

IS 709/809: Computational Methods for IS Research

Research Reflection

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IS 709/809 Application

Smart Service Systems



Partnerships for Innovation: Building Innovation Capacity - Smart Service Systems

<https://www.nsf.gov/eng/iip/pfi/bic.jsp>

[1] Maglio, Paul P.; Kwan, S.K.; Spohrer, J. (2015). Toward a Research Agenda for Human-Centered Service System Innovation. Editorial Commentary. Service Science 7(1):1-10. <http://dx.doi.org/10.1287/serv.2015.0091>

[2] Ng, I. (2015). The Internet of Everything and the Future of Service. Speech, 2015 Frontiers in Service Conference in San Jose, CA. Accessible online at: <http://hubofallthings.com/hat-in-the-usa/>.

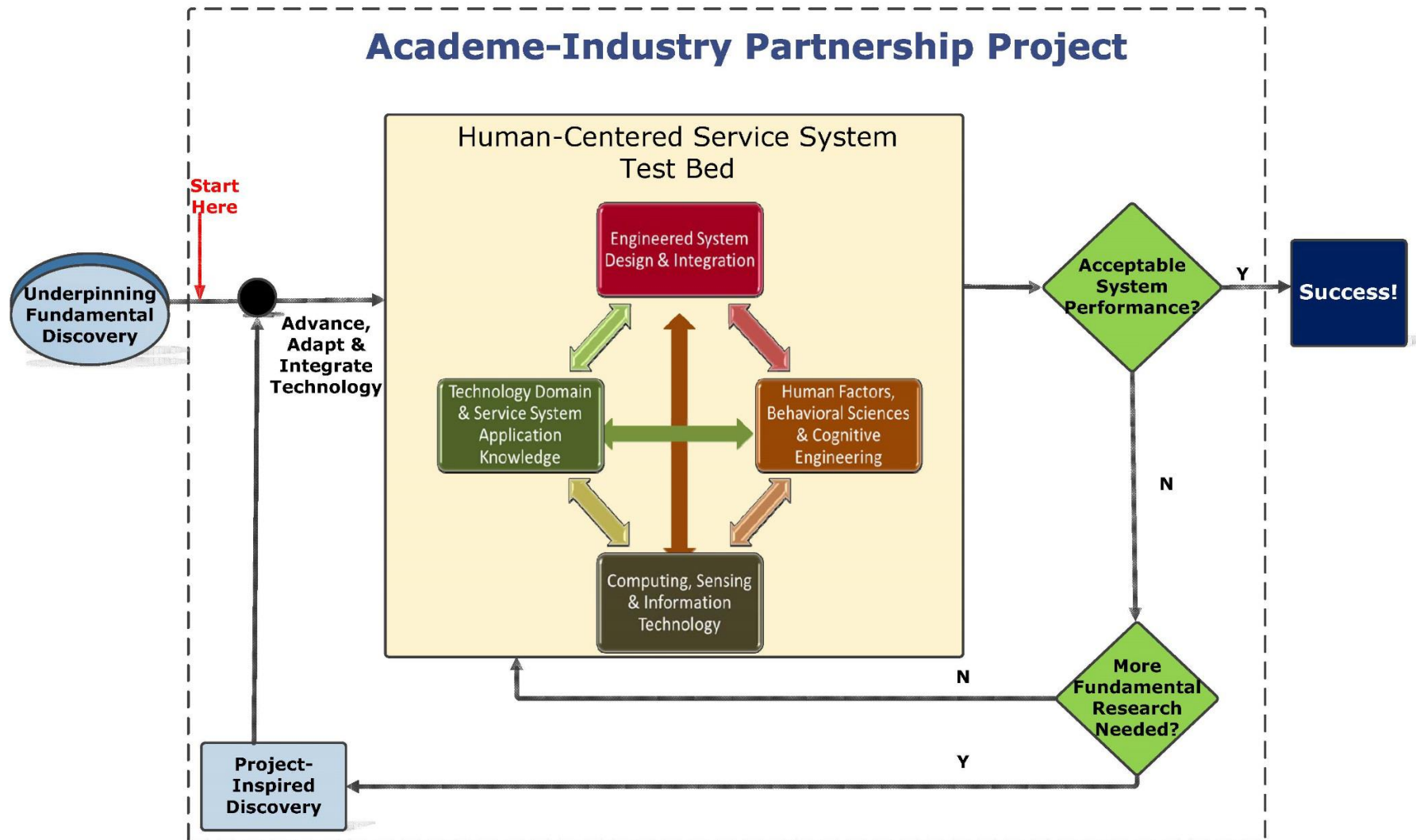
What Is a Smart Service System? (source NSF)

- A **“smart” service system** is a system that amplifies or augments human capabilities to identify, to learn, to adapt, to monitor and to make decisions
- The “smart” service system does so through.....
 - self-detection, self-diagnosing, self-correcting, self-monitoring, self-organizing, self-replicating, and/or self-controlled functions
- These capabilities are the result of the incorporation of technologies
 - Sensing, actuation, coordination, communication, control, etc.

What is PFI:BIC?

- An academe-industry partnership led by an interdisciplinary academic research team collaborating with at least one industry partner in order to carry out research
 - advance, adapt, and integrate technology into a specified human-centered, smart service system that functions as a test bed
- The objective is to create or transform a “smart(er)” service system that has the potential for significant social and economic impact

Anatomy of a PFI:BIC Smart Service System



Successful Integration into a Smart Service System

- Engineered System Design and Integration
 - To provide knowledge of service system design and system integration issues
- Computing, Sensing and Information Technologies
 - To provide knowledge of considerations involving data transfer, communication and/or data processing needed for successful integration of the technology into a “smart” service system
- Human Factors, Behavioral Sciences, and Cognitive Engineering
 - To provide knowledge of the potential effects of human factors as they interact with the technology proposed. These findings will have an impact on ensuring that the design of the “smart” service system is human-centered

Human-Centered Services

- Human-Centered Services
 - Further Elaboration upon the Human Factors Research Component in Conjunction with Achieving Acceptable System Performance
 - Conduct studies to evaluate how humans use or perceive these services
 - Use the results from these studies to inform the design
 - Testing the usability of the system could promote project-inspired fundamental research

NSF invests \$13 million in smart, human-centered service systems

■ Advanced manufacturing

- Next Generation Real-Time Distributed Manufacturing Service Systems Using Digital Process Planning and GPU-Accelerated Parallel Computing: Thomas Kurfess of Georgia Tech Research Corporation, principal investigator.
- MAKERPAD: Cognitively Intuitive Shape-Modeling and Design Interface enabling a Distributed Personalized Fabrication Network: Karthik Ramani of Purdue University, principal investigator.
- Smart Factories - An Intelligent Material Delivery System to Improve Human-Robot Workflow and Productivity in Assembly Manufacturing: Laurel Riek of the University of Notre Dame, principal investigator.

PFI:BIC Awards 2016

■ Intelligent spaces/ambient intelligence

- Multimodal-Sensor-Enabled Environments with Advanced Cognitive Computing Enabling Smart Group Meeting Facilitation Services: Richard Radke of the Rensselaer Polytechnic Institute, principal investigator.

■ Smart emergency warning systems

- CityWarn - A Smart, Hyperlocal, Context-Aware Hazard Notification Service System: Brenda Philips of the University of Massachusetts Amherst, principal investigator.

PFI:BIC Awards 2016

■ Smart energy services

- [Energy Smart Community - Leveraging Virtual Storage to Turn Advanced Metering Infrastructure into a Smart Service System](#): Edwin Cowen of Cornell University, principal investigator.

■ Smart environmental services

- [A Smart, Flexible, Large-Scale Sensing and Response Service System \(LASSaRESS\) for Monitoring and Management of Ground, Air and Waterborne Contaminants](#): Jesko Von Windheim of Duke University, principal investigator.

PFI:BIC Awards 2016

■ Smart health services

- Smart Laser-Based Imaging and Optical Spectroscopy System: Optical quantification of bacterial load, oral health surveillance, and caries prediction: Eric Seibel of the University of Washington, principal investigator.
- iSee - Intelligent Mobile Behavior Monitoring and Depression Analytics Service for College Counseling Decision Support: Mi Zhang of Michigan State University, principal investigator.

PFI:BIC Awards 2016

■ Smart transportation

- [RouteMe2 - A Cloud-Integrated Sensor Infrastructure for Assisted Public Transportation Services](#): Roberto Manduchi of the University of California-Santa Cruz, principal investigator.
- [Smart Human-Centered Collision Warning System: sensors, intelligent algorithms and human-computer interfaces for safe and minimally intrusive car-bicycle interactions](#): Rajesh Rajamani of the University of Minnesota-Twin Cities, principal investigator.
- [A Smart Service System for Traffic Incident Management Enabled by Large-data Innovations \(TIMELI\)](#): Anuj Sharma of Iowa State University, principal investigator.

PFI:BIC Awards 2016

■ Smart water reclamation systems

- [Self-Correcting Energy-Efficient Water Reclamation Systems for Tailored Water Reuse at Decentralized Facilities](#): Tzahi Cath of the Colorado School of Mines, principal investigator

PFI:BIC Awards 2015

2015

- A smart service system (ESPnet) for enhanced monitoring and management of toxic algal blooms: Donald Anderson of the Woods Hole Oceanographic Institution, principal investigator.
- Pathtracker: A smartphone-based system for mobile infectious disease detection and epidemiology: Brian Cunningham of the University of Illinois at Urbana-Champaign, principal investigator.
- A smart, always-on health monitoring system: YongGang Huang of Northwestern University, principal investigator.

2015

- Smart CROwdsourced Urban Delivery (CROUD) system:
Yu Nie of Northwestern University, principal investigator.
- Developing advanced resilient microgrid technology to improve disaster response capability: Thomas Ortmeyer of Clarkson University, principal investigator.
- Human-centered smart-integration of mobile imaging and sensing tools with machine learning for ubiquitous quantification of waterborne and airborne nanoparticles:
Aydogan Ozcan of the University of California, Los Angeles, principal investigator.

2015

- [Adaptive robotic nursing assistants for physical tasks in hospital environments](#): Dan Popa of the University of Texas at Arlington, principal investigator.
- [Utility-driven smart energy services](#): Prashant Shenoy of the University of Massachusetts, Amherst, principal investigator.
- [Cyber-physical service system for 3-D printing of adaptive custom orthoses](#): Albert Shih of the University of Michigan, principal investigator.
- [A cost-effective accurate and resilient indoor positioning system](#): Bruno Sinopoli of Carnegie Mellon University, principal investigator

PFI:BIC Awards 2014

2014

- PFI:BIC: [The Living Bridge: The Future of Smart, User-Centered Transportation Infrastructure](#), Principal Investigator: Erin Bell, Organization: University of New Hampshire
- PFI:BIC: [Making Full Use of the High-Resolution Image Capability of Smartphones to Collect Data through Ophthalmic Devices for Smart Mobile- and Tele-Health](#); Principal Investigator: Wolfgang Fink; Organization: University of Arizona
- PFI:BIC: [A Smart-city Cloud-based Open Platform and Ecosystem \(SCOPE\)](#); Principal Investigator: Azer Bestavros; Organization: Trustees of Boston University

2014

- PFI:BIC: [Enhanced Situational Awareness Using Unmanned Autonomous Systems for Disaster Remediation](#); Principal Investigator: Kam Leang; Organization: Board of Regents, NSHE, obo University of Nevada, Reno
- PFI: BIC: [Wearable Smart Textiles Based on Programmable and Automated Knitting Technology for Biomedical and Sensor Actuation Applications](#); Principal Investigator: Kapil Dandekar; Organization: Drexel University

2014

- PFI:BIC: [Fraud Detection via Visual Analytics: An Infrastructure to Support Complex Financial Patterns \(CFP\)-based Real-Time Services Delivery](#); Principal Investigator: Hasan Davulcu; Organization: Arizona State University
- PFI:BIC: [Affordable and Mobile Assistive Robots for Elderly Care](#); Principal Investigator: Mark Yim; Organization: University of Pennsylvania

2014

- PFI:BIC: [Nutriphone: A Nanoparticle-based Optical Contrast Assay to Monitor Vitamin and Micro-nutrient Levels Using Smartphones](#); Principal Investigator: David Erickson; Organization: Cornell University
- PFI:BIC: [Self-Learning Algorithms for Advancement of Smart Stormwater Green Infrastructure Systems](#), Principal Investigator: Bridget Wadzuk, Organization: Villanova University

Questions

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