From the Editor in Chief

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Could Pervasive Computing Influence Democracy?

Maria R. Ebling, *IBM T.J. Watson Research Center*

Like many people in the US, I have become much more active politically in recent months. At the same time, I have observed many people across the political spectrum who feel like their voices are not being heard, which seems to be a concern shared beyond the US borders, in Europe and perhaps other countries as well. Given this backdrop, I have found myself wondering how pervasive computing could help address this problem.

IMPROVING DIALOGUES IN DEMOCRACY

Could we get to the point where every citizen of a country could participate fairly and securely in polls about the current issues of the day? When you register to vote, perhaps you are given a device that records your district and lets you participate directly in polling, sending results directly to your local, state, and federal representatives. Everyone's voice would be heard, and representatives could then reflect on their votes in light of the opinions of their constituents.

Many perceive that social media helped create a bubble during the last presidential election in the US, in which people only saw opinions similar to their own. Can technology help pop that bubble for the next election and beyond? Could technology be used to improve the dialogues across different social circles to facilitate the exchange of different views?

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This brings up many other questions. From a technology perspective, we must ask the following:

- What technology would we use to ensure that everyone's voice is heard?
- Would people receive a voting device when they register to vote?
- Would we leverage a device that they own?
- How would we make sure that everyone can afford the device?
- How would we secure whatever device is used?
- How would we make sure the polling is fair and equitable?

From a social perspective, related questions include these:

- How do we ensure access so that the voices of all citizens are heard, no matter their socio-economic status?
- How do we ensure an educated and informed public?
- Can we avoid popularity contests in which people tell their friends on social media to support one position or another?
- Can we set up a system for debating the issues ahead of the vote so that people could share their opinions and listen to the other side?

Finally, we must also consider questions from a practical perspective:

- Who would set up the questions for the polls?
- How would we debate the issues?
- How would the results be shared?
- Would it be a one-time poll or would we do a straw poll ahead of the final poll to facilitate more discussion?

The bottom line is that we need a system to help people feel that their voices are being heard and that their opinions matter. Such a system might be a first step in healing the divides of our nation and beyond.

MOVING BEYOND OUR OWN BUBBLE

In the spirit of broadening our sphere of influence beyond our own networks, *IEEE Pervasive Computing* recently circulated a call for volunteers to a

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variety of channels. We had an overwhelming response to our invitation, and I am pleased to announce that we have many new faces joining our editorial board (see the "New Editorial Board Members" sidebar). These volunteers serve the magazine and have editorial responsibility for its content. This includes overseeing the review process and writing for one of our department columns. People on the board also typically anchor our guest editor teams for each special issue.

I'm also pleased to announce we are forming an initiatives team, a group of people who will help expand the reach of the magazine. These volunteers will serve the magazine in noneditorial positions and will help promote the magazine through different forums, such as via conferences or via social media. They might also support our global audience by translating key articles and departments. We're also creating a review team to serve the magazine by providing timely reviews of articles, much as a program committee supports a conference. We'll introduce the members of these two new teams in the next issue.

All volunteers play important roles, and I appreciate all the time and effort they put into *IEEE Pervasive Computing*!

NEW EDITORIAL BOARD MEMBERS

Oliver Amft is a full professor at the University of Passau, where he founded and is currently leading the ACTLab research group. His research interests include digital health, wearable devices, multi-modal context inference, and biomedical sensor technology. Amft received his PhD in IT and electrical engineering from ETH Zurich. He is a member of IEEE. He will be co-chair of *IEEE Pervasive Computing*'s Wearable Computing department. Contact him at amft@computer.org.

Fahim Kawsar leads the Internet of Things research at Bell Labs and holds a Design United Professorship at TU Delft. His research explores novel algorithms and system design techniques to build multisensory software systems for disruptive mobile, wearable, and IoT services. At heart, he is an experimental computer scientist who aims to build end-to-end systems with real-world deployment. Kawsar has a PhD in computer science from Waseda University, Japan. He will be serving as the IEEE Computer Society's IoT Portal curator. Contact him at fahim.kawsar@gmail.com; www.fahim-kawsar.net.

Andrew L. Kun is an associate professor of electrical and computer engineering at the University of New Hampshire and a faculty fellow at the US DOT Volpe Center. His primary research interest is in-vehicle human-computer interaction. He serves as co-chair of the Steering Committee of the ACM AutomotiveUI conference series. Kun received his PhD from the University of New Hampshire in electrical engineering. He will be serving as the department editor *IEEE Pervasive Computing*'s Education and Training department. Contact him at andrew.kun@unh.edu.

Kristof Van Laerhoven is a professor of ubiquitous computing at the University of Siegen, Germany. His research focuses on the design of embedded algorithms and hardware modules that can analyze sensor data as close to the sensor hardware as possible, using innovative machine-learning and data-mining approaches. He is particularly active in the wearable and ubiquitous computing communities. Van Laerhoven received his PhD in computer science from the University of Lancaster, UK. He will be co-chair of *IEEE Pervasive Computing*'s Wearable Computing department. Contact him at kvl@eti.uni-siegen.de.

IN THIS ISSUE

This special issue is a retrospective on Mahadev Satyanarayanan's (Satya) paper, "Pervasive Computing: Vision and Challenges," published in 2001 in *IEEE Personal Communications*. We examine the impact Satya's paper has had on our field over the past 15+ years and the progress we have made toward achieving the vision he shared.

We also have a feature article, "An Interactive Telecare System Enhanced with IoT Technology," by Shih-Jung Wu, Rui-Dong Chiang, Shih-Hao Chang, and Wei-Ting Chang. Wu and his colleagues describe a system that supports diabetic patients not only by capturing blood sugar readings but also by supporting direct communications between the patients, their family members, and emergency response personnel. They categorize glucose readings according to how close to normal levels they fall. When the reading falls beyond a certain threshold, the patient is given specific instructions about what actions to take, and the reading is sent to the patient's caregivers. Doctors in numerous countries have found the technology promising. Of course, it will take a long-term study to demonstrate that the technology improves long-term outcomes for patients with diabetes.

In our second feature article, "'It's Natural to Grab and Pull': Retrieving Content from Large Displays Using Mid-Air Gestures" Ville Mäkelä, Jobin James, Tuuli Keskinen, Jaakko Hakulinen, and Markku Turunen present their work experimenting with different gestures to support transferring data between large displays and personal devices. They studied two different gestures: grab-and-pull and grab-and-drop. They expected that grab-and-drop would come more naturally due to the similarity to mouse interactions, but that grab-and-pull would be faster. They found that grab-and-pull was the more compelling gesture for this use case. Overall, they found that mid-air gestures such as these worked well for retrieving content from large displays. Readers working on designing spaces with large displays will enjoy reading this article and should find it helpful as they design their own systems.

We then move to our lineup for departments for this issue. In our Notes from the Community department, we learn about a way to turn any solid device into a touch-sensitive surface, no matter the size or amount of irregularity. Yang Zhang and his colleagues invented a spray paint that turns irregular surfaces into touch services and that allows them to define new ways of interacting with those objects via touch. We also learn about a helpful

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approach to addressing the widespread problem of food insecurity. It's like "have a penny, leave a penny; need a penny, take a penny," but applied to meals. Someone wanting to give food to those needing a meal can leave a meal in a refrigerated locker. Someone needing a meal can see what's in those lockers and pick their meal. We also learn about an ethical issue surrounding the use of data from personal devices to incriminate the device owners. These and other topics from the community make for some interesting discussions to ponder over a coffee or around the dinner table!

In our Smartphones department, Nic Lane, Sourav Bhattacharya, Akhil Mathur, Petko Georgiev, Claudio Forlivesi, and Fahim Kawsar consider the needs and challenges around using deep-learning techniques on mobile devices, such as smartphones, watches, and other devices. They make a strong case about the need for deep learning to support image recognition, activity recognition, and audio classification and the importance of such capabilities within the smartphone system. They then outline the many challenges around using such techniques in constrained devices, including limited power, limited memory, and the need for immediate responses. Finally, they discuss some of the approaches being used to overcome these challenges and recognize that no one approach is likely to be the magic bullet that makes this possible. Instead, many approaches will, together, get us to that point.

In our Education and Training department, Andrew Kun reviews a number of textbooks that could be used in pervasive computing classes. He examines books that provide comprehensive overviews as well as books focused on particular subareas. Readers who teach pervasive computing courses at either the undergraduate or graduate level will find this discussion useful. It's clear that we have come quite a distance from the last time this topic was discussed in this department more than a decade ago.

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In our Human Augmentation department, Pedro Lopes and Patrick Baudisch discuss using electrical muscle stimulation to create interactive devices that are much smaller and less Borg-like than other wearables. The article is a fascinating look into a possible direction that wearable technology may someday head. Some of the advantages are the size and physical unobtrusiveness. Some of the disadvantages are the fact that you are running current through your muscles and the augmentation doesn't augment the human's physical abilities (you can't pick up more than you're already capable of lifting).

In the Pervasive Health department, "Pervasive Technologies for Perception Change," Jesus Favela discusses how our perceptions influence our behaviors in a wide range of situations and how pervasive technology might be able to change our perceptions. Our perceptions have been shown to influence our eating habits and our interactions with others. Favela highlights the issue around relative deprivation—the perception that one is worse off than their peers. This perception leads to a host of problems with both mental and physical health. Favela then hypothesizes that, just as pervasive computing technology was able to change people's perceptions and support better eating behaviors and social interactions, perhaps it could also change people's perceptions relative to their peers—or at least give a more balanced perception than we currently have.

Technologies that give us a more balanced view of information coming across our social networks, whether about how great our friends' lives seem or how much people agree with our political positions, brings me back to the question of how pervasive computing could improve our political dialogues. I guess it all boils down to having a more balanced view of ourselves, our friends, and our world. P

Maria R. Ebling is a director at the IBM T.J. Watson Research Center. She manages a team building systems capable of supporting a Smarter Planet while not forgetting about the people who use such systems. Ebling received her PhD in computer science from Carnegie Mellon University. She's a member of the IBM Academy of Technology, a distinguished member of the ACM, and a senior member of IEEE. Contact her at ebling@us.ibm.com.

WEB EXTRA

Keep an eye out for the upcoming "History" feature on computer.org/pervasive! It will be linked from the top navigation bar and will make it easy to access articles from each issue and any author as well as to see publication statistics and more!