Marine Industry Research, Gyeongsang National University.

Legal Classification: National R&D Program, Non-classified (Innovation Act not applicable).

Research Goal: To develop a dynamic Time-Sensitive Networking (TSN) and network slicing framework enabling seamless and reliable handover between autonomous vehicle edges.

Key Outcomes: Designed and validated adaptive TSN scheduling and slicing mechanisms to ensure deterministic latency and bandwidth allocation in real-time vehicular communication networks.

Oct 2019–Oct 2020 **A Study on the Implementation of Network Slicing over Wi-Fi Networks**, Institute of Information & Communications Technology Planning & Evaluation (IITP), Principal Investigator.

Contracted research project supported by **OLRADIO Co., Ltd.** under the supervision of the IITP (Information and Communications Technology Planning and Evaluation).

Affiliation: Institute of Marine Industry, Gyeongsang National University.

Project No.: 2019-1124.

Project Duration: Oct 1, 2019 – Oct 31, 2020 (Completed: Dec 31, 2019).

Total Budget: ₩47,560,000 (Current Year: ₩18,840,000).

Legal Classification: National R&D (Other Category), Non-classified, Innovation Act not applicable.

Research Goal: To investigate and prototype network slicing mechanisms applicable to Wi-Fi infrastructures for dynamic service differentiation and QoS assurance.

Key Contributions: Proposed a lightweight slicing framework enabling multiple logical service channels over a shared Wi-Fi medium, enhancing real-time communication capability in edge and IoT environments.

Dec 2014– Dec 2019 **Prototyping Automotive Plug-and-Play Application Environment under Virtualized Resources**, University of Pennsylvania, USA, Postdoctoral Researcher.

Conducted collaborative research with Toyota Motor Corporation on next-generation automotive software architectures.

Developed a **Plug-and-Play (PnP) framework** enabling safe and dynamic integration of in-vehicle applications over virtualized computing resources.

Focused on ensuring real-time and safety properties during runtime composition, using formal modeling and compositional verification methods.

Currently extending the formal PnP framework to support dynamic resource allocation and system reconfiguration based on compositional reasoning.

Dec 2014- **Methods for detecting interoperability failures in dynamically composed interoperable medical devices**, University of Pensylvania, US, Post-doctoral Researcher.

Developing a formal methodology to generate monitors for intergrating medical devices based on ICE (Integrating Clinical Environment).

Developing monitoring tree and a way of composing a monitoring logic based on temporal logic so that individually and independently developed medical devices are composed to provide patients with comprehensive clinial care.

Dec 2012- Dec 2014 **MBAT - Combined Model-based Analysis & Testing of Embedded Systems**, *Aablorg University*, Denmark, Post-doctoral Researcher.

Developing use-cases of modeling and analysis, such as automotive control systems, using UPPAAL and UPPAAL SMC for automotive systems,

Developing a new process algebra, called **PACoR (Process Algebra of Communicating Resources)**, and analysis methods of PACoR using UPPAAL and UPPAAL SMC. Designed the PACoR inspired by ACSR. The results were presented at ECRTS 2014 and FMICS 2015. Now, developing its translator of the PACoR to analyze using UPPAAL tools.

Grant $ 220,000/ 3 years

Dec 2012- Dec 2014 **Constraint and Application driven Framework for Tailoring Embedded Real-time Systems (CRAFTERS)**, *Aablorg University*, Denmark, Post-doctoral Researcher.

Developing a methodology for schedulability analysis of for various scheduling systems, such as hierarchical scheduling systems and probabilistic scheduling systems, using UPPAAL and UPPAAL SMC. The results were presented at FACS 2013, ECRTSS 2014, FACS 2014, TASE 2014, ISORIC 2015, and CBSE 2015.

Grant $ 140,000/ 3 years

Jan 2012- Dec 2012 **High Risk High Return Project: Formal Modeling and Analysis of Dynamic Production and Consumption of Resources Under Timing Constraints**, *KAIST*, Korea, Post-doctoral Researcher.

Studied various types of resources for cyber physical systems, developed modeling and analysis methods for resource-constrained systems based on process algebraic approaches. The paper about this study was published in REACTION 2012.

Grant $ 42,000/ 1 year

Jan 2011- Sep 2011 **Safety Analysis, Verification and Validation for Nuclear Digital Equipment**, *Korea Nuclear Technology (Co)*, Korea, Verification and Validation (V&V) Engineer.

Applied formal methods to verification and validation of requirements and design of digital hydrogen monitoring system for nuclear power plant protection systems.

Grant $ 25,000/ 6 months

Oct 2010- Nov 2010 **FMEA of Youngkwang Nuclear Plant 3,4 Control Systems**, *VITZROSYS (Co)*, Korea, Verification and Validation (V&V) Engineer.

Assisted to analyze the reliability of the system via FMEA,

Developed formal requirement and design specifications of control logics of nuclear power plant protection systems for Young-Kwang 3 and 4 and Ul-Jin 1 and 2 using STATEMATE Statecharts,

Formally verified the model of control system using model checking, and validated it by means of virtual prototyping and simulation.

Aut 2007- Jun 2009 **Study Formal Specification for Assurance of Railway Control Systems**, *Korea Railroad Research Institute*, Korea, Verification and Validation (V&V) Engineer.

Developed formal requirement and design specifications for a component of a railway inter-locking system, such as Distance Control System, uaing STATEMATE Statecharts,

Verified statechart models of DCS with model checking, and validated them with virtual prototyping techniques.

Grant $ 34,000/ 2 years

Jul 2001- Apr 2008 **Analysis using Formal Method and Testing Technique for the Processor Module for Safety-Critical Application**, *Korea Atomic Energy Institute*, Korea, Verification and Validation (V&V) Engineer and Researcher.

Developed formal requirements and design models of a real-time operating system, named **pCOS (POSCON C/OS)**, dedicated to a newly developed Korean I&C system for nuclear power plant protection systems, using STATEMATE Statecharts,

Formally verified and validated the models of pCOS by means of model checking techniques and virtual prototyping and simulation,

Assisted in specifying certification documents for the pCOS certification to be approved by KINS (Korea Institute of Nuclear Security).

Grant $ 442,000/ 7 years

Apr 2002- Jul 2002 **Audited Verification and Validation for Nuclear Power Plant Control System**, *U-ri Technology (Co)*, Korea, Verification and Validation (V&V) Engineer.

Audited verification and validation documents of DCS (Distributed Control Systems) for korean I&C of nuclear power-plant protection systems.

Grant $ 17,000/ 4 month

Sep 2000- Sep 2001 **Formal Specification and Verification of Nuclear Power Plant Controlling System**, *Korea Electrical Engineering Science Research Institute*, Korea, Fundamental Researcher.

Studied a formal methods for I&C software of nuclear power plant control systems.

Feb 1999- Nov 2000 **Develop A formal Method Tool for Shutdown Control Systems**, *Han-U Tech (Co)*, Korea, SW Developer.

Developed a formal analysis tool for control logic analysis based on Esterel analysis framework.

Grant $ 17,000/ 1 year

Teaching Portfolio

Sungkonghoe University, Seoul, Korea

Instructor

UNIX Network Programming

Spring 2004 Responsible for 3 hour lectures where junior undergraduate students learned how to develop inter-networking services with UNIX socket services.

Network Programming

Spring 2004 Responsible for 1 hour lectures and 2.5 hour where undergraduate students conducted their own projects for inter-networking services.

Experiments of Micro-processor Controller

Autumn 2004 Responsible 2 classes of 3 hour lectures where undergraduate students learned an assembly language for a specific micro-processor. In this class, students developed their own programs to control individual components of a micro-processor controller.

LINUX Programming

Autumn 2004 Responsible 3 hour lectures where undergraduate students learned LINUX system services to program system software.

Logic Design

Spring 2005 Responsible 2 classes of 3 hour lectures where undergraduate students learned fundamentals of logic design for computational circuits.

Kunkuk University, Seoul, Korea

Part-time lecturer

Software Analysis and Design

Autumn 2006 Responsible for 8 hour lectures where junior and senior undergraduate students learned fundamentals of software analysis and design based on UML. In this class, students learned the syntax and semantics of UML languages and how to use them for modeling and analysis of software systems.

Duksung Woman's University, Seoul, Korea

Part-time lecturer

Discrete Mathematics (for Compute Science)

Spring 2008 Responsible for 3 hour lectures where junior undergraduate students learned fundamentals of discrete mathematics relating to computer science.

Sangmyung University, Seoul, Korea

Part-time lecturer

Algorithm

Autumn 2005 Responsible for 3 hour lectures where junior undergraduate students learned fundamentals of algorithm.

Programming Languages

Autumn 2005 Responsible for 3 hour lectures where junior and senior undergraduate students learned fundamentals of programming languages and theory. In this class, students learned functional and formal languages for embedded system programming. Also, they conducted several projects to learn how to use such languages and design a new language.

Korea University, Seoul, Korea

Part-time lecturer

Introduction to Internet Practice

Cyber Safety Lab – Gyeongsang National University, Jinju 52828, Republic of Korea
(+82)(010)) 9253 - 1935 • ☎ (+82) (055) 772 - 9174
✉ jin.kim@gnu.ac.kr/jhkim07@gmail.com/ http://jin-kim.net

Autumn 2001 Spring 2010 Autumn 2010	Responsible for 3 hour lectures where undergraduate students learned various services of Internet and basic programming skill for Internet service, such as HTML, JavaScript, and CSS.
	Introduction to Internet Application
Spring 2001 Autumn 2002 Spring 2003 Autumn 2003 Autumn 2009	Responsible for 3 hour lectures where undergraduate students learned foundation and basics of Internet service, such as HTML, JavaScript, CSS and various Internet programs.
	Information and Society
Autumn 2001 Spring 2002	Responsible for 3 hour lectures where undergraduate students learned various office software, such as WORD, EXCEL, POWER-POINT, etc., and Internet services.
	Introduction to Information and Society
Winter 2002 Winter 2003 Autumn 2004 Spring 2005 Spring 2006 Summer 2006 Autumn 2006 Spring 2007 Winter 2007 Spring 2008 Spring 2009 Summer 2009 Spring 2010	Responsible for 3 hour lectures where undergraduate students learned various office software, such as WORD, EXCEL, POWER-POINT, etc., and Internet services
	Introduction to Computer Science and Lab-Work
Winter 2005 Winter 2006	Responsible for winter semester where undergraduate students learned basic programming skills for JAVA, and C++, and conducted various projects applicable for actual development of software system.

Awards

2012 Good Paper Award of Korea Institute of Information and Scientists and Engineers

Technical skills

Experienced in extensive verification, validation, and implementation of CPS software architecutre using formal methods and techniques. Experienced in developing formal sepcfication and proofs of applications in avionics, automotive, and railway control system, avionics, real-time operating systems, etc.

Computer Science: Formal Methods, Design and Analysis of CPS Software

2013-Present **UPPAAL Symbolic and Statistical Model Checking Techniques** ***Advanced***

Experienced in formally modeling and analysis of varied real-time systems, particularly complex scheduling systems, such as hierarchical scheduling systems, probabilistic scheduling systems, mode-change scheduling systems, and adaptive scheduling systems. Also, experienced in analysis for automotive systems components using formal verification techniques.

2010-Present **Process Algebra Techniques** ***Advanced***

Experienced in formally modeling and analysis of real-time operating systems and automotive system component in AUTOSAR. CCS (Calculus of Communicating Systems), PACoR (Process Algebra of Communicating Resources), ACSR (Algebra of Communicating Shared Resource.

2001-2009 **STATEMATE Statecharts Methodology** ***Advanced***

Experienced in modeling of various embedded software system and **real-time operating systems**, analyzing with model checking, simulation, and virtual prototyping techniques.

1999-2001 **ESTEREL Methodology** ***Intermediate***

Experienced in developing a formal analysis framework for embedded software based on ESTEREL methods.

Computer Science: Formal Methods Tools

UPPAAL and UPPALL SMC Model Checker ***Advanced***

STATEMATE Magnum Engineering Tools ***Advanced***

Computer Science: Programming Skills

2013-Present **MATLAB** ***Intermediate***

C, C+, Java, Python,LaTeX ***Intermediate***

Software Engineering Skills

UML(Sequence charts, State-charts diagram, Class-diagram) ***Advanced***

RTOS design and implementation (e.g. uC/OS, pCOS (for nuclear power plant systems))) ***Advanced***

Languages

Korean Mother-tongue

English Speaking:Very good command, Writing: Highly proficient

Chinese Speaking:Very good command, Writing: Very good command

Interests

- Movie
- Car

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- Flight
- Travelling
- Running

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References

Insup Lee

- E-mail: lee@cis.upenn.edu; Phone: +1-215-898-3532
- Professor, Department of Computer and Information Science, University of Pennsylvania
- Prof. Lee is my current advisor at PRECISE Center in UPenn He inspired me to study formal methods and engineering for cyber-physical systems.

Sung-won Kang

- E-mail: sungwon.kang@kaist.ac.kr ; Phone: +82-10-3408-8760
- Professor, Computer Science Department, Korea Advanced Institute of Science and Technology,
- Prof. Kang has been a valuable interdisciplinary resource in the area of software architecture.

Ulrik Nyman

- E-mail: ulrik@cs.aau.dk ; Phone: +45-9940-9985
- Associate Professor , Computer Science Department, Aalborg University,
- Prof. Nyman is my valuable interdisciplinary resource in the area of real-time model checking.

Jalil Boudjadar

- E-mail: jalil@eng.au.dk; Phone: +45-9350-8726
- Assistance Professor, Department of Engineering - Electrical and Computer Engineering, Edison, Aahus University, Denmark
- Prof. Boudjadar is my former reseach colleage and interdisciplinary resource in the area of real-time system and formal methods.