

The Internet of Things for Precision Agriculture an NSF Engineering Research Center



Industrial Membership Program

Partnerships to revolutionize US agriculture:

Creating, enabling, and translating to practice precision agriculture technologies to ensure food, energy, and water security.











Need: Food, Energy, and Water Security

By 2050, the US population is estimated to grow to 400 million and the world population to 9.7 billion. Current agricultural practices account for 70% of global water use, energy use accounts for one of the largest costs on a farm, and inefficient use of agrochemicals is altering Earth's ecosystems. With finite arable land, water, and energy resources, ensuring food, energy, and water security will require new technologies to improve the efficiency of food production, create sustainable approaches to supply energy, and prevent water scarcity.

Opportunity: Create the Future of Agriculture with IoT4Ag!

IoT4Ag is an NSF-funded Engineering Research Center (ERC) uniting academia, industry, and government in a partnership to engineer transformational, high-value, integrated systems with significant societal impact. Industry partners are integral to guiding and developing the strategic directions of the ERC and translating results to practice.

Join this innovation ecosystem as an industry member and harness the collective insight, expertise, and resources of academic, industry, investment, and government partners. Collaboratively define and realize the future of precision agriculture and enable and educate a diverse workforce that will address the societal grand challenge of food, energy, and water security for decades to come.

Vision: Sustainable, Efficient, High-Output Precision Agriculture

IoT4Ag is dedicated to dramatically and sustainably improving agricultural crop production while minimizing the use of energy and water resources and the environmental impact of agricultural practices. We will create novel, integrated systems that capture the microclimate and spatially, temporally, and compositionally map heterogeneous stresses for early detection and intervention to better outcomes in agricultural crop production. The Center will create internet of things (IoT) technologies to optimize practices for every plant; from sensors, robotics, and energy and communication devices to data-driven models constrained by plant physiology, soil, weather, management practices, and socio-economics.

Solutions: Breakthrough IoT Technology

- Multi-mode, low-cost, distributable, environmental and soil sensor technologies
- Autonomous aerial and groundbased robots
- Energy storage and delivery technologies for field-scale operation
- Ag-specific communications
- Biophysically-constrained data analytics to produce decision Ag interventions and improve outcomes in agricultural fields



Transforming the Future of Agriculture

Membership Benefits

Industrial Practitioner Advisory Board (IPAB) – Exclusive seat on the IPAB. Meet with **IoT4Ag** leadership twice annually and provide the highest level of strategic guidance on **IoT4Ag** research directions. Elect a 10-member industrial practitioner executive committee (IPEC) to communicate IPAB recommendations to the **IoT4Ag** Executive Committee.



Research and Development – Leverage National Science Foundation (NSF) federal funding, university cost share, and pooled membership fees to support research and development in strategic areas of Internet of Things (IoT) technologies and precision agriculture.

Early Access to Research – Receive early exposure to unpublished and innovative ideas through direct contact with **IoT4Ag** researchers, the internal **IoT4Ag** website (open to **IoT4Ag** members only), the annual **IoT4Ag** technical meeting, quarterly newsletters, workshops, short courses, and webinars.

Intellectual Property and Licensing – Receive early notification of **IoT4Ag** innovations. Have a right to recommend IP filings and an option to negotiate a license.

Sponsor-driven Research Projects – Sponsor specific research projects that leverage the resources and expertise of **IoT4Ag** but with a focus that is set by the sponsor. **IoT4Ag** offers a streamlined process for sponsored research agreements.

Visiting Scientists – Work at IoT4Ag multi-user facilities.

Knowledge Exchange – Have access to technical experts and educational programs in agronomy; sensor, energy, and communication technologies; robotics; information and decision systems; precision agriculture; and food security from academia, industry, and government.

Sector Leadership – Be part of defining the technology outlook and roadmap for precision agriculture.

Promotion – Brand visibility to **IoT4Ag** university, industry, innovation, and government partners; professional organizations; and the NSF.

Recruiting – Unique access to talented, highly-educated, and collaborative **IoT4Ag** undergraduate and graduate students and postdoctoral fellows.

Education and Diversity and Inclusion – Contribute to education and inclusion programs to develop a diverse workforce of K-12 students and teachers, university researchers, and agricultural professionals, crop advisors, extension agents, and growers.

Type of Entity	No. of Employees	Annual Fees*	IPAB Votes
Large	≥500	\$30,000	3
Medium	100-499	\$15,000	2
Small	11-99	\$2,500	I
Very Small	≤10	\$1,000	I
Government**	unlimited	\$0	0

*Up to 50% of annual fees may be in the form of in-kind contributions, at the discretion of the Center Director. These contributions shall be limited to tangible contributions (i.e., materials, capital equipment, etc.). **Government agencies, offices, or organizations authorized by the US or any State or Nation, including 501(c)(3) non-profit organizations.

IoT4Ag Value Proposition

IoT4Ag

Ensuring a food, energy, and water secure future requires new agricultural technologies. IoT4Ag will meet this need by creating transformative science and engineering advances, achieving novel, integrated systems that capture the microclimate; spatially, temporally,

and compositionally map heterogeneous stresses; and enable early detection and intervention. IoT4Ag will deliver IoT technology – sensors, robotics, energy and communication devices, and data-driven models – to optimize agriculture for each plant.

Join IoT4Ag's innovation ecosystem and network with academic, industry, investment, and government partners; work with and recruit a diverse, well-trained workforce; and collaboratively build the future of precision agriculture!



Delivering more crop with less environmental impact for every drop of water and Joule of energy.

IoT4Ag Leadership

Director Cherie Kagan, Penn

Site Directors David Arnold, UF David Cappelleri, Purdue Catherine Keske, Merced Kevin Turner, Penn

Research Leaders

Systems Integrator Melba Crawford, Purdue

Thrust I Leaders Reza Ehsani, Merced Troy Olsson, Penn

Thrust 2 Leaders Mark Allen, Penn David Love, Purdue

Thrust 3 Leaders Dennis Buckmaster, Purdue Charlie Messina, UF

Testbed Leaders Reza Ehsani, Merced Ian Small, UF Tony Vyn, Purdue

Education Leaders

Pre-College Education Director David Cappelleri, Purdue

University Education Director Sue-Ann Bidstrup Allen, Penn

Professional Education Directors Ian Small, UF Tony Vyn, Purdue

Diversity & Inclusion Leaders Recruiting Paulo Arratia, Penn

Climate Catherine Keske, Merced

Innovation Ecosystem Leaders

Industry/University Partnerships David Arnold. UF

Tech Transfer Steven Weiner, Penn

Administrative Director Holly Mayton, Penn

Assessment Ayesha Boyce, ASU Contact IoT4Ag[™] to learn more about getting involved and becoming a member:

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