From the Editor's Desk

Internet-of-Agro-Things (IoAT) Makes Smart Agriculture

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I WELCOME ALL the readers to the fourth issue of year 2021, the July 2021 issue, of the IEEE Consumer Electronics Magazine (MCE).

I am pleased that the current issue is dedicated to agriculture cyber-physical system (A-CPS), which makes smart agriculture. The issue presents many articles covering various key aspects of A-CPS or smart agriculture. In the July 2020 issue of MCE, we covered transportation cyber-physical system (T-CPS). In the September 2020 issue, we presented many articles covering various key aspects of healthcare CPS (H-CPS). Other important CPS, such as energy CPS (E-CPS) making smart energy also deserves coverage. MCE also has covered themes of smart cities and smart villages like bigger concepts, which are designed based on these individual smart components.

STATE-OF-THE-ART OF SMART AGRICULTURE

We have learnt from the past issues that deployment of Internet-of-Things (IoT) in the physical systems make cyber-physical-systems (CPS), which then make a specific smart component. A specific example, Internet-of-Medical-Things (IoMT) makes healthcare CPS (H-CPS) leading to smart healthcare. In a similar manner, we can define Internet-of-Agro-Things (IoAT) makes agriculture CPS (A-CPS) leading to smart agriculture. While IoT is a dynamic network connecting "Things," specific instances like IoMT differ IoAT in terms of the details such as types of sensors and network connectivity. In the context of smart agriculture, several questions including the following are worth discussing: What is smart agriculture? Why is it needed? What makes smart agriculture possible?

Smart agriculture (also known as smart farming) can be defined as an agriculture system that uses information and communication technologies (ICT) for maximizing crop growth with ever reduced land area available for farming. The predecessors of the smart agriculture digital farming (DF), precision farming (PF), or precision agriculture (PA), also aimed at the same objective, i.e., to significantly increase crop production and farming efficiency. In the A-CPS, aggregation of data from sensors and their analytics through artificial intelligence (AI) or machine learning (ML) models to monitor various parameters of agriculture, including the environmental conditions, soil moisture, and crop health, are key driver for smart agriculture. The major features of the smart agriculture include continuous monitoring, energy harvesting, automatic irrigation, and disease prediction.

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The challenges of smart agriculture include the following: variety of sensors, integration of sensors, communication among the sensors, lack of connectivity in rural areas, sensor big data analytics, and cybersecurity and privacy. Various technologies including low-cost sensors, low-cost communications, unnamed aerial vehicle (UAV), AI/ML modeling, and distributed ledger or blockchain technology can drive agriculture system to agriculture 4.0.

Smart agriculture is as important as smart healthcare in the current world. In fact, they have interdependent factors like "food" and "pharmacy." Quality food is important to ensure good health. In the current pandemic affected worlds, the importance of quality food supply chain as well as quality drugs/pharmacy cannot be overstated.

FEATURE ARTICLES

DRAM-based Authentication Using Deep Convolutional Neural Network: This article presents a convolutional neural network (CNN) based approach that is deployed dynamic random-access memory (DRAM) for hardware counterfeit prevention. This presents a paradigm for hardware counterfeit prevention, which is complimentary of physical unclonable function (PUF)-based approaches.

Preventing COVID-19 Spread using Information and Communication Technology: This article presents an information and communication (ICT) framework for screening, testing, and contact tracing to help prevent the COVID-19 spread.

COLUMNS

Bits Versus Electrons—The Age of Software—An Introduction: This article presents perspectives of impact software in the current connected computing world.

Energy and Security—Cybersecurity Threats in AI: This article presents brief overview of the cybersecurity threats of consumer electronics, which deploy AI.

Standards—Towards Unified Ultimate Gaming Experience: This article presents the efforts of IEEE Standards Association to develop a standard for optimizing the performance of game applications and devices.

SOCIOECONOMIC IMPACTS

Age Appropriate Digital Services for Young People—Major Reforms: This article presents the issues of the "Terms and Conditions" of digital services and outlines some remedies.

SPECIAL SECTION

There are two Special Sections in the current July 2021 issue: 1) *Consumer Technologies for Smart Agriculture* and 2) *Physical Unclonable Function (PUF)-based Sustainable Cybersecurity*. I would like to sincerely thank the guest editors, Debanjan Das and Venkanna Udutalapally, for the Special Section on Smart Agriculture, for all their sincere effort for this strong Special Section, which is also the cover theme of the current July 2021 issue. I would like to thank the guest editor, Himanshu Thapliyal, for the Special Section on Sustainable Cybersecurity, for all his sincere effort for this Special Section. I strongly believe that both Special Sections will be excellent reading for the readers of the MCE as well as the researchers around the globe.

LOOKING FORWARD

I hope that the current issue dedicated to the smart agriculture becomes a good reading for a wider set of consumer technology, consumer electronics, IoT, CPS, and sensor researchers to advance their knowledge. MCE will continue the trend of covering more themes for its enthusiastic and dedicates readers in future issues on the current topics and emerging topics with the active support of the editorial board members, reviewers, and authors, around the globe.

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