

the institute

VOLUME 39 • ISSUE 4 • DECEMBER 2015 • THEINSTITUTE.IEEE.ORG

Laying the Foundation for **Smarter Homes**



REGION EASTERN UNITED STATES

2 ■ Student branch formed at **American Public University System, Charles Town, W.Va.**

REGION CENTRAL UNITED STATES

4 ■ **Southern Michigan Section** forms IEEE Nuclear and Plasma Sciences Society chapter.
■ Student branch at **Ohio State University, Columbus**, forms IEEE Industry Applications Society chapter.

REGION WESTERN UNITED STATES

6 ■ Student branch at the **University of Arizona, Tucson**, forms IEEE Intelligent Transportation Systems Society chapter.

REGION CANADA

7 ■ **Windsor (Ontario) Section** forms IEEE Young Professionals affinity group, a joint chapter of the IEEE Circuits and Systems and IEEE Computer societies, and a joint chapter of the IEEE Communications and IEEE Signal Processing societies.

■ Student branch at the **University of Calgary, Alberta**, forms IEEE Microwave Theory and Techniques Society chapter.

REGION EUROPE, MIDDLE EAST, AND AFRICA

8 ■ Student branch formed at **Al-Azhar University, Cairo**.

■ Student branch at **Helwan University, Cairo Governorate**, forms IEEE Women in Engineering (WIE) affinity group.

■ Student branch formed at **Université de Franche-Comté, Besançon, France**.

■ Student branch at **Óbuda University, Budapest**, forms IEEE Systems, Man, and Cybernetics Society chapter.

■ Student branch at **Yarmouk University, Irbid, Jordan**, forms IEEE WIE affinity group.

■ Student branch at **Delft University of Technology, the Netherlands**, forms joint chapter of IEEE Industry Applications and IEEE Power Electronics societies.

REGION LATIN AMERICA

9 ■ Student branch formed at **Universidad Pública de El Alto, Bolivia**.

■ Student branch at **Universidade Estadual Paulista, Guaratinguetá, Brazil**, forms IEEE WIE affinity group.

■ Student branch at **Universidade Federal do Vale do São Francisco**,



Petrolina, Brazil, forms IEEE Power & Energy Society chapter.

■ Student branches formed in Bogotá at **Corporación Universitaria Unitec** and **Universidad Distrital Francisco José de Caldas**.

■ Student branches in Colombia at the **Corporation Unified National Higher Education, Bogotá**, and **Universidad Surcolombiana, Neiva**, form IEEE WIE affinity groups.

■ Student branch at **Universidad El Bosque, Bogotá**, forms chapters of IEEE Communications, IEEE Power & Energy, and IEEE Robotics and Automation societies.

■ Student branch at **Tecnológico de Costa Rica, Cartago**, forms IEEE WIE affinity group.

■ Student branch at **Universidad Politécnica Salesiana, Cuenca, Ecuador**, forms IEEE Power & Energy Society chapter.

■ Student branch at **Universidad Técnica del Norte, Ibarra, Ecuador**, forms IEEE Communications Society chapter.

■ Student branch at **Universidad Técnica Particular de Loja, Ecuador**, forms IEEE Robotics and Automation Society chapter.

■ Student branch at **Universidad de Sonsonate, El Salvador**, forms IEEE Computer Society chapter and IEEE WIE affinity group.

■ **Guadalajara (Mexico) Section** forms IEEE Microwave Theory and Techniques Society chapter.

■ **Puebla (Mexico) Section** forms IEEE Industrial Electronics Society chapter and IEEE WIE affinity group.

■ Student branch at **Instituto Tecnológico de Puebla, Mexico**, forms IEEE Computer Society chapter.

■ Student branch at **Universidad del Cono Sur de las Américas, Asunción, Paraguay**, forms IEEE Computer Society chapter.

REGION ASIA AND PACIFIC

10 ■ **Victorian Section in Australia** forms IEEE Life Members affinity group.

■ Student branch at **Royal Melbourne Institute of Technology, Australia**, forms IEEE Communications Society chapter.

■ **Bangladesh Section** forms IEEE Engineering in Medicine and Biology Society chapter.

■ **Chengdu (China) Section** forms IEEE Communications Society chapter.

■ **Shanghai Section** forms IEEE Geoscience and Remote Sensing Society chapter.

■ Student branch at **Shanghai Jiao Tong University** forms IEEE Oceanic Engineering Society chapter.

■ Student branch at **North China University of Technology, Beijing**, forms IEEE Power Electronics Society chapter.

■ **Kolkata (India) Section** forms IEEE Solid-State Circuits Society chapter.

■ Student branches in India at **Amrita School of Engineering, Lalbhai Dalpatbhai College of Engineering**, and **Shiv Nadar University** form IEEE WIE affinity groups.

■ Student branch formed at **University of Brawijaya, Malang, Indonesia**.

■ **Karachi (Pakistan) Section** forms IEEE Power & Energy Society chapter.

■ **Taipei (Taiwan) Section** forms IEEE Power Electronics Society chapter.

SEND US YOUR NEWS

We announce the formation of new groups once they've been approved by IEEE Member and Geographic Activities. To send us local news of student branch events and competitions, WIE or preuniversity outreach efforts, or other IEEE group activities, use the form on the Region News page at <http://theinstitute.ieee.org/region-news>.



Herz Award Goes to Hassler

SUSAN HASSLER has been chosen to receive the 2015 IEEE Eric Herz Outstanding Staff Member Award “for enhancing the global impact of IEEE by creating the distinctive publication *IEEE Spectrum*, which exemplifies the highest values of science, technology, and engineering journalism.” She was presented with the award last month at the IEEE Meeting Series in New Brunswick, N.J.

Hassler, an IEEE member, has served as editor in chief of *IEEE Spectrum*, in New York City, since 1999. Under her leadership, the magazine has received several prestigious publishing awards, including a 2012 National Magazine Award for General Excellence in the Thought-Leader Magazines category. In 2012

INSIDE

Building Smarter Homes 4

Technologists Meet and Innovate on IEEE Collabratec 10

SURE House: Designed With Extreme Weather in Mind 17

ONLINE

Available at theinstitute.ieee.org

IN MEMORIAM IEEE mourns the loss of three of its members

ACHIEVEMENTS Read about members who have been recognized for their career accomplishments

THE INSTITUTE (ISSN 1050-1797) is published quarterly by The Institute of Electrical and Electronics Engineers Inc., 3 Park Ave., 17th Floor, New York, NY 10016-5997; tel. +1 212 419 7900. Periodicals postage paid at New York, NY, and at additional mailing offices. Canadian GST# 125634188. Annual subscription rate: US \$26.95. Eight additional monthly issues are available online. The editorial policies for IEEE's major publications are determined by the IEEE Board of Directors. Unless otherwise specified, IEEE neither endorses nor sanctions any positions or actions espoused in THE INSTITUTE. Major IEEE boards review items within their purview prior to publication. When published in THE INSTITUTE, individual viewpoints of elected IEEE officers are labeled as such. They are reviewed by the individuals to whom they are attributed, unless they are a matter of record. The editorial staff is responsible for selection of subject matter and its placement within the issue. Copyright © 2015 by The Institute of Electrical and Electronics Engineers Inc. THE INSTITUTE is a registered trademark owned by The Institute of Electrical and Electronics Engineers Inc. POSTMASTER: Send address changes to THE INSTITUTE, IEEE Operations Center, Coding Department, 445 Hoes Lane, Piscataway, NJ 08854. IEEE prohibits discrimination, harassment, and bullying. For more information, visit <http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html>.

Calendar & IEEE Events

IEEE Spectrum introduced Robots for iPad, a mobile app dedicated to the latest developments in robotics. The next year the magazine launched a Chinese-language edition. Hassler also oversees *The Institute* and is a member of its editorial board.

The IEEE Board of Directors created the Herz Award in 2005 to honor longtime volunteer Eric Herz, who served in many capacities, including IEEE general manager and executive director. The award recognizes a present or past full-time IEEE staff member with at least 10 years of service for demonstrated contributions over a long period of time.

The nomination deadline for the 2016 IEEE Herz Award is 31 January. For more information, visit http://www.ieee.org/about/awards/recognition_herz.html.

—Amanda Davis



Bartleson Is IEEE's 2016 President-Elect

SENIOR MEMBER Karen Bartleson has been chosen as 2016 IEEE president-elect. She will begin serving as IEEE president on 1 January 2017. Bartleson is the organization's third female president-elect.

She received 22,367 votes in this year's election. The runner-up, Life Fellow Frederick "Fred" Mintzer, garnered 17,887 votes. The results were made official when the IEEE Teller's Committee report was accepted by the IEEE Board of Directors in November.

Bartleson is senior director of corporate programs and initiatives at Synopsys, an electronic design automation company in Mountain View, Calif. Her responsibilities include

creating programs for technical standards development and software tool interoperability, building relationships with universities and research institutions worldwide, and engaging customers through social media. She joined Synopsys in 1995 as manager of its standards group and was director of quality from 2000 to 2002.

She received the 2003 Marie R. Pistilli Women in Electronic Design Automation Achievement Award. Bartleson has also authored a book, *The Ten Commandments for Effective Standards: Practical Insights for Creating Technical Standards*, published by Synopsys Press in 2010.

Bartleson was president of the IEEE Standards Association in 2013 and 2014. In that role, she led the development of a new strategic plan; furthered OpenStand, a set of principles for developing global standards; and finalized IEEE's membership in the Global Standards Collaboration, a volunteer organization that promotes cooperation and collaboration in communications standards development.

As a member of the IEEE Board of Directors in 2013 and 2014, Bartleson chaired and led the development of a strategic plan for the IEEE Internet Initiative Committee, which aims to boost IEEE's influence in the areas of Internet governance, cybersecurity, and policy development. She was also a member of the IEEE Ad Hoc Committee on Strategic Planning, overseeing the development of IEEE's role in global public policy. She is currently a member of the IEEE Ad Hoc Committee on Global Public Policy and the Public Visibility Committee.

To find out who was chosen IEEE Standards Association president-elect, IEEE-USA president-elect, and more, read the annual election results at http://www.ieee.org/about/corporate/election/election_results.html. —A.D.

More to Consider

ADDITIONAL SERVICES have been added to "Kick-start Your Business With IEEE Resources" since the article was published in the September special report on startups. Now included is an insurance program to protect assets and income, as well as a free online course on risk management. To find out about these new services, visit <http://theinstitute.ieee.org/0915kickstart>.

December

3

1924

Birth date of **John Warner Backus**, an IBM fellow who helped develop computer languages, including FORTRAN and ALGOL.



5

1951

The **world's first automated parking garage** [above] begins operation, in Washington, D.C. Its two elevators carry automobiles up and down the garage's 16-story structure, which could store up to 72 cars.

10

1901

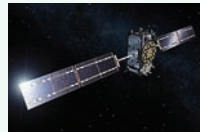
King Oscar II of Sweden presents the **first Nobel Prizes**, in accordance with the will of dynamite inventor Alfred Nobel.



21

1904

Birth date of **Francis Thomas Bacon** [above], who developed the first practical applications for hydrogen-oxygen fuel cells.



28

2005

The European Space Agency launches its first **Galileo satellite** [above]. Eventually, ESA would have a network of 30 satellites, ending Europe's reliance on the U.S. Global Positioning System.

January

5

1998

Monthlong **power outages** affect four Canadian provinces and four northeastern U.S. states after ice storms down more than 1,000 transmission towers and 35,000 wooden utility poles.

11

1895

Birth date of Laurens Hammond, inventor of the electronic musical instrument known as the **Hammond organ**.



14

1913

Henry Ford, founder of Ford Motor Co., introduces the **first continuous-motion assembly line** [above], which cut production time from more than 12 hours to 90 minutes per automobile.



25

2003

A computer worm known as **Slammer** shuts down large parts of the Internet, ultimately causing US \$1 billion in damage.

26

1875

Inventor and dentist George Green receives a patent for the **electric dental drill**.

February

4

1883

Birth date of **Reinhold Rüdenberg**, coinventor of the electron microscope and a Fellow of the American Institute of Electrical Engineers, one of IEEE's predecessor societies.

5

1952

In response to numerous pedestrian fatalities, New York City installs the **first electric Walk/Don't Walk sign**.



6

1959

IEEE Fellow Jack Kilby files a patent application for the **integrated circuit** [above]. He received the 2000 Nobel Prize in Physics for the invention.

10–15

IEEE Meeting Series, in San Diego.

20

1962

Astronaut **John Glenn** becomes the first American to orbit Earth, aboard NASA's *Friendship 7* capsule [below].



Historical events are provided by the IEEE History Center. For photos and videos of these engineering milestones, visit <http://theinstitute.ieee.org/briefings/calendar>.

LIVING SMARTER



TODAY'S so-called smart homes aren't so smart—they are mostly a collection of piecemeal systems, with each addressing only one specific need. The systems, primarily controlled by mobile apps, don't yet talk to one other and can't intuitively anticipate your needs. They just scratch the surface of what's possible.

IEEE AND ITS MEMBERS are working on technologies to turn today's smart homes into truly intelligent ones [this page, right]. That includes wireless communication systems that allow sensors and devices to talk to each other, the cloud to store the data being generated, analytical systems to make sense of it all, and cybersecurity measures to ensure the data is safe and secure.

In this special report, we feature two smart homes that IEEE members and students are building. Researchers in Bristol, England, are retrofitting an old Victorian home with a custom integrated system of some 60 sensors, cameras, and wearables to determine if the data it collects on people living there can help gauge their health [p. 6].

The damage caused by Hurricane Sandy, which struck the U.S. East Coast in 2012, inspired students at Stevens Institute of Technology, in Hoboken, N.J., to design an energy-efficient smart

house that could withstand powerful storms and rising sea levels [p. 17]. There's also a profile of IEEE Fellow Tariq Samad [p. 16], who for 30 years has been at the forefront of making homes and buildings more intelligent and energy efficient.

We also list smart appliances and gadgets considered to be among the best on the market today [p. 8]. But beware, some home-automation systems are said to be so complicated that even engineers may have a difficult time programming them [p. 12]. Have you found that to be the case?

In IEEE President Howard Michel's column [p. 13], he calls on technology professionals not to limit their role to creating the nuts and bolts of smart homes but also to consider the responsible development of the technologies and to play a role in shaping their adoption. And speaking of the president, you can find out on page 3 whom voters chose to be the 2016 president-elect.

—Kathy Pretz, editor in chief

BUILDING SMARTER HOMES

IEEE opens the door to more intelligent homes

BY KATHY PRETZ

THAT ONCE-FUTURISTIC vision of a home full of smart gadgets that anticipate our needs, keep us healthy, and save us money is slowly taking shape. Thermostats now learn our preferred settings and schedule, lights turn on and off as we come and go, and refrigerators adjust their temperatures according to how much food they hold.

Such applications make the home a bit smarter, but they're not really intelligent. That's because most home-automation devices are loners: They don't work with each other. They're made by different manufacturers, and by the way, they lack privacy and security protection. IEEE is working with industry to build an architecture that provides connectivity; simultaneously, it is developing standards and addressing security concerns.

"The smart home is a great example of where many technology and business domains start interacting and leveraging the Internet of Things," says IEEE Member Oleg Logvinov, chair of the IEEE P2413 Standard for an Architectural Framework for the Internet of Things Working Group. "IoT probably represents the biggest tidal wave in technology development since the industrial revolution."

And IEEE, like no other organization, is "well positioned to contribute its technology expertise and provide a platform to help industry, academia, and policymakers," he says. Logvinov is director of special assignments at STMicroelectronics, in Piscataway, N.J.

FOUNDATIONAL TECHNOLOGIES

The smart home brings together under one roof several IEEE-enabled technologies. Most smart devices use IEEE 802.3, 802.11, or 802.15,

better known as the standards for Ethernet, Wi-Fi, and Bluetooth. The devices likely also contain sensors, actuators, and RFID and near-field communication tags. Taken all together, these will make up the Internet of Things (IoT), a self-configuring and adaptive system of networks of sensors and smart objects. Its purpose is to connect all of these in such a way as to make them intelligent, programmable, and more capable of interacting with humans and other devices.

The IEEE IoT standards and the work of the IEEE Internet of Things Initiative, launched last year, could lead to great improvements in such applications as home monitoring, the smart grid, electric vehicle charging, and electronic medical devices. The P2413 working group, formed in July, is undertaking several activities, including enabling IoT systems to be compatible, interoperable, safe, and secure.

"The P2413 framework will be critical to really getting a handle on how the IoT will be interconnected and which pieces of information will be absolutely necessary," says Bill Ash, strategic technology program director for the IEEE Standards Association. Ash oversees e-health, smart grids, and smart cities.

Some smart gadgets are controlled by mobile apps connected to the cloud. The IEEE 1901 Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications allows for networking features within a home so that devices can be connected to a hub, which then communicates information to the cloud.

The cloud might seem ubiquitous today, but it wasn't in 2011, when IEEE launched its Cloud Computing Initiative to accelerate the cloud's



and external clouds and access services can be offered that run on still more clouds for business and application requirements.

Smart devices are expected to generate enormous and continuous streams of data, well beyond the capabilities of existing data-management software. The IEEE Big Data Initiative, launched last year, is working not only to support and make sense of all the data but also to ensure that they remain secure. Experts expect data analysis to lead to more intelligent gadgets that understand our habits, react to our needs, and help us make better decisions.

POWER TO THE PEOPLE

There's no better example of a system that could tie all the technologies together and help improve people's lives than the smart grid, which is expected to save energy, reduce greenhouse-gas emissions, and make electricity more reliable. The smart meter will be the interface between you, your smart appliances, and your energy provider's smart grid.

The IEEE 2030 Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System and End-Use Applications and Loads, completed in 2011, provides a blueprint. Some smart meters transmit wirelessly to the electric company the total kilowatt-hours of electricity used in a home. Utilities could then retransmit that information to customers so as to give them a better idea of how they might conserve energy or whether to replace a power-hungry appliance. The electric company could also send signals that turn off discretionary appliances to reduce peak loads.

For homeowners who want to install photovoltaic, wind, and other renewable and intermittent power sources, the IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems spells out how to connect these sources to the grid. And there's also the IEEE 1901 Broadband over Power Line standard, which allows the grid itself to act as a communication link for power management in areas without dedicated broadband links.

PRIVACY AND SECURITY

Concerns are being raised about the security and privacy of the information gathered by the smart grid and by smart devices. "When these devices begin to easily track people's behavior and location and exchange

that data with other devices, privacy becomes a huge issue," Ash says. "It's one we're always going to struggle with as more and more sensors and devices are connected to each other."

That's why IEEE is considering cybersecurity from many fronts. The IEEE Cybersecurity Initiative, launched last year, is accelerating cybersecurity R&D for privacy technologies applied to protect commerce, innovation, and freedom of expression. The IEEE Computer Society Center for Secure Design focuses on identifying and preventing software flaws. And earlier this year, the cybersecurity initiative issued "Building Code for Medical Device Software Security," a set of guidelines that establish a secure baseline for software development and production practices.

According to Logvinov, those working on the IEEE P2413 IoT framework standard are devoting a lot of effort ensuring that the overall system is private and secure and data cannot be misused.

He points out that approaches to privacy and security are made more complex because they depend on policies within each country: "There are not only concerns about the technology itself but also issues that lie at the intersection of policy and technology development."

IEEE believes that technologists should help shape technology policy by providing sound guidance for legislators and policymakers in understanding the implications of their decisions. That's why the IEEE Internet Initiative was launched earlier this year. Logvinov also chairs the initiative, a platform for bringing the technical community together with policymakers to discuss Internet governance, cybersecurity, and privacy.

"I think we will reach a point where privacy and security will become defining factors in deciding whether to buy a product," he says.

Logvinov and Ash agree that shifting to intelligent homes will take time because of the expense of replacing infrastructure and appliances with smart options. "We'll see a gradual adoption as prices drop and it all becomes easier to use," Logvinov says.

"I believe there's great potential for smart homes to really affect our communities and help improve the world," Ash adds. "But first, consumers must be educated about how to get the most out of them. Even the best technologies won't have an impact unless they're used at their full potential." ♦

development. One of the reasons people trust the cloud is the IEEE P2302 Standard for Intercloud Interoperability and Federation, which specifies methods for cloud-to-cloud interworking. The standard, still under development,

defines topology, protocols, and functionality. The word *Intercloud* in the standard's title refers to an interconnected mesh of clouds that depend on open standards for their operation. *Federation* implies that data may be moved across internal



A Home That Watches Over You

The SPHERE House can monitor its residents' health BY MONICA ROZENFELD

WHAT IF SLIGHT changes in your facial expression, posture, or how often you eat are enough to determine whether you're at risk for developing a disease or mental disorder? How would you spot these early-warning signs? One research group in Bristol, England, has designed a smart home that could help its inhabitants gauge such factors over time.

Known as the SPHERE (Sensor Platform for Healthcare in a Residential Environment) House, it's an old,

two-story Victorian home [above] that the project's researchers retrofitted with smart technologies to determine if data it collects on the occupants can track their health. The group designed the home with an integrated and synchronized system of some 60 sensors, cameras, and wearables. The project received funding of a little more than US \$18 million from the Engineering and Physical Sciences Research Council, the United Kingdom's equivalent to the U.S. National Science Foundation. The goal is to have the system installed in 100 homes in the Bristol area by 2017.

"This system, which is invisibly embedded in the house, monitors changes that might be correlated with certain health conditions," explains IEEE Senior Member Ian Craddock, who is leading a research team composed of several IEEE members. Craddock, an engineering professor at the University of Bristol, is also managing director of the Toshiba Telecommunications Research Laboratory, in Bristol.

"Many long-term health conditions are highly correlated to lifestyle," Craddock says. For example, if someone is sleeping more than they used to, eating less, and slouching, it may be a sign they are developing depression. Eventually, the system could point out key behaviors that have changed over time.

SMART DESIGN

The 60 researchers on the team come from universities in Bristol, Reading, and Southampton, as well as from IBM, Toshiba, and Bristol City Council. The two-bedroom house that the team retrofitted is owned by the University of Bristol. Researchers have been occupying the house for the past few months to ensure the sensors and cameras are tracking occupants accurately. They are now recruiting volunteers, including families with children, to move in for several weeks at a time.

Sensors that measure, for example, temperature and air quality are placed on ceilings, and others are placed in faucets to collect data on when they're turned on. Sensors measure how often major appliances are used. There are passive infrared motion sensors and depth sensors to determine where people are in a room, too. Collectively, they provide a host of data, including the times of day residents cook and how often they make meals, Craddock notes.

Cameras are installed in the house's main living areas, specifically focused on the couch in front of the television and the staircase to monitor sedentary behavior and physical activity. The system mines the video camera feeds, extracting information about, say, posture and whether the person is walking, exercising, or sitting, and for how long. To protect residents' privacy, the video footage itself is not saved and cannot be seen by the researchers. The cameras and sensors are off-the-shelf, but the algorithms to capture data from them were developed by the SPHERE video experts, led by IEEE Senior Member Majid Mirmehdi.

Each person in the house wears a wristband with a number of motion

sensors so the system can monitor who is engaging in which activities. The wearables, developed by Rob Piechcocki and IEEE Senior Member William Harwin's research group, allow SPHERE to identify the participants. The wearables' ultralow-power design means they can collect and stream data over a long period of time without being recharged. IEEE Member Bernard Stark is working on a way to wirelessly power the devices with energy harvested from, say, walking.

The data from all the sensors, cameras, and wearables are merged together to help answer questions about changes over time. Craddock's researchers are now focusing on how to present the data so the occupants can learn about their health and behavior and then present the information to their doctors.

Data from the past may hold clues to a person's present health: Is she sitting more than usual, drinking less water, or cooking or eating less? Is her mental state being affected by her sleep pattern or staying up too late at night? Seeing such information might prompt the person to alter a behavior in hopes of feeling better or to at least discuss it with a doctor.

Although the hardware will be the same in every home, the software can be tweaked to focus on a particular condition and the data that may affect it. "However, people and their families have evolving health conditions. They are not static," Craddock says. "We are creating a platform that is flexible."

BEYOND BRISTOL

The data can help the medical community better understand how certain conditions progress over time. But privacy concerns remain paramount, and occupants can adjust the system when they do not wish to have some, or any, data collected about them.

At this time, the system is not set up to advise users about what steps to take to improve their health based on the data. Nor is it designed to alert emergency workers if someone falls or needs help. However, such features are likely to be standard in smart homes in the future, so as to make the elderly and disabled safer in their homes.

"SPHERE's role is to do adventurous research that companies and health care providers can't do on their own," Craddock says, given the staff, funding, and time required. "Once we can prove what the benefits of these technologies can be, others can follow in our footsteps." ♦

While the world benefits from what's new,
IEEE can focus you on what's next.

IEEE *Xplore* can power your research
and help develop new ideas faster with
access to trusted content:

- Journals and Magazines
- Conference Proceedings
- Standards
- eBooks
- eLearning
- Plus content from select partners

IEEE *Xplore*® Digital Library

Information Driving Innovation

Learn More

innovate.ieee.org

Follow IEEE *Xplore* on  





IEEE SMART-HOME RESOURCES

INITIATIVES

Several IEEE initiatives focus on technical areas integral to building a smarter home. Their websites list conferences, workshops, publications, educational resources, and related standards.

Big Data <http://bigdata.ieee.org>

Cloud Computing <http://cloudcomputing.ieee.org>

Cybersecurity <http://cybersecurity.ieee.org>

Life Sciences <http://lifesciences.ieee.org>

Smart Cities <http://smartcities.ieee.org>

Smart Grid <http://smartgrid.ieee.org>

SOCIETIES

Below are some of the societies sponsoring conferences, publishing magazines and journals, and developing tutorials and webinars.

IEEE Computer Society <http://www.computer.org>

IEEE Consumer Electronics Society <http://cesoc.ieee.org>

IEEE Control Systems Society <http://www.ieeecss.org>

IEEE Engineering in Medicine and Biology Society
<http://www.embs.org>

IEEE Industrial Electronics Society <http://vps.ieee-ies.org>

IEEE Power & Energy Society <http://www.ieee-pes.org>

INDUSTRY GROUP

The IEEE Standards Association Industry Connections Convergence of Smart Home and Building Architectures group (<https://standards.ieee.org/develop/indconn/icshba>) is addressing interworking, secure separation and privacy of data belonging to various domains, the ability to add new devices easily, and system and device maintenance.

PUBLICATIONS

You can find the titles below in the IEEE Xplore Digital Library (<http://ieeexplore.ieee.org>).

Cloud Computing eNewsletter

IEEE Cloud Computing Magazine

IEEE Electrification Magazine

IEEE Foundations for Smart Grid

IEEE Life Sciences Letters

IEEE Life Sciences Newsletter

IEEE Pulse

IEEE Spectrum EnergyWise blog

IEEE Smart Grid Newsletter

IEEE Transactions on Big Data

IEEE Transactions on Cloud Computing

IEEE Transactions on Smart Grid

IEEE Transactions on Sustainable Energy

Proceedings of the IEEE



Boosting Your Home's IQ

*These gadgets are designed to make
life simpler* BY **AMANDA DAVIS**

READY TO START building your smart home? Here are some products that can make your life easier, lower your energy costs, and even entertain your cats.

KITCHEN CONFIDENTIAL

Cooking can be enjoyable, but it's also time-consuming. From remembering what you need to buy to figuring out how long to cook a roast, new smart appliances can save you valuable time.

Ever gone to the grocery store and blanked on what you need or bought milk to find you still had half a container at home? Now there's an app that lets you look inside your refrigerator from anywhere. The Bosch HomeConnect app works with the company's Series 8 refrigerator. Two cameras inside the fridge take photos of the contents each time you close the door. Then, when you're at the store,

the app on your mobile device lets you see inside the fridge and even zoom in on certain items. The refrigerator and app are available only in Europe for now, at a price of US \$3,000. They're expected to debut in the United States next year.

If you worry about cooking food to the right temperature or simply don't want to burn dinner again, take a look at the June Intelligent Oven. Engineers at June, a smart-appliance startup, designed its countertop oven to take the guesswork out of cooking and baking. The oven weighs your food with sensors in its base, takes a video of the food with an internal camera, and figures out how to power its electric cooking elements for optimum cooking time and temperature.

Once the food is in, the oven relies on computer vision, a graphics processor, and machine learning to determine what you're cooking. The camera can also transmit a real-time



video of the cooking food over Wi-Fi to your mobile device so you can check on the food without opening the door. The oven may be small—it measures 56 centimeters wide, 36 cm tall, and 45 cm deep—but it comes with a whopping price tag: \$1,500. Expect it in stores next year.

SKIP THE CHORES

A number of gadgets can handle tasks you often don't have time for or forget to do, such as watering your houseplants. And if you haven't yet done so, why not have a robot clean your floors?

Parrot, a wireless-technology company, debuted its Flower Power H20, a high-tech plant sensor, in January at the Consumer Electronics Show (CES) in Las Vegas.

The gadget is an improved version of Parrot's Flower Power, which is meant to be stuck in the soil near a houseplant or in an outdoor garden. The unit then transmits data via Bluetooth about moisture and fertilizer levels, the amount of sunlight, and soil temperature to a smartphone app, which alerts you when to water and fertilize. With the H20, you can attach a screw-top water bottle (holding up to 2 liters) to the sensor. The gadget releases water into the soil depending on the factors that the sensor measures. H20 should be in stores this month, but at press time, Parrot had not announced its price. The original Flower Power, without the self-watering feature, sells for \$60.

If you've decided to sit back and let a robot clean your floors, you can choose from a number of autonomous vacuums that have grown in popularity during the last decade. They can suck up dirt while navigating their way around.

The Wi-Fi-equipped Neato Botvac Connected vacuum can be started, paused, and steered remotely through a smartphone app—ideal if you must do a quick spot cleaning when you're expecting guests and are still at the office. It can also run through your rooms on its own, vacuuming as it goes. The Botvac Connected is equipped with a laser to scan its surroundings and avoid hitting obstacles. Its lithium-ion battery can run for up to 2 hours between charges. The vacuum has two settings: Turbo mode for dirtier floors or Eco mode for lighter cleaning. The Eco setting saves battery life and is quieter.

The Botvac Connected was unveiled in September at IFA Berlin, Europe's largest consumer electronics event. Its manufacturer, Neato, won the 2015 Best of IFA Award in the smart-home category from Digital Trends, a consumer technology publisher that sponsors the competition. The company was cited particularly for its smartphone app. The vacuum is expected to debut next year with



a price tag of around \$700, which is toward the top end of the robo floor-cleaning price spectrum.

KEEPING YOUR COOL

The Nest smart thermostat, which learns your schedule and allows you to control your home's temperature remotely, can now become a control panel for all your home's smart devices. Nest Labs launched its flagship product in 2011, and it continues to dominate



the market. CNET this year named it Best Smart Thermostat.

At CES, the company announced it is partnering with several other developers of smart-home technologies to make their products compatible with the Nest. They include Control4, which develops automated lighting, security, and entertainment systems, and Crestron, a specialist in smart-home lighting and climate control.

Nest Labs is also working with Jawbone, a wearables developer. When the Jawbone fitness band wakes you with its alarm, the Nest can adjust your thermostat automatically to make your home more comfortable when you're hopping out of bed.

The Nest is also compatible with Ecovent, a system of battery-powered air vents whose actuators allow them to be individually opened or closed when a thermostat sends a signal over a wireless network to adjust the temperature in a room. You can control the climate in just one area without having to heat or cool your entire home, which saves energy. Temperature settings for different rooms can be adjusted

via a smartphone app, too. Prices vary depending on the size of the rooms and the number of vents, but the Ecovent system costs about \$2,000 for a four-bedroom home.

JUST FOR FUN

Smart-home gadgets can help you simplify your home entertainment system and even entertain you and your pets.

If you're good at holding onto your mobile device but prone to losing the remotes for your home entertainment devices, Pronto can help. Pronto—both the name of the company and its product—is a hub about the size of a saltshaker that works with a smartphone to turn the phone's Bluetooth signals into infrared signals recognizable by televisions and other devices. Working with the company's Peel Smart Remote app, Pronto lets you control your cable box, DVD player, speakers, and more. It also provides a schedule of TV programs, and as it learns your viewing habits, Peel can recommend shows to watch. The Pronto hub costs \$50; the Peel app is free.

When you're ready to get off the couch and go outside, you don't have to leave your pets completely behind. Petcube is a video camera system that lets you remotely keep an eye on your furry friends. A wide-angle, 0.5-kilogram camera on a tripod streams high-definition video to your mobile device. And you can talk to your pet through a two-way audio system. You can even activate a moving laser pointer for your cat to chase while you're away. Petcube is \$199. ♦

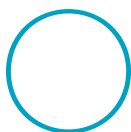




IEEE Collabratec: Changing How Technologists Meet and Innovate

This new online platform can help people network, collaborate, and create, all from one central hub

BY **MONICA ROZENFELD**



ONE OF THE KEYS to innovation is finding like-minded people to brainstorm and create with.

Think Hewlett and Packard, Gates and Allen, Jobs and Wozniak. But nowadays it's not necessarily two

people in a garage or office; it can be any number and in different parts of the world, exchanging ideas at all hours via social media, e-mail, and more.

That's the idea behind IEEE Collabratec, an online platform that offers a suite of tools that

members and technology professionals can use to network, collaborate, and create. Those who sign up can discover others in their fields of interest, develop professional profiles with which to showcase key accomplishments, participate in conversations

around areas of expertise, receive resources based on professional pursuits, and create a private virtual space in which to work on research papers and projects more efficiently. IEEE Collabratec offers networking and authoring services, as well as the convenience of accessing third-party accounts such as Twitter and LinkedIn and cloud storage services such as Google Drive without having to leave the site.

"IEEE Collabratec builds on the idea of bringing together all of our members in one place, and that is very powerful," says IEEE Senior Member Ralph Ford. As director and vice president of IEEE Member and Geographic Activities (MGA) in 2013 and 2014, he helped spearhead the project. "It will connect us in a much more meaningful way than in the past," he adds.

Some 15,000 people have been using the platform since its pilot program was launched in November 2014. It's now open for free to all IEEE members and nonmembers in the science, engineering, and technology communities.

A RICHER EXPERIENCE

"When IEEE embarked on designing IEEE Collabratec, we started with a blank sheet of paper," says John Day, director of member products and programs for MGA, in Piscataway, N.J., who helped lead the development of the platform. "Those involved with the development effort—volunteers and staff from across the organization—recognized that people engage with IEEE for many reasons and that IEEE has distinct and overlapping audiences." The platform is user-centric in its design and capable of offering features customized to each user's needs and preferences, he adds.

"Fifteen years ago, the IEEE Xplore Digital Library brought together in one location the intellectual property published by the organization," Day says. "I see IEEE Collabratec bringing together the people engaged with IEEE—creating a public square for the organization, one without borders or boundaries."

Like IEEE, the platform draws together technical expertise that currently doesn't exist in one location, Day notes. "IEEE Collabratec will enable users in niche technical fields or research areas to find and engage each other around the globe."

GETTING STARTED

IEEE makes it easy for people to use the platform. Members can sign in to <http://iee-collabratec.ieee.org> with their IEEE e-mail aliases. Non-members can simply create an IEEE account. Once logged in, users may select from many areas of interest, such as bioengineering, nanotechnology, and robotics. Interests, profile information, and privacy settings can be updated at any time. IEEE membership comes with privileges, such as participating in certain technical communities, and a member's profile contains a badge signifying the person's membership grade.

Users can look for people from the search bar found at the top of each page based on their location, company, interests, and other criteria, or they can search for events by city, date, or sponsoring IEEE society. They can also add events to their personal calendars and share them with others.

STAY INFORMED

Based on their interests, participants receive recommendations: new arti-

cles added to the IEEE Xplore Digital Library, upcoming conferences and events, and people to connect with. In addition, users can stay up to date with the latest content from *IEEE Spectrum* and IEEE.tv.

Another feature, Professional Communities, provides a place in which to find collaborators based on geographical or technical interests. By joining groups here, participants can spark conversation about activities and news in their local areas as well as discover upcoming events and conferences. There are also groups based on affiliation, such as IEEE Young Professionals and IEEE Women in Engineering. Others are based on technical interests, such as big data, cloud computing, or the Internet of Things.

Those who are not IEEE members may be restricted from accessing certain groups unless given permission.

Users may create private groups and invite others to join. These are by invitation only and are not discoverable by users other than the owner and the

invitees. Such groups let the participants have discussions, share resources, and work together on a project. Users can create virtual work spaces and assemble global working groups. During the pilot program, IEEE committees created such groups to help plan upcoming events and meetings. Several college instructors have used private groups to communicate with their students.

IEEE Collabratec also gives people quick access to a number of IEEE's career resources, job listings, internships, mentoring opportunities, consultant communities, and links to RésuméLab.

KNOWLEDGE SHARING

The Library feature lets people access a suite of research and authoring tools. Authors may use it to upload and store documents or create new ones and invite others to coauthor with them. They can also tap into their new communities to find people who can contribute. One of the main features is the integration of Overleaf, a

tool for collaborative authoring in LaTeX, commonly used by authors to create technical documents.

The library feature also offers templates for creating bibliographies and citations. It makes it easy to import citations from third-party online research platforms such as Mendeley and Zotero for those who have accounts with them. Users can sync with their IEEE Xplore Digital Library accounts. And they can also create their own research collections.

"IEEE Collabratec lets people from around the globe work together on the same document, whether it is a research paper, a grant proposal, or a presentation," says IEEE Fellow Gianluca Setti, 2013 and 2014 vice president of IEEE Publication Services and Products, who helped lead the product's development. "No other tool offers all these capabilities." ♦

To learn about IEEE Collabratec's features, read our series of articles online at <http://theinstitute.ieee.org/IEEEcollabratec>.



Inspiring the Future

Donate and Enable the Impact of IEEE *through IEEE Foundation*

EDUCATION ▪ **INNOVATION** ▪ **PRESERVATION**

Your generous donations motivate students and young professionals, enable innovators to make a difference, promulgate technology's influence on the world and inspire the future.

IEEE Foundation

Dedicated to providing philanthropic services to support the core purpose of IEEE—**Advancing Technology For Humanity.**

Visit ieeefoundation.org to learn more.

Be an inspiration. Donate Today. [ieeefoundation.org/donate](http://ieeefoundation.org)





Must You Be Smart to Own a Smart Home?

In a *Wall Street Journal* article, people—including some with technical backgrounds—who bought smart-home gadgets said they were frustrating to use, often causing more problems than they solved. As smart products for the home continue to roll out, are they making our lives easier, or are they adding to the digital divide?

CHIME IN Tell us what you think by commenting online at <http://theinstitute.ieee.org/opinions/question>.

Sparking Conversation on Startups

In September, *The Institute* described IEEE's efforts to attract more entrepreneurial types to the organization and to support members' ventures through online resources, networking events, and more. The conversation continued on our website.

KUDOS TO LIMOR FRIED
Fried, an IEEE member, founded the DIY electronics company *Adafruit Industries*.

"I am an unrepentant Adafruit (and, by extension,



Limor Fried) fan. I began tinkering with electronics long before she was born. Adafruit is the best thing to come down the pike in years. Fried and her company brought the excitement, color, curiosity, and fun necessary to get kids—especially girls—interested in electronics. Keep up the good work!"

—OldManAnalog

"Limor's venture is quite inspiring! Her ambition and hard work have made the company's phenomenal

success possible. Thank you, IEEE, for motivating first-time entrepreneurs."

—Karthikeyan Ovuraj

AGEIST OR SMART?
We asked readers if Silicon Valley companies' practice of hiring mostly young employees is a benefit or a detriment to their businesses.

"If a company discriminates based on age, then it is violating federal law. It is that simple. Why should this be a survey? Hiring only young people is a form of discrimination."

—kichha

"Older workers tend to use a proven method because they have already tried many others that didn't work. Younger workers tend to use a riskier approach, which results in many failures but can produce something better than the proven methods. It is the same as gambling; some will win, but most will lose. Best practice: Find someone willing to let you gamble on their dime."

—Soccerslider

ASK THE EXPERTS

Ralph Sheridan, who screens startups for Launchpad Venture Group, Boston's largest angel investment firm; Milton Chang, who runs Incubic, an investment company in Los Altos Hills, Calif., focused on biotech and photonics companies; and George Jakobsche, a patent attorney with Sunstein Kann Murphy & Timbers, an intellectual property law firm in Boston, answered readers' questions about startups.

Q: What are the steps for taking a product from just an idea to launching it on the market?

Sheridan: The first step is to validate that the product concept is valuable to the marketplace. Does it solve an important need for prospective buyers? Can customers buy your product from competitors? Are there operational obstacles to adoption that must be solved? Armed with this knowledge, you can tailor your product's design and begin to court investors on the potential rewards from a successful venture.

Q: Once you have a working prototype, what is the next step to bring it to market if you lack financial resources? This seems to be a big obstacle, especially for high-tech products.

Chang: Start by applying for government grants, which are easier to get than venture capital funding because VCs invest only when investment risks are quantifiable.

Once you have used government funding to resolve technical issues, you may be able to persuade angel investors to provide funds. You may also be able to sway strategic investors—companies that can use your technology or product—to provide additional capital. At that stage, you may very well find VCs clamoring to get on board.

Crowdfunding is another way to get seed capital. One of the companies I work with found crowdfunding to be an excellent way to promote its product, and it was able to use the advance funding for pre-orders to get the products manufactured and shipped. None of this is easy, but when there's a will, there's a way.

Q: Some fellow students from my research group are pursuing an entrepreneurial endeavor. However, we are using university-owned equipment. How do we distinguish our business from our academic activities so the school cannot later claim our profits?

Jakobsche: Obtain a written agreement ahead of time from the university, disclaiming ownership of your inventions. Graduate students, especially those with fellowships, often work under contracts that grant ownership of their inventions to their university.

Check with the university technology licensing office. It may be advantageous to have the school own the invention, especially if the university foots the bill for patent work and then grants you the license for a small fee. ♦

EDITOR IN CHIEF

Kathy Pretz, k.pretz@ieee.org

ASSOCIATE EDITOR

Monica Rozenfeld, m.rozenfeld@ieee.org

SENIOR EDITORIAL ASSISTANT

Amanda Davis, amanda.davis@ieee.org

EDITORIAL CONSULTANT

Alfred Rosenblatt

COPY EDITORS

Joseph N. Levine, Michele Kogon,
Mark Yawdoszyn, Peter Borten

SENIOR ART DIRECTOR

Mark Montgomery

ART DIRECTOR

Bonnie Nani

PHOTOGRAPHY DIRECTOR

Randi Kleff

DIRECTOR OF PERIODICAL PRODUCTION SERVICES

Peter Tuohy

EDITORIAL & WEB

PRODUCTION MANAGER

Roy Carubia

WEB PRODUCTION COORDINATOR

Jacqueline L. Parker

MULTIMEDIA PRODUCTION SPECIALIST

Michael Spector

EDITORIAL OFFICES

IEEE Operations Center
445 Hoes Lane, Piscataway, NJ
08854-4141 USA
Telephone: +1 732 562 6825
Fax: +1 732 562 1746
E-mail: institute@ieee.org
Web: theinstitute.ieee.org

EDITORIAL ADVISORY BOARD

Alexei Botchkarev, Hierold Christofer,
Michael B. Forster (Managing Director, IEEE
Publications), Matthew Genovese, Susan
Hassler (Editor in Chief, *IEEE Spectrum*),
Sheila Hemami (Vice President, IEEE
Publication Services and Products),
Terrance Malkinson, Cecilia Metra,
Mirela Sechi Moretti, Annoni Notare,
James O'Neal, Krishnan Parameswaran,
Chonggand Wang

IEEE MEDIA

PUBLISHER

James A. Vick

SENIOR MEDIA ADVERTISING AND PRODUCT DEVELOPMENT MANAGER

Mark David

MARKETING SPECIALIST

Mindy Belfer

BUSINESS MANAGER

Robert T. Ross

MARKETING & PROMOTION MANAGER

Blanche McGurr

ADVERTISING SALES

+1 732 562 3946

ADVERTISING PRODUCTION MANAGER

Fellicia Spagnoli

ADVERTISING PRODUCTION

+1 732 562 6334



Home, Smart Home

Technologists need to ensure the smart home's responsible development

HOWARD E. MICHEL IEEE PRESIDENT AND CEO



The self-driving car you're in pulls into your driveway, triggering a sensor in one of the car's doors to turn on your home's

interior lights and open the garage. As the car parks itself, its sensors recognize that exhaust fumes are no longer being produced and send a signal to close the garage door.

As you walk to your home, a wireless signal from your wearables hub triggers the door to unlock. You step through the door and your smart wristband reminds you to walk your dog. It also notifies you that the veterinarian will be refilling a prescription because the wellness chip embedded in the dog indicates that medication levels for your pet's chronic condition are too low.

You then go to the refrigerator, which displays a list of possible food choices to ensure that your daily calorie consumption remains in the recommended 2,000- to 2,500-calorie range. The list is prioritized for items in the refrigerator nearing their expiration dates.

Meanwhile, your home's thermostat, having registered your presence, is increasing the heat to reach the preset temperatures in the rooms you normally occupy. Sensors in the ceiling have detected elevated levels of stress-indicative corticosteroids in your bloodstream, have put on your favorite music, and have displayed on your wristband the recipe for a cocktail that you saw online and marked for future use.

Some of what you've just read is available now or could be coming soon. We're still some steps away from truly "smart" homes; what I've just described only scratches the surface of what's possible. The time-sensitive maintenance tasks surrounding home ownership, in-home health monitoring for the aged and disabled, the most efficient power consumption—

smart homes are poised to become extensions of the people living in them. The homes will essentially function as part of a nearly autonomous ecosystem, rather than require a building's occupants to control them.

To think of smart homes as single entities, however, does a disservice to their potential. When a home is smart, its occupants benefit. When

individual need not decide if assistance is needed. That could lead to systems' alerting first responders, even if the individuals did not need help.

When this happens on an individual basis, it is a false alarm. When it happens at a societal level—when dozens, hundreds, or even thousands of these false alarms are being triggered—the systems in place for initial public

Security must be at the fore when making homes smarter, but it cannot be the only consideration

all homes are smart, society benefits—through reduced power consumption, intelligent provision of health care, and so on. This is especially true in so-called smart cities, in which smart homes will provide improvements and efficiencies at the micro level while smarter infrastructures complement these efforts at the macro level.

TOUGH QUESTIONS

Smarter homes, however, raise security questions. What if your home is "hacked" and no longer recognizes you? What if a computer virus deactivates your home security system? What if a denial-of-service attack renders useless thousands of smart homes housing our aged?

Some may argue that these are outlier questions. However, security must be at the fore when making homes smarter. But it cannot be the only consideration.

Today, an elderly or disabled person can press a button on a wearable and have it trigger a remote alarm for help. In a smart home, technology could automate that process so the

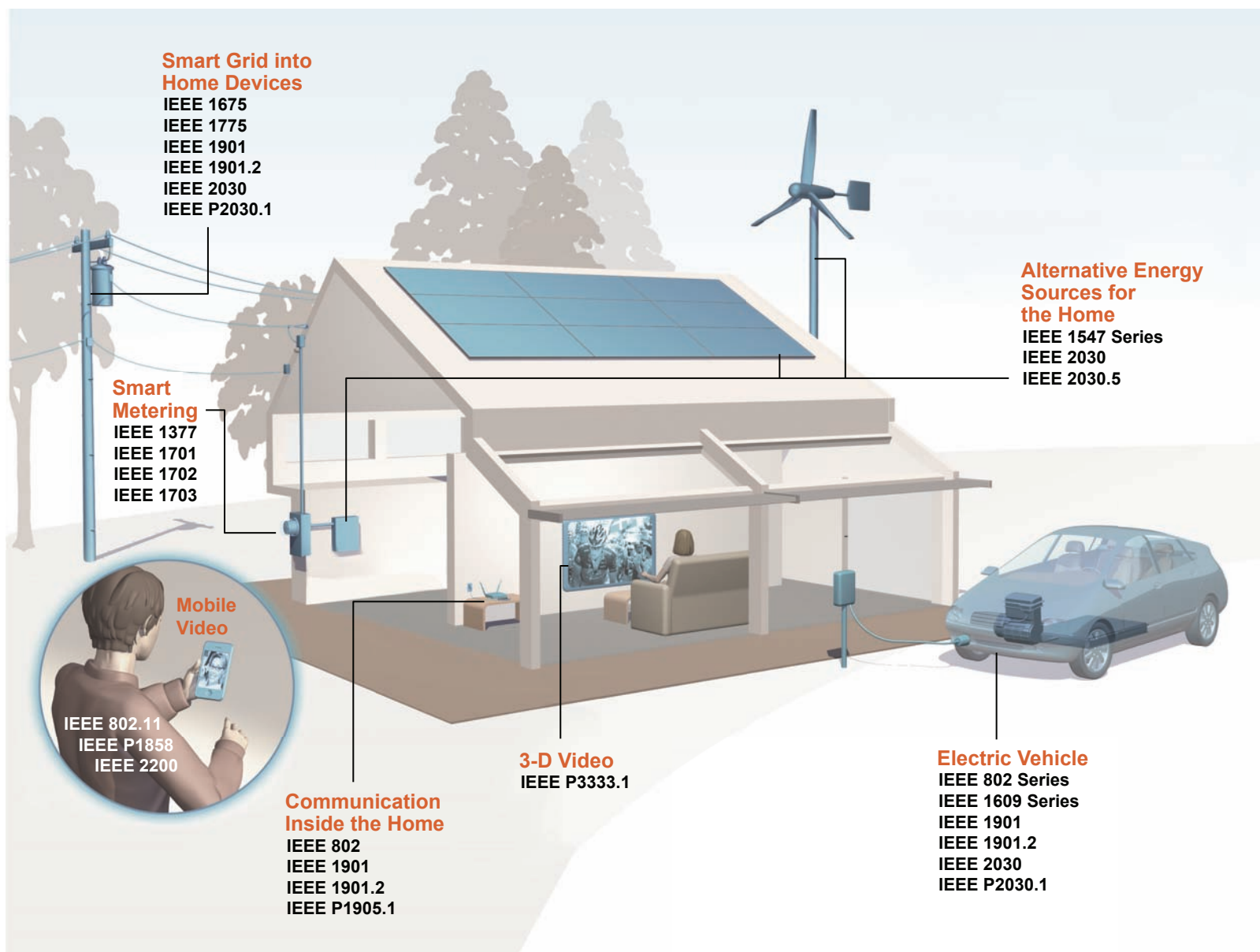
safety and health responses may be overwhelmed.

And then consider the data a person interacting with a smart home can generate. Does that data belong to the person? Does it belong to the manufacturer of the machine that captures that data? Can the government monitor it in the name of national security? The legal, ethical, and regulatory questions surrounding the issues of data, privacy, and security are staggering and must be considered long before smart homes become widespread.

In the years ahead, smart homes will be created, developed, and improved by our global professional community. It is critical that technical professionals not limit their role to creating the hardware, software, and interfaces. As a community, we should consider the responsible development of these technologies in the smart-home ecosystem and how to best play a role in shaping their adoption.

I welcome your perspectives on what you believe the future holds for smart homes. Please send your views to president@ieee.org. ♦

BENEFITS



Standards for a Connected Home

They will enable your gadgets to talk to each other

BY KATHY PRETZ

MORE THAN TWO dozen IEEE standards are key to allowing your smart appliances, devices, and plug-in cars to work together seamlessly. The standards deal with the countless

technical considerations required to support a multitude of networks and interfaces in your home.

Perhaps the most important standards of all describe what will power

your home: a smart grid. The grid is expected to reduce or even prevent power outages by anticipating equipment failures and rerouting electricity transmission to compensate.

These standards cover such functions as load control, data analysis, and security management. They also address the creation of a common technical platform.

The smart metering standards ensure two-way data communications among all the components so that information about the grid's condition can be shared and acted upon.

For those using renewable energy sources for power, there are standards that describe how to connect these sources to the grid.

There are also standards that allow you to access the Internet and ensure you can stream video, including 3-D video, on devices from anywhere inside the home.

Finally, standards for a bidirectional vehicle-to-grid interface will enable an electric car to take energy from the grid when it is being charged and put it back on the grid when it is in the garage.

For more information, visit <http://standards.ieee.org>.

THE IEEE SUPPORT CENTER

Visit <https://supportcenter.ieee.org> to search the knowledge base for information by topic, read answers to frequently asked questions, submit your own question, or initiate an online chat with an agent.

THE IEEE CONTACT CENTER

For assistance with IEEE products and services or help with publication delivery

FOR E-MAIL INQUIRIES

The IEEE Contact Center is open from 4:30 p.m. ET (20:30 GMT) Sunday to 4:30 p.m. ET Friday.

E-mail: contactcenter@ieee.org

Tel.: +1 732 981 0060 (worldwide)

Tel.: +1 800 678 4333

(U.S. and Canada)

Fax: +1 732 562 6380

TO RENEW MEMBERSHIP

<http://www.ieee.org/renew>

TO JOIN

<http://www.ieee.org/join>

CONTACT POINTS

IEEE OPERATIONS CENTER

Tel.: +1 732 981 0060

445 Hoes Lane

Piscataway, NJ 08854-4141 USA

Business hours: 8 a.m. to 5 p.m. ET

(12:00 to 21:00 GMT),

Monday through Friday

IEEE CORPORATE OFFICE New York City

Tel.: +1 212 419 7900

IEEE-USA

Washington, D.C.

Tel.: +1 202 785 0017

Fax: +1 202 785 0835

E-mail: ieeeusa@ieee.org

CONFERENCE INFORMATION

Tel.: +1 732 562 3878

Fax: +1 732 981 1769

ELEVATION FORMS

Associate to member:

<http://ewh.ieee.org/forms/v2/md/memelv.htm>

Member to senior member:

http://www.ieee.org/membership_services/membership/senior/application/index.html

IEEE MEMBER DISCOUNTS PROGRAM

Tel.: +1 800 438 4333

Fax: +1 732 981 0538

E-mail: discounts@ieee.org

OMBUDSMAN

Tel.: +1 800 678 4333

E-mail: ombudsman@ieee.org

SECTION AND CHAPTER INFORMATION

Tel.: +1 732 562 5511

Fax: +1 732 463 9359

E-mail: sec-chap-support@ieee.org

STUDENT ACTIVITIES INFORMATION

Tel.: +1 732 562 5527

Fax: +1 732 463 3657

E-mail: student-services@ieee.org

TECHNICAL SOCIETIES INFORMATION

Tel.: +1 732 562 3900

E-mail: society-info@ieee.org

Conferences on Smart-Home Technologies

Events next year cover home automation, sensors, and real-time monitoring systems



IEEE/IFIP Network Operations and Management Symposium

ISTANBUL; 25–29 APRIL

TOPICS: Smart homes, home networking, smart cities, the smart grid, the Internet of Things, social networks, software-defined networking, network-functions virtualization, ad hoc networks, vehicular networks, wireless sensors, and data center management.

SPONSORS: IEEE Communications Society and the International Federation for Information Processing (IFIP)
VISIT: <http://noms2016.ieee-noms.org>

IEEE Consumer Communications and Networking Conference

LAS VEGAS; 9–12 JANUARY

TOPICS: Home networking systems, multimedia systems, social networking, information and communication software services, cloud computing,

crowdsourcing, social media, and data integration and analytics.

SPONSOR: IEEE

Communications Society

VISIT: <http://ccnc2016.ieee-ccnc.org>

IEEE International Conference on Consumer Electronics

LAS VEGAS; 9–12 JANUARY

TOPICS: Smart-home and home-automation technologies, remote-care and real-time home-monitoring systems, smart grid, mobile devices, wearables, energy harvesting, sensors, computer vision, cloud computing, virtual and augmented reality, social gaming, and location-based services.

SPONSOR: IEEE Consumer

Electronics Society

VISIT: <http://www.icce.org>

International Conference on Cyber-Physical Systems

VIENNA; 11–14 APRIL

TOPICS: Sensor networks for smart homes, smart building automation, smart distribution systems for energy and water, medical-assistive technology, social networks, robotics, signal processing, machine learning, and cloud computing.

SPONSORS: IEEE Computer

Society and the Association

for Computing Machinery

VISIT: <http://liccps.acm.org/2016>

Conference on Innovative Smart Grid Technologies

MINNEAPOLIS; 13–16 JUNE

TOPICS: Advances in smart buildings and industrial facilities, power distribution systems, vehicle-to-grid communication systems, smart grid analytics, microgrids, and cybersecurity.

SPONSOR: IEEE Power

& Energy Society

VISIT: <http://ieee-isgt.org>

International Conference on Intelligent Green Building and Smart Grid

PRAGUE; 27–29 JUNE

TOPICS: Control systems and sensor technologies for smart buildings, smart-home control and automation, intelligent electric-power systems, green communication networks, and RFID systems.

SPONSOR: IEEE

Czechoslovakia Section

VISIT: <http://ligbsg2016.cz>

PEOPLE

Automating Everyday Life

Tariq Samad's research and foresight have led the way to modern conveniences BY PRACHI PATEL

IEEE FELLOW Tariq Samad is at the forefront of making homes and buildings intelligent and energy efficient. He is helping to identify what customers will need in the coming years and is steering his company to develop such products.

Samad is a 30-year veteran at Honeywell, a global manufacturer of automation and control systems, well known for its smart thermostats and Internet- and voice-controlled home-automation and security systems. He works for Honeywell's Automation and Control Solutions group, in Minneapolis.

"Automation is a central pillar in our lives," he says. "It is key for keeping us safe, comfortable, and productive and for managing our energy consumption."

As the group's corporate fellow for the past 15 years and now its global innovation leader—a position he took on this year—Samad has been involved less with hands-on R&D and more with promoting innovation.

"My goal," he says, "is to encourage technically innovative ideas within Honeywell and make sure effective processes are in place to evaluate and support them."

FINGER ON THE PULSE

Samad's early research helped pave the way for the algorithms that allow control systems to make intelligent decisions, such as automatically adjusting thermostats based on whether someone

is home. Samad promotes Honeywell's research efforts that focus on Internet-connected systems for home automation.

"Thermostats and security systems are no longer old-school devices," he says. "Today, they're all about connectivity, the cloud, analytics, and user experience. We are designing and developing products for connected homes and buildings that can be controlled from smartphones and other devices."

Working with the Smart Grid Interoperability Panel, an organization formed by the U.S. National Institute of Standards and Technology, he has been pushing for smart-home standards and interoperability.

"Standards allow for more competition, and they reduce the risk to consumers of buying a product that might go obsolete," he says. "Interoperability is a close cousin to standards, allowing different home-automation devices to connect with each other and with your smartphone or smart watch."

In the last few years, Samad has focused on Honeywell's smart-grid systems. Smart grid refers to a reliable, efficient power grid that interacts with computerized home and building controls to match supply with demand. The grid can also give households better insight into their energy consumption and costs.

Samad has been instrumental in promoting standards for Honey-



well's automated demand response (ADR) technology, which connects utilities with customers and applies intelligent software to automatically adjust power usage based on regional conditions and customer preferences. If the grid is overloaded on a hot summer day or if electricity prices are high, for example, ADR technology can adjust a thermostat or turn off nonessential lights to reduce power consumption.

More than 2 million homeowners across North America now use Honeywell's smart grid-compatible thermostats. Samad is promoting the company's demand response program across Europe and Asia as well. In China, he says, load reductions of up to 30 percent have been achieved with the program.

Samad also wants to accelerate smart-home innovations in China, India, and other countries with growing economies. He frequently travels to present Honeywell's technologies and better understand customers' needs.

"Much of the world's building construction in

the past few years has been in China," he points out. "These buildings need energy management, comfort controls, and security systems."

SOLVING THE PUZZLE

Samad grew up in Rawalpindi, Pakistan. He wasn't sure what he wanted to study in college, but his father was an engineer so he got into engineering as a "default option," he says. After receiving his bachelor's degree in engineering and applied science from Yale, in 1980, he earned a Ph.D. in electrical and computer engineering at Carnegie Mellon University, in Pittsburgh, in 1986.

Samad then joined Honeywell's R&D team in Minneapolis, focusing on computer science. The job offered him intellectual freedom, he says. The company's exploratory research grants program, which he now runs, allows employees to work for part of their time on their pet projects. Before he took over the program, he used it to apply artificial neural networks—statistical machine-learning methods inspired by biological neu-

ral networks—to different technical applications. That led to several publications and patents and to applications for homes, buildings, and industrial processes.

Samad's first major volunteer role at IEEE was as editor in chief of *IEEE Control Systems* magazine, from 1998 to 2003. He has coedited two issues of an online report, "The Impact of Control Technology," which highlights real-world success stories and research challenges in automation and control. Samad also leads the editorial board of IEEE Press, the organization's book-publishing arm, and is on the IEEE Fellow Committee, which evaluates nominees' credentials.

He stresses that creativity must be coupled with analytical rigor and believes in the importance of intellectually stimulating workplaces and activities. He says he considers himself lucky to be able to explore technologies for solving vital problems such as energy management, safety, and security.

"Fitting all the pieces of the puzzle together," he says, "is challenging and fun." ♦

SURE House: Built for Extreme Weather

Students design a smart home that can withstand flooding and powerful storms

BY AMANDA DAVIS

WHEN HURRICANE SANDY reared its ugly head in October 2012, many people were ill prepared for its aftermath. The storm, which tore through six countries in the Caribbean before hitting the East Coast of the United States and Canada, racked up an estimated US \$65 billion in damages. It battered and destroyed countless buildings and caused massive blackouts, some of which lasted for weeks.

In New Jersey alone, Sandy caused almost \$30 billion in damages and destroyed some 346,000 homes. The storm inspired students at Stevens Institute of Technology, in Hoboken, N.J., to design an energy-efficient smart home that could withstand powerful storms and floods. The home features solar panels to provide power during a blackout, shutters that lock in place to guard against hurricane-force winds, and outdoor charging stations that neighbors can use during a power outage.

The students entered their finished project, called the SURE house—for *sustainable* and *resilient*—in the U.S. Department of Energy’s Solar Decathlon, a contest that challenges students around the world to build solar-powered homes. The Stevens team took first place at the event, which was held in October in Irvine, Calif.

The IEEE Photonics Society partnered with the SURE house team early in the design process, providing financial support and connecting the students with the IEEE community. The society also sponsored the team in the Solar Decathlon as part of its celebration of the International Year of Light and Light-Based Technologies, a United Nations observance to raise awareness of how optical technologies foster sustainable development.

BRACING FOR DISASTER

The project was a multidisciplinary effort. More than 50 students and

faculty members from the school’s engineering, architecture, and business departments worked together beginning in 2013 to design and build the structure from the ground up.

The SURE house is a single-level structure measuring 92 square meters. It has two bedrooms, a bathroom, a kitchen, a dining area, and a living room. It has an open wood-truss frame, but instead of plywood or vinyl siding, it is sheathed in acrylonitrile butadiene styrene (ABS), a low-cost, durable plastic building material. The ABS can protect the house if water levels reach as high as 2 meters. Thus, the SURE house is more resistant to floods than the average home.

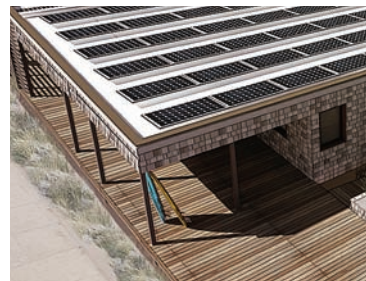
The process could be a relief for residents who find it daunting to raise their existing homes above their town’s base flood elevation (BFE), the U.S. Federal Emergency Management Agency’s estimate for how high flood waters are likely to rise in a particular area. Hoboken, which sits

at sea level along the Hudson River across from New York City, has a BFE of a worrisome 2 meters. More than half the city was flooded when Sandy hit on 29 October, and many of its residents needed to be evacuated from their homes.

The house’s solar panels produce a peak of about 10 kilowatts of electricity. It is equipped with a transformerless inverter, which converts DC power from the photovoltaic panels to AC power for lighting, the appliances, and other needs. During a blackout, the inverter switches the house to “resiliency mode” and begins producing 3 kW of emergency power, which could last for up to two weeks while the house is isolated from the grid. It also has an outdoor USB charging outlet for phones and other portable devices.

ENERGY INDEPENDENCE

The SURE house incorporates energy-efficiency features and smart design. It has no battery or diesel backup. Walls and doors are airtight. Unlike



The SURE house has several features to guard against extreme weather, including the shutters [above] that lock in place during a storm and can withstand hurricane-force winds. The house is solar powered, with photovoltaic panels attached to the shutters as well as on the roof [top].

the fiberglass insulation found in many homes, the SURE house’s rigid foam insulation is water-resistant. The house uses about 90 percent less energy than traditional fiberglass-insulated houses.

Six photovoltaic panels on the roof provide electricity. More electricity is derived from photovoltaic cells incorporated into the storm shutters, which by themselves produce enough power to heat 70 percent of the house’s water. The shutters can be lowered and locked in place when a storm is approaching and can withstand wind speeds of more than 200 kilometers per hour.

A number of smart appliances contribute to the house’s energy savings, including a high-efficiency pump that heats, cools, and dehumidifies the space. The pump is connected to zone sensors placed throughout the house that make it possible to control the temperature in each room. The heating and air-conditioning systems can keep one or two rooms comfortable without having to heat or cool the entire house.

The students installed an energy-efficient LG ultralarge-capacity TurboWash washer and dryer. The washer is equipped with twin water sprays, which cuts the time it takes to complete its cycle in half.

EDUCATING THE PUBLIC

After being transported from Hoboken to Irvine to compete in the Solar Decathlon, the SURE house is now back in New Jersey, where it has settled in Seaside Park, on the Atlantic Ocean about 130 km south of Hoboken. The structure is serving as a community center as well as a place to educate people about solar energy and green building technologies.

Keith Sheppard, associate dean of the Schaefer School of Engineering and Science at Stevens, noted at the house’s unveiling in August that the project was a unique learning opportunity for students and the public.

“Building the SURE house has evolved students’ skills and provided rich experiences that cannot be obtained in a classroom,” Sheppard said. “And with it, we can educate the public about the role of sustainable design and engineering solutions to both energy and climate challenges for housing—especially in coastal communities.” ♦

OF NOTE

Recognizing Innovators Who Transform Our World

You can nominate someone for IEEE's highest awards or serve on a selection committee BY LYNN FRASSETTI

IEEE FELLOW RALPH BAER invented the first home video-game console, Life Fellow Martin Cooper helped develop the handheld cellular telephone, and Life Fellow Mildred Dresselhaus [below, center] is a pioneer of carbon science. What do they all have in common? All three Fellows have received one of IEEE's top awards.

You can help IEEE honor innovators by nominating a colleague for one of the organization's Technical Field Awards, Medals, and Recognitions. Each year the IEEE Awards program seeks nominations for the awards, which are presented on behalf of the IEEE Board of Directors.

Since the IEEE Awards program's establishment in 1917 (when it was part of the American Institute of Electrical Engineers, one of IEEE's predecessors), it has paid tribute to technical professionals whose outstanding contributions have made a lasting

impact on technology, the engineering profession, or humanity.

The top awards are presented at the annual IEEE Honors Ceremony. The 2016 event is scheduled for 18 June at Gotham Hall, in New York City. Look for award recipients to be announced this month at <http://www.ieee.org/awards>.

HOW TO NOMINATE

You don't have to be an IEEE member to receive an award nor to nominate or endorse a candidate. For help with submitting a nomination, including award criteria, candidate eligibility, and submission guidelines, visit http://www.ieee.org/about/awards/awards_guidelines.html.

Nominations are due 31 January for IEEE Technical Field Awards and 1 July for Medals and Recognitions.

For a list of IEEE awards and to download nomination forms, visit <http://www.ieee.org/awards>. Completed forms must be e-mailed to awards@ieee.org.

LENDING A HAND

The IEEE Awards program needs volunteers to serve on its committees. Volunteers provide expertise in evaluating nominations and making recommendations to the IEEE Awards Board. You can apply to serve on one of the following committees or councils:

- Awards Review Committee
- Planning and Policy Committee
- Finance Committee
- Presentation and Publicity Committee
- Joint Awards with National Societies Committee
- Medals Council
- Technical Field Awards Council
- Recognitions Council
- Medal, Technical Field Award, and Recognition Selection committees

Questions? E-mail awards@ieee.org, or call +1 732 562 3844. ♦



Award recipients, including Medal of Honor winner Mildred Dresselhaus [center], at the 2015 IEEE Honors Ceremony in New York City.

3 ways for advertisers to reach the highly targeted IEEE membership

The Institute Print

The #1 IEEE News Source — Reach 394,540 IEEE members in their own quarterly newspaper! *The Institute* features news, upcoming IEEE conferences, new standards, products, services, benefits, plus information from regions, sections, and societies.

The Institute Website

Expands the coverage of the print version, receiving 37,550 total visitors monthly. *The Institute* website keeps members informed and involved through IEEE news and events, plus blogs, videos, slide shows, and podcasts. New content posted daily.

The Institute Alert

The most qualified e-mail alert in the EE market! With 380,000 subscribers, *The Institute* Alert informs subscribers of updates to *The Institute* website in a biweekly e-mail.

Contact your local IEEE Media sales representative at <http://advertise.ieee.org/contact/product/> or call +1 732 465 6473.

IEEE MEDIA ADVERTISING

Product	Recruitment
Midatlantic Dawn Becker db.ieeemedia@ieee.org	Midatlantic Lisa Rinaldo lr.ieeemedia@ieee.org
New England/Southwest/ Eastern Canada Jody Estabrook je.ieeemedia@ieee.org	New England/ Eastern Canada Liza Reich e.reich@ieee.org
Southeast Cathy Flynn cf.ieeemedia@ieee.org	Southeast Cathy Flynn cf.ieeemedia@ieee.org
Midwest/Central Canada Dave Jones dj.ieeemedia@ieee.org	Midwest/Texas/ Central Canada Darcy Giovengo dg.ieeemedia@ieee.org
Midwest/Ontario, Canada Will Hamilton wh.ieeemedia@ieee.org	West Coast/Southwest/ Mountain States/Asia Tim Matteson tm.ieeemedia@ieee.org
West Coast/Northwest/ Mountain States/ Western Canada Marshall Rubin mr.ieeemedia@ieee.org	Europe/Africa/ Middle East Michael O'Kane mo.ieeemedia@ieee.org
Europe/Africa/ Middle East/Asia/ Far East/Pacific Rim Louise Smith les.ieeemedia@ieee.org	



Fuel your imagination.

The **IEEE Member Digital Library** gives you the latest technology research—so you can connect ideas, hypothesize new theories, and invent better solutions.

Get full-text access to the IEEE *Xplore*® digital library—at an exclusive price—with the only member subscription that includes any IEEE journal article or conference paper.

Choose from two great options designed to meet the needs of every IEEE member:

IEEE Member Digital Library

Designed for the power researcher who needs a more robust plan. Access all the IEEE content you need to explore ideas and develop better technology.

- 25 article downloads every month

IEEE Member Digital Library Basic

Created for members who want to stay up-to-date with current research. Access IEEE content and rollover unused downloads for 12 months.

- 3 new article downloads every month

Get the latest technology research.

Try the IEEE Member Digital Library—FREE!

www.ieee.org/go/trymdl



IEEE Member Digital Library is an exclusive subscription available only to active IEEE members.

Get members-only discounts* on everything from computers to car rentals.



Technology

Computers
Student Software



Home / Office

Financial Wellness Center
Shipping Services



Travel

Car Rentals
Travel Insurance
Credit Card



Insurance

Auto, Home, Renter

Health, Dental

Life

Disability

Long Term Care

Medicare Supplement

Professional Liability

Small Employer Group Plans

Expatriate Life Insurance

Mobile Property Coverage

Visit www.ieee.org/discounts

*Discount availability varies by country.

