IEEE Systems, Man, and Cybernetics Society
Announcement: Establishment of the Technical Committee on Embodied AI Systems

Introduction

We are excited to announce the formation of the **Technical Committee on Embodied AI Systems** within the IEEE Systems, Man, and Cybernetics Society (SMCS). This new committee is dedicated to advancing the research, development, and application of embodied artificial intelligence (AI), a multidisciplinary field that bridges the gap between advanced AI systems and the physical world. Embodied AI refers to systems that integrate cognitive abilities with sensory and action capabilities, enabling machines to perceive, reason, and act autonomously in dynamic environments.

The rapid evolution of AI, particularly in robotics, autonomous systems, and industrial automation, makes the establishment of this technical committee timely and critical. The integration of AI with physical systems is transforming industries such as manufacturing, healthcare, and transportation, and we aim to harness this potential by creating a dedicated forum for collaboration and knowledge sharing among experts, practitioners, and researchers in the field of embodied AI.

These embodied AI systems possess advanced autonomous perception, decision-making, and execution capabilities. Supported by large-scale models, they can engage in deep learning and optimization from extensive datasets, providing real-time feedback that seamlessly integrates with physical operations. This allows embodied AI systems to not only execute complex tasks with efficiency and safety but also to dynamically adjust their strategies in response to evolving environments and task demands. As holistic systems, they facilitate intelligent management across the entire process from data perception to decision execution, overcoming the traditional limitations of industrial systems, such as single-task functionality and limited adaptability to external changes.

The advent of embodied AI is not only establishing a novel theoretical foundation and a practical platform for robotics but is also driving transformative changes across industries, including industrial automation, intelligent manufacturing, and service systems. With the continuous advancement of technology, embodied intelligence is rapidly becoming a pivotal force in enhancing social productivity.

This committee will prioritize research and development in several key areas: multimodal perception fusion, autonomous learning and adaptation, action decision-making and execution, natural interaction and collaboration, and the establishment of ethical and safety standards for embodied AI systems. Additionally, the committee will explore new frameworks in control theory tailored for embodied AI, develop a universal simulation-learning-deployment toolchain, and contribute to the standardization of embodied AI hardware. Our primary objectives are to expand the application scenarios for embodied AI systems, enhance deployment efficiency and convenience, and promote adaptability in human-machine integrated environments.

Mission and Vision

The mission of the **Embodied AI Systems Technical Committee (TC)** is to provide a platform for advancing the science and application of embodied AI. The committee will focus on creating new methodologies, frameworks, and technologies that will drive innovation in embodied AI systems across diverse sectors.

The vision of this TC is to be a leader in promoting the use of embodied AI in both theoretical and practical settings, enabling breakthroughs in AI systems that interact seamlessly with the physical world. Through collaboration, we aim to:

- Foster interdisciplinary research on embodied intelligence, bringing together AI, robotics, control theory, human-robot interaction, and sensor technologies.

- Drive the development of robust control systems that allow embodied AI systems to operate safely and efficiently in complex, dynamic environments.
- Establish standards and frameworks for the deployment of embodied AI systems, ensuring their adaptability, safety, and interoperability.

Our ultimate goal is to push the boundaries of what embodied AI can achieve, enabling smarter, safer, and more autonomous systems that enhance productivity and quality of life across industries.

Scope of Interest

The **Embodied AI Systems TC** will focus on a broad range of topics and research areas related to embodied intelligence, including, but not limited to:

1. **Multimodal Perception and Sensor Fusion** Advanced techniques for combining sensory data from various modalities (vision, sound, touch, etc.) to enable robots and autonomous systems to perceive their environment accurately and efficiently.
2. **Autonomous Learning and Adaptation** Developing methods for embodied AI systems to autonomously learn from interactions with the environment, adapt to changing conditions, and improve performance over time.
3. **Human-Robot Interaction (HRI)** Investigating the integration of embodied AI systems with human operators in collaborative tasks, enhancing intuitive communication, and improving safety and effectiveness in human-machine interfaces.
4. **Decision-Making and Execution** Researching novel algorithms and frameworks for decision-making in embodied AI, enabling real-time, reliable execution of tasks based on sensory input and environmental changes.
5. **Action Control and Precision** Developing technologies for high-precision control, ensuring that embodied AI systems can perform complex tasks with high reliability and safety, especially in dynamic and unpredictable environments.
6. **Ethics, Safety, and Standards** Establishing ethical guidelines and safety protocols for the deployment of embodied AI systems, addressing concerns related to autonomy, accountability, and human impact.
7. **Application Areas** Embodied AI applications in industrial automation, healthcare, robotics, autonomous vehicles, smart cities, and more.
8. **New Frameworks in Control Theory** Developing novel control theories that are specifically tailored to the challenges posed by embodied AI, including complex decision-making, adaptation, and system integration.
9. **Simulation, Learning, and Deployment** Creating simulation platforms that support the learning and deployment of embodied AI systems across a variety of real-world applications.

Objectives and Activities

The **Embodied AI Systems TC** has set forth the following objectives:

- **Promote Interdisciplinary Research**: By bringing together experts from AI, robotics, control systems, cognitive sciences, and other fields, the TC will facilitate research collaborations that address the complex challenges of embodied AI.
- **Foster Industry Collaboration**: We will work closely with industries, from manufacturing to healthcare, to ensure that the research and technologies developed by the TC are relevant and impactful.
- **Develop Educational Resources**: Organizing tutorials, webinars, and educational materials will help disseminate knowledge about embodied AI to both academia and industry practitioners.
- **Support Standardization Efforts**: The TC will play a key role in establishing standards for embodied AI systems, focusing on interoperability, safety, and ethical considerations.
- **Host Conferences and Workshops**: The TC will organize special sessions, workshops, and symposia at major IEEE SMC conferences and other international events.
- **Edit Special Issues**: We will work with leading journals to publish special issues on embodied AI, showcasing the latest advancements in the field.

Recent Activities

We are pleased to report that the **Embodied AI Systems TC** has already begun to engage the community through academic forums and workshops. Recently, we hosted the **IEEE SMC High-End Academic Forum** in Chongqing and Xi'an, where we had in-depth discussions on the future of embodied AI in industrial automation and robotics. The forum featured:

- Keynote talks on the integration of AI and robotics in industrial systems.
- Sessions on the challenges and opportunities of multimodal perception in autonomous systems.
- Interactive workshops on designing safe and adaptive human-robot interaction systems.

These events brought together leading experts and practitioners from academia and industry, fostering collaborations and promoting the exchange of ideas.

TC Chair and Co-Chairs

TC Chair: Xiaojie Su (Affiliation: Chongqing University, Chongqing, China)

Xiaojie Su (Senior Member, IEEE) received the Ph.D. degree in Control Theory and Control Engineering from Harbin Institute of Technology, Harbin, China, in 2013. He is currently a Professor and the Dean of the College of Automation at Chongqing University, Chongqing, China. His research interests include intelligent control systems, advanced control and system analysis, and the application of intelligent robot control.Prof. Su has authored or coauthored three research monographs and over 80 research papers in internationally referred journals. He was named to the **Highly Cited Researchers** list by Clarivate Analytics from 2017 to 2023, recognizing his significant contributions to the field. He is the Founding Chair of the **IEEE Beijing Section Systems, Man, and Cybernetics and Robotics and Automation Joint Societies Chapter** and serves on the **Board of Governors** for the **IEEE Systems, Man, and Cybernetics Society** for the 2024–2026 term. He is also a **Steering Committee Member** of **IEEE Transactions on Big Data** (2022–2023) and serves as an **Associate Editor** for several prominent journals, including **IEEE Transactions on Fuzzy Systems**, **IEEE Transactions on Systems, Man, and Cybernetics: Systems**, **IEEE Systems Journal**, and **Information Sciences**. Additionally, he is an Associate Editor for the **Conference Editorial Board** of the IEEE Control Systems Society.

TC Co-Chair: Peng Shi, IEEE Fellow, EIC of IEEE Transactions of Cybernetics (Affiliation: The University of Adelaide, Australia)

Peng Shi (Fellow, IEEE) received the Ph.D. degree in Electrical Engineering from the University of Newcastle, Newcastle, NSW, Australia, in 1994, the second Ph.D. degree in Mathematics from the University of South Australia, Adelaide, SA, Australia, in 1998, the D.Sc. degree from the University of Glamorgan, Pontypridd, U.K., in 2006, and the D.Eng. degree from the University of Adelaide, Adelaide, in 2015. Currently, he is a Professor at the University of Adelaide, Australia. His research interests span systems and control theory with applications to autonomous and robotic systems, network systems, and cyber-physical systems. Dr. Shi serves as the **Editor-in-Chief** of **IEEE Transactions on Cybernetics**, the **Senior Editor** of **IEEE Access**, and a **Distinguished Lecturer** for the IEEE SMC Society. He is the **President** of the **International Academy for Systems and Cybernetic Science**. Dr. Shi is a Fellow of the **IET**, **IETI**, **IEAust**, **CAA**, and a member of the **Academy of Europe**.

TC Co-Chair: Alois Knoll (Affiliation: Technical University of Munich, Germany)

Alois Knoll (Fellow, IEEE) received the diploma (M.Sc.) degree in Electrical/Communications Engineering from the University of Stuttgart, Stuttgart, Germany, in 1985, and the Ph.D. (summa cum laude) degree in Computer Science from the Technical University of Berlin, Berlin, Germany, in 1988. He served on the faculty of the Computer Science Department at TU Berlin until 1993, after which he joined the University of Bielefeld, Germany, as a Full Professor and Director of the Technical Informatics Research Group, a position he held until 2001. Since 2001, he has been a Professor in the Department of Informatics at the Technical University of Munich (TUM), Munich, Germany. Additionally, he served on the Board of Directors of the **Central Institute of Medical Technology** at TUM (IMETUM), and from 2004

to 2006, he was the Executive Director of the **Institute of Computer Science** at TUM. Prof. Knoll's research interests include cognitive, medical, and sensor-based robotics; multi-agent systems; data fusion; adaptive systems; multimedia information retrieval; model-driven development of embedded systems with applications to automotive software and electric transportation; and simulation systems for robotics and traffic. Dr. Knoll was a member of the **EU's highest advisory board on information technology**, the **Information Society Technology Advisory Group (ISTAG)**, and its subgroup on **Future and Emerging Technologies (FET)** between 2007 and 2009. In this capacity, he played an active role in developing the concept for the EU's **FET Flagship projects**.

TC Co-Chair: Shuoyu Wang, Fellow of The Engineering Academy of Japan (Affiliation: Kochi University of Technology, Japan).
Shuoyu Wang received the B.Sc. and M.Sc. degrees in Control Engineering from Shenyang University of Technology, Shenyang, China, in 1983 and 1988, respectively, and the Ph.D. degree in Electrical Engineering from Hokkaido University, Sapporo, Japan, in 1993. He is currently a Professor at the School of Systems Engineering and the Director of the **Advanced Robot Research Center** at Kochi University of Technology, Kami, Japan. His research interests include walking rehabilitation robots, human support robots, control systems, and fuzzy reasoning. Dr. Wang served as the **Editor-in-Chief** of the **Journal of the Robotics Society of Japan** from 2014 to 2015 and as the **President** of the **Japanese Biomedical Fuzzy Systems Association** from 2015 to 2017. He is an **Academician** of the **Engineering Academy of Japan** and a **Fellow** of both the **Robotics Society of Japan** and the **Japan Society of Mechanical Engineering**. Additionally, he is a member of several professional associations, including the **Japanese Society of Instrument and Control Engineers**, the **Japanese Society for Medical and Biological Engineering**, and the **Japan Society for Fuzzy Theory and Intelligent Informatics**.

TC Co-Chair: Jiangshuai Huang (Affiliation: Chongqing University, Chongqing, China).
Jiangshuai Huang received the B.Eng. and M.Sc. degrees in Automation from the School of Automation, Huazhong University of Science and Technology, Wuhan, China, in July 2007 and August 2009, respectively. He earned the Ph.D. degree in Electrical and Electronics Engineering from Nanyang Technological University, Singapore, in 2015. Dr. Huang was a Research Fellow with the Department of Electrical and Computer Engineering at the National University of Singapore from August 2014 to September 2016. He is currently a faculty member at the School of Automation, Chongqing University, Chongqing, China. His research interests include adaptive control, nonlinear systems control, control of underactuated mechanical systems, and multi-agent system control. Dr. Huang serves as an Associate Editor for several esteemed journals, including **IEEE Transactions on Cybernetics** and **IEEE Transactions on Industrial Electronics**.

TC Co-Chair: Wengang Ao (Affiliation: Chongqing Technology and Business University, Chongqing, China)
Wengang Ao is a Professor at Chongqing Technology and Business University, specializing in engineering mechanics, intelligent control, and life support robotics. He has published over 30 academic papers, with 10 indexed by SCI/EI, and authored two academic monographs and three textbooks. Prof. Ao has led one project under the Ministry of Science and Technology's "Science and Technology Partner Program" and has been a key researcher in three National Natural Science Foundation projects and seven Chongqing Science and Technology projects. He has also applied for 20 invention patents, with seven granted. His recent research interests focus on key technologies for intelligent mobile robots, particularly in the field of life support robots. His work includes developing precise life scenario map models, visual semantic extraction mechanisms, adaptive navigation, and autonomous control theory, as well as semantic map construction and dynamic updating using multi-source data fusion.