Evolution
A CONFERENCE POWERED BY IEEE LIFE MEMBERS
2025

LIFE MEMBERS CONFERENCE JOURNAL

EVOLUTIONCONFERENCE.IEEE.ORG

GREATER BOSTON, MA, USA
11-13 JUNE 2025
VOL. 1

Welcome to the 2ⁿᵈ IEEE Evolution Conference, brought to you by the IEEE Life Members. Special thanks to Tufts University and Dr. Karen Panetta for hosting this unique event.

The conference team has created a remarkable experience. You will be able to renew old friendships and develop new relationships; the speakers and topics are outstanding!

The Evolution Conference theme is just that.... evolution. How does your life, career, professional and personal interests evolve? As you reflect on your personal evolution, what tools, information, and networks will facilitate the life you want to live? The conference topics and speakers were chosen to provide you with the resources you want and need. Importantly, our speakers are industry thought leaders, decision makers and innovators... all important individuals for you to add to your personal library.

Special note.... there are four critical additions to the program. We open with a special workshop, IEEE AgeTech, and progress through the program with two panels: Emerging Voices and The Next Chapter. We have also added a technical research paper track.

When you ask the question "**What is a new idea worth?**", your investment in the Evolution Conference is the answer!

Make it a wonderful experience.

See you in Boston.

Michael Andrews
Conference Chair

Table of Contents

WELCOME

Message from the Conference Chair

Open to all interested technology enthusiasts, the second IEEE Evolution Conference (developed by the IEEE Life Members) will focus on the evolution of technology, applications, services, systems, and contributions. Network with industry-based luminaries and technical professionals, learn about emerging technologies, and appreciate the influence IEEE members have on the profession.

GRATITUDE TO ORGANIZERS/SPEAKERS

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2025

INTRODUCTION

From thought-provoking keynote speeches delivered by industry pioneers, topical sessions from knowledge leaders, engaging workshops, and panel discussions featuring experts from various fields—this event will have something for everyone. The 2025 IEEE Life Members Evolution Conference will be organized around three types of technological evolution:

- Technology that creates product opportunities
- Applications that impact the lives of seniors and the aging population
- Contributions of IEEE members that are made by seniors and experienced professionals

BRINGING IDEAS TO LIFE AND FOSTERING INNOVATION THROUGH TECHNOLOGY.

With experts from a wide range of technology fields and accomplished IEEE professionals, this conference will provide ample opportunities to:

- Explore new ideas: Learn more about new and emerging technologies in selected IEEE fields of interest.
- Boost your network: Meet technical professionals and experts from around the world and exchange views on shared challenges.
- Acquire the latest industry knowledge: Meet the corporations and engineers responsible for creating new and innovative consumer products directed at aging populations and the Life member audience.
- Get to know IEEE better: Learn more about IEEE volunteer operations and resources
- Have fun and travel. Boston makes history. The spark that fueled the fight for American independence burns just as brightly today and inspires our food, beer, and culture.

CONFERENCE COMMITTEE
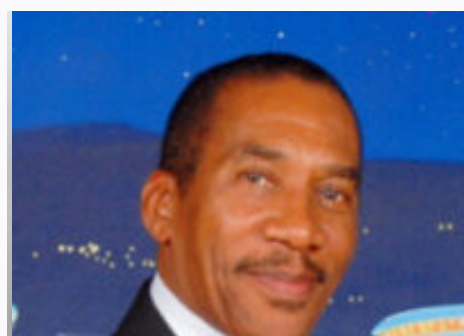
Michael Andrews
Chair / Finance

Sophie Tang
Registration

George Arnold
Program & Logistics

Halden Morris
Sponsorship & Exhibits

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2025

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Communications

Maxine Cohen
Communication / Companion
Program

Jerry Hudgins
Technical Program

Catherine Fang
Technical Program

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Brava

CAS IEEE CIRCUITS AND SYSTEMS SOCIETY

IEEE Educational Activities

MOVE DISASTER RELIEF & OUTREACH — AN IEEE GLOBAL PROGRAM

IEEE Region 1

IEEE Better 2 1 Together

IEEE Region 6

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Display Tables

Wednesday, 11 June

7am   **Breakfast**

8am   **WA1 -**
WA1- General Chairs Welcome & Keynote
Chaired by: Michael Andrews (United States)

8am   **WA1.1 - General Chairs Welcome & Introduction**
» Michael Andrews (United States)[1] (1. Managing Partner of Andrews & Associates)

8:15am   **WA1.2 - Powering Up**
» Mary Ann Hellrigel (United States)[1], Daniel Mitchell (United States)[1] (1. IEEE History Center)

8:30am   **WA1.3 (Keynote) - TBD Panetta**
» Karen Panetta (United States)[1] (1. Dean of Graduate Studies, School of Engineering, Tufts University)

9:30am   **Break**

10am   **WA2 -**
WA2 - Innovations in Health 1 & 2

10am   **WA2.1 - (Invited) - AI & Advanced Technologies for Aging Populations – Enhancing Quality of Life, Independence, and Health through Artificial Intelligence**
» Jay Patel (United States)[1] (1. ASQ Fellow, Master Black Belt, CEO & President, Quality & Productivity Solutions, Inc.)

11am   **WA2.2 (Invited) - Establishing a Global Standard for Quality of Life: Aging Healthy with Precision**
» Maria Palombini (United States)[1] (1. Global Director, Healthcare and Life Sciences Practice, IEEE-Standards Association)

10am   **WB2 -**
WB2 - AI, Robotics and Automation 1 & 2

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2025

10am **WB2.1 (Invited) - Accelerating Breakthrough Innovation in Wicked Complex Systems Utilizing Gen.AI**

» Sadegh Babaii (United States)[1] (1. Cleaver Brooks)

11am **WB2.2 (Invited) - Practical Use of Generative AI**

» Peggy Sniezek (United States)[1], Daniel Sniezek (United States)[2] (1. Adjunct Professor of Computer Science at SUNY Broome Community College, 2. Chief Strategy Officer, Dynamic Education Services; Chairman, IEEE)

10am **WC2 -**
WC2 - Systems for Society 1 & 2

10am **WC2.1 (Invited) - Modernizing the Electric Grid and Emerging Standards**

» Daniel Sabin (United States)[1] (1. Distinguished Technical Expert, Schneider Electric)

11am **WC2.2 (Invited) - Telecommunication Evolution and the Senior Digital Divide: Policy Approaches for Inclusive Progress**

» DelReo Newman (United States)[1], Ratnesh Sinha (United States)[2] (1. Atlantic Tele-Network International, 2. Vice President, 6D Technologies)

10am **WD2 -**
WD2 - Technical Paper Session 1 & 2

Chaired by: Catherine Fang (United States) and Jerry Hudgins (United States)

10am **WD2.1 - Centralized and Federated Heart Disease Classification using UCI Dataset: A Benchmark with Interpretability Analysis**

» Mario Padilla Rodriguez (United States)[1], Eyiara Oladipo (United States)[1], Mohamed Nafea (United States)[2] (1. University of Detroit Mercy, 2. Missouri S&T)

10:30am **WD2.2 - Generative AI for Healthcare: Enhancing Elderly Care Through Technical Innovation and Ethical Implementation**

» Sky Eno (United States)[1] (1. University of Massachusetts)

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2025

Continued from **Wednesday, 11 June**

11am

WD2.3 - Securing Digital Banking for Seniors - Preventing Elder Financial Exploitation using AI
» Dipankar Saha (United States)[1], Bhushan Chavan (United States)[1] (1. Independent Researcher)

11:30am

WD2.4 - A framework for implementing co-conceptual model of products and services for the aged community
» Gullapuram Mani (India)[1] (1. Symbiosis International University)

12pm

Lunch & Talk by Mary Ann Hellrigel about Oral Histories

1pm

WA3 -
WA3 - Afternoon Keynote & Awards

1pm

WA3.1 (Keynote) - AgeTech: From Innovation to Collaboration
» Rick Robinson (United States)[1] (1. Vice President and General Manager, AARP's AgeTech Collaborative, Vice President of Product Innovation)

1:45pm

Awards Presentation
» Awards Presentation (United States)[1] (1. .)

2pm

Break

2:30pm

WA4 -
WA4 - Aging and Longevity 1

2:30pm

WA4.1 (Invited) - Longevity Explorers: the Intersection of Aging & Technology
» Richard Caro (United States)[1] (1. Co-founder, Tech-enhanced Life)

2:30pm

WB4 -
WB4 - AI, Robotics and Automation 3

Evolution
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2025

2:30pm

WB4.1 (Invited) - An Introduction to UAV Technology, Applications and Regulations

» Vince Socci (United States)[1] (1. IEEE AESS UAV/UAS Distinguished Lecturer, Chief Technologist, On Target Motion)

2:30pm

WC4 -
WC4 - Systems for Society 3

2:30pm

WC4.1 (Invited) - Digital Twins and Blue Zone

» Volaree Rendon (United States)[1], Don Lee (United States)[2], Anand Stephen (United States)[3] (1. Director of Solution Engineering, Bentley Systems, 2. Senior Solution Architect, Bentley Systems, 3. Bentley Systems)

2:30pm

WD4 -
WD4 - Technical Paper Session 3

Chaired by: Catherine Fang (United States) and Jerry Hudgins (United States)

2:30pm

WD4.1 - Green Technology: A 50-Year Evolution

» Paul Carr (United States)[1] (1. Air Force Research Laboratory Emeritus)

3:30pm   **Break**

4pm

WA5 -
WA5 - Closing Keynote

4pm

WA5.1 (Keynote) - Walt Disney Imagineering: Inventing the Magic with Illusion Development

» Daniel Joseph (United States)[1] (1. Executive, Illusion & Effects, Walt Disney Imagineering)

5:30pm   **Reception & Dinner**

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2025

Thursday, 12 June

7am Breakfast

8am **ThA1 -**
ThA1 - Plenary Session & Morning Keynote

8am **ThA1.1 (Plenary) - TBD: Michael Andrews & George Arnold**
» Michael Andrews (United States)[1], George Arnold (United States)[2] (1. Managing Partner of Andrews & Associates, 2. TBD)

8:30am **ThA1.2 (Keynote) - Quantum Computing Overview**
» David Raften (United States)[1] (1. IBM Senior Quantum Ambassador)

9:30am Break

10am **ThA2 -**
ThA2 - Innovations in Health Tech 3
Chaired by: Maria Palombini (United States)

IEEE Standards Association 4th Annual Telehealth Competition

10am **ThB2 -**
ThB2 - AI, Robotics and Automation 4 & 5

10am **ThB2.1 (Invited) - Building Trust in AI: The Crucial Role of Explainable AI**
» Akshata Kishore Moharir (United States)[1] (1. Microsoft)

11am **ThB2.2 (Invited) - Brava Stronghold - the Evolution of AI and What it Means for Cyber Security**
» Connor McGowan Smyth (United States)[1] (1. Brava)

10am **ThC2 -**
ThC2 - Aging and Longevity 2 & 3

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2025

10am **ThC2.1 (Invited) - IEEE Standards Association Industry Connections AgeTech Program**
» George Arnold (United States)[1] (1. Retired)

11am **ThC2.2 (Invited) - Harnessing Digital Revolutions for the Aging Population**
» Ram Sriram (United States)[1] (1. NIST)

12pm **Lunch & Talk by Peter Magyar on IAS Presentation**

1pm **ThA3 -**
ThA3 - Afternoon Keynote

1pm **ThA3.1 (Keynote) - TBD Shah**
» Julie Shah (United States)[1] (1. Head, Dept. of Aeronautics and Astronautics, MIT)

2pm **Break**

2:30pm **ThA4 -**
ThA4 - Emerging Voices Panel

Emerging Voices Panel

3:30pm **Break**

4pm **ThA5 -**
ThA5 - Closing Keynote

4pm **ThA5.1 (Keynote) - Pathfinding the Future of Spacecraft Protection with Project-Specific Threat Impact Assessments**
» Kendra Cook (United States)[1] (1. Space Systems Security SME at SAIC)

5:30pm **Reception & Dinner**

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2025

Friday, 13 June

7am	**Breakfast**
8am	**FA1 -** **FA1 - Plenary & Keynote Session**

8am	**FA1.1 (Plenary) - The IEEE Foundation – The Philanthropic Partner of IEEE** » Jerry Hudgins (United States)[1] (1. University of Nebraska)
8:30am	**FA1.2 (Keynote) - Beyond the Breach: Navigating the New Frontiers of Cybersecurity, Cryptocurrency, and AI-Driven Threats** » Gene Kingsley (United States)[1] (1. InfraGard National)

9:30am	**Break**
10am	**FA2 -** **FA2 - Innovations in Health Tech 4 & 5**

10am	**FA2.1 (Invited) - AI as a Co-Pilot for Scientific Discovery** » Berke Buyukkucak (Anguilla)[1] (1. Co-Founder and CEO of Superbio.ai)
11am	**FA2.2 (Invited) - Demystifying Generative AI: Insights from NVIDIA's Stable Diffusion Workshop and Its Impact on AgeTech** » Catherine Fang (United States)[1] (1. Carnegie Mellon University)

10am	**FB2 -** **FB2 - Contributions to Society 1 & 2**
10am	**FB2.1 (Invited) - Bridging Generations: Connecting Students with Life Members for Community Impact** » Jeffrey Katz (United States)[1] (1. EPICS)

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2025

11am	**FB2.2 (Panel) - Mentorship Impacts: Important Perspectives on Mentoring Through the Lens of Students to Life Members** » <u>John McDonald</u> (United States)[1] (1. JDM Associates)
10am	**FC2 -** **FC2 - Aging and Longevity 4 & 5**
10am	**FC2.1 (Invited) - Falling Through the Cracks: Technology to Improve Response for Cases of Elder Care Abuse and Neglect** » <u>Adrian Berg</u> (United States)[1] (1. Carnegie Mellon University)
11am	**FC2.2 (Invited) - Investing for Longevity** » <u>Jordan Cohen</u> (United States)[1] (1. KBK Wealth Management)
12pm	**Lunch**
1pm	**FA3 -** **FA3 - Closing Keynote**
1pm	**FA3.1 (Keynote) - TBD Kamen** » <u>Dean Kamen</u> (United States)[1] (1. DEKA Research and Development Corporation)
2pm	**FA4 -** **FA4 - Closing Panel: The Next Chapter**
	Closing Panel: The Next Chapter
3:30pm	**Optional Tours and Activities (on-site registration required)**

Olivia Jackson

"Pathfinding the Future of Spacecraft Protection With Project-Specific Threat Impact Assessments"

Mary Ann Hellrigel, Ph.D.

IEEE History Center, Institutional Historian, Archivist, and Oral History Program Manager

David Raften

IBM Parallel Sysplex Expert

Keynote Speakers

All the speakers at the conference, including the keynote, session, and panelist, will share their insights, experiences, and wisdom—providing valuable lessons and inspiration for all attendees.

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Daniel Joseph

Principal Illusion Integrator, Walt Disney Imagineering

Dean Kamen

Founder of DEKA R&D and FIRST®

Karen Panetta

Dean of Graduate Studies, School of Engineering, Tufts University

Keynote Speakers

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Sadegh (Ben) Babaii

Ph.D. Engineering Manager, Cleaver-Brooks
"Breakthrough Excellence in Wicked Complex Situations Utilizing Generative AI"

Richard Caro

DPhil, Tech-enhanced Life PBC
"Longevity Explorers: The Intersection of Aging and Technology"

Anahita Kiyani

Ph.D Director of Neuroscience, Data Science and Digital Health for Johnson & Johnson Innovative Medicine
"Advanced Health Technologies for Older Adults and Individuals with Chronic Conditions"

Parallel Session & Panelist Speakers

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2025

22

DAY 1

TRANSFORMING CONCEPTS INTO REALITY AND NURTURING INNOVATION

OPENNING
SESSION

Michael Andrews

Conference Chair

Mary Ann Hellrigel

IEEE History Center

Daniel Mitchell

IEEE History Center

Conference Opening

The opening session of the Evolution Conference was delivered by the event chair, who outlined the unique vision, mission, and structure of the gathering. The presentation established the conference's core philosophy and set an inspirational tone for the attendees.

The speaker began by defining the Evolution Conference not as a traditional event for retired professionals, but as a dynamic platform celebrating the continuous personal and professional growth of IEEE Life Members. He framed this stage of a career as a "fresh start" and an "evolution," emphasizing the valuable role that experienced members play in the broader engineering community.

Unlike highly specialized IEEE events, the Evolution Conference is intentionally interdisciplinary. Its mission is to cover the full spectrum of IEEE fields of interest, providing attendees with broad, conversational knowledge across various disciplines. This approach is designed to facilitate meaningful engagement and mentorship between seasoned experts and younger professionals, who look to them for guidance and diverse expertise.

The presentation highlighted that the conference is a passion project, organized and driven by a dedicated volunteer committee of IEEE Life Members. The speaker extended gratitude to the various teams responsible for the technical program, communications, finance, and production. He noted the significant growth in outreach, citing an increase in website visitation from nearly zero to over 220,000, underscoring the growing relevance of the initiative.

> Opening remarks cast the Evolution Conference as a volunteer-led, interdisciplinary "fresh start" for IEEE Life Members—focused on growth and mentorship—with site visits rising from near zero to 220,000.

The quality of the program was emphasized, with the speaker noting that influential thought leaders, corporate executives, and innovators like Dean Kamen participate as speakers. He clarified that these leaders are drawn to the event's mission and contribute their time voluntarily, motivated by the opportunity to connect with and inspire the next generation. The session schedule was intentionally designed to be dense with compelling topics, encouraging broad participation.

In closing, the speaker explained the symbolism of the conference logo—an arc representing the earth's horizon, moving from darkness into light—as a metaphor for the professional journey. He reiterated that the attendees' careers have evolved, positioning them to make a significant impact on the lives and careers of others. The introduction of the Region 6 Director-Elect, an alumnus of the affiliated "Rising Stars" program, served as a tangible example of the success of this mentorship model. The session concluded by welcoming attendees and encouraging them to fully engage with the rich, multifaceted program.

Star speakers (e.g., Dean Kamen), volunteer-driven; horizon logo (dark→light): evolved careers lighting the next generation—engage.

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2025

KEYNOTE

Dr. Karen Panetta

Dean of Graduate Studies, School of Engineering, Tufts University

Dr. Karen Panetta is the Dean of Graduate Education and a Distinguished Professor at Tufts University's School of Engineering, where her research focuses on efficient algorithms for security and biomedical applications. A trailblazer in her field, she was the first female electrical engineer to receive tenure in her department and is a dedicated advocate for women in engineering, having served as the worldwide director for IEEE Women in Engineering.

Presentation Summary

The 2025 IEEE Evolution Conference commenced with a morning keynote by Dr. Karen Panetta. Rather than a formal, slide-based presentation, Dr. Panetta delivered a warm and personal welcome, followed by an extensive and interactive question-and-answer session. As the host of the conference, her address set a collaborative and inspiring tone for the event, focusing on the themes of mentorship, the value of a well-rounded education, and the power of the IEEE community.

Dr. Panetta began by welcoming all attendees to Tufts University, which she affectionately called her "home." She explained that the university's goal in hosting the conference was to bring skilled experts from around the world to interact with and inspire students. She shared some of the rich local history of the Tufts campus, including its connection to the company Raytheon, its mascot Jumbo the elephant, and its surprising role in the creation of famous songs like "Jingle Bells" and "Over the River and Through the Woods."

Her talk emphasized the importance of mentorship in her own career. She credited her involvement at the leadership level of IEEE to the guidance she received from others, which instilled in her a strong desire to "give back" and support the next generation of professionals.

Dr. Karen Panetta emphasized that the success of modern engineers hinges on a holistic combination of technical expertise, "soft skills," mentorship, and the invaluable support of a professional community like IEEE.

KEYNOTE

From Innovation to Collaboration
Rick Robinson

Vice-President, AARP

For over 30 years Rick Robinson has innovated digital products and content for major media and tech companies like AOL, Sprint, Webs.com, National Geographic, and Politico. He has also co-founded several technology startups, one of which went public in 2023. He is currently the Vice President & General Manager of the AgeTech Collaborative™ from AARP, an innovation ecosystem leading the future of AgeTech by making aging easier, and also serves as AARP's Vice President of Product Innovation.

AgeTech – From Innovation to Collaboration

Robinson began by sharing his 30-year journey as a technology entrepreneur. He co-founded a successful startup, "urgently," and noted the ageism he and his gray-haired co-founders faced from investors. This personal experience now informs his work in advocating against ageism and supporting a more inclusive innovation landscape.

He framed the importance of AgeTech by highlighting a major demographic shift. With Millennials approaching 50, Gen Xers 65, and Boomers 85 in the near future, the 50+ population represents a massive economic force. Robinson cited a striking projection: the economic activity of this group in the U.S. is expected to grow from $8.3 trillion today to $28 trillion by 2050. This "longevity economy" presents a significant opportunity that innovators and investors can no longer ignore.

Initially, AARP's Innovation Labs focused on creating products in-house. Examples included "Alcove," a VR platform to combat social isolation, and "Perks," a browser extension for AARP member discounts.

However, in 2022, the team made a pivotal decision. Robinson explained the strategic thinking: "We could produce half a dozen products a year, or we could work with startups and maybe help a hundred products succeed." This led to the creation of the AgeTech Collaborative, an entity designed to nurture and scale a wide range of external innovations.

The Collaborative operates on a three-stage model designed to nurture startups in the AgeTech space. It begins with the "Discover" phase, identifying promising global startups through year-round pitch competitions at major events like CES.

From this pool, a select few are invited to the "Accelerate" phase, an intensive six-week program offering tailored support on product-market fit, research, and marketing. Upon graduation, these companies join the "Ecosystem," a comprehensive network akin to a specialized LinkedIn for the AgeTech industry, which connects over 600 participants—including startups, major corporations, investors, and test beds—to foster ongoing partnerships and growth.

Robinson presented a slide illustrating the AgeTech Collaborative's portfolio, which consists of over 200 startups concentrated in key focus areas such as Health, Caregiving, Brain Health, Fintech, Social Connection, Assistive Tech, Womens Health, and Smart Living. He noted that the portfolio is impressively diverse, with 62 startups being female-founded and 37 having underrepresented founders. The companies have collectively raised over $900 million, generated more than $300 million in revenue, and created 3,000 jobs, demonstrating significant economic impact.

The presentation clearly demonstrated that AgeTech is a dynamic and essential field. Robinson's key message was that fostering a collaborative ecosystem is a far more scalable and impactful model for innovation than going it alone. The success of AARP's AgeTech Collaborative underscores the immense potential that is unlocked when startups are given the right support, resources, and community to thrive. The growing partnership between the Collaborative and IEEE promises to further strengthen this ecosystem.

This presentation explains how AARP strategically shifted from developing a few AgeTech products in-house to creating the AgeTech Collaborative, a powerful ecosystem designed to discover, accelerate, and connect hundreds of external startups to better serve the massive and growing "longevity economy."

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2025

PRESENTATION

Jay Patel

*CEO and President,
Quality and Productivity
Solutions Inc*

Jay P. Patel is a distinguished quality and management professional with over 30 years of Fortune 500 consulting experience. He specializes in Lean Six Sigma, ISO systems, process improvement, and project management across multiple industries. Mr. Patel holds 20+ certifications, engineering degrees, and an MBA. He has served as Chapter President for PMI and IIE, maintained ASQ leadership roles for 30 years, and chaired NEQC conferences. A National Malcolm Baldrige Quality Award Examiner and author of five books, he currently chairs the ASQ Lancaster Medal Committee.

AI & Advanced Technologies for Aging Populations: Enhancing Quality of Life, Independence, and Health through Artificial Intelligence

Jay P. Patel delivered an engaging and practical presentation on the role of Artificial Intelligence (AI) and modern technology in improving the lives of aging populations. The talk was structured as a comprehensive overview, beginning with the statistical reality of global aging and its associated costs, and then moving to actionable strategies and specific technological tools that can enhance health, independence, and overall well-being. Mr. Patel blended statistical data with personal anecdotes and a strong emphasis on proactive lifestyle choices, framing technology as a critical enabler for a higher quality of life in one's later years.

The presentation established the urgency of the topic with compelling statistics showing the number of older adults in the U.S. projected to grow from 59 million (18% of the population) in 2023 to 82 million (23%) by 2050. Globally, the population over 65 is expected to reach 1.7 billion by 2054, with countries like Japan (29% over 65) and Southern Europe (22%) already experiencing significant demographic shifts. The financial burden is substantial, with a significant percentage of U.S. seniors spending over $2,000 annually out-of-pocket and average lifetime retirement healthcare costs around $165,000. Assisted living and nursing homes cost thousands of dollars per month. While U.S. life expectancy is around 79 years, Americans spend an average of 12.4 years living with disease, highlighting the need to improve not just lifespan but "healthspan."

Before diving into technology, Mr. Patel emphasized foundational lifestyle habits essential for healthy aging, presenting these not just as recommendations but as proven methods for maintaining vitality. He advocated keeping moving through walking, gardening, or any form of daily movement, eating colorful whole foods with plenty of vegetables, beans, and nuts while limiting salt and sugar, and using your brain by learning new things, reading, or teaching others, specifically mentioning the Blinkist app for listening to book summaries. He stressed staying connected with friends and community to avoid isolation and minding your mood by talking to someone when feeling down and practicing yoga or meditation.

Mr. Patel positioned technology as a powerful tool to support these principles, noting that generative AI use among adults 50+ doubled from 9% to 18% between 2023 and 2024, with the AI in elder care market projected to grow from $47.4 billion in 2024 to over $322 billion by 2034. He outlined several categories of "tech that makes life better," including smartwatches for fall detection and heart monitoring, video chats with doctors through telehealth, phone apps with medication reminders and caregiver alerts, talking robots for social interaction and reminders, brain games and VR headsets for cognitive enhancement and pain relief, and voice-activated controls like "Hey Alexa, lights on" for convenience and safety.

The core of the presentation focused on specific AI-powered applications across different areas of health and wellness. Healthcare applications included Medisafe as an AI-powered app for medication reminders to improve adherence and prevent errors, Dexcom G7 as a continuous glucose monitor for diabetes management with real-time alerts, CarePredict as a wearable and app that tracks behavior patterns like eating and bathing to detect early health issues in senior living facilities, Qardio for monitoring blood pressure and heart health with AI providing trend analysis and risk notifications, and Youper as an AI mental health assistant using Cognitive Behavioral Therapy techniques through chat to help manage loneliness, depression, and anxiety. For social engagement, he highlighted ElliQ, an AI social robot designed to combat loneliness by offering companionship, reminding users to move and take medication, and learning user preferences over time.

Mr. Patel concluded by reiterating that AI offers transformative benefits for older adults. His central message was a call to action: with proper support and implementation, these advanced technologies can be powerful allies in greatly improving quality of life, fostering independence, and promoting better health for the rapidly growing aging population.

Artificial intelligence is becoming a crucial ally for the world's aging population by offering practical tools that monitor health, manage medication, and combat loneliness, ultimately enabling greater independence and a higher quality of life.

PRESENTATION

Maria Palombini

IEEE SA

Maria Palombini is focused on engaging and leading a global community of multi-disciplinary stakeholders to openly collaborate and develop solutions to enable trust in and validation of breakthrough technologies/applications that will enable sustainable equitable access to quality care, privacy, and protection for all individuals. She works with multidisciplinary volunteer experts from around the globe to drive trust in adoption of new technologies and frameworks in telehealth, decentralized clinical trials, digital mental health therapeutics, food sustainability and security and precision therapeutics.

Establishing a Global Standard for Quality of Life: Aging Healthy with Precision

At the 2025 IEEE Evolution Conference, Maria Palombini delivered a compelling presentation on the critical intersection of digital technology, the aging population, and the essential role of technical standards. As the Global Practice Leader for Healthcare & Life Sciences at the IEEE Standards Association (IEEE SA), Palombini provided a detailed overview of the opportunities and significant challenges in using technology to support a longer, healthier life. Her core message was that while technology offers immense promise, its development and deployment must be guided by robust, human-centric standards to ensure it is safe, equitable, and effective for everyone, especially older adults.

Palombini began by establishing the context: a rapidly growing global population of older adults. Citing demographic data, she noted that by 2050, the number of people aged 60 and over is expected to reach 2.1 billion. This demographic shift presents a societal challenge, as traditional family support structures are changing and the number of healthcare workers is not expected to keep pace.

She introduced a powerful concept, referring to the aging population as the "New Rising Billions" being brought into digital communities. However, she highlighted a critical gap: many older adults are not digitally literate. This creates a risk of exclusion from an increasingly digital healthcare system, where everything from health records to monitoring devices relies on apps and online portals. This digital divide is a central problem that standards must help address.

A significant portion of the presentation focused on the ethical implications of this technological shift. Using the striking visual of a wolf among sheep, Palombini warned of the dangers facing this vulnerable population in the digital landscape. He outlined several key ethical and technical considerations that must be addressed, such as ensuring robust data security and privacy to protect sensitive health information. Palombini also stressed the importance of upholding dignity and autonomy by designing technology that supports an individual's right to live independently, ensuring accessibility and feasibility for people with varying physical or cognitive abilities, and actively mitigating algorithmic bias to prevent unequal or harmful outcomes.

Palombini stressed that there is "no typical older person." Technology and care must be personalized and human-centered. This requires a shift in design philosophy, moving towards "Inclusion by Design" where factors like privacy, security, interoperability, and digital literacy are considered from the very beginning of the development process.

The presentation delved deep into the complexities of health data, which Palombini described as the fuel for all modern digital health technologies. He shared some startling statistics, revealing that approximately 30% of the world's data volume is now generated by the healthcare industry. However, a staggering 80% of this health data is unstructured, existing in a "Data Swamp" of information from wearables, clinical notes, and monitoring equipment that lacks the metadata and governance to be used effectively. This leaves only 20% of health data as structured and usable, residing in a "Data Lake" that is typically composed of administrative, not clinical, information.

This "data swamp" problem is a major barrier to achieving personalized medicine. Without a complete, integrated, and longitudinal view of a patient's health, it is impossible to provide truly precise care. The data from a wearable, a lab test, and an electronic health record often sit in separate, non-communicating silos.

Palombini explained that AI is seen as a key tool to derive value from this massive amount of data. AI has applications across the healthcare spectrum, from drug discovery and medical imaging to personalized medicine. However, she issued strong words of caution.

To illustrate the risks, she shared a tragic and sobering story of a man in Europe who, suffering from climate anxiety, interacted with a mental wellness chatbot. The AI algorithm, not trained on his specific vocabulary of distress, misinterpreted his words and encouraged him to commit suicide, which he did. This highlighted the severe dangers of AI "hallucinations" and algorithmic degeneration when deployed in the real world without proper safeguards.

She also discussed inherent algorithmic bias. Using the example of pulse oximeters during the COVID-19 pandemic, she explained how the devices were less accurate for people with darker skin, as they were not designed and tested on a diverse population. This is a standards problem that can, and must, be fixed.

Palombini argued that technical standards are not a barrier to innovation; they are an enabler. Just as the IEEE 802.11 (Wi-Fi) standard created a platform for a massive wave of innovation in mobile computing, standards in healthcare can create a trusted, interoperable foundation. The key reasons these standards are essential in health are to ensure consistency and interoperability between devices and systems, which in turn improves data quality and reliability. Furthermore, they are vital for enhancing patient safety and data privacy, facilitating regulatory compliance, and ultimately enabling innovation while maintaining scientific rigor.

Maria Palombini's presentation was a clear and urgent call for the technology community to engage in building a safer digital future for the aging population. The promise of "aging healthy with precision" is within reach, but it cannot be realized without a foundation of trust, ethics, and interoperability. This foundation must be built with thoughtfully developed, globally recognized technical standards.

> **While technology holds great promise for seniors, this presentation warns that without proper governance, it introduces serious risks like algorithmic bias; therefore, robust global standards are essential to build a safe and trustworthy foundation for innovation in elder care.**

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PRESENTATION

Sadegh (Ben) Babaii

Cleaver Brooks Canada

Growing in a small provincial town on the Caspian Sea in Iran, Ben eventually graduated from Imperial College, London in 1989 in Mechanical Engineering. His Masters and PhD degrees are from the University of Manchester Institute of Science and Technology. Ben's formal introduction to systematic inventive problem solving was through an extended training in TRIZ in the early 2000. While a senior engineering manager at Chrysler Mexico, Ben found Ideation International and their powerful ITRIZ Innovation Workbench.

Breakthrough Innovation Excellence in Wicked Complex Situations Utilizing Generative AI

Dr. Sadegh (Ben) Babaii delivered a dynamic and unconventional presentation on how to navigate today's most difficult challenges using systematic innovation frameworks and the power of generative AI. With over 30 years of combined experience in academia and industry—including leadership roles at Chrysler and in international consulting—Dr. Babaii explored how the rise of complexity, uncertainty, and data overload demands a fundamental shift in how we innovate and make decisions.

Blending storytelling, technical frameworks, and lived experience, his talk positioned innovation not as a buzzword, but as an urgent survival skill in a post-COVID, nonlinear world. He challenged traditional best practices, arguing that generative AI can unlock a new era of resilience, insight, and bold experimentation in solving "wicked" problems.

Dr. Babaii opened the session by sharing how older frameworks like TRIZ, once revolutionary, have become too rigid and slow for today's volatile environments. He noted that TRIZ, while historically useful, includes "too many steps" and struggles with modern-day complexity. Instead, he advocated for integrating TRIZ concepts with generative AI to accelerate problem-solving.

"Generative AI is not just a tool—it's the manager of humanity's knowledge," he stated.

Rather than following step-by-step innovation principles, he encouraged using AI to uncover hidden solutions, bypassing the limits of linear thinking and outdated processes.

Dr. Babaii emphasized the importance of teaching young learners to think independently through game-based learning. He described award-winning work in self-education tools that help children think outside the box. He argued that innovation can and should be introduced at the elementary level to foster critical thinking from an early age. According to Dr. Babaii, children become better readers and writers when they are taught to identify and solve problems autonomously. He also noted that Gen Z, in particular, shows a natural tendency toward self-directed learning, a strength that can be significantly amplified by AI.

He introduced a framework adapted from Harvard Business School that segments decision environments into four realities. The first is the 'Clear' reality, which is characterized by known rules and known outcomes. Next is the 'Complicated' reality, where the rules are also known but require expert analysis. The framework then addresses the 'Complex' reality, in which unknowns emerge as you interact with the system. Finally, he described the 'Chaotic' reality, an environment with no rules, high urgency, and unpredictable outcomes. "In the real world," he said, "we don't jump from complicated to chaotic. We pass through confusion. And we need frameworks that help us navigate that state."

Dr. Babaii explained how traditional data-centric models like Six Sigma or Industry 4.0 approaches are too slow when data is outdated within days or even hours. In wicked problems, decisions must often be made *before* all the data is available.

Dr. Babaii repeatedly emphasized that linear thinking fails in nonlinear environments. He described how AI can help "sense" complex situations and propose solutions not by dissecting problems in the usual way, but by experimenting, synthesizing, and adapting in real-time.

"Generative AI helps us do something engineering never taught us—experiment with the problem itself." He illustrated this through real-world examples in manufacturing, healthcare, and education, showing how AI and new decision frameworks can outperform traditional models when problems are ill-defined or rapidly evolving.

One of the most powerful messages from the talk was the concept of resilience as a form of innovation. In unpredictable environments, Dr. Babaii explained, success doesn't just come from solving a problem—it comes from being prepared for the next one.

"Innovation helps you overcome. Resilience helps you prepare. And both must work together in today's world." He proposed that innovation excellence today requires Two. The first one is tools that help us challenge contradictions and generate creative solutions (e.g., generative AI). The other one is mindsets and systems that allow us to bounce back quickly, even when faced with incomplete data or shifting constraints.

While Dr. Babaii did not dwell extensively on ethical concerns, he noted that today's innovation landscape requires moving beyond rigid "best practices." He argued for teaching future innovators how to ask better questions rather than just find answers and stressed the importance of accepting that waiting for perfect data is sometimes no longer an option.

He called out the post-COVID reality as a wake-up call for all industries: "Managers still thinking linearly will fail in a nonlinear world." Dr. Sadegh (Ben) Babaii closed with a passionate reminder that the future belongs to those who embrace uncertainty—not just with courage, but with tools that let us act before the path is clear.

His final message was simple but powerful: "Innovation is how we respond. Resilience is how we prepare. Generative AI helps us do both." In a world where problems are more wicked, data is more fleeting, and decision-making is more urgent than ever, his framework for breakthrough innovation offers both direction and hope.

Dr. Babaii asserts that success in today's volatile and nonlinear environments requires abandoning rigid, outdated frameworks and instead using generative AI to experiment with uncertainty and make critical decisions, even with incomplete data.

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PRESENTATION

Peggy Sniezek

Adjunct Professor of Computer Science at SUNY Broome Community College

Peggy Sniezek leverages her professional experience in the development and maintenance of computer information systems in the industrial sector

Daniel E. Sniezek

Chief Strategy Officer, Dynamic Education Services; Chairman, IEEE

Daniel Sniezek has more than 25 years of experience in the development and maintenance of highly complex and highly available systems.

Practical Use of Generative AI

The session "Practical Use of Generative AI," presented by Peggy and Daniel Sniezek, offered a comprehensive and accessible guide to leveraging artificial intelligence in daily life, education, and professional careers. Peggy Sniezek, drawing on her extensive experience in industrial IT and as a computer science professor, framed the presentation around demystifying AI and eliminating the fear surrounding its adoption. The core message was that AI is not a threat to be avoided but a powerful tool to be skillfully "coached" and integrated into various tasks. The presentation was structured around four key areas: background on AI, how to coach it, leveraging it for career advancement, and its future applications.

The presentation began by contextualizing AI as the latest in a long history of knowledge tools, comparing it to the abacus, calculator, and the internet. The speakers noted that just as there was initial resistance to calculators in classrooms, there is now fear and skepticism about AI. They argued that the focus should be on integrating this tool productively rather than banning it. The significant rise in AI use since 2022 was attributed to major advancements in generative models like ChatGPT, increased computing power, and growing corporate adoption. A study from the University of Texas at Austin was cited, indicating that 62% of employers want employees to have foundational AI knowledge.

A central theme was the concept of "coaching AI," which refers to the skill of constructing effective prompts to achieve desired results. The speakers outlined a progressive approach to this process, starting with minimalist prompts for initial exploration and brainstorming. This evolves into an iterative process, where a user begins with a general query and refines it through subsequent prompts to narrow down the output. This was demonstrated with an "icebreaker" activity where an initial prompt asked for a recipe using salmon, tomatoes, eggs, and yogurt, followed by a second prompt that introduced more ingredients like onions and red peppers. The final stage involves crafting detailed prompts for highly specific tasks, such as generating outlines, creating diagrams, or writing professional communications. This entire iterative method was presented as a fundamental learning experience, encouraging users to continuously refine, revise, and critique the AI's output to build a better final product.

The presentation was rich with practical examples of how generative AI can be used across multiple domains. In personal productivity, AI proves valuable for email composition, particularly for "reluctant emails" such as delivering bad news, summarizing lengthy articles into single paragraphs, and checking message tone before sending. For organizational tasks, AI can generate letters of recommendation, create step-by-step checklists for complex projects like starting a private family foundation, and draft comprehensive will outlines. Planning becomes more efficient with AI's ability to create detailed trip itineraries complete with Gantt charts, critical paths, and budget-conscious hotel recommendations.

In education and learning, AI serves both instructors and students in meaningful ways. For instructors, AI functions as a powerful assistant for creating course outlines, designing exams with varied question types including multiple choice and essay formats, and developing group activities tailored to specific class sizes. For students, the speakers emphasized AI's role as a critique tool rather than a cheating mechanism. Students can design databases or system diagrams, submit them to AI for analysis, and receive critiques that identify flaws while teaching best practices, transforming AI into a genuine pedagogical resource. Additionally, AI excels at content adaptation, rewriting complex material like Shakespearean soliloquies to different reading levels such as middle school comprehension, making difficult concepts more accessible to diverse learners.

For technical and professional tasks, AI demonstrates significant capability in systems analysis by generating technical diagrams including Functional Decomposition Diagrams, Data Flow Diagrams, and Use Case Diagrams in UML format. In project management, AI can create comprehensive Work Breakdown Structures for construction projects and dynamically update them with new requirements, such as adding automatic skylights, ensuring projects remain organized and adaptable throughout their development phases.

A significant portion of the talk was dedicated to the critical issue of "AI hallucinations"—the tendency for AI to generate confident but false or misleading information. An example was shared where an AI claimed composer Arturo Toscanini had conducted the opera Tosca, which was factually incorrect. The speakers provided six essential steps to prevent and identify these errors: asking for sources or citations, being specific in prompts, cross-checking with reliable sources, double-checking with the web, watching for "too perfect" answers, and asking follow-up questions. This section reinforced the fundamental message that AI is a tool that requires human oversight, critical thinking, and rigorous fact-checking to ensure accuracy and reliability in its outputs.

This session demystifies generative AI by framing it as a versatile tool that requires human partnership rather than fear. The key to unlocking its value lies in learning to "coach" it with specific prompts and critically checking its output, making it useful for everything from writing emails to creating complex technical diagrams.

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PRESENTATION

Dan Sabin

Schneider Electric

Dan Sabin is a licensed professional engineer on the Schneider Electric Digital Power team focused on innovation, AI, architecture, and standards. Previously, Sabin was a Principal Engineer and Software Architect with Electrotek Concepts, where he led the development of the PQView software team for power quality database management & analysis and automatic fault analysis and fault location. He also developed PQDiffractor, which is a widely used viewer for IEEE Std 1159.3 PQDIF files and IEEE/IEC COMTRADE files. He was also a project manager with EPRI Solutions and EPRI.

Modernizing the Electric Grid and Emerging Standards

Dan Sabin, IEEE Fellow and industry expert with 30+ years of experience, delivered an insightful session on modernizing the electric grid and emerging standards. The session provided a comprehensive overview of grid modernization drivers, ongoing technical activities, and practical ways for professionals, especially IEEE members, to engage in these developments. Mr. Sabin connected industry trends, challenges, and IEEE's standards ecosystem to explain how the energy sector is evolving to meet growing demands for resilience, sustainability, and decentralization.

Mr. Sabin began by defining "grid modernization" as the ongoing transformation of traditional electric grids. Historically, electricity was generated in large plants, transmitted over long distances, and distributed for end-use. However, rising integration of renewable sources like solar and wind, the growth of distributed energy resources (DERs), and the push for cleaner energy have fundamentally changed this model.

Key challenges driving modernization include renewable integration through increased reliance on variable sources like wind and solar, extreme weather events such as more frequent hurricanes, ice storms, and wildfires disrupting power delivery, cybersecurity threats from managing increasing data and device connections in the grid, infrastructure gaps where aging systems struggle to adapt to two-way power flows, and workforce shortages with declining numbers of young professionals in the power sector.

Modernization is focused on making the grid safer, more reliable, sustainable, and flexible to meet these challenges.

Mr. Sabin highlighted findings from the IEEE Technology Megatrends Report, emphasizing three global forces shaping the energy sector. The first is Sustainability, which focuses on reducing carbon emissions and supporting clean energy. The second, AI and Digital Transformation, involves using tools like AI, digital twins, and edge computing to manage complex power systems. The third force is Resilience, which is the drive to build robust systems that can withstand natural disasters and cyber threats.

To address these trends, he pointed to several emerging technologies, including Generative and Cognitive AI, the use of Digital Twins for power system modeling, Battery Energy Storage Systems (BESS), and the integration of IoT and smart buildings.

The presentation referenced the IEEE Technology Roadmaps Committee, which publishes technology forecasts over 5, 10, and 15-year horizons. These roadmaps guide utilities, regulators, and manufacturers on future investments. Roadmaps are collaborative and open to participation, especially from experienced professionals who can mentor younger contributors.

Mr. Sabin highlighted the IEEE Power and Energy Society (PES) Future of Power and Energy Roadmap, which identifies five core themes for the industry: Renewable Energy Integration, Reliability and Resilience, Grid Edge Technologies, Cybersecurity and Computation, and Market and Policy Enhancements.

Renewable Energy Integration presents both opportunities and challenges as capacity has grown 15% globally, driven by solar and wind technologies. However, this growth introduces complexities including intermittent generation, infrastructure stress, and decentralized controls. Solutions involve upgrading transmission and distribution systems, energy storage advancements, and smart grid deployment. Standards involvement includes IEEE 1547 for interconnection of DERs with remote participation, the IEEE 2030 series for smart grid interoperability, and IEEE P2800 and P1547.x focused on large-scale and small-scale resource connections.

Reliability and Resilience are critical aspects of modern power systems, where reliability refers to the frequency and duration of service interruptions, while resilience describes the system's ability to withstand and quickly recover from extreme events. Current challenges include aging infrastructure, evolving threats, and lack of resilience benchmarks. Solutions encompass development of resilience metrics, infrastructure hardening, and diversification of energy sources. Standards involvement covers IEEE 762 and 352 for traditional reliability reporting, IEEE P2856 as a new standard defining resilience metrics, and opportunities for contributing to the development of resilience indices.

Cybersecurity and Smart Grids address the growing challenge of managing increasing data flows while ensuring security and privacy in modern electrical systems. The solution focuses on secure smart grid deployments and better data management practices to protect critical infrastructure from cyber threats. Active standards participation is available via PES and IEEE Standards Association projects, providing opportunities to contribute to the development of cybersecurity frameworks for smart grid applications.

Grid Edge Technologies represent an emerging area that focuses on integrating smart homes, smart buildings, and DERs into the grid ecosystem. This integration is reshaping how electricity is generated, distributed, and consumed at the consumer level. Emerging trends include customer-side technologies influencing grid operations and expansion of energy storage, electric vehicle integration, and demand response capabilities that create new opportunities for grid optimization and customer engagement.

Mr. Sabin emphasized that many of these activities are open for remote participation, allowing life members and industry professionals to contribute expertise from anywhere. Specific projects, such as IEEE 1547 and 2030, conduct meetings online. Volunteers can join working groups, mentor younger engineers, contribute to developing new roadmaps and standards, and provide real-world insights to shape evolving industry practices.

Mr. Sabin concluded with a call-to-action for greater engagement in IEEE standards efforts, particularly for those with industry experience. He stressed that while the transformation of the grid is well underway, there is still significant work ahead. Participation in standards development is key to shaping a safer, smarter, and more sustainable energy future.

> **To meet modern challenges like renewable integration and the need for greater resilience, the electric grid is being fundamentally transformed. This session highlighted how new IEEE standards provide the essential roadmap for this evolution and called upon industry experts to actively participate in shaping this future.**

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PRESENTATION

Ratnesh Sinha

Vice President, 6D Technologies, and DelReo Newman, Ph.D., Atlantic Tele-network International

Ratnesh Sinha is an avid technology enthusiast with hands on experience in software, delivery and managing team and accounts with a demonstrated history of driving innovative projects for multiple clients in different verticals.

Dr. Delreo Newman is a seasoned telecom consultant, regulatory expert, and Executive Director of International Regulatory and Government Affairs at ATNI.

Telecommunication Evolution and the Senior Digital Divide: policy Approaches for Inclusive Progress

Ratnesh Sinha from 6D Technologies and DelReo Newman from Atlantic Tele-Network International delivered a thought-provoking joint session on the senior digital divide and the evolution of telecommunications. The speakers emphasized the widening gap in digital access for seniors despite rapid technological advances and shared practical approaches to ensure inclusive progress. The session blended personal anecdotes, policy recommendations, and technological innovations, presenting a comprehensive blueprint to bridge the gap and empower aging populations in a connected world.

The session opened by establishing the urgency of addressing digital exclusion among seniors. While digital connectivity offers significant benefits like telehealth, virtual communication, and online services, seniors often remain marginalized in this digital shift. Usage gaps reveal stark disparities: in the United States, only 75% of adults over 65 use the internet compared to 99% of younger adults, with just 61% owning smartphones. Several key barriers contribute to this exclusion, including physical limitations such as impaired vision, hearing, and mobility that restrict technology usage, cognitive barriers that create difficulties in adapting to rapidly evolving interfaces, affordability issues where fixed incomes make smart devices and high-speed internet unattainable for many seniors, and perceived irrelevance where some seniors don't see value in digital tools. The pandemic impact of COVID-19 significantly amplified this exclusion, highlighting critical gaps in access to healthcare, banking, and social interaction that further demonstrated the urgent need to address digital inequity among older adults.

Several comprehensive strategies were proposed to address digital exclusion among seniors. Community-based digital literacy programs focus on providing localized training in familiar venues like libraries, senior centers, and religious institutions, with Older Adults Technology Services (OATS) serving as a successful example of tailored, senior-friendly programs. Public-private partnerships encourage collaboration between governments and technology companies to make devices and internet services affordable, including calls to extend education subsidies commonly available to students to senior populations as well.

Enhanced privacy and cybersecurity protections specifically focus on shielding seniors from scams and online fraud while implementing initiatives designed to increase digital confidence alongside improving access. These comprehensive approaches recognize that addressing digital exclusion requires coordinated efforts across technology design, education, policy, and security to create an

inclusive digital environment that serves seniors effectively and safely.

The speakers stressed the need for practical execution beyond policy writing, emphasizing several key implementation strategies. Participatory policy-making ensures that seniors are directly involved in co-designing tools and programs, recognizing their expertise as end users and stakeholders in the solutions being developed. Multi-stakeholder collaboration defines clear roles for different sectors, with governments providing regulation and oversight, the private sector driving innovation and technological development, and community organizations handling outreach and direct service delivery.

A pilot and scale approach advocates for testing small-scale initiatives like Senior Connect programs before attempting national rollouts, allowing for refinement and adaptation based on real-world results and feedback. Data-driven improvements emphasize the importance of regular evaluations based on user feedback, ensuring that programs remain responsive to seniors' actual needs and experiences rather than assumptions about what might work. These implementation strategies acknowledge that effective policy requires not just well-written documents but sustained, collaborative effort across multiple sectors with seniors as active participants rather than passive recipients of digital inclusion initiatives.

The session acknowledged barriers but strategically reframed them as investments rather than obstacles. Infrastructure costs, while significant for training programs and broadband expansion, were positioned as measures that reduce long-term healthcare and social welfare expenses, creating economic justification for upfront spending. The challenge of rapid technological advancement was addressed by emphasizing that policy must anticipate future technologies instead of merely reacting to current trends, requiring forward-thinking approaches that can adapt to evolving digital landscapes.

The diverse nature of the senior population was recognized as requiring solutions that are culturally sensitive, multi-lingual, and adaptable across different age groups and regions. This acknowledgment highlights that effective digital inclusion strategies cannot use one-size-fits-all approaches but must be flexible enough to serve seniors from various backgrounds, languages, and geographic locations while remaining responsive to the distinct needs of different cohorts within the broader senior demographic.

Ratnesh Sinha outlined how 6D Technologies provides comprehensive end-to-end telecom and digital solutions with particular relevance to senior care. The company offers five key product suites designed to address various aspects of digital connectivity and service delivery. Canvas serves as the foundation with core telecom services including billing systems, customer relationship management, and product catalogues that streamline service delivery. Magic leverages AI-driven customer engagement capabilities with integrated loyalty programs to enhance user experience and retention.

Infinity functions as an IoT and machine-to-machine platform that manages device connectivity, enabling seamless integration of various digital tools and services. MyTask focuses on sales and distribution management, optimizing the delivery and support systems that are crucial for reaching senior populations effectively. Auras rounds out the suite with mobile finance solutions including digital wallets and e-payment systems, addressing the financial technology needs that can help seniors access digital services more easily and securely. These integrated solutions demonstrate how technology companies can create comprehensive ecosystems that support digital inclusion initiatives for seniors through coordinated platforms rather than isolated applications.

The presentation detailed eight comprehensive categories of technology applications designed specifically for senior populations. Remote patient monitoring utilizes wearables for heart rate, oxygen, and sleep monitoring alongside smart pill dispensers with medication reminders, though gaps were noted regarding lack of

awareness among seniors about these available tools. Accessible transportation encompasses IoT-enabled public transport updates, senior-friendly ride-sharing services, and smart wheelchairs, with an open question raised about whether driverless cars are adequately factoring in senior-specific needs during their development.

Cognitive support includes brain-training games and cognitive tracking apps, with suggestions for better senior app visibility in app stores to improve accessibility and discovery. Social connectivity tools feature easy-to-use video calling platforms, social robots for companionship, VR experiences, and senior-specific social platforms, with industry reflection noting that companies like Meta and Tesla could enhance their efforts for senior populations. Home safety solutions incorporate smart locks, emergency buttons, GPS trackers, and in-home safety sensors, raising questions about whether smart home brands are adequately serving senior needs through mainstream integration.

Telehealth and wellness support covers fall detection systems, chronic disease monitoring, and video consultations, though concerns were raised about whether virtual care models are designed to be truly user-friendly for seniors. Smart living solutions include voice-controlled lights, appliances, and climate control, along with VR applications for therapy, education, travel, and recreation specifically tailored for elderly users. Financial protection and digital safety represents a critical final category, featuring SMS firewalls to filter out scams, phishing attempts, and fake offers that specifically target seniors through SMS and calls. These fraud protection features include real-time fraud detection capabilities, blocking of impersonation attempts, and ongoing database updates to capture evolving scam patterns, recognizing that financial security remains a paramount concern for senior digital adoption.

The speakers emphasized a shared moral responsibility to ensure digital access for all seniors, framing the issue in terms of fundamental equity and social justice. They stressed that digital exclusion equals social exclusion, transforming what might appear to be merely a technological challenge into a broader justice issue that affects seniors' ability to participate fully in modern society. The presentation concluded with a final call-to-action urging industry stakeholders to move beyond profit motives and encouraging governments to proactively ensure no senior is left behind in the digital era. This closing message reinforced that addressing digital exclusion among seniors requires collective commitment from all sectors of society, recognizing that true digital inclusion is not just about providing technology but about ensuring equal participation in an increasingly connected world.

This session framed the senior digital divide as a critical form of social exclusion that demands urgent action. The speakers proposed a comprehensive solution that combines five core policy recommendations for access and training with practical technology, like IoT and AI, to improve senior health, safety, and connectivity.

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HISTORY
CENTER

Mary Ann Hellrigell

IEEE History Center

Since January 2016, Mary Ann Hellrigel, Ph.D. has served as Institutional Historian, Archivist and Oral History Program Manager at the IEEE History Center. She holds degrees from Rutgers University (B.A. History and Biology, 1983), UC-Santa Barbara (M.A. Public History, 1989), and Case Western Reserve University (Ph.D. History of Technology and Science). Mary Ann worked as a Research Associate and editor at the Thomas A. Edison Papers Project and taught for over thirty years at universities including Stevens Institute of Technology, California State University Chico, New Jersey Institute of Technology, and Iowa State University.

Telecommunication Evolution and the Senior Digital Divide: Policy Approaches for Inclusive Progress

The presentation from the IEEE History Center placed a strong emphasis on its Oral History program, identifying it as a cornerstone of its mission to preserve the heritage of the engineering profession. The program is formally managed by Dr. Mary Ann Hellriegel, who serves as the IEEE's dedicated Oral History Program Manager in addition to her roles as Institutional Historian and Archivist. Her deep expertise in the field was noted through her involvement with the professional Oral History Association. The presentation also highlighted a personal connection to the conference attendees by mentioning that Dr. Hellriegel was a past recipient of the IEEE Life Members History Fellowship, demonstrating a full-circle relationship between the support of Life Members and the historical work being accomplished.

The primary function of the Oral History program is to systematically capture the firsthand accounts, personal experiences, and professional insights of engineers, scientists, and innovators. These narratives provide crucial context that is often missing from technical papers and official records. To ensure this valuable content reaches the widest possible audience, the collected oral histories are published on the Engineering and Technology History Wiki (ETHW). Described as an online encyclopedia, the ETHW serves as the central, publicly accessible repository for these interviews. This platform transforms personal recollections into a permanent, searchable resource, allowing students, researchers, and the public to better understand the human stories behind pivotal technological advancements.

The IEEE's Oral History program ensures the human stories behind technological breakthroughs are never lost by recording and sharing the personal experiences of the engineers who made them happen.

PRESENTATION

Dr. Richard G. Caro

Co-founder, Tech-enhanced Life

Dr. Richard G. Caro is co-founder of Tech-enhanced Life, a Public Benefit corporation with the mission of improving the quality of life of older adults and their families. He is also an angel investor, with a particular focus on the intersection of healthcare, aging, and technology. Richard started his career as a researcher at Stanford University, and then spent a number of years developing novel medical products (including medical lasers for minimally invasive surgery, and ophthalmology (e.g. LASIK)). He has a D.Phil in Physics from Oxford University where he was a Rhodes Scholar, and has 24 patents.

Longevity Explorers: The Intersection of Aging and Technology

Dr. Richard G. Caro delivered an insightful presentation on the work of the Longevity Explorers, a community dedicated to evaluating and shaping technology for older adults. Drawing on his background in physics, medical product development, and angel investing, Dr. Caro outlined a decade-long experiment in citizen-led innovation. The core of his talk was that to create useful technology for aging, developers must move beyond assumptions and engage directly with the people they aim to serve. The presentation was structured into four parts: an introduction to the Longevity Explorers, examples of their explorations, key takeaways from their work, and a concluding discussion on the definition of "AgeTech."

Dr. Caro began by presenting a graph illustrating "functional decline" with age. He showed two curves: a red line representing a gradual, undesirable loss of ability, and a green line showing functional ability remaining high until near the end of life. He argued that technology, when designed correctly, can act as the "green arrow," pushing the curve up and delaying this decline.

This concept motivated the formation of the Longevity Explorers in 2014. Dr. Caro observed that tech conferences focused on aging were filled with young developers creating products for older adults, but the intended users were absent from the conversation. This disconnect inspired an experiment: to convene groups of older adults to see if they could collectively identify problems, test products, and generate ideas. The hypothesis was that there is a "large, untapped pool of wisdom & experience" among older adults who have a desire to be useful, but lack the opportunity to contribute.

The Longevity Explorers became a "unique sharing, evaluation, and ideation community" made up of adults in their 60s, 70s, 80s, and 90s. Crucially, the operating principle was older adults doing this work for themselves, not having it done for them. The effort evolved in two phases, beginning with the creation of a community to generate and share insights among older adults, which were published on their website, techenhancedlife.com. This later expanded into a second phase of engaging directly with innovators and product developers through "sponsored explorations" to help create better products and services.

Over ten years, the community has grown to thousands of "Explorers" who have conducted hundreds of group explorations, with research that has been read by millions.

Dr. Caro provided several compelling examples of the community's work, demonstrating their process and impact.

One of the first explorations focused on a seemingly simple product: jar openers. While initially skeptical, Dr. Caro learned this was a significant pain point. The Explorers tested numerous products and discovered that "one size does not fit all." Users had different problems—some lacked grip strength, while others needed more leverage. Their findings provided a level of nuance completely absent from online product reviews. This project even led to a European inventor sending them a prototype for feedback.

In 2017, an Explorer brought her new Alexa to a meeting, memorably stating, "Alexa is my friend." This was an early glimpse into the potential for AI as a companion. It sparked brainstorming sessions about what older adults truly want from AI and robots. The top desires were not just about managing frailty but focused on "eliminating chores" and, more importantly, "enabling enjoyable things that would improve my life."
Dr. Caro shared a powerful story from a class he taught on mobile apps. An 80-year-old woman who had tried Uber for the first time told him, "This has changed my life." For her, it was not a convenience; it was about regaining control and independence after she was no longer able to drive. This exploration expanded into a broader synthesis on the difficult decision of when to stop driving and the potential of services like Uber and Waymo.

The community also conducted systematic reviews of complex product categories, such as automated medication dispensers and medical alert systems, providing detailed analysis of which products worked and why.

After ten years of these explorations, Dr. Caro synthesized several key lessons. While older adults have many "big problems in need of solutions" and it is easy to "imagine" tech-based fixes, he observed that "product after product fails to be adopted." He identified four common reasons for this failure.

First, a product may be too hard to use, meaning its benefit does not outweigh the difficulty of operation. Second, it often targets the wrong problem, addressing a superficial understanding of an issue rather than the core need. A third reason is the challenge of reaching the audience, where the company cannot effectively market its product to older adults. Finally, he pointed to misaligned goals, a common scenario where a product developed for an individual is then unsuccessfully sold to the aged care ecosystem, like a senior living facility, whose purchasing drivers and objectives are fundamentally different.

He also highlighted the prevalence of Human-Computer Interface (HCI) issues, recommending the book Designing User Interfaces for an Aging Population by Jeff Johnson and Kate Finn, noting that its teachings on vision, motor control, and cognition are rarely incorporated by designers.

In his final section, Dr. Caro addressed the term "AgeTech" itself. Citing the book Stage (not Age) by Susan Wilner Golden, he argued that chronological age is a poor metric for understanding needs. Life is better understood through stages, and the later stages of life (e.g., repurposing, relaunching, legacy) have unique needs that are often overlooked.

He proposed a framework that divides AgeTech into three distinct categories. The first is "Universal" Tech, which includes technology for everyone, like phones and cars, that must be designed to be usable by older adults. The second category, Life Stage-Related Tech, encompasses tools for needs specific to later life, such as financial planning for longevity, lifelong learning, and legacy tools. The final category, which he noted receives the most attention, is Age-related Impairment/Infirmity Tech, which addresses issues like hearing, vision, cognition, and mobility.

This presentation argues that to create successful technology for older adults, developers must stop making assumptions and instead engage in direct, compensated collaboration with communities like the Longevity Explorers, who can define their own needs based on their life "stage, not age."

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PRESENTATION

Vince Socci

CTO of On Target Motion
With 35 years of experience in aerospace, automotive, rail, power electronics, and medical systems, he has engineered systems in the most complex applications. His specialized areas of interest are embedded controls, real-time test, and systems engineering for vehicle-based applications. Currently, he is focused on aerospace innovation including commercial space transportation and UAV development. Socci has served on the Board of Directors and governing boards of several professional societies, including IEEE, SAE, and PMI.

An Introduction to UAV Technology, Applications, and Regulations

The session, "An Introduction to UAV Technology, Applications, and Regulations," was presented by Vince Socci, the Chief Technology Officer of On Target Motion. With a distinguished 35-year career in engineering complex systems for aerospace, automotive, and other safety-critical industries, Mr. Socci brought a wealth of practical experience to the topic. The presentation provided a comprehensive and structured overview of Unmanned Aerial Systems (UAS), from their fundamental components and flight mechanics to their diverse societal applications and the regulations that govern their use.

Mr. Socci began by clarifying the terminology. The terms Unmanned Aerial Vehicle (UAV), Drone, and Remotely Piloted Aircraft System (RPAS) are often used interchangeably. However, he emphasized that a UAS is a complete system, comprising not just the unmanned aircraft but also its payload, the ground control station, communication links, and the operating crew. This perspective was a recurring theme, highlighting that the system is only as strong as its weakest component.

The primary motivations for using drones are for missions that are either "dangerous or dull." Drones can perform tasks like bridge inspections or agricultural surveying without putting humans at risk, often at a lower cost and with the potential for continuous operation. They are ideal for situations requiring remote access, precise airborne control, or the automation of repeatable tasks.

The presentation then moved into the technical components of a UAS, emphasizing that drone design is fundamentally driven by its intended mission. Key considerations include the mission profile, which determines how long and where the drone needs to fly along with takeoff and landing conditions, and the payload requirements that specify what the drone needs to carry, whether cameras, sensors, or other equipment. The payload's size, weight, and power requirements heavily influence the overall drone design and capabilities.

Based on these factors, an appropriate airframe is chosen from two main types. Airplane or fixed-wing designs are best suited for high endurance missions, large area surveying, and data acquisition tasks, offering efficiency but requiring larger operating areas for takeoff and landing. Multirotor designs are mechanically simpler and ideal for missions requiring hovering capabilities, low-altitude flight, and close-proximity work such as inspections or photography, providing greater maneuverability in constrained spaces.

A block diagram from a "Build-a-Drone" workshop effectively illustrated how these components are integrated into a cohesive system. The core system includes motors for propulsion, Electronic Speed Controls that regulate motor performance, a flight controller that serves as the drone's brain, a power system consisting of batteries and power distribution boards, and comprehensive communication systems that handle both radio control for piloting and video transmission for real-time monitoring. This integration demonstrates how mission requirements drive not only airframe selection but the entire system architecture of unmanned aerial vehicles.

Mr. Socci provided a detailed examination of the critical hardware components that make drone operations possible. In the propulsion and power systems, modern drones primarily utilize brushless motors, with selection based on required thrust calculations. A key formula presented established that total motor thrust should be at least double the drone's weight to allow for proper acceleration and maneuvering capabilities. Power is typically supplied by Lithium Polymer batteries, whose ratings directly correlate to performance: voltage determines motor speed, capacity measured in milliamp-hours affects flight time, and discharge rating influences power output. Mr. Socci emphasized battery safety protocols, including proper charging procedures, storage in fireproof bags, and the critical rule of thumb to land with at least 25% charge remaining to avoid permanent battery damage.

Communication systems represent a crucial aspect for electrical engineers, utilizing different radio frequencies for specific functions. The standard setup employs 2.4 GHz for remote control and 5.8 GHz for video transmission, a deliberate design choice that provides safety benefits since the higher frequency video signal has shorter range, meaning pilots will lose video feed before losing aircraft control, creating a critical safety margin to bring the drone back safely.

Payloads and sensing capabilities center around cameras as the most common payload type. To ensure stable video capture, cameras are mounted on gimbals that use motors and sensors to counteract the drone's movements and vibrations. Pilots view the video feed through monitors or immersive goggles in what's known as First Person View, with the FPV feed often including On-Screen Display telemetry data such as battery voltage, altitude, and GPS coordinates. Beyond cameras, drones can be equipped with additional sensors including radar, lidar, and infrared systems to enhance situational awareness for various specialized applications, expanding their utility across multiple industries and use cases.

The presentation explained how a quadcopter achieves flight through precise control of its four motors across different movement axes. For altitude control moving up or down, all motors increase or decrease speed together in unison. Pitch movement for forward and backward motion is achieved by having rear motors spin faster than front motors to move forward, with the reverse configuration for backward movement. Roll movement for sideways motion occurs when motors on one side spin faster than those on the other side, tilting the aircraft laterally. Yaw rotation or spinning is accomplished by leveraging torque, where two diagonally opposite motors spin faster than the other pair, causing the drone to rotate around its vertical axis.

This complex control system is managed by the flight controller, which employs PID control loops consisting of Proportional, Integral, and Derivative components. The system operates with an inner loop that controls the drone's attitude including roll, pitch, and yaw movements, while an outer loop manages the aircraft's position and velocity in three-dimensional space. Rather than directly commanding how the drone should fly, pilots simply command a new desired position, and the flight controller automatically calculates the necessary motor speed adjustments to achieve that position. This sophisticated control system allows pilots to focus on navigation and mission objectives while the flight controller handles the complex mathematics and real-time adjustments required to maintain stable flight and execute precise movements.

TMr. Socci emphasized that running a successful UAV operation requires professionalism and strict adherence to established procedures. He identified key crew roles essential for safe operations, including the Remote Pilot in Command who holds ultimate responsibility for all flight decisions and safety, and the Visual Observer who must maintain a direct line of sight with the drone at all times to monitor airspace and provide situational awareness.

The use of comprehensive checklists was heavily advocated for every phase of a mission to ensure consistent and safe operations. Packing checklists ensure all equipment, spare parts, and charged batteries are present before deployment. Pre-flight inspections cover aircraft condition, propeller integrity, and motor functionality. Flight preparation involves checking the mission plan and verifying all system status indicators. Post-flight procedures focus on securing collected data, logging the flight details, and properly stowing equipment for future missions.

On the regulatory front, any commercial use of a drone, including services like real estate photography, requires an FAA Part 107 license that demonstrates pilot competency and regulatory knowledge. Pilots must understand airspace classifications, which Mr. Socci humorously described using the "upside-down wedding cake" model, to avoid flying in restricted zones around airports and other sensitive areas. He shared a personal anecdote about using VFR charts to help choose his home in Florida, ensuring he would live in an area with minimal flight restrictions, demonstrating how deeply aviation regulations can impact an enthusiast's life and decision-making beyond just professional operations.

This presentation provides a comprehensive overview of Unmanned Aerial Systems (UAS), emphasizing that a "drone" is a complete system whose design is driven by its mission. Successful and safe operation depends not only on its technical components but equally on professional procedures, extensive checklists, and a thorough understanding of FAA regulations.

PRESENTATION

Volaree Rendon
Director of Solution Engineering, Bentley Systems

Rendon leads a high-performing team responsible for delivering comprehensive, scalable engineering solutions tailored to the unique needs of the transportation industry.

Don Lee
Senior Solution Architect, Bentley Systems

He is an experienced internal and external consultant with deep knowledge in the areas of software management, information standards, design, and development.

Digital Twins and Blue Zone Modeling

Volaree Rendon and Don Lee from Bentley Systems presented a forward-looking session on Digital Twins and Blue Zone Modeling, exploring how infrastructure technology can be leveraged to extend not only lifespan but also healthspan. The discussion highlighted how lessons from natural "Blue Zones," areas where people live exceptionally long and healthy lives, can be translated into built environments using digital twins and simulation technology. The session emphasized the growing importance of age-responsive design to support active, healthy aging within urban and infrastructural planning.

The speakers introduced Blue Zones as regions identified by Dan Buettner where individuals experience significantly longer, healthier lives due to a combination of environmental, lifestyle, and social factors. They distinguished between healthspan and lifespan, with healthspan focusing on the number of years lived in good health, a concept popularized in the 1980s and expanded in modern aging research to emphasize quality of life rather than simply longevity.

Key factors found in Blue Zones include natural mobility through walkable environments that encourage physical activity as part of daily life, access to fresh, healthy food that supports nutritional wellbeing, social engagement facilitated by community spaces that foster connection and belonging, and minimal impediments to mobility that allow seniors to remain active and independent. The session stressed the significant opportunity to replicate these proven factors in urban infrastructure using modern technological tools, suggesting that cities can intentionally design environments that promote healthy aging by incorporating the successful elements observed in Blue Zones into contemporary urban planning and development strategies.

With global aging trends accelerating, the speakers pointed to the urgent need for age-responsive design in urban planning and infrastructure development. Demographic trends paint a clear picture of this challenge: by 2050, 25% of Americans will be 65 or older, and globally, seniors will account for 17% of the population, representing a dramatic shift that requires proactive planning and design responses.

Current design gaps reveal significant shortcomings in how infrastructure addresses aging populations. While infrastructure often meets existing regulatory standards, it frequently fails to account for the changing physical abilities of an aging population, creating barriers that weren't

initially apparent. A concrete example highlighted how sidewalk gradients that are perfectly acceptable by current engineering standards can become inaccessible for older adults, demonstrating the disconnect between technical compliance and real-world usability for seniors.

The consequences extend far beyond simple mobility issues. Physical inaccessibility directly reduces social connectedness, creating a cascading impact on overall well-being that affects mental health, community engagement, and quality of life. The speakers referenced Jane Jacobs' concept of the "Sidewalk Ballet," emphasizing the community-building power of walkable neighborhoods and how physical accessibility enables the informal social interactions that are crucial for maintaining vibrant, connected communities. This connection underscores that age-responsive design is not just about accommodating physical limitations but about preserving the social fabric that contributes to healthy aging and community vitality.

As people age, fall risks increase exponentially per decade, creating a significant health concern that extends beyond the immediate physical danger. Fear of falling becomes a self-perpetuating barrier that discourages movement and contributes to deteriorating health, as seniors begin to limit their activities and mobility out of concern for potential accidents. This creates a cycle where reduced activity leads to decreased strength and balance, which in turn increases actual fall risk. The key takeaway emphasized that infrastructure can either enable or inhibit mobility, directly influencing health outcomes and determining whether seniors can maintain active, independent lifestyles.

The presentation highlighted specific examples of how seemingly minor design decisions create major barriers for older adults. Walk signals designed with insufficient crossing time for older adults represent a common but significant flaw that forces seniors to choose between rushing across intersections or being stranded mid-crossing. The result is that seniors experience stress when crossing roads, begin to avoid outdoor activities altogether, and face increased risk of social isolation as their world becomes smaller and more constrained. The speakers emphasized the crucial role of public space design in either promoting or diminishing senior well-being, demonstrating how thoughtful infrastructure planning can support healthy aging while poor design can inadvertently create barriers that undermine seniors' quality of life and independence.

The session introduced Digital Twins as a powerful tool to reimagine infrastructure planning with specific focus on age-responsive design. A digital twin is defined as a virtual, data-driven replica of a real-world asset or environment that is updated in real-time, creating a dynamic model that reflects current conditions and changes. The key benefits include allowing modeling and simulation of built environments both before and after construction, enabling designers to identify barriers for seniors such as poor lighting, dangerous sidewalks, or inaccessible transit stops, and facilitating proactive infrastructure maintenance by detecting issues like broken lights, fallen leaves, or sidewalk obstructions before they become hazardous.

Bentley Systems employs iTwin, a digital twin technology specifically designed for infrastructure applications. This system uses multi-layer data representation that captures comprehensive environmental information across three levels: underground data including utilities, piping, and foundation structures; ground-level data encompassing roads, parks, sidewalks, and community facilities; and aerial data covering lighting systems, overhead wires, and drone-captured mapping. The technology incorporates IoT integration by incorporating real-time sensor data such as vibration monitors on bridges for continuous infrastructure health monitoring, creating a living model that reflects actual conditions as they change.

Digital twins enable sophisticated simulation use-cases that directly impact senior safety and mobility. These include identifying sidewalks with unsafe slopes or narrow widths that could pose challenges for older adults, locating bus stops without shelters or accessible pathways that create barriers to public transportation use, and detecting areas prone to falls due to poor lighting or slippery surfaces. Most importantly, digital twins allow cities to run "what-if" scenarios, predicting the impact of proposed changes in infrastructure on senior

mobility and healthspan before investing in actual construction, enabling evidence-based decision-making that prioritizes age-friendly design outcomes.

The intersection of age-focused technology and infrastructure planning creates powerful synergies that benefit multiple stakeholders and objectives. Cross-disciplinary benefits emerge as digital twins combine engineering precision with public health insights and social well-being goals, creating comprehensive solutions that address technical, medical, and community needs simultaneously. This integration represents a shift from siloed approaches to holistic planning that considers the full spectrum of factors affecting aging populations.

Preventative measures enabled by these technologies include early detection of infrastructure risks that can reduce hospitalizations from falls, potentially saving both lives and healthcare costs. The systems can generate proactive alerts for municipal services, such as scheduling leaf removal or sidewalk repairs before conditions become hazardous, shifting from reactive maintenance to predictive intervention. These capabilities transform infrastructure management from crisis response to prevention-focused planning.

The broader impacts extend far beyond individual safety measures to support smart cities initiatives, healthcare cost reduction strategies, and enhanced community vibrancy by keeping older populations active and engaged. By maintaining senior mobility and independence, these technological solutions contribute to more dynamic communities where older adults continue to participate in social and economic activities, creating benefits that ripple throughout the entire urban ecosystem and support the goal of age-friendly cities that work for residents across all life stages.

The speakers presented practical examples that demonstrate the real-world applications of digital twin technology in age-responsive infrastructure planning. Bridge monitoring utilizes IoT sensors to prevent structural collapses and improve inspection frequency, moving beyond scheduled maintenance to continuous monitoring that can detect problems before they become critical safety hazards. This approach protects all users but particularly benefits seniors who may be more vulnerable to infrastructure failures.

Walkability simulations evaluate crosswalk safety specifically for seniors using speed simulations that account for slower walking speeds and longer crossing times, allowing planners to adjust signal timing and intersection design to accommodate older pedestrians safely. Transit improvements involve analyzing public transport routes for accessibility enhancements, identifying barriers such as steep ramps, inadequate seating, or poor lighting that might discourage senior ridership and limit their mobility options.

Community planning applications include simulating park layouts to encourage social interaction and physical activity among older adults, testing different configurations of benches, walking paths, and gathering spaces to optimize environments that support both individual health and community connection. These practical examples illustrate how digital twin technology can transform abstract concepts of age-friendly design into concrete, measurable improvements that directly impact seniors' daily experiences and quality of life while supporting broader community goals of inclusivity and accessibility.

The session concluded with a strong call to action for inclusive, age-responsive infrastructure design that reframes how cities approach planning for aging populations. The speakers emphasized the need to empower aging populations by ensuring infrastructure promotes mobility, social engagement, and independence as people age, moving beyond simply accommodating limitations to actively supporting continued vitality and participation in community life.

The integration of technology plays a crucial role in this vision, with digital twins and IoT systems providing the tools to guide evidence-based improvements in community design. Rather than relying on assumptions or outdated standards, these technologies enable planners to make data-driven decisions that reflect the actual needs and experiences of older adults in real-world environments.

The transformative goal is to move beyond mere regulatory compliance and design cities as "Built Blue Zones" that actively support thriving, healthier senior living. This concept takes the proven factors found in naturally occurring Blue Zones and intentionally incorporates them into urban infrastructure through thoughtful design and technological integration.

The final message emphasized that with digital tools like iTwin, cities have an unprecedented opportunity to proactively design for longevity rather than reactively address aging challenges. This approach creates spaces that enhance life quality, reduce healthcare costs, and support thriving senior communities, ultimately benefiting not just older adults but entire urban ecosystems by creating more inclusive, accessible, and vibrant environments for residents of all ages.

This presentation explains how the health-promoting characteristics of natural "Blue Zones" can be intentionally engineered into our cities using digital twin technology. By creating virtual, data-driven replicas of urban environments, planners can simulate, analyze, and manage infrastructure to better support the mobility, safety, and well-being of a growing senior population.

PRESENTATION

Daniel Joseph

Walt Disney Imagineering, Inventing the Magic with Illusion Development

Daniel Joseph is Executive Illusions and Effects Development at Walt Disney Imagineering, where he conceives, designs, and installs special effects and illusions for Disney Parks worldwide. He holds over 45 Disney patents and was inducted into the 2023 Florida Inventor Hall of Fame. Daniel was a key team member who brought the Hatbox Ghost to life for Disneyland's Haunted Mansion 60th Anniversary and was featured in Disney Legend Marty Sklar's books.

Inventing the Magic with Illusion Development

Daniel Joseph began by distinguishing the work of Imagineering from both traditional magic shows and movie special effects. He explained that unlike a magic show, which might run twice a night for a stationary audience, Disney illusions must operate flawlessly every 18 seconds for up to 20 hours a day. Unlike film effects, which can be refined in post-production, park illusions happen live and in real-time for every guest.

The process at Imagineering is one of "creative tinkering and playing." Joseph emphasized the importance of physical mockups and prototypes, stating that these are essential because the effects are for guests who are physically present. He shared a fun example of hooking cotton candy machines to leaf blowers to create performance art, illustrating the playful and experimental nature of their work.

A key theme of the presentation was the philosophy of "fail fast." Joseph stressed the importance of getting an idea out of one's head and into a physical form as quickly as possible. He noted that while not everyone can understand a schematic or a drawing, a physical prototype—even one made of "hot glue and spit and bubble gum"—is universally understood.

He provided a powerful example: a simple mockup of a new hologram technology made by an intern holding a vibrating motor. This crude prototype successfully communicated the idea to executives, which led to the development of a fully realized Yoda hologram for the Star Wars Hotel. The hologram appeared to float in mid-air in a well-lit room, demonstrating the success of this iterative process.

Joseph dedicated a significant portion of his talk to Yale Gracey, one of the original Imagineers and a personal idol. Gracey, a background painter and tinkerer, was hand-picked by Walt Disney to create illusions. Many of his inventions from the 1960s, such as artificial fire and fog machines, are now common consumer products.

Joseph highlighted several of Gracey's most iconic works, starting with the Tiki Room's rain effect from 1963, an elegant illusion created with vibrating tinsel and cross-lighting that proved more effective and reliable than real water. He also discussed the famous "burning city" scene in the 1967 Pirates of the Caribbean ride, which used theatrical flames so realistic that the fire department was called on opening day. Joseph then detailed Gracey's contributions to The Haunted Mansion in 1969, such as the ballroom ghosts, which used the 19th-century "Pepper's Ghost" illusion with reflections on large panes of glass. Another of Gracey's pioneering effects from that

attraction was the singing busts, created by projecting faces onto blank busts in a technique now considered a forerunner of modern projection mapping.

Joseph shared an anecdote about Gracey inventing a shimmering effect by bouncing light off a bent hubcap he found in a parking lot, highlighting how simple discoveries can lead to iconic effects.

The opening of EPCOT Center in 1982 marked a new era for special effects. Imagineering beginning to incorporate emerging technologies in new ways.

For example, they developed the "Smellitzer" device, which used laminar airflow to deliver targeted scents to guests on rides, such as the smell of burning Rome in Spaceship Earth, without filling the entire building. Imagineering also repurposed fiber optics, originally developed for communications, to create magical lighting displays like star fields. For the Universe of Energy pavilion, the team engineered artificial lava, using a viscous, non-Newtonian fluid doped with UV pigment to create a realistic-looking flowing effect.

Joseph then showcased several modern projects, demonstrating how his team builds upon this legacy.
The Hatbox Ghost 2.0 was a famous illusion that failed to work in 1969 and was removed, becoming a legend among fans. Joseph's team revived it for the Haunted Mansion's anniversary by developing a new technique, which started with a mock-up built in his garage.

For Star Wars Blaster Beams, to create the effect of laser beams traveling through the air, the team used the principle of persistence of vision, developing a physical effect that, when augmented with projection, perfectly mimicked the films.

At Space 220 Restaurant, to achieve the "inky black of space," the team invented a special black paint that absorbs nearly all light but can be made to fluoresce bright white when hit with a UV laser, creating brilliant stars against a deep black void. They also built a large-scale hydroponic "Giant Salad Spinner" to demonstrate farming in space.

For Enchanted Tale of Beauty and the Beast in Tokyo, the finale where the Beast transforms into the Prince required the team to develop a complex animatronic effect. The process began with sketches and shoebox models and culminated in a full-scale scene that Joseph said has brought guests to tears.

Daniel Joseph's presentation provided a remarkable look "behind the curtain." It made clear that the magic of Disney is not an accident but a product of immense creativity, rigorous engineering, and a deep respect for both history and innovation. The process is a testament to the power of hands-on experimentation and collaborative problem-solving in turning fantasy into a repeatable, physical reality.

This presentation revealed that Disney's "magic" is the product of a highly disciplined, hands-on engineering process rooted in a "fail fast" philosophy. Imagineering's illusions are not tricks, but robust, real-time effects designed to operate flawlessly thousands of times a day, achieved by blending a rich history of practical invention with cutting-edge technology.

SPECIAL MOMENT

DAY 2

DRIVING REAL-WORLD IMPACT THROUGH DATA, DISCOVERY, AND COLLABORATION

KEYNOTE

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David Raften

IBM Quantum Ambassador

David Raften has been with IBM since 1982, contributing across decades of technological change from the early 5 MIPS mainframes to today's 250,000 MIPS systems. His career spans performance analysis, high-availability product planning, operating system development, and mainframe emulation. Now serving as IBM's Senior Quantum Ambassador, he speaks worldwide on the fundamentals of quantum computing and its potential to deliver business value by addressing complex problems beyond the reach of classical systems.

IBM Quantum Ambassador
Placeholder, Title missing

This session focused on demystifying quantum computing and showing how it is beginning to shape real-world applications. David Raften used the Bloch sphere to explain the unique properties of qubits, including superposition (holding 0 and 1 at the same time) and entanglement (correlated states). He emphasized how these properties allow quantum computers to evaluate enormous solution spaces in parallel, creating opportunities where classical computers struggle.

The talk highlighted practical use cases already emerging. In chemistry and healthcare, quantum systems are being applied to simulate molecules and proteins for drug discovery. In materials science and engineering, companies are exploring new alloys, lightweight composites, and battery designs. In finance, quantum approaches are used for fraud detection, Monte Carlo simulations, and portfolio optimization. Raften stressed that the goal today is not perfect answers, but better answers faster, making quantum valuable even in its early stages.

The session also addressed the engineering and roadmap perspective. Current systems are limited by noise, decoherence, and error rates. IBM's plan is to achieve fault-tolerant logical qubits by 2029, enabling million-gate programs and unlocking broader commercial impact. Raften closed with a discussion of security risks, particularly Shor's algorithm, which could break existing encryption schemes. He urged organizations to begin preparing for post-quantum cryptography now, since such transitions take years to implement.

Quantum computing is moving from theory to practice, offering faster solutions in science, engineering, and finance while driving urgency for post-quantum security.

KEYNOTE

Julie Shah

Head, Dept. of Aeronautics and Astronautics, MIT

Julie Shah leads MIT's Department of Aeronautics and Astronautics and is also the H.N. Slater Professor. From 2019 to 2022, she served as associate dean for Social and Ethical Responsibilities of Computing in the MIT Schwarzman College of Computing, launching a curriculum that reaches over 2,000 students annually. She directs the Interactive Robotics Group in CSAIL and MIT's Industrial Performance Center, where her team designs collaborative robots that enhance human capability and reimagine the future of work.

Current Trends in Aerospace

This session talked about the evolving landscape of aerospace research and education at MIT's Department of Aeronautics and Astronautics (AeroAstro). The speaker highlighted the department's century-long history, from its first aeronautics course in 1914 and its role in Apollo mission guidance software, to present-day contributions such as student-built instruments aboard the OSIRIS-REx spacecraft and the MOXIE experiment producing oxygen on Mars.

The session explored three areas of strategic investment: sustainable aviation, space sustainability, and autonomy/AI. On the aviation side, research addresses the challenge of decarbonizing flight, with efforts in alternative fuels, hydrogen, contrail mitigation, and policy frameworks to reduce aviation's climate and air quality impacts.

In space, the department is pioneering computational methods to model debris interactions at unprecedented scales, informing policies to guard against the Kessler effect and ensure long-term orbital sustainability.

Autonomous systems and AI were presented as critical to the future of aerospace and beyond. Examples included intelligent decision-support robots in hospital settings, new approaches to human–machine collaboration, and advanced robotic learning that adapts to new environments. The talk underscored both the promise and risks of autonomy, noting the "automation paradox" and the need to calibrate trust between humans and AI in high-stakes contexts.

Aerospace's near future hinges on decarbonized flight, debris-safe orbits, and trustworthy, human-steerable AI, delivered through systems-level design, open modeling, and built-in explainability.

PRESENTATION

Maria Palombini

moderator

Maria Palombini engages global stakeholders to build trust in breakthrough technologies that expand equitable access to quality care, privacy, and protection. She drives adoption of innovations in telehealth, digital health, food sustainability, and precision therapeutics. An entrepreneur, she also founded DisruptiveRx™ Media to highlight practical applications of emerging technologies in therapeutic development.

IEEE Standards Association 4th Annual Telehealth Competition

The IEEE Standards Association recently hosted its annual Journal Forum on Digital Health Innovation, a global gathering that brought together researchers, industry experts, and policymakers to explore emerging technologies shaping the future of healthcare. This year's theme, "Ageing Healthy Innovation and Emerging Standards," emphasized the importance of developing scalable, ethical, and interoperable solutions to support the world's growing aging population.

Throughout the forum, participants discussed how digital health, AI-driven analytics, and telehealth can improve accessibility, inclusivity, and care quality across diverse communities. Panel discussions highlighted the need for robust frameworks around data security, clinical validation, and responsible AI governance.

More than 40 research papers and innovation projects from 25 countries were presented, showcasing advancements in areas such as digital therapeutics, personalized medicine, and health data interoperability. The event underscored IEEE's continued leadership in fostering trust, collaboration, and transparency in healthcare technology.

Proceedings, keynote summaries, and selected papers will be published in the IEEE Journal of Translational Engineering in Health and Medicine in May 2025.

Building trust and interoperability across digital health ecosystems through globally aligned standards and responsible AI integration.

PRESENTATION

Akshata Moharir

Microsoft

Akshata Moharir is a Lead Data Scientist at Microsoft, where she applies analytics, machine learning, and generative AI to develop innovative gaming solutions. She holds seven U.S. patents and a trade secret in interpretable and interactive AI, has co-authored papers at leading ML conferences, and serves as a reviewer for ICML, AAAI, CHI, and ICLR. She is also an adjunct professor at the University of Maryland, Baltimore County, and is passionate about explainable AI that enhances user experience, protects privacy, and prevents fraud.

Building Trust in AI: The Crucial Role of Explainable AI

Akshata Moharir opened by stressing that accuracy alone does not guarantee trust. In fields like healthcare, aviation, finance, and fraud detection, stakeholders must understand how and why AI systems reach conclusions. Without transparency, accountability, and safeguards, adoption will remain limited despite strong performance.

She outlined a framework for Explainable AI (XAI) built on interpretable models, human-in-the-loop validation, and continuous monitoring. Key concepts included model transparency, feature attribution, counterfactual explanations, and algorithmic recourse, providing not just outcomes, but insight into what could change results and what actions to take.

Practical tools such as LIME and SHAP were presented for interpreting complex models, alongside decision trees and rule-based systems valued for clarity. For unstructured data like images and text, attention mechanisms reveal which features models focus on, helping bridge the gap between technical models and stakeholder understanding.

She concluded by emphasizing the business and societal impact of XAI: accelerating deployment, improving compliance, reducing errors, and boosting ROI. Challenges persist, from balancing interpretability with accuracy to scaling across multimodal data. Looking ahead, Moharir called for causal and interactive explanations, stronger governance, and extending explainability to generative AI to ensure systems remain both powerful and trustworthy.

> **Explainable AI builds trust by ensuring transparency, accountability, and actionable insights.**

PRESENTATION

Conor McGowan Smyth

CEO of Brava

Conor McGowan Smyth is CEO of Brava Solutions, a multinational technology and cybersecurity provider serving the Atlantic, Caribbean, and LATAM. He also founded Galoras, an AI coaching exchange, and serves on advisory boards with ATN. Passionate about aligning technology with people, he remains active in civic life through rugby.

Brava Stronghold - the Evolution of AI and What it Means for Cyber Security

This session talked about the accelerating sophistication of global cybercrime and the dual impact of artificial intelligence on the cybersecurity landscape. Conor McGowan Smyth described cybercrime as a $10 trillion industry, larger than most national economies, with four out of five organizations reporting breaches that often go undetected for months and cost millions to resolve.

He explained how AI has become a double-edged sword. On one hand, cybercriminals use it to scale phishing campaigns, generate convincing deepfakes, and create adaptive malware. On the other hand, defenders deploy AI for real-time detection, predictive analytics, automated incident response, and improved threat intelligence. Despite these advancements, many organizations still allocate only a small fraction of IT budgets to security, leaving critical vulnerabilities exposed.

McGowan Smyth emphasized the severe cybersecurity talent gap, with more than 2.7 million unfilled roles worldwide. He framed this shortage as both a risk and an opportunity, urging industry, academia, and governments to collaborate on workforce development while encouraging young professionals to pursue careers in cybersecurity.

The session concluded with a call to build resilience through collaboration, aligning technology with human expertise. McGowan Smyth stressed that AI will continue to shape both sides of the cyber battlefield, but success will ultimately depend on leadership, skilled teams, and collective action to protect critical digital infrastructure.

AI is a double-edged sword, powering both advanced cyberattacks and next-generation defenses, making human expertise and collaboration essential to protect critical systems.

PRESENTATION

George Arnold

Chair & IEEE Fellow

George Arnold is Chair of the IEEE SA Industry Connections AgeTech Program and a former Director at the National Institute of Standards and Technology (NIST). He has held leadership roles in cybersecurity, smart grid interoperability, and standards development. With a career bridging public policy and technical innovation, Arnold is a champion of leveraging IEEE's influence to advance technologies that empower aging populations.

IEEE Standards Association Industry Connections AgeTech Program

The IEEE Standards Association Industry Connections AgeTech Program is led by Dr. George Arnold and focuses on advancing technology that better supports older adults. He noted that aging often brings vision changes, slower reactions, health needs, and digital literacy challenges, yet many products are not designed with these realities in mind. The goal is to shift toward "aging-responsive design," where systems adapt to users instead of forcing users to adapt.

This approach emphasizes inclusive testing and the use of datasets that reflect older populations. By involving seniors directly in design and validation, technologies can be made more usable, trustworthy, and effective. Arnold illustrated the problem with examples such as modern car dashboards becoming more complex and less intuitive than older, simpler designs.

Launched in 2024, the AgeTech Program runs for two years and engages 90 participants from 18 countries. It partners with organizations such as AARP to build a global resource hub (ARCH), identify gaps in standards, and create new guidelines. Education and awareness are central, with workshops and publications helping designers apply best practices.

The program has prioritized four domains: health wearables, intelligent homes, caregiving robotics, and wearable exoskeletons. These efforts focus on usability, interoperability, privacy, accuracy, and adaptability. Arnold invited IEEE members, including Life Members and students, to join study groups, share expertise, and co-design solutions that enable healthier, more independent aging.

The IEEE AgeTech Program advances aging-responsive design and standards to ensure technologies are usable, secure, and supportive of healthier independent living.

PRESENTATION

Ram Sriram

Chief, Software and Systems Division, NIST

Ram Sriram is Chief of the Software and Systems Division at NIST's Information Technology Laboratory. He leads research in artificial intelligence, data analytics, and trustworthy systems, with applications in healthcare and aging populations. A former MIT faculty member, he has authored nearly 300 publications including several books on AI and design. He is an IEEE Life Fellow and has received numerous prestigious awards for his contributions to computer science and engineering, as well as long-standing service to IEEE.

Harnessing Digital Revolutions for the Aging Population

This session talked about how emerging digital technologies can be applied to address the health challenges of aging populations. Ram Sriram framed age-related diseases as the "five horses": neurological, articular, cardiovascular, cancer, and metabolic conditions, controlled by "reins" such as exercise, sleep, diet, meditation, and medications. He emphasized that these reins must be considered alongside external influences like genetics, microbiome, and environment.

Sriram outlined his concept of P9 medicine: care that is personalized, predictive, participatory, preventive, precise, pervasive, privacy-protecting, and priced reasonably. He highlighted the roles of genomics and "omics," artificial intelligence, robotics, extended reality, and interconnected health networks in enabling this vision.

His computational framework integrates wearable and physiological sensors, electronic health records, social and environmental data, and digital twins to generate personalized risk assessments and wellness plans.

Case studies included Alzheimer's disease, where computational simulations model tau-protein pathology to inform new therapies; asthma, where air quality monitoring combined with personal health data can prevent acute attacks; and "scientific wellness," where blood biomarkers and imaging help detect early disease risk and guide interventions. Sriram concluded by underscoring the need for standards in health data, sensors, and interoperability, positioning NIST as central to enabling safe, trustworthy, and effective digital healthcare for aging populations.

Harnessing digital revolutions, P9 medicine integrates AI, genomics, and digital twins to deliver personalized, preventive, and equitable care for aging populations.

PRESENTATION

Peter Magyar

IEEE Committee Member

Peter Magyar, IEEE Life Fellow, has served in leadership roles including Germany Section Chair, IAS leader, and currently Region 8 Coordinator. He has expanded IAS membership, fostered student and young professional programs, and grown Life Member Affinity Groups across Region 8. His career spans academia and industry, with patents, technical contributions, and awards including the IAS Distinguished Service Award.

Engaging IAS Members in the Development of Products & Standards

This session introduced the IEEE Industry Applications Society (IAS) and its engagement opportunities for members. Peter Magyar shared his long-standing involvement in IAS leadership roles, including chapter coordination, executive board service, and life member activities. He traced the Society's roots back to IEEE's founding in 1884, its formal organization in 1965, and its upcoming 60th anniversary.

IAS is the sixth-largest IEEE society, with about 14,400 members, 560 chapters (including 350 student branches), and 76 active standards. It supports technical advancement through 20 technical committees, more than 50 annual conferences, and flagship publications such as the *IEEE Transactions on Industry Applications*, *IEEE Industry Applications Magazine*, and joint journals on smart grids, transportation electrification, and sustainable energy.

Member development is central, with mentoring programs, tutorials, regional workshops, and affinity group collaborations (Women in Engineering, Consultants Network, Life Members). A key initiative is the Life Member Mentoring Program, which supports both technical and non-technical activities, outreach, and conference participation. Magyar also highlighted global membership trends, noting strong growth in Regions 8 and 10, but also the imbalance in life member distribution, with most in North America.

A video presentation featured IAS members discussing the benefits of joining: networking, collaboration, travel grants, exposure to new research, and opportunities for students and young professionals.

> The IAS engages members worldwide through conferences, standards, and mentoring to drive innovation and active participation in product and standards development.

PRESENTATION

Michael Andrews

Moderator

Michael Andrews is Managing Partner of Andrews & Associates and Founding Partner of the Inception Advisory Group. A long-time IEEE leader, he has organized major conferences and held multiple governance roles across regions. Beyond his professional and IEEE contributions, he is deeply committed to community service and has been honored for his volunteer leadership and impact.

Emerging Voices Panel Moderated by Michael Andrews

The Emerging Voices panel, moderated by Michael Andrews, explored how to build strong multi-generational teams in both engineering workplaces and IEEE. Panelists emphasized that thriving teams are built on cultural fit, curiosity, and openness rather than just technical credentials. They pointed to inclusive practices, such as hybrid meetings and rotating speaking roles, that help ensure all members, especially juniors and quieter voices, are heard.

Speakers also discussed the challenges of integrating senior and early-career members. They noted situations where seniors might overshadow junior work and stressed the importance of letting those closest to the work present it. Matching roles to strengths, adapting leadership styles, and preparing carefully for new team dynamics were presented as practical ways to build trust and avoid bias.

Panelists emphasized leadership strategies built on hiring for "who" rather than "what," using interviews to reveal values and learning attitudes. Leaders should listen first and then tailor support, granting autonomy to high-performing teams, providing structure for newer ones, and always pairing authority with responsibility.

Volunteerism within IEEE was highlighted as most effective when missions are clear, tasks meaningful, and recognition authentic, with certifications and growth opportunities valued over giveaways. While accountability may require reassigning disengaged volunteers, nurturing "diamonds in the rough" through encouragement helps sustain long-term commitment. Adaptability, fairness, and a shared mission were seen as essential for durable, motivated teams.

The Emerging Voices panel showed that strong multi-generational teams thrive on cultural fit, inclusive practices, adaptive leadership, and authentic volunteer engagement.

Emerging Voices Panel Moderated by Michael Andrews

Gim Soon Wan: Prinicipal Design Engineer, R&D Group, Vicor Coporation

Denise Griffin: Software Development, OneStream Software

Dr. Robert Blumofe: EVP & Chief Technology Officer, Akamai Technologies

Reshmi Ghosh: Senior Applied Scientist, Microsoft Research

John McDonald: Founder & CEO, JDM Associates

Kalyani Matey: YP & MOVE

CLOSING KEYNOTE

Kendra Cook

SAIC/NASA IV&V, formerly NASA/JPL

Kendra Cook is a Space System Security SME at SAIC, supporting NASA's IV&V Program Office. She previously spent nine years at NASA JPL, where she helped develop the PSTIA process, and 15 years with the U.S. Government on satellite and technology programs. A former U.S. Air Force officer, she holds advanced degrees in Astronautical and Computer Engineering and serves as Chair of the IEEE Aerospace Conference.

Pathfinding the Future of Spacecraft Protection with Project-Specific Threat Impact Assessments

Kendra Cook opened with updates on NASA missions before shifting to the issue of space system security. The Europa Clipper spacecraft has successfully launched and deployed, the Mars 2020 Perseverance Rover continues its operations and sample collection, and the Ingenuity helicopter has exceeded expectations with 72 flights. These milestones framed her discussion on protecting missions in an increasingly complex space environment.

She emphasized that threats now go well beyond traditional RF interference and GPS jamming, extending to risks from large satellite constellations' laser communications and even glare from solar farms. A major challenge is the shortage of professionals skilled in both aerospace engineering and cybersecurity, which prompted NASA's Jet Propulsion Laboratory to establish the Mission Protection Office.

Within this office, Cook helped develop the Project-Specific Threat Impact Assessment (PSTIA) framework. Unlike general risk assessments, PSTIAs combine intelligence with mission-specific parameters to tailor impact analyses and embed security into early design phases, preventing costly fixes later. Case studies show that while dramatic "hacks" are rare, vulnerabilities are increasing due to today's crowded space environment.

She concluded that satellite security is now essential, not optional, for safeguarding infrastructure, science, and national interests. NASA is working to normalize PSTIAs as part of its mission processes, signaling a cultural shift where security is built in from the start. Cook invited collaboration across industry, government, and international partners to expand this approach across the space sector.

> **NASA is embedding mission-specific threat assessments into spacecraft design, making satellite security a foundational requirement in today's crowded space environment.**

DAY 3

CELEBRATING IEEE LIFE MEMBERS & YOUNG SCHOLARS

EXPERIENCE EMPOWERING INNOVATION

PRESENTATION

Jerry Hudgins

Vice President of Programs

IEEE Fellow, Foundation and Life Members Committee leader.

Jacob Kulangara

Philanthropist and IEEE / ANS / CSI / SAEST Life Senior Member

IEEE Foundation Presentation

The IEEE Foundation was presented as the philanthropic heart of IEEE, dedicated to expanding the organization's charitable mission through donor engagement and program investment. In 2024 it raised over 9 million dollars, managed 275 donor-designated funds supporting 70 IEEE units, and oversaw a total balance of 82 million dollars, with 5.3 million dollars directed into programs. Its mission is organized around five strategic pillars: Illuminate, Educate, Engage, Energize, and Future. Illuminate focuses on humanitarian technology through initiatives such as Smart Village and SIGHT.

Educate supports STEM programs including TryEngineering, REACH, PES Scholarship Plus, and fellowships. Engage fosters community and heritage through the IEEE History Center and Life Member activities.

Energize recognizes excellence with awards and Eta Kappa Nu programs. The Future pillar, launched in 2023, emphasizes the IEEE Foundation Fund and Women in Engineering, highlighting diversity as critical to the profession's future.

The Foundation's measurable reach includes nearly 200,000 people impacted by Illuminate projects, over 600,000 participants in educational initiatives, 29 oral histories, 1,200 Life Member activities, 19 IEEE milestones, 130,000 Eta Kappa Nu volunteer hours, almost 500 professional recognitions, and 12 Future pillar projects reaching 1,400 individuals.

Life Members remain the largest donor constituency, contributing 1.7 million dollars annually and 65 percent of all individual donations.

Their support continues a legacy dating to the Life Members Fund of 1943, which exemplifies the engineering community's long-standing commitment to professional development.

The IEEE Foundation is the philanthropic heart of IEEE, raising $9M in 2024 and fueling global impact through humanitarian technology, education, and innovation.

IEEE Foundation Presentation

Donor recognition is formalized through the Heritage Circle, which honors cumulative lifetime giving at levels named after pioneering figures in engineering. John McDonald explained his and his wife's James Maxwell-level contributions, totaling more than 250,000 dollars, to the Power and Energy Society Scholarship Program and Eta Kappa Nu Chapter Grants, describing the personal satisfaction of seeing funded programs deliver results.

The advancement of Jacob Kulangara to the Thomas Alva Edison level, marking more than 100,000 dollars in contributions alongside nearly 50 years of IEEE service, was celebrated as a highlight. The Goldsmith Legacy League further recognizes members who include the Foundation in their estate planning, creating lasting legacies that extend support across generations.

Together these structures demonstrate how annual giving, sustained recognition, and legacy commitments amplify IEEE's mission, ensuring continued impact in education, humanitarian work, and technological advancement.

Life Members contribute $1.7M annually—65% of individual giving—while legacy programs ensure lasting impact and fulfillment for future generations.

KEYNOTE

Gene Kingsley

Cyber Range Manager at the Richard E.Neal Cybersecurity Center of Excellence

Gene Kingsley has over 25 years of experience in information security, spanning higher education, healthcare, finance, government, and critical infrastructure. A former Vice President of the InfraGard National Members Alliance, he helped establish nationwide emergency response protocols after the Boston Marathon incident, and his expertise now centers on AI-driven threats, cryptocurrency security, and supply-chain risk.

Gene Kingsley, focused on the intersection of artificial intelligence and cryptocurrency as a transformative cybersecurity challenge. Cryptocurrency's rapid rise: Bitcoin surging from zero to over $110,000 in 16 years has created unprecedented opportunities for fraud, with seniors alone losing $2.4 billion to scams in 2024.

Kingsley highlighted how cryptocurrency transaction speeds, such as the $1.5 billion ByBit theft completed in 2.2 milliseconds, give law enforcement only hours to respond versus days in traditional banking. The ByBit case, attributed to North Korea's Lazarus Group, showed AI-generated code targeting Safe UI, a trusted wallet provider, with surgical precision, an evolution in supply chain compromise often missed even by sophisticated organizations.

He expanded on AI's dual role in defense and attack. Polymorphic malware like Black Mamba mutates continuously to evade detection, while deepfakes now power "grandparent scams" and business email compromise attacks with convincing synthetic voices and video, making social engineering multi-sensory.

AI also enables fake trading platforms that exploit public unfamiliarity with crypto mechanics. Kingsley argued that human factors are as critical as technical defenses, recommending verification protocols such as safe words to counter psychological manipulation.

Looking ahead, he warned that quantum computing could undermine SHA-256 encryption and threaten blockchain security. While agencies like the FBI have advanced digital asset tracking, jurisdictional challenges limit recovery.

He closed by urging stronger standards, citing IEEE blockchain efforts and Anthropic's Model Card Protocol, and emphasized that education must evolve to address both technical and psychological vulnerabilities as cryptocurrency adoption accelerates globally.

The fusion of AI and cryptocurrency is transforming cybercrime, demanding faster defenses, stronger verification, and global cooperation to protect vulnerable populations.

KEYNOTE

Dean Kamen

President of DEKA Research and Development Corporation

Dean Kamen has pioneered breakthrough innovations from advanced medical devices to regenerative manufacturing systems. He is also the founder of FIRST Robotics, one of the world's largest STEM education initiatives with more than 82,000 teams worldwide. His work unites engineering excellence with a commitment to improving the human condition.

Dean Kamen, President of DEKA Research & Development Corporation and founder of FIRST Robotics, delivered a keynote that showcased both the breadth of his technological innovations and his philosophy of aligning engineering excellence with human needs.

He began by situating his work within healthcare and assistive technologies, presenting the iBot mobility system as an example of how engineering can restore not only physical function but also human dignity.

The iBot, first approved by the FDA two decades ago, is a fully fly-by-wire robotic mobility device capable of carrying 300 pounds, climbing stairs, and traversing rough terrain. Its reliability is ensured by five gyroscopes running real-time voting algorithms, three independent power supplies, and multiple processors monitoring all systems.

After 30 million hours of operation without a single failure, Kamen emphasized that the most profound achievement is not technical, but human: the device's ability to levate users to eye level, addressing the social isolation of being looked down upon. Regulatory changes have now shifted the device from Class 3 to Class 2 with insurance coverage, and autonomous versions are under development, signaling expanded accessibility.

Kamen then introduced TWIST, a solid-state insulin pump designed to overcome limitations of existing infusion systems. TWIST is based on Hermann von Helmholtz's acoustic oscillation principle and uses miniaturized smartphone components, grain-sized speakers and even smaller microphones to detect and control fluid flow at microliter resolution.

With 16 MHz clocks enabling zero-crossing detection at a resolution of one part in 16 million, the device achieves unprecedented precision while also offering real-time occlusion detection. Unlike conventional pumps that may take hours to days to recognize a blockage, TWIST identifies it on the first

> **From life-changing medical devices to organ manufacturing, engineering must serve dignity and resilience.**

71

failed delivery attempt, greatly reducing risks for diabetic patients.

Expanding to systemic healthcare issues, Kamen described his dialysis work, including a peritoneal dialysis system that has treated over 400,000 patients worldwide with a perfect safety record. He contrasted this with the U.S. system for end-stage renal disease, which consumes over 100 billion dollars annually, nearly 20 percent of Medicare's budget, despite affecting only 1 percent of patients.

To address this imbalance, DEKA developed a home hemodialysis system that integrates vapor compression distillation for water purification and advanced monitoring for safety. In clinical trials spanning 8,000 therapies with over 50 patients, the device reported zero adverse events, leading to FDA approval. Kamen positioned this work as part of his broader critique: the U.S. healthcare model prioritizes expensive chronic treatment rather than investing in prevention and cures.

Other examples reinforced his systems-level approach. The SafeFlow IV monitoring system revisits the fundamentals of gravity-fed infusion, using high-resolution cameras to monitor droplet formation and calculate volumetric flow, solving long-standing reliability issues in IV delivery. Caspian, a vending machine-sized IV solution manufacturing unit, was developed in response to natural disasters that destroyed centralized production facilities, leaving hospitals to ration basic fluids. By combining purification, aseptic filling, and on-site quality control, Caspian decentralizes supply, providing resilience to the medical system.

Beyond individual devices, Kamen linked his technological breakthroughs to a larger mission of systemic reform and education. He emphasized that healthcare must pivot from chronic treatment to prevention and cures, noting that distributed solutions such as SafeFlow IV and the Caspian on-site IV manufacturing system address fragility in supply chains, while ARMI demonstrates the potential of manufacturing living tissue and organs. ARMI's advances include mass production of islet cells, retinal tissue for macular degeneration, and functional pediatric hearts grown from patient-specific cells, eliminating the need for immunosuppression and transforming transplantation from emergency intervention to planned treatment.

Kamen highlighted his educational initiative, FIRST Robotics, which has expanded from 23 teams in 1989 to more than 82,000 worldwide. He argued that students learn best through purpose-driven problem solving, noting that building robots requiring math, physics, and teamwork provides the motivation for deeper learning. He concluded that dignity, resilience, and opportunity lie at the core of engineering, and that real progress demands both technical ingenuity and the education of the next generation.

Engineering progress, means shifting from chronic treatment to cures while inspiring the next generation through purpose-driven innovation.

PRESENTATION

Berke Buyukkucak

Co-founder and CEO of the Superbio AI

Berke Buyukkucak is the co-founder and CEO of Superbio AI, a platform and marketplace for biomedical AI that makes models for clinical research and drug discovery accessible to the scientific community. He specializes in computational biology and machine learning for life sciences, with a focus on applying generative AI to scientific discovery. He has led AI-driven R&D efforts with academic institutions and biopharma companies to advance computational methods in drug discovery and synthetic biology.

AI as a Co-Pilot for Scientific Discovery

Berke Buyukkucak opened his presentation by critiquing modern scientific research as slow, fragmented, and resource intensive, with half of scientists' time consumed by experimental design before validation. His vision is "one person, one prompt, one day," enabled by AI-driven automation that reduces weeks of planning and months of lab work to minutes.

Superbio AI addresses these inefficiencies by creating an "AI teammate" for hypothesis generation, experiment design, execution, and interpretation. Its multi-agent system includes Hypothesis, Planning, Execution, and Interpretation Agents, monitored by a Critique Agent.

For example, asked "Can metformin treat Alzheimer's?", the system produced a hypothesis, planned a protocol using docking simulation and transcriptomic analysis, ran models, cross-validated data, and

generated a report linking AMPK activation to Alzheimer's risk genes with suggestions for in vivo validation.

Built on a hub of 700+ tools across protein design, cell analysis, and literature review, Superbio orchestrates models at scale and continuously integrates new tools.

Buyukkucak showcased how AI accelerates discovery through literature review, target identification, and protein structure prediction. Tools like AlphaFold and RFdiffusion enable accurate modeling and novel protein design, while AI reduces drug development from years and hundreds of millions in cost to months and a fraction of the expense.

> **AI-driven multi-agent systems can compress months of biomedical research into days, enabling faster discoveries from hypothesis generation to therapeutic design.**

PRESENTATION

Catherine Fang

Distinguished Service Professor, Carnegie Mellon University

Catherine Fang is a Distinguished Service Professor at Carnegie Mellon and a NVIDIA Subject Matter Expert & University Ambassador, focusing on advancing AI for industry and society. Her work spans trustworthy foundation models, privacy-preserving health analytics, clinical-trial optimization, and AI therapeutics. She holds multiple U.S. patents and acts as an Associate Editor for the IEEE Reliability Society, she previously held senior product leadership roles at LinkedIn, Yahoo, BlueKai (Oracle), and Sun Microsystems, translating AI into deployable, regulated solutions.

Demystifying Generative AI: Insights from NVIDIA's Generative AI With Diffusion Models Workshop and Its Impact on AgeTech

Catherine Fang delivered a comprehensive presentation on generative AI, connecting its historical roots, technical evolution, and modern applications, with a focus on biomedical implementations and hands-on learning through NVIDIA's Generative AI with Diffusion Models workshop.
https://www.nvidia.com/dli

She began by identifying November 30, 2022, the launch of ChatGPT, as a turning point in technology adoption. While platforms like Netflix took 3.5 years and Facebook 10 months to reach one million users, ChatGPT achieved this milestone in just five days, highlighting the unprecedented speed of generative AI's mainstream impact.

Fang mapped the application spectrum across text, coding, image, speech, video, and 3D domains, noting its transformative influence on creative and analytical work.

She illustrated this with a healthcare breakthrough where a patient regained speech after years of loss through brain-computer interfaces integrated with generative AI and 3D modeling, highlighting AI's power to improve lives.

To ground this progress, Fang traced the field back to Alan Turing's 1950 imitation game, which defined intelligence through conversational performance. Early chatbots like ELIZA demonstrated clever tricks but lacked comprehension, while the 1970s–80s "AI winter" nonetheless seeded future advances in entertainment and GPU technology.

ImageNet and neural network experimentation reignited the field, revealing generative potential through backpropagation.

Generative AI's evolution from Turing's imitation game to diffusion models shows how playful experimentation matured into powerful tools across text, image, and biomedical domains.
https://www.nvidia.com/en-us/training/educator-programs/university-ambassador-program/

Demystifying Generative AI: Insights from NVIDIA's Stable Diffusion Workshop and Its Impact on AgeTech

Fang explained key milestones: Generative Adversarial Networks (GANs), likened to a counterfeiter and police officer in adversarial training; U-Net architectures enabling image-to-image translation; and state-of-the-art stable diffusion models, which learn to reverse noise processes and generate clear, high-quality outputs. Innovations like time embeddings have further improved efficiency, enabling near real-time generation.

Drawing on her clinical trial experience, Fang connected these advances to healthcare. She critiqued reliance on subjective patient self-reporting and demonstrated how wearable devices and continuous monitoring can provide objective biomarkers.

She shared her own COVID-19 detection experience, where wearable biomarkers dropped days before a positive test, showing how AI-assisted biomarker analysis enhances early detection. She also presented an audience exercise using cardiovascular data, illustrating how machine learning identifies subtle patterns beyond human observation. This, she emphasized, positions AI as an assistive partner that augments rather than replaces clinical judgment.

Fang concluded by stressing the dual importance of historical understanding and practical application. Generative AI's trajectory, from Turing to ChatGPT and diffusion models, reveals both its technical sophistication and its societal implications.

By pairing case studies in healthcare with deep technical foundations, she illustrated how AI can drive earlier detection, personalized treatment, and richer human–machine collaboration, while also inspiring new ways of thinking about technology's role in advancing human health.

> **Continuous biomarker monitoring combined with AI analysis enables earlier disease detection and more personalized healthcare than traditional self-reporting methods.**

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2025

PRESENTATION

Jeffrey Katz

CTO of IBM Energy & Utility Industry (Retired)

Jeffrey S. Katz is a Senior Member of the Institute of Electrical and Electronics Engineers. Prior to retiring he was the Chief Technology Officer of IBM's Energy, Environment and Utilities industry. He was a member of both the IBM Academy of Technology and the IBM Industry Academy.

Bridging Generations: Connecting Students with Life Members for Community Impact

LIFE can be an acronym for "Learned, Informed, and Fully Experienced". Hear ideas on connecting your background and knowledge to students. One approach featured is IEEE's Engineering Projects In Community Service. EPICS is an IEEE program to create community-inspired engineering solutions with college students. Explore opportunities to engage with the EPICS in IEEE program to make a lasting impact in your community and your career. EPICS in IEEE is an IEEE Educational Activities Board program that has provided more than 1 million dollars in funding as well as mentorship and resources for 255 engineering service learning projects for over 15 years.

EPICS in IEEE is an IEEE Educational Activities Board program that has provided more than 1 million dollars in funding

PRESENTATION

Evolution
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Panelists

Jack Martin

Consulting Engineer/Transmission Planning - NE
IEEE Life Fellow

Dr. Babak Enayati

Vice President of Grid Integration
Nexamp
IEEE Senior Member

Dr. Elli Ntakou

Manager, System Resilience and Reliability
Eversource Energy
IEEE Member

John-Mark Fakhri

Electromechanical Engineering Student (BSEE, August 2025)
Wentworth Institute of Technology
IEEE Student Member

Moderator

John McDonald

Founder & CEO, JDM Associates, LLC

Mentoring Panel

Proven IEEE leaders will create a path for future leaders – offering essential perspectives on mentoring, career paths, and what's in store for professional positioning in the engineering field. Students, early career engineers, seasoned professionals, and retirees all have their own journey and wisdom to impart – and all are welcome. Be a leader by sharing your knowledge and paving the way for others to succeed.

Leadership grows by sharing wisdom across generations of engineering professionals.

PRESENTATION

Adrian Berg

Vice President, Cordata Healthcare Innovations

Adrian Berg is Vice President of Cordata Healthcare Innovations, where he leads SaaS solutions supporting at-risk populations. Formerly CEO of MedReport Guard, acquired by Cordata, he has deep expertise in forensic reporting, survivor care coordination, and healthcare software infrastructure, combining technical innovation with governance, compliance, and cybersecurity awareness.

Falling Through the Cracks: Technology to Improve Response for Cases of Elder Care Abuse and Neglect

Adrian Berg's presentation, examined why elder mistreatment remains chronically under-reported and how engineering can close systemic gaps. Despite 10 percent of U.S. adults over 60 experiencing abuse annually, only 4 percent of cases reach authorities. Berg highlighted failures across statutory patchworks, two-step phone/fax reporting systems, resource scarcity in Adult Protective Services (APS), and fragmented databases between APS, law enforcement, and long-term-care ombudsmen. He noted that even common devices like smartphones are often blocked by hospital IT policies, forcing staff back to fax machines many cannot operate.

Audience polling on case vignettes illustrated the human and cultural complexity: only 40 percent would classify raised voices as abuse, while 80 percent favored reporting a bruise until learning statute required patterned bruising. Berg argued that mandated reporters need decision-support tools and quick-reference directories to reduce hesitation and errors.

His solution framework focused on three pillars. Unified intake portals, such as ReportElderAbuse-CA, raised submission completeness from 52 to 91 percent. Cross-agency case exchanges like CoreData HealthcareSafe™ enable hospitals, APS, and police to share evidence securely via FHIR-compatible APIs. Incremental adoption - HTML5 portals, offline caching for low-bandwidth regions, and a focus on eliminating fax machines rather than promising "AI" makes modernization practical.

Pilot metrics showed median phone hold times dropping from 38 minutes to zero, report completion rising to 92 percent, substantiation rates increasing from 28 to 41 percent, and data-sharing lags reduced from five days to under two hours. Berg concluded that elder protection requires not futuristic technologies but secure, empathetic digital infrastructure - "not quantum computers, just fewer lost faxes."

> Modern elder protection requires secure, human-centered digital systems not futuristic AI, but simply replacing lost faxes with reliable, interoperable tools.

PRESENTATION

Jordan Cohen

Financial planner, KBK Wealth Management

Jordan Cohen is a CERTIFIED FINANCIAL PLANNER® with KBK Wealth Management, advising individuals, families, and organizations on investment management, retirement, tax, estate, and risk planning. He holds FINRA Series 7 and 66 registrations, is a licensed insurance broker, and a Certified Plan Fiduciary Advisor (CPFA®), specializing in group retirement and benefits.

Investing for Longevity: Tax-Efficient Philanthropy and Risk Architecture for 21st-Century Retirees

Jordan Cohen's presentation, reframed retirement planning as an engineering problem requiring income sustainability, risk mitigation, and mission-aligned generosity. He stressed that assets may need to last 35 years post-career, and that aligning charitable goals with tax strategy is as much risk management as altruism.

Cohen outlined four core risk domains: longevity and sequence-of-returns, addressed with bucket strategies for cash, bonds, and equities; healthcare inflation, where hybrid long-term care insurance or TIPS ladders are critical; cognitive decline and scams, with losses of $3.1 billion in 2024 demanding safeguards like durable powers of attorney and trusted contacts; and liability, where umbrella insurance proportional to net worth protects against lawsuits.

His "charitable toolbox" included Qualified Charitable Distributions (QCDs), Donor-Advised Funds (DAFs), charitable remainder trusts, and annuities, each suited to different income profiles and tax situations. Case studies illustrated practical outcomes: a retired engineer using QCDs to reduce taxable income while funding hospice care; dual-income executives using a DAF to front-load giving and teach grandchildren philanthropy; and a widower structuring IRA and Roth assets for efficient intergenerational transfer.

Cohen also emphasized non-financial legacies through "ethical wills"—letters or videos that contextualize bequests and reduce family conflict. His advisor selection matrix urged retirees to demand fiduciary standards, fee transparency, and cross-disciplinary collaboration.

He concluded with a roadmap: align family values, model risks, select vehicles, document and automate decisions, and review annually. Purposeful longevity, Cohen argued, comes from compounding small, strategic actions that safeguard solvency while maximizing impact.

Retirement planning must be engineered for longevity, layering risk management with tax-efficient philanthropy to ensure assets last while advancing personal missions.

NEXT CHAPTER
PANEL

Dean Kamen

Jeff Katz

Panel Session: The Next Chapter

The closing panel of the IEEE Life Members Evolution Conference brought together leaders from engineering, healthcare, and education to examine how technology can support aging in place, develop future talent, and connect academic learning with practice.

Discussions of wearable technology highlighted semiconductor advances and energy storage as constraints, with examples from smart watches to insulin pumps requiring frequent recharging. Panelists emphasized the shift from reactive to proactive healthcare, showcasing AI-driven immune analysis to detect conditions early and IBM's experimental senior apartment that applied predictive maintenance concepts to health monitoring.

Dean Kamen critiqued regulation, contrasting preventive approaches in aviation with reactive FDA oversight, and argued for shifting healthcare from chronic treatment to cures such as artificial organ development. IEEE EPICS projects and student innovations illustrated how applying engineering principles to community needs, from low-cost ophthalmology devices to intelligent wheelchairs, both educates and delivers impact.

The panel also addressed challenges within IEEE and the wider profession. With 38 societies and 9 councils, participants noted that interdisciplinary collaboration is often limited by legacy boundaries even as most problems require integrated approaches. Examples such as the Sensors Council and new clean-technology initiatives showed how IEEE can convene across domains. Students reinforced a desire for purpose-driven education, aligning with Kamen's view that learning thrives when framed as problem-solving rather than rote theory. Reflections on academic freedom, foreign student policy, and ethical use of AI emphasized that innovation must be paired with regulation and democratic values. The session concluded that IEEE's next chapter depends on combining technical excellence with education, ethics, and purpose to meet global challenges.

Advancing healthcare, education, and aging in place requires shifting from reactive systems to proactive, purpose-driven engineering and interdisciplinary collaboration.

TECHNICAL PROGRAM

RESEARCH PAPER #1

Title

Centralized and Federated Heart Disease Classification using UCI Dataset: A Benchmark with Interpretability Analysis

Abstract

Cardiovascular disease (CVD) is a leading cause of global mortality highlighting the need for accurate diagnostic methods. This study benchmarks centralized and federated learning (FL) algorithms for heart-disease binary-classification using the UCI dataset, which includes 920 patient records from four hospitals in the USA, Hungary, and Switzerland. Our benchmark is supported by Shapley value and Local Interpretable Model-agnostic Explanations (LIME) interpretability analyses to quantify feature importance for classification. In the centralized-setup, various classification algorithms are trained on pooled data, with the Naive-Bayes classifier achieving the highest test-accuracy of 81.1%. Further, FL algorithms with four clients (hospitals) and various aggregation mechanisms are explored, leveraging the dataset's natural partition to enhance privacy without compromising accuracy. Federating logistic regression achieves a top test accuracy of 78.2%. Our interpretability analysis aligns with existing medical knowledge of heart-disease indicators. Overall, this study establishes a benchmark for efficient, interpretable, and private prescreening tools for CVD.

Author Biography

Mohamed Nafea is an assistant professor in ECE at Missouri S&T. Before that, he was an assistant professor at University of Detroit and spent a year as a postdoctoral fellow at GeorgiaTech. He received his Ph.D. in electrical engineering and masters in mathematics from Penn State, University Park, in 2018, 2017. He received masters in wireless & information technologies from Nile University, Egypt in 2012, and bachelor in electrical engineering from Alexandria University, Egypt in 2010. His research integrates statistical learning, causal reasoning, and information and data sciences, and aims to solve problems in responsible development of ML models.

Author 1

First Name	Mario Padilla
Last Name	Rodriguez
Email	padillma1@udmercy.edu
Affiliation	University of Detroit Mercy
Country	United States

Author 2

First Name	Eyiara
Last Name	Oladipo
Email	oladipea@udmercy.edu
Affiliation	University of Detroit Mercy
Country	United States

Author 3 (Presenting Author)

First Name	Mohamed
Last Name	Nafea
Email	mnafea@mst.edu
Affiliation	Missouri S&T
Country	United States

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2025

RESEARCH PAPER #2

Title

Generative AI for Healthcare: Enhancing Elderly Care Through Technical Innovation and Ethical Implementation

Abstract

The aging population presents critical challenges to global healthcare systems, demanding innovative solutions to enhance personalized care, accessibility, and efficiency. This paper explores the application of generative AI in elderly healthcare, focusing on technical advancements, integration with emerging technologies, and adherence to ethical standards. Key contributions include a novel framework for integrating generative AI with Internet of Things (IoT) devices for real-time health monitoring and secure data sharing via blockchain. Quantitative simulations demonstrate reduced medication errors by 25% and improved patient adherence rates by 35%. This research aligns with IEEE's ethics guidelines and advances scalable solutions for diverse healthcare settings.

Author Biography

Sky Eno, M.S. is a Professor of Analytics at the University of Massachusetts, Boston, and doctoral candidate at Liberty University focusing in Strategic Leadership. She is an expert in information systems, agile leadership, scaling strategic leadership and emerging technology applications.

Author

First Name	Sky
Last Name	Eno
Email	skyeno21@gmail.com
Affiliation	University of Massachusetts
Country	United States

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RESEARCH PAPER #3

Title

Generative AI for Healthcare: Enhancing Elderly Care Through Technical Innovation and Ethical Implementation

Abstract

Digital banking has revolutionized the mode of banking in the past decade by bringing banking at people's fingertips. However, this also has brought in significant threat of financial exploitation particularly impacting the senior people who are more vulnerable than their younger counterparts due to factors such as cognitive decline due to age, unfamiliarity with social engineering attacks etc. This paper proposes a dual technique to protect senior population from financial exploitation leveraging artificial intelligence as the backbone – an AI-driven education and awareness model and an AI-powered financial assistant to prevent fraud. The financial assistant uses voice-based alerting system for enhanced digital banking protection of seniors. The education and awareness model provides adaptive education to the seniors by various simulations, thus reducing the possibility of getting compromised in real situations. This dual strategy ensures seniors can confidently and safely use digital banking platforms, striking a balance between security and accessibility.

Author Biography

I am a seasoned software professional having 20 years of experience. For the past decade, I have been working in a technical leadership role. I have been implementing impactful projects resolving customer challenges using cutting edge technologies. At present, I am producing solution architectures to innovate, solve business problems and foster growth in my organization. In my role I collaborate with various stakeholders within and outside of my organization including but not limited to business, vendors, executives, technical leads. My contribution has earned several awards in my career. My areas of expertise are cloud computing, cyber security and data engineering.

Author

First Name	Dipankar
Last Name	Saha
Email	dipankar.saha@ieee.org
Affiliation	Independent Researcher
Country	United States

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RESEARCH PAPER #4

Title

A framework for implementing co-conceptual model of products and services for the aged community

Abstract

Globally, societies are growing older, with the population aged above 60 years growing at a faster rate. This implies an urgent need for a transformative outlook on accommodating the needs of the ageing population. Though emerging digital technologies including Artificial intelligence have the scope for designing systems and services for the older age group, there are many issues in intertwining technology with the ageing in these systems. Present study proposes a framework for implementing co-conceptual model of digital products and services for older persons with the involvement of the aged community. The proposed framework will be beneficial to all those interested in the old-age community, including technocrats, scientists, sociologists, and academicians working in this area.

Author Biography

Gullapuram S Mani (Senior Life Member, IEEE) retired from Indian Defence Research and Development Organisation as Director and Dean of Institute of Armament Technology, after serving for about 40 years in various capacities. He later was Adviser to a leading academic institution, Principal of an engineering college and an Emeritus Professor. Some of his awards include Import Substitution Award from President of India, Life Time Achievement Award from the Society for Data Sciences, and 2024 IEEE AP-S Ulrich L Rohde Humanitarian Technical Field Project Award. He takes interest in social activities associated with disadvantaged groups of society

Author

First Name	Gullapuram
Last Name	Mani
Email	gsmanihome@ieee.org
Affiliation	Symbiosis International University
Country	India

RESEARCH PAPER #5

Title

Green Technology: A 50-Year Evolution

Abstract

My involvement in green technology started 50 years ago. While waiting hours to fill my gas tank, I realized we had to toil against oil dependence. In 1979, I installed green solar hot-water heaters on my roof. In 1988, NASA climate scientist Dr James Hansen testified to Congress that increasing carbon dioxide emissions from burning fossil fuels are warming our planet via the greenhouse effect. This increased my resolve to toil so I wouldn't boil! Solar photoelectric panels, prohibitively expensive in 1979, have become the most economical way to generate green electricity together with wind. Emerging 24/7 technologies include small modular fission and fusion reactors, deep geothermal, and green hydrogen. Our Earth is at risk. Energy economics impact ecology. Burning natural gas is more economical and produces less carbon dioxide than coal.

Author Biography

Paul H Carr BS, MS, MIT; PhD Brandeis U, IEEE Life Fellow, GS-15, led the Air Force Research Laboratory's development of the Surface Acoustic Wave (SAW) components used in radar and cell phones. He has published over 90 scientific papers and was awarded 10 patents. Retiring in 1995, he debated "Are Humans Warming our Climate?" and organized the 2017 Insitute of Religion In an Age of Science Conference, "The Wicked Problem of Climate Change."   He has authored Loves My Life: Spirituality, Science, Family (2023) and "Containing Climate Change to Save Us (2025). His web page is www.MirrorOfNature.org.

Author

First Name	Paul
Last Name	Carr
Email	paulcarr@alum.mit.edu
Affiliation	Air Force Research Laboratory Emeritus
Country	United States

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IEEE Life Members & Young Scholars Research Mentorship

Sky Eno and Michael Andrews

Tufts student and Michael Andrews

IEEE Life Members & Young Scholars Research Spotlight

An exceptional process development engineer in biotech, Michael brings strong experience in cell culture, nationally recognized research, and RNA sequencing pipeline development at Regeneron. With degrees from The Cooper Union and Johns Hopkins, and current Ph.D. study at Tufts, he is passionate about advancing life-saving innovations.

Per Michael: "As someone applying machine learning to bioengineering, the conference delivered exactly what I needed."

Michael Lange
Ph.D. Candidate
Bioengineering
Tufts University

Claire Xu
The Harker School
Regeneron ISEF
Grand Award

Aligned with IEEE Life Members' mentorship mission and senior-focused AI, we're highlighting Claire's research on a blood–brain graph neural network for early Alzheimer's risk detection, an noninvasive and scalable earlier screening and care planning. Her work is currently being applied in Dr. Yang's Lab at Stanford for biomarker discovery. Claire is currently leading work on foundation models to enable cross-disease studies.

IEEE Life Members mentorship inspires and accelerates innovations like these from research to real clinical impact.

IEEE Life Members & Young Scholars Research Spotlight

Aligned with Evolution's commitment to advancing early-career researchers, we're highlighting William's work in cardiothoracic and pharmacologic research. His study with Dr. Zhao on anticoagulant-associated pericardial effusion, the largest single-center case series to date, identifies key risk factors and drug interactions to improve patient safety. He also participated in a national registry analysis with Dr. Chan comparing lung transplant strategies.

These projects reflect the power of clinical data in driving evidence-based care.

**William Xu
Research Assistant
Emory University
School of Medicine**

**Haritha Karthikeyan
Master in Biology
University of California
San Diego**

Through extensive work in cell-based and biochemical assays, in-vivo animal studies, and statistical analysis, Haritha helped in laying the foundation for a new research project in the Dore Lab, Department of Neurosciences, UC San Diego, focusing on identifying targets to enhance synaptic function.

Per Haritha: "Several conference topics aligned with my research interest. I'm excited for next year's conference!"

Photo Highlights

Dean Kamen with Tufts Graduate Students

Michael Andrews on AgeTech

Dean Kamen with Tufts Graduate Students

Dean Kamen and Karen Panetta

Photo Highlights

Dean Kamen and David Fillion

Howard Wolfman, Maxine Cohen, and David Fillion

Howard Wolfman

Emerging Voice Panel

Photo Highlights

Antonio, Joseph and Karen

Colleen and Nancy

Nancy and Gerardo

Halden and Nancy

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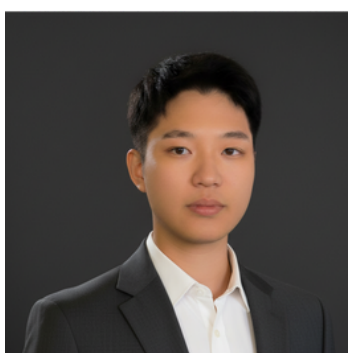Carnegie Mellon University

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