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Computer Science Professor Rajesh Gupta Receives One of Computing's Most Prestigious Honors

Rajesh Gupta, a professor of computer science and engineering at University of California San Diego, has been awarded the IEEE Computer Society 2019 Wallace McDowell Award for his seminal contributions in design and implementation of microelectronic systems-on-chip and cyberphysical systems.



"I am not surprised that Professor Gupta received one of computing's most prestigious individual honors," said UC San Diego Chancellor Pradeep K. Khosla. "As a world leader in embedded systems research, his work continues to impact both industry and the academy. Here at UC San Diego, Rajesh is currently leading efforts to bring together researchers from across campus to incorporate data science into their work and into the classroom. The application of his research to our campus is invaluable."

The award puts Gupta in illustrious company. Previous winners include Gordon Moore, who co-founded Intel; Seymour Cray, who developed early super computers; Tim Berners-Lee, who helped invent the World Wide Web; and other academic and industry leaders.

"It's kind of humbling for me," said Gupta, who is founding director of the Halicioğlu Data Science Institute at UC San Diego. "I don't know if I belong to that community."

Gupta is being honored, in part, for his work on cyberphysical systems, which bring together computer-based algorithms with real-life physical systems, for example in robotics and smart grids.

“Your car is a cyberphysical system,” says Gupta. “When you press the gas pedal, you don’t actually release gas. You tell a computer to increase speed, and the computer decides how much gas to release,” says Gupta. He holds the Qualcomm Professor in Embedded Microsystems in the Department of Computer Science and Engineering at the UC San Diego Jacobs School of Engineering.

Making these disparate systems work well together can be challenging. Buildings are full of sensors for temperature, security, machine maintenance.

“If you look at real life systems, there is a deluge of data coming through,” says Gupta. “The question is, how do you organize that data to make meaningful decisions?”

Gupta has spent a significant part of his career trying to make sense of the sensory information in cyberphysical systems. Harnessing this information could offer many potential benefits: smarter buildings; smoother building evacuations during an emergency; more consistent and personalized environmental control; energy savings.

“My group has conceptualized the built environment as a distributed sensor and actuator system,” says Gupta. “A system where, for instance, the buildings talk to each other or to infrastructure for transportation, healthcare, etc. Now you can think of a building as having many resources, just like a computer has memory, storage and computing. Over time, you can write ‘programs’ that operate the building more efficiently, if we get the abstractions to address and discover resources and their capabilities right.”

But these concepts are hardly limited to buildings. Gupta and many colleagues have a vision for smart cities, in which electricity, water, transportation, telecommunications and other systems are precisely controlled and coordinated.

“The city has a digital twin, as if you’re running a SimCity kind of a game on a parallel plane,” says Gupta. “But the SimCity in this case isn’t just a hypothetical universe, instead it is connected causally to the actual city. You have sensory eyes on the city that are updating the models in real time. That allows you to have a much better environment for humans and a much more responsive system.”

Once again, harnessing this sensory data can have a huge impact on quality of life. Cities can use it to better manage traffic, power grids, water, homelessness and emergency services. The list is long.

“Conceptualizing our physical spaces as logically programmable places is a powerful paradigm,” says Gupta. “It means we can customize the spaces to what we need at any given time, as well as giving situational awareness to operators.”

Research and recognition

Gupta currently serves as founding director of the Halicioğlu Data Science Institute at UC San Diego. His research is in embedded and cyber-physical systems with a focus on sensor data organization and its use in optimization and analytics. He has led several large scale projects including NSF Expeditions on Variability and DARPA projects under Data Intensive Systems (DIS) and Circuit Realization at Faster Timescales (CRAFT) programs.

He also leads NSF project MetroInsight and a co-PI on DARPA/SRC Center on Computing on Network Infrastructure (CONIX) with the goal to build new generation of distributed cyber-physical systems that use city-scale sensing data for improved services and autonomy. His past contributions include SystemC modeling and SPARK parallelizing high-level synthesis, both of which have been incorporated into industrial practice.

Among recent recognition of Gupta’s work is a best demonstration paper award at ACM BuildSys’16. He has served as EIC of IEEE Design & Test of Computers and founding EIC of IEEE Embedded Systems Letters. He currently serves as Editor-in-chief of IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems.

Gupta received a bachelor of technology in electrical engineering from IIT Kanpur, India; a master of science in EECS from University of California, Berkeley; and a Ph.D. in electrical engineering from Stanford University. Earlier he worked at Intel Corporation, Santa Clara and on the computer science faculty at University of Illinois, Urbana-Champaign and UC Irvine.

Gupta holds the Qualcomm Endowed Chair in Embedded Microsystems at UC San Diego and INRIA International Chair at the French international research institute in Rennes, Bretagne Atlantique. He is a Fellow of the IEEE, the ACM and American Association for the Advancement of Science (AAAS).

For more about Gupta’s work, visit his Jacobs School of Engineering [faculty profile](#) or the [Microelectronic Embedded Systems Laboratory](#).

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