



Industry Forums and Industry Day at IEEE Industrial Electronics Society Conferences

The IEEE Industrial Electronics Society (IES) continues with its many industry activities, as shown in its continuing summer and fall conferences for 2022. Interesting and inspirational industry forums at the 2022 IEEE International Conference on Industrial Informatics (INDIN) and the 23rd IEEE International Conference on Industrial Technology (ICIT) are covered here. Of particular note are the panel sessions after each of the industry forums at INDIN 2022 and ICIT 2022. These are possibly the most interesting part of the conferences, with provocative and insightful Q&As between industry panelists and audiences. An event was featured at the 2022 IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), where the organizers took a step further in organizing and promoting industry activities by devoting time to Industry Day. Held on the first day of the conference, the event featured eight workshops covering 17 industry sessions and a plenary talk.

As stated before, industry forums and industry days are prime examples of involving industry speakers to present their prevailing industry views and issues for discussions and interactions with conference participants. The goal is to bring together industry and academia so that both can benefit and tackle real-world problems. More industry forums are forthcoming under the guidance of the IES Industry

Activities Committee (IAC), and emerging topics of interest, such as those presented in this article, will be continued. For more details of the IAC and industry forums, please find the IAC activities at the IES website <http://www.ieee-ies.org/industry-forum>.

—Victor Huang

Industry Forum at INDIN 2022

The 20th INDIN was held on 25–28 July 2022, in Perth, Australia, as a virtual conference due to the worldwide COVID-19 pandemic. The general chairs were Dr. Farhad Shahnian, Prof. Yousef Ibrahim, Prof. Valeriy Vyatkin, and Dr. Kim Fung Man. The Industry Forum, also held virtually, was organized by Regina Roos and Dr. Peter Sokolowski. The Industry Forum featured a full session of five speakers, with a theme of “Digital Transformation Requires More Than Technical Competence:

Cyber Security, Financial Models, EoT Versa IoT, Risk and Eco Systems.”

The virtual platform provided entertaining “sights and sounds” of Perth, in Western Australia, before the forum was formally presented by the general chair, Dr. Shahnian, with opening remarks and a welcome to all attendees. He introduced Roos, forum chair, who kicked off the session. She emphasized that the forum was about people, processes, performance, and projects (via case studies) occurring at various places and geographical locations (Figure 1), and she introduced the sequence of speakers.

The first speaker, Sadredin Sahesch-Pur, founder and chief executive officer (CEO), Airpurdrones, Baden, Switzerland, gave “Cyber Security in General and in Particular in the Med Tech Sector.” He began by stating that cybersecurity is an essential topic and

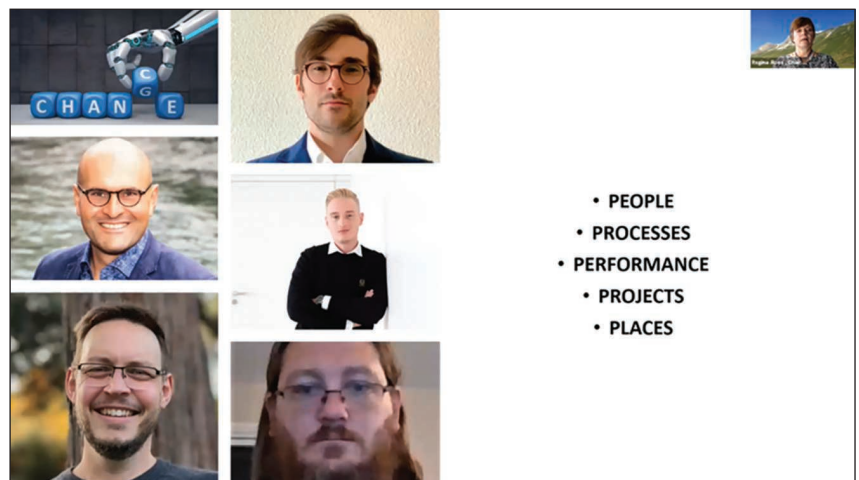


FIGURE 1 – The INDIN 2022 Industry Forum speakers: (clockwise from the top) Alessandro Mosca, Marius Miller, Dr. Paul Gogarty, Steve Rodgers, and Sadredin Sahesch-Pur. (Source: Regina Roos; used with permission.)

a discipline critical to infrastructure sectors that cover various aspects of European and international society. The main focus of his talk was on the critical medical device sector. Failure to provide adequate cybersecurity controls within critical infrastructure sectors renders the country open to attack, with debilitating effects on security, national public health, safety, and economic security. He then covered basic concepts, followed by regulatory requirements, and he concluded with examples from the health sector situation in the European Union (EU) and Switzerland.

After a brief summary of the cyberthreats in health care, the opportunities in cybercrime for bad actors, and the fight against criminals in cyberwar, he mentioned the reasons the health-care industry is a target for cyberattacks: it is easy to access valuable patient data, medical devices and device manufacturers have insufficient security protection, and there is inadequate training of health-care staff on data security risks. He showed a detailed list of legislative regulatory requirements from both a strategic and industry level, followed by an example from the medical device regulation legislation update in Switzerland. He concluded with a view of the current situation in standards and standardization for medical device regulations among the EU, U.S. Food and Drug Administration, and other international consensus organizations, such as the International Medical Devices Regulators Forum.

The second presentation was by Dr. Paul Gogarty, ABB Sweden. His presentation was “ABB Cyber Security in Industrial Projects.” Continuing on the theme of cybersecurity, Dr. Gogarty covered challenges, secure system design, and how secure design reduces risk. Among the challenges, he showed why cybersecurity is necessary and the complexities that industrial projects bring into the process, due to modular and distributed systems, the generation of analytical data from smart devices, the transmission of such data, and compliance with regulatory requirements. Next, he covered secure system design to show how

cybersecurity is designed into industrial projects to mitigate and reduce risks to industrial companies facing elevated cybersecurity risks. He presented an approach to build and maintain distributed systems, focusing on control systems and covering the following steps: procedures and design, controls, training, maintenance, monitoring, and operations. His conclusions showed how properly segregated networks ensure that only permitted data and network traffic pass between the industrial system and the outside world, thus securing systems against data theft and malicious access.

The third presentation was by Steve Rodgers, CEO, the people project. His talk was “Shifting Industry for Sustainability: A Case Study in (Not) Using AI to Differentiate for People.” He began the talk by stating that business cannot use artificial intelligence (AI) to help people in general while our economy and industries are organized in silos. The presentation used a case study of current Australian policy changes that seek to bridge the energy, construction, and environmental sectors. Each sector has developed practices for delivering goods and services in isolation. Therefore, how could AI be used to create connections across sectors that help business and people? It turns out that the limit is not the technology but how people relate to one another. Rodgers discussed how to harmonize AI with people, looking at integration among the energy, building, and environmental sectors, which is the sustainability focus, and then asking if Industry 4.0 or 5.0 can help people in general as well as provide a framework where people can contribute to sustainability, climate change, and so forth. The suggested “contemporary” approach to this end is to use innovation and contemporary modeling techniques to create individualized cost–benefit assessments in housing over the standardized regulatory National Construction Code policy in the calculation of generic energy efficiency requirements for all homes per climatic region. It is better to factor in innovation and commercialization to

the regulatory standard to drive scale. Rodgers concluded his talk by stating that technology should be used as a differentiator for people in general and to boost the human spirit in solving problems to create realistic and desirable outcomes.

The fourth speaker, Marius Miller, presented “Safe and Smart Last Mile Logistics—Drivetrain Control for Electrified Cargo Bike Trailers.” Miller is an academic researcher at the Institute of e-Mobility, University RWTH Ravensburg, Germany. Miller opened his talk by presenting the motivation and goals of an environmentally friendly transportation approach in last-mile logistics that is efficient, safe, and cost effective. The solution is the provision of bicycle cargo trailers for the inner-city transportation of packages, optimized for suitability and the safety of users. Emphasis is placed on solutions for safety, as inexperienced users underestimate the driving dynamics of cargo trailers on bicycles, which may potentially result in dangerous driving situations. After giving a quick view of the trend toward increasing use of micromobility and its economics, Miller showed the disadvantages of a bicycle trailer for transporting loads, where the electric bicycle now deals with additional mass that needs to be moved, a reduction in range due to increased power requirements, and, most of all, a change in dynamic driving behavior.

The solution is the electrification of the trailer and to provide controls to the powertrain of the trailer to mitigate three distinct issues affecting the driver: increased braking distance due to the additional mass of the trailer, unstable handling in curves due to the forward-push motion of the trailer, and the “snaking” and “jackknifing” impact of the trailer during the trip. The investigation led to the goals to improve the braking stability of the trailer by using regenerative braking, to explore safe cornering behavior of the trailer without pushing the bicycle, and to suppress snaking and jackknifing motions of the trailer. The problems were researched, and the solutions were developed under modeling techniques (termed *modeling in*

the loop) (Figure 2) and then transferred to hardware-in-the-loop (HIL) techniques and test validation via HIL. Test results showed close correlation between modeling outcomes and actual real-time outcomes. Miller concluded by stating that with such encouraging results, the approach can be extended to more complex transportation vehicles (e.g., cars and trucks) and make the transportation of freight with cargo trailers more friendly and safer in the future.

The final talk, “AI Defines the Speed to Market—Workflow Engine for Orchestrating Business and Industrial Process,” rounded out the session, and the speaker was Alessendo Mosca, chief engineer, F-ONE Group, Germany. Introducing F-ONE as a new start-up, he stated its business focus on helping small and medium enterprises (SMEs) to automate their internal processes for cost reduction and increased efficiencies and accuracies by decreasing and eliminating errors. He covered the F-ONE work methodology on the workflow process, from process definition to complete automation, and indicated several possible applications in different industry sectors. This was followed by a case study in automation in the transportation sector by a logistics company, before concluding remarks. Based on the unprecedented access to enormous information and computational resources that unlocks the possibility to bring automation deeper into any organizational level, in particular, operational, Mosca presented an overview of the methodology used for orchestrating business and industrial processes by defining a digital twin powered by a workflow engine and integrated in a cloud-based microservices architecture.

The methodology includes three steps: creation, digitalization, and automation. In creation, the problem and solution are defined together with the customer, and a workflow is laid out through Business Process Model Notation, which graphically lays out the complex steps of the target process and bridges business and IT. This is followed by the implementation of the digitalization process that develops a

digital twin that is 100% transparent to the developers and provides links between the Internet of Things (IoT), people, and software. Next, execution takes place through a workflow engine in the automation process, where it automates the high volume of repetitive rule-based manual tasks through numerous microservices tasks in the workflow engine’s microservices network, thus reaching project goals faster and more accurately.

This technology can be applied as a key enabler for many end-to-end automation industries, such as manufacturing, oil and gas, transportation and logistics, health care, finance, and real estate. Mosca showcased this technology with a case study of a transportation application by a logistics company, where the linking of document classification and information extraction spanned the transportation route between locations in the EU and United Kingdom, covering data in e-mail servers, transportation management systems, enterprise resource planning systems, and governmental web portals among countries. In combination with the latest AI technologies, F-ONE has successfully provided robust and reliable solutions for automizing business processes, introducing benefits such as

risk reduction, increasing returns on investment, workload reduction, and faster service.

At the conclusion of the talks, Roos conducted an extremely interesting panel discussion with thought-provoking questions and answers among the panelists. Questions were also fielded from the floor. A sampling of the Q&A follows.

Question: For Marius Miller, what might the Ackerman steering linkage, a very technical element, have on your research for transportation trailer modeling?

Answer: We must first differentiate this model from the driving kinetics of car trailers, so for this case, it considers nonskid trailers with fixed wheel positions and no camera angle and where Ackermann equations are taken into account, but the Ackermann angle is not affecting the modeling.

Question: What’s the main impact element in the trailer modeling? Will it be the mass or loading?

Answer: Yes, the mass or loading dimension in the equation has become a main topic of discussion in the project.

Question: On hacking attacks, is there a trend toward hacking during start-up phases versus fully operational plants?

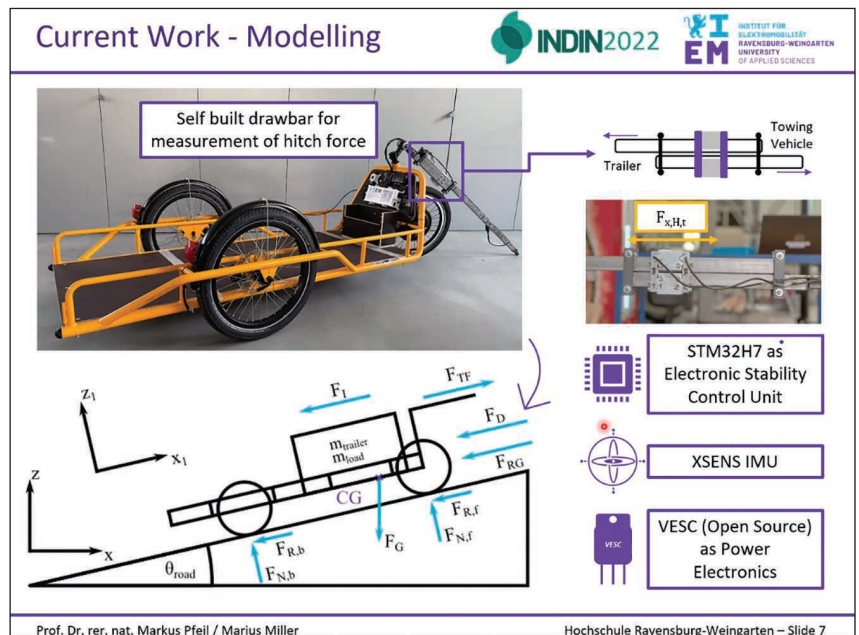


FIGURE 2 – The “Safe and Smart Last Mile Logistics—Drivetrain Control for Electrified Cargo Bike Trailers” presentation. (Source: Marius Miller; used with permission.)

Answer: Hackers don't usually know when companies are in start-up mode or in mature operations mode. But during start-up modes of a plant, security measures may still be under development or being installed or commissioned, thus making that period most vulnerable to hackers. Hackers look for unsecured or insecure industrial devices to exploit the insecurities to obtain data.

Question: In the health-care sector, what are regulators doing in cybersecurity regulations to prevent fatalities caused by breaches in cybersecurity and hacking?

Answer: Data security is viewed at different levels of importance in different countries, but all regulators realize the importance of protection and to secure data. It is believed regulators are working diligently with manufacturers to close this gap.

Question: What is the view of cybersecurity in the area of business process automation with the use of AI? Are the data safe, and how are they protected?

Answer: This is under discussion, and it is one of the most important concerns with the client. First, all client data generated are stored in the client's database on their site, and no transfers of data occur outside its site. Secondly, client data and documents in workflow processes with F-ONE servers are erased once the work is done. These procedures are used to minimize the risk of data leakages during the work processes. This issue should not be underestimated, so it was beneficial to learn of solutions stated in this forum on actions to take to improve cybersecurity.

Question: With all the myriad of new technologies used in multiple industry sectors, how does one cope with the explosion of data and technology advancements today?

Answer: Keeping the future in mind, the most important point is how you acquire your data. In legacy plants, the infrastructure to acquire the data is not there. The advice is to design a system with the future in mind, and most important is knowing how you are going to acquire the data.

Design with the data acquisition philosophy in mind, have a mechanism for gathering the data, have the network infrastructure in place as part of the design even if you are not going to leverage the data as yet, build the foundation first, and then you can add on top of it as new technologies are available and then merge into your system. Additionally, in the foundation, make sure cybersecurity protection is initially included before the data are used in the rest of the system.

Question: What is the advice or main points that need to be put in place to secure data in the systems we are designing?

Answer: Use the power of control in securing data in satellite systems. Use a zero-trust system, which consists of three parts: a strong authentication system of all connections, especially during data transmissions; data protection in transit using encryption; and protect the data at rest, meaning when the data are at the destination location, they are encrypted at the destination server and have a retention policy. This policy controls the retention period of the data, which will be deleted when they are no longer needed when the retention period expires.

Question: Directed toward the trailer project, do you see how all the information presented today on cybersecurity might impact your research?

Answer: At present, the project focuses on the classical design problem, but for the future, one can see, when larger applications require multiple or a fleet of trailers, security protection for data management may be important. Additionally, data accumulated in the testing of electric motors and the trends of customer usage will become important and proprietary to the company and need to be protected.

Closing the session, Roos thanked the speakers for their presentations and panel participation and thanked the audience for its attendance. More emerging topics of interest, such as those presented in this forum, will be addressed in forthcoming industry forums, under the guidance of the IAC. The editor gratefully acknowledges

assistance with this article from Roos and Dr. Stamatis Karnouskos.

—Victor Huang

Industry Forum at ICIT 2022

ICIT 2022 was held on 22–25 August, in Shanghai, China, as a virtual conference due to the worldwide COVID-19 pandemic. The general chairs were Prof. Luis Gomes, Prof. Valeriy Vyatkin, Prof. Mo Yuen Chow, and Prof. Xinpeng Guan. The technical program chairs were Prof. Yousef Ibrahim, Prof. Thilo Sauter, Prof. Jose Lastra, Prof. Wenbin Dai, and Prof. Fuqin Deng. The Industry Forum, also held virtually, was organized by Dr. Zhibo Pang and Dr. Victor Huang. The theme of this year's ICIT Industry Forum was "Industrial Digitalization," where industrial AI and industrial edge computing and wireless are being explored and introduced in manufacturing and industrial complexes. The forum was formally introduced by the technical chair, Prof. Dai, who made opening remarks and welcomed the attendees. The forum chairs, Dr. Pang and Dr. Huang, remarked that industry forums are an IES program in which invited industry and business speakers address technology directions and products and introduce IES conference attendees to challenges and industry perspectives that need to be faced every day.

The first speaker, Dr. Huazhen Song, technology communications manager, B&R Industrial Automation, delivered "Industrial AI—Discrete Manufacturing Scenario Analysis and Applications." Dr. Song stated that the rapid development of AI has led the automation industry to consider AI in solving discrete manufacturing problems, such as quality improvement, defect detection, parameter optimization, and predictive maintenance. However, discrete manufacturing needs to be considered for real-time reliability, interpretability, and robustness. He showed the difference between process and discrete manufacturing and followed with presentations of the applications of industrial AI in software and hardware architecture design, data acquisition and processing, and information modeling and transmission. He stated that

the potential of industrial AI is with the integration of physics-based and data-driven modeling and test verification. In particular, he discussed human-machine collaboration, known as *human in the loop*. With specific case scenarios, he showed how problems and solutions are analyzed, leading to ideas for the application of industrial AI in discrete machines.

Dr. Yi Huang followed with the second presentation, “The Digitalization of Elevator Maintenance Services.” He is the cofounder of Robustel Technologies, a leading industrial IoT product and solutions provider. He remarked that elevators are widely used by the general public, including industry, commerce, and residents, and that there are 22 million elevators in the world today, with 8 million within China alone. Thus, continued maintenance after installation is critical to high operational reliability, which includes ensuring safety and reliability, extending the useful life of the equipment, and eliminating or reducing major repairs by identifying possible issues in advance, as breakdowns and repairs are usually complicated and costly. Recent advances in information technologies, such as the IoT, AI, and cloud computing, enabled the digitalization of elevator services, covering elevator condition monitoring, elevator emergency services, and elevator maintenance service supervision, to name a few.

Discussing the challenges and solutions for the digitalization of elevator maintenance services, Dr. Huang started with the regulations promoting elevator maintenance services in China, leading to challenges for elevator supervision. He then described the architecture of intelligent elevator supervision systems. He pointed to some of the important tasks in elevator supervision systems, covering maintenance data collaboration, emergency rescues, elevator data monitoring, and various customer information services provided in elevators, such as emergency codes for elevator rescues as well as publicity and advertising information. Finally, he described the “on-demand” maintenance capability

and operations management systems provided by elevator maintenance companies using IT.

The third presentation was by Dr. Yi Shen, product director, Industrial Solutions Division, Intel. His talk was “Industrial Real-Time System on Intel Architecture.” Dr. Shen began his talk by stating that many IT giants have spent years solving the complexities of the IT-operational technology (OT) divide, fine-tuning and validating edge software and silicon, and working with partners to bring hundreds of market-ready packages to customers and tens of thousands of end user deployments. In this talk, he covered challenges and possible solutions for industrial real-time systems in industrial factories. Starting with a chart showing Intel’s footprint in factories—the use of computing and silicon in factory environments—where software-defined systems and workload consolidation systems are heavily used. The biggest challenge is how to maintain the real-time capability of the systems. Dr. Shen focused on real-time challenges in such environments by first defining the real-time system taxonomy.

Key real-time solutions to design challenges are successfully resolving end-to-end worst-case execution time and ultrareliable low-latency communication execution time for the performance of IoT use cases. To this end, Dr. Shen proposed time-sensitive networking (TSN) approaches and the use of Intel time-coordinated computing

(TCC) solutions, where TSN will be derived from IEEE TSN standards used between systems, while Intel TCC® will be used within a system, basically for time synchronization within the CPU and input-output levels. Following this, Dr. Shen discussed core elements of TSN, real-time optimizations throughout the system on chip within the CPU, and available solutions using Intel’s edge control for industry open platforms.

Dr. Ling Fu, the fourth speaker, presented “The Future of Digitalization.” Dr. Fu is a principal key expert research scientist, Siemens Technologies, where she drives digital twin-based solutions across businesses and functions within Siemens. Dr. Fu started her presentation by introducing Siemens and the innovation milestones in its 175-year history. In 2020, Siemens began a new chapter in technology and services covering digital industries, smart infrastructure, mobility, and its portfolio companies. In this new era, digital transformation is imperative for every industry. Siemens is one of the most successful companies in digital transformation, among the top 10 software companies in the world and the second-largest in industrial software. Within its 11 core and digital businesses, digital twins are one of the most important. Dr. Fu briefly described Siemens’ approach to its digital twin business, emphasizing that building a comprehensive digital twin business is difficult (Figure 3).

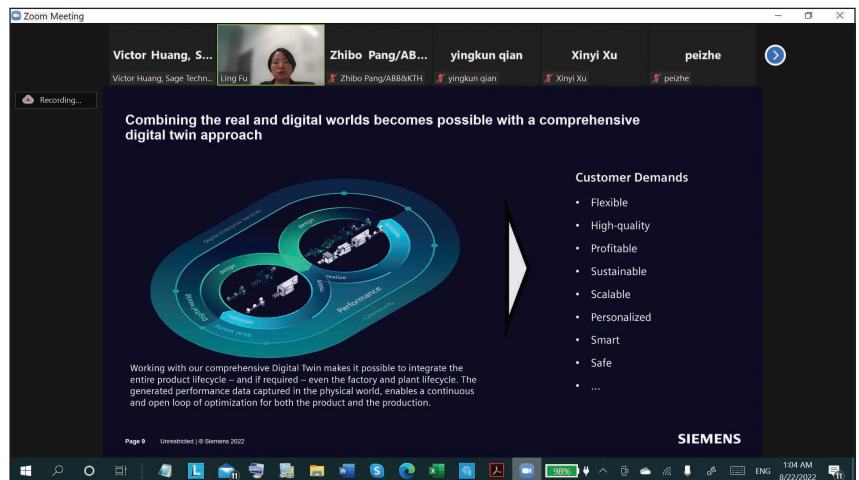


FIGURE 3 – The ICIT 2022 Industry Forum presentation on Siemens’ digital twin business approach. (Source: Dr. Ling Fu; used with permission.)

She described some case examples of digital twin approaches undertaken by Siemens together with its enterprise partners, one in an automated robotic factory and another in an automobile manufacturing assembly plant. She concluded by stating that in this digital era, Siemens continuously sharpens its competence to realize self-digitalization and enable industrial customers with digital offerings and core know-how.

The final talk, “Universal Automation,” rounded out the session, and the speaker was Dr. Yong Wang, chief cybersecurity officer, industrial automation, Schneider Electric China. Dr. Wang stated that industry is on the verge of a digital transformation. Companies are struggling with a lot of difficulties and challenges, such as increased costs, demand fluctuations, and workforce shortages. They are also looking for solutions to support their evolution with new technologies, including data analytics, digital twins, edge and cloud computing, AI/machine learning, and augmented reality/virtual reality. With automation systems known to be a barrier to change, the conventional way of introducing proprietary solutions from automation vendors is no longer sustainable. Automation systems must evolve. IT applications must be made easy and simple to connect and integrate with automation systems, and application software must be made portable and

easily decoupled from hardware. A standardized and open automation solution is the only way for future industrial automation.

Dr. Wang proposed the use of UniversalAutomation.org (UAO) solutions, which promote open automation through International Electrotechnical Commission (IEC) 61499-based industrial-grade reference runtime execution engines committed to portable automation software applications to benefit automation vendors and customers with high-quality products and flexibility solutions, with the benefits of lower costs and shorter times to market. Dr. Wang described universal automation in some detail, referring to the IEC 61499 standard as the technology enabler of UAO and describing the UAO community, consisting of users, IT and OT vendors, universities, and start-ups, dedicated to the use of the portability and reusability of vendor-independent automation application software. He concluded by stating that universal automation is the world of plug-and-produce software components and that UAO-compliant offers are ready for use and testing (Figure 4).

At the conclusion of the extremely interesting presentations in this forum, Dr. Pang led a panel discussion with the speakers and the audience.

Question: As you know, IES industry forums bring together industry speakers in an IEEE conference environment consisting mainly of

academia, students, and young professionals. From your view of your area of expertise and industry focus, what is the primary technical area where you hope academia might help or contribute?

Answer: Yi Huang, of Robustel, mentioned that they are presently facing some problems in their projects, and they are working with a university on the problem associated with the AI camera used in elevator maintenance services. The issue is the inability or misrecognition of objects or people flow in the elevator scenarios. They are working with academic support in these AI recognition areas.

Answer: Yi Shen of Intel spoke about the talent pipeline. Academia must continue to produce highly qualified high-technology engineers and to generate their interest and motivation in these high-technology areas, so they would not be siphoned off by the more lucrative fields operated by popular social media companies, such as Baidu, TenCent, and others.

Dr. Pang commented that this certainly seems to be the case, where the OT industry seems to lag behind the IT industry in terms of exciting jobs and better salaries. However, Zhibo states that the OT industry needs to do a better promotional job in academia to excite young professionals to join the OT domain, where the field is more technically challenging, bringing more long-term career development and, eventually, more career satisfaction.

Question: Given the very new and interesting initiative of the UAO, are there any university programs for education, training, and avenues for researchers to contribute in the industrial automation field?

Answer: Not as yet, but as the initiative is building up, the member organizations are working toward some of these initiatives.

Question: Are there any membership fees for the UAO?

Answer: Yes. There is a fee for academic members, while industry fees are distinguished by several levels of membership (silver, gold, and

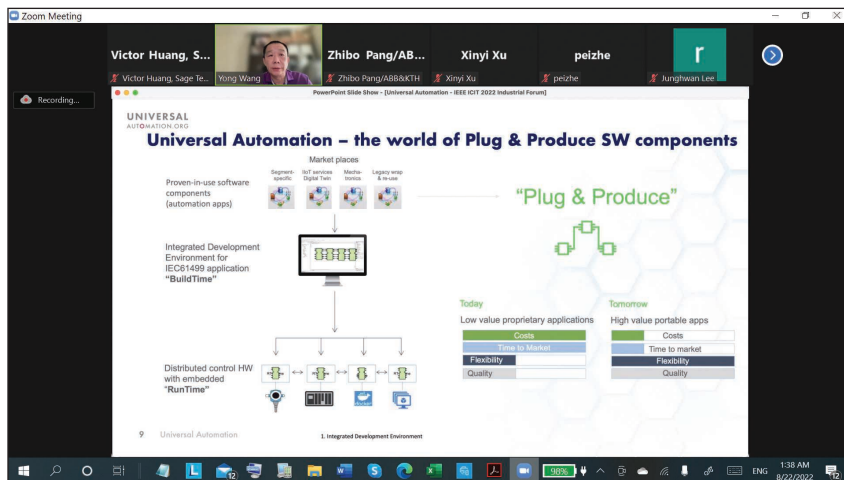


FIGURE 4 – The presentation “Universal Automation,” by Dr. Yong Wang, at the ICIT 2022 Industry Forum. (Source: Dr. Yong Wang; used with permission.)

platinum) and special fees for start-up companies to encourage them to participate in this open consortium and contribute to the technology.

Question: Specific to B&R, it is known that the company has specific university collaborative programs sponsoring joint labs for research and development. What are your views about academic contributions to industry?

Answer: Yes, B&R has over 30 collaborative labs with universities in China and annually trains over 1,000 engineers in B&R technologies. B&R also sponsors R&D with universities on advanced technologies.

Question: Do you have any advice to young engineers and researchers in AI research?

Answer: Yes. Working in industry provides long-term career development and goals, and where a young engineer can learn more technologies in many different disciplines, including mechanical, electromechanical, and processing technologies. It provides more satisfaction and long-term financial security. However, in IT technologies, it is lucrative, but there is concern for its long-term prospects.

Question: Given that all our electronics, almost all appliances, including public appliances like elevators, are powered by electricity, what safeguards are there to public elevators for preventing being stuck 50 stories high due to power failures?

Answer: There are two scenarios regarding power failure in elevators. The first is a simple solution by providing battery backup for the IoT elevator systems. The second solution is now a key part of the design component for smart buildings. Large companies (for example, Siemens and ABB) that provide elevators to smart buildings have elaborate state-of-the-art elevator control schemes that have built-in power failure and recovery systems, making them fail-safe and reducing passenger anxiety. Elevator SMEs also provide such fail-safe mechanisms into their elevator design and implementation. Schemes vary, but all are sophisticated to ensure passenger safety. The chair states that at the very least, there

should be considerations to provide enough battery backup systems to enable all stuck elevators to resume to the ground floor and discharge the trapped passengers during power failures. This way, it will guarantee safety in elevator use and build the confidence of passengers.

At the end of the session, Dr. Pang called upon Dr. Karnouskos, IES vice president of industrial activities, and Prof. William Dai, ICIT 2022 program chair, to close the forum. Dr. Karnouskos thanked the organizers and speakers for a very interesting forum, and Prof. Dai thanked the speakers for their presentations and the audience for its attendance. He said he hoped there would be an opportunity to have the speakers at another IES industry forum.

The editor gratefully acknowledges assistance with this article from Dr. Pang, forum chair.

—Victor Huang

Industry Day at ETFA 2022

IES ETFA conferences have a long-standing tradition of sponsoring full industry days, and this year was no exception, with the 2022 Industry Day held on 6 September, ahead of the main ETFA conference. The 27th ETFA was held on 6–9 September, in Stuttgart, Germany, hosted by the Institute for Automation Technology and Software Engineering, Stuttgart

University. The general chairs were Prof. Michael Weyrich, University of Stuttgart, and Prof. Marco Porta, University of Pavia, Italy (Figure 5). Prof. Marina Indri, Politecnico di Torino, Italy, and Prof. Antonio Visioli, University of Brescia, Italy, were the program chairs. The workshop chairs were Prof. Antoni Grao, Polytechnic University of Catalonia, Spain, and Prof. Lukasz Wisniewski, Ostwestfalen-Lippe University of Applied Sciences, Germany. The conference was successfully held over four days, with upward of 400 participants engaged in many scientific presentations and technical exchanges.

Industry Day, held on the first day, kicked off the conference and was organized as a series of eight workshops totaling 17 sessions, which featured 48 papers, three panel sessions, and one invited talk. Many contributions to Industry Day were from the automation industry (Figure 6). A plenary speech was the highlight of the day: “Practicalities of Data Analytics and AI in Industrial Control” by Dr. Andrea Dunbar, Swiss Center for Electronics and Microtechnology (CSEM SA) (Figures 7 and 8). The workshops spanned trending technologies, new innovations, and applications relevant in today’s industrial and manufacturing fields. There were two workshops covering applications and process automation in the biomedical field.

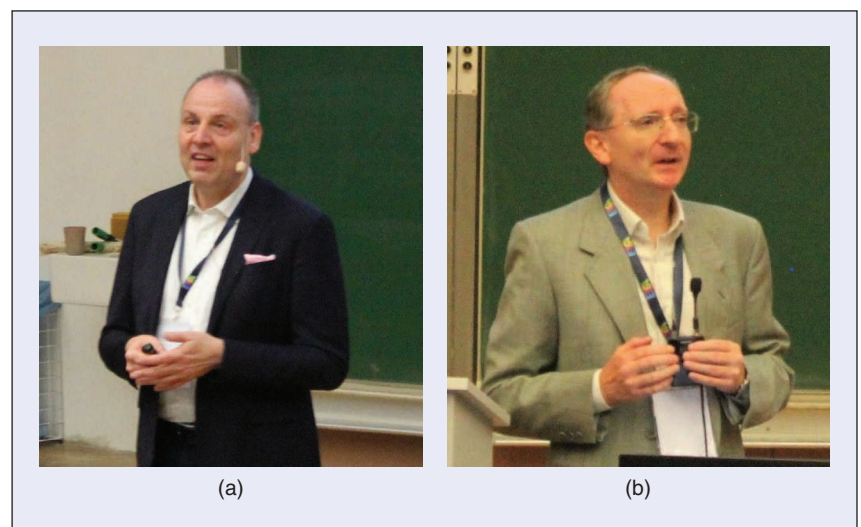


FIGURE 5 – The opening remarks by (a) Prof. Michael Weyrich and (b) Prof. Marco Porta, ETFA 2022 general chairs. (Source: Prof. Michael Weyrich; used with permission.)



FIGURE 6 – An Industry Day presentation at ETFA 2022. (Source: Prof. Michael Weyrich; used with permission.)



FIGURE 7 – The plenary speech by Dr. Andrea Dunbar, “Practicalities and Data Analytics and AI in Industrial Control” at Industry Day. (Source: Prof. Michael Weyrich; used with permission.)

A short summary of each workshop is provided in the following, with an abstract and the number of papers presented. Most presentations ran between 15 and 20 min, allowing more face-to-face discussions among the participants and speakers to share and trade ideas, discuss collaboration, and allow student participants to get a feeling for the practical aspects of industry research, product development, and applications.

The “CLONAR—Cloud Native Real-Time Systems” workshop was chaired by Mohammad Ashjaei, Mälardalen

University, Sweden, and Daniel Corujo and Paulo Pedreiras, Instituto de Telecomunicações, Universidade de Aveiro, Portugal. It was “a place where R&D solutions involving cloud native and real time systems will be manifested and shared. The objective is to attract works focusing on either advancement from the industrial sphere or the cloud sphere (or both), in order to achieve groundbreaking innovative systems for industry automation. Theoretical, experimental, trials or lessons learned will allow the expert communities of both areas to witness the deployment capability of the state of the art, or to pave the way for further evolutions.” This workshop had four presentations.

The “First Workshop on Implementing Asset Administration Shells (ImplAAS)” was “to discuss research challenges and experiences regarding the digital transformation of manufacturing environments with Asset Administration Shells and digital twins. Further relevant topics cover the use of AAS for the creation of digital twins, and to virtualize (production) systems. All system domains are welcome. We solicit papers around the use, practical implementations, and experiences with Asset Administration Shells and digital twins that cover a wide range of research topics with a focus on the digital transformation of manufacturing and the digitization of value chains.” This workshop, chaired by Dr. Thomas Kuhn, Fraunhofer Institute for Experimental Software Engineering, Germany; Dr. Sten Grüner, ABB Corporate Research, Germany; Dr. Pablo Oliveira Antonino, Fraunhofer Institute for Experimental Software Engineering; Dr. Daniel Porta, German Research Center for Artificial Intelligence, Germany; and Frank Schnicke, Fraunhofer Institute for Experimental Software Engineering, had nine presentations.

Martin Cech, University of West Bohemia, Czech Republic, and Manuel Beschi and Antonio Visioli, University of Brescia, Italy, were the chairs of the workshop “Digital Twins, Components and Systems for Smart Mechatronic Applications,” which featured 10



FIGURE 8 – The plenary speech attendees. (Source: Prof. Michael Weyrich; used with permission.)

presentations. “Research on digital twin technologies is affecting all of engineering domains. Specifically, one can see huge interest of applying digital twin technologies in smart production technologies, robots and mechatronic devices. However, lots of components and systems must be modeled, each with a bit different approach. The workshop focuses on specific systems (SW, HW, sensors, actuators) that are necessary to run machines in optimal ways. Next, the workshop focuses on specific toolchains and modeling platforms that allow to model those components and integrate partial models into bigger units using standardized interfaces.” This workshop has 10 presentations.

Dionisis Andronas, University of Patras, Greece; Marco Faroni, Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing of the National Research Council of Italy (CNR-STIIMA); Stefano Ghidoni, University of Padova, Italy; and Alessandro Umbrico, National Research Council, Institute of Cognitive Sciences and Technologies (CNR-ISTC), Italy, chaired the workshop “Towards the Factory of the Future: Advances in Planning, Control, and Perception of Industrial Robots.” “Industrial robots play a key role in industrial automation. Robotic arms populate shop-floors; they are used for pick-and-place, assembly, inspection, and many other tasks, to increase the throughput of productive processes and alleviate fatigue and risks of human workers. A huge research effort has been put into the reasoning, planning and control of robotic manipulators. Nonetheless, industrial implementations often do not exploit at full potential the great advancements made in these fields. This workshop aims at discussing how recent developments in planning and control of robot manipulators, on the one hand, and synergetic integration with results

MOST PRESENTATIONS RAN BETWEEN 15 AND 20 MIN, ALLOWING MORE FACE-TO-FACE DISCUSSIONS AMONG THE PARTICIPANTS AND SPEAKERS TO SHARE AND TRADE IDEAS.

from AI and cognition, on the other, can advance the state of the art and be applied to real-world manufacturing.” This workshop had four papers, an invited talk, and a panel discussion.

The workshop “DIVERSE—Workshop on Advanced Technologies in Industrial Vehicular Systems” featured eight papers and one panel discussion.

The chairs were Saad Mubeen and Mohammad Ashjaei, Mälardalen University. The workshop concerned the fact that “the innovation of modern vehicles can be largely attributed to advanced computer-controlled functionalities. With the increasing volume of these functionalities, the complexity in vehicular systems has increased enormously over the past few years. The workshop’s objective is to provide a platform to the

researchers and practitioners to present and discuss advanced technologies that can address the challenges faced by the developers of vehicular systems.” This workshop had eight presentations and a panel discussion.

The aim of the workshop “Enabling Robust, Converged Networks for Industry 4.0” was to “present and practically demonstrate the state of the art of some of the key enabling technologies of Industry 4.0, such as SPE, TSN and OPC-UA PubSub, and to evaluate how these facilitate the convergence of OT and IT networks for Industry 4.0. This workshop delivers high quality lectures by experienced domain experts, describing the potentials as well as the limits of the technologies mentioned above. To facilitate the interactive discussion, the workshop is accompanied by several live demonstrations using industrially relevant equipment, that practically show the current possibilities of the mentioned technologies, a number of measurement tools and methods and aspects of robustness such as EMI/EMC and redundancy.” This workshop was chaired by Prof. Wisniewski;

Jos Knockaert, EELab/Lemcko–Ghent University, Belgium; and Philippe Saeys, KU Leuven, Belgium. It had five presentations and seven live demonstrations.

Two workshops in the biomedical areas are summarized here. The aim of the workshop “Biointelligent Manufacturing—Looking to Biology With Engineering Eyes” was to “bring together researchers and practitioners and provide them with a platform to report on recent advances in the newly emerging area of biointelligent manufacturing. After the talks of three invited speakers, we attempt to define the basis for a joint perspective paper in a peer-reviewed journal in a collaborative workshop.” This workshop was led by Prof. Thomas Bauernhansl, Fraunhofer Institute for Manufacturing Engineering and Automation and the Institute of Industrial Manufacturing and Management, Germany; Robert Mieke, Fraunhofer Institute for Manufacturing Engineering and Automation; and Ralf Takors, Institute of Biochemical Engineering, Germany.

The “Future of Process Automation in BioPharma” workshop was chaired by Lucas Vogt and Anselm Klose, both of Process-to-Order Lab, Dresden, Germany. This workshop covered the fact that “the biopharma industry imposes a unique set of requirements and challenges for the automation of its processes, whose emphasis differs significantly from other industries. Consequently, this workshop aims to create a discussion platform for the industry specific needs regarding automation technologies. The talks aim to interconnect process automation, factory automation and operator centric design for biopharma from an industry point of view.” This workshop had five papers and a panel discussion.

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—Victor Huang
—Dietmar Bruckner

