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“Revolutionizing Nanofab Knowledge Management with Generative AI”

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Bio: Samantha Roberts is an Assistant Professor and Director of the Nanofabrication Facility at the CUNY Advanced Science Research Center, supporting the nanofabrication needs of the greater New York City area. She has been engaged in research, management, and leadership of nanofabrication facilities since her graduate studies at Cornell University, where she earned her Ph.D. from the Laboratory of Atomic and Solid State Physics in 2014. Her research on nanotube MEMS, high-temperature semiconductor devices and various applications of silicon photonics provided her with hands-on experience at multiple shared nanofabrication facilities, including Columbia University, the University of Pennsylvania, Princeton University, Brookhaven National Laboratory, and the City University of New York. This diverse background has equipped her with broad expertise in the technical and operational aspects of academic shared facilities.

Currently, Samantha’s primary focus is leveraging her expertise in Python programming and generative AI to enhance management and user experience in shared facilities. Her work, including *nanobot.chat*, demonstrates how generative AI can transform uncurated technical data into a user-friendly, searchable resource, streamlining both knowledge gathering and knowledge retrieval, which will revolutionize facility operations and accelerate scientific discovery.

Abstract: Managing and operating an academic nanofabrication facility often depends on fragmented, uncurated knowledge scattered across multiple sources, making it difficult to access and utilize effectively. This predominantly text-based knowledge spans critical resources, including management documents such as tool manuals, maintenance logs, operating procedures, safety protocols, and procurement records, as well as user-focused materials like training guides, process recipes, and historical fabrication data. These resources are stored in various formats and locations, including websites, PDFs, cloud platforms, emails, spreadsheets, and images.

We will explore how generative AI, paired with Retrieval-Augmented Generation (RAG), offers a transformative solution to unify and streamline access to information. RAG enhances a large language model (LLM) by enabling it to deliver domain-specific knowledge through advanced semantic search. By converting text into high-dimensional numerical representations, RAG allows the LLM to generate accurate, contextually relevant responses, complete with references—accessible via a simple and intuitive chat interface. This technology provides the framework for AI Agents, which have the power to optimize lab management, enhance research productivity, and preserve institutional knowledge in unprecedented ways. By making critical information readily accessible, nanofabrication facilities can unlock new levels of efficiency and foster deeper collaboration across the research community.