

CONFERENCE PROGRAM

CMAEE 2022

**2022 International Conference on Mechanical,
Automation and Electrical Engineering**

CMAIR 2022

**2022 International Conference on Mechatronics, Artificial
Intelligence and Robotics**

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Welcome Address

Dear Participants,

We are delighted to welcome you to CMAEE 2022 & CMAIR 2022 conferences. Currently, the entire world is struggling against the virulent pandemic COVID-19. Unfortunately, each of us is affected, either overtly or covertly. Our conference, 22022 International Conference on Mechanical, Automation and Electrical Engineering (CMAEE 2022) in conjunction with 2022 International Conference on Mechatronics, Artificial Intelligence and Robotics (CMAIR 2022), is not an exception. To actively respond the call of the government, to strengthen the protection work, to effectively reduce people gathering and prevent coronavirus transmission, CMAEE 2022 which should be held in Chengdu, China from Dec. 16-18, 2022 as planned is now changed as online conference.

Changing the format however shall not affect the desire of the conference. We wish to continue our communication to share our new research ideas, discuss challenges and form collaborations to solve various issues on Mechanical, Automation and Electrical Engineering. Also, the change of conference form will not influence the papers' publication and indexing. All the registered and presented papers will be included in the conference proceedings, which will be published by Conference Publishing Services (CPS), which will be submitted for inclusion in IEEE Xplore and CSDL, and indexed by EI Compendex, Scopus, INSPEC, EI's Engineering Information Index, ISI Thomson's Scientific and Technical Proceedings, ISTP/ISI Proceedings, and Current Contents on Diskette.

After several rounds of review procedures, the program committee accepted those papers to be published in conference proceedings. We wish to express our sincere appreciation to all the individuals who have contributed to CMAEE 2022 & CMAIR 2022. Special thanks are extended to our colleagues in program committee for their review of all the submissions, which is vital to the success of the conferences, and to the members in the organizing committee who had dedicated their time and efforts in planning, promoting, organizing and helping the conferences. Last but not the least, our special thanks go to our speakers: **Prof. Rui Zhang**, The Chinese University of Hong Kong (Shenzhen), China; **Prof. Zhaoyang Dong**, Nanyang Technological University, Singapore; **Prof. Ruqiang Yan**, Xi'an Jiaotong University, China and **Prof. Zhongsheng Hou**, Qingdao University, China for all the kind and patient support and assistance they offered to our whole conference procedures.

In all, I would like to express my deepest gratitude to all of you sitting here, to the whole organizing committee, to all the reviewers and those who are not able to show up today, for your great support for CMAEE 2022 & CMAIR 2022.

While we are not able to meet each other face to face in Chengdu, China, we hope the conference can still establish a solid linkage among all the participant as desired. We look forward to your contribution to making CMAEE 2022 & CMAIR 2022 a success.

CMAEE 2022 & CMAIR 2022

Conference Speakers



Professor Rui Zhang

The Chinese University of Hong Kong (Shenzhen) , China

Biography: Dr. Rui Zhang (Fellow of IEEE, Fellow of the Academy of Engineering Singapore) received the Ph.D. degree from Stanford University in electrical engineering in 2007. He is now a X. Q. Deng Presidential Chair Professor in School of Science and Engineering, The Chinese University of Hong Kong, Shenzhen. His current research interests include wireless information and power transfer, UAVtellite communication, and reconfigurable MIMO. He has published over 450 papers, which have been cited more than 60,000 times with the h-index over 120. He has been listed as a Highly Cited Researcher by Thomson Reuters / Clarivate Analytics since 2015. He was the recipient of the IEEE Communications Society Asia-Pacific Region Best Young Researcher Award in 2011, the Young Researcher Award of National University of Singapore in 2015, the Wireless Communications Technical Committee Recognition Award in 2020, and the IEEE Signal Processing and Computing for Communications (SPCC) Technical Recognition Award in 2021. He received 14 IEEE Best Journal Paper Awards, including the IEEE Marconi Prize Paper Award in Wireless Communications (twice), the IEEE Communications Society Heinrich Hertz Prize Paper Award (thrice), the IEEE Communications Society Stephen O. Rice Prize, the IEEE Signal Processing Society Best Paper Award and Donald G. Fink Overview Paper Award, etc. He has served as an Editor for several IEEE journals, including TWC, TCOM, JSAC, TSP, TGCN, etc., and as TPC co-chair or organizing committee member for over 30 international conferences. He served as an IEEE Distinguished Lecturer of IEEE Communications Society and IEEE Signal Processing Society in 2019-2020.

Speech Title: Intelligent Reflecting Surface (IRS) Empowered 6G: Fundamentals, Applications and Challenges

Abstract: While 5G wireless networks are being deployed globally, wireless communication researchers have started to investigate the next-generation 6G wireless networks, which are expected to achieve even higher spectral and energy efficiency over 5G. In this talk, we introduce a new promising wireless technology, named Intelligent Reflecting Surface (IRS), which has been identified by wireless industry as a potential key technology to achieve the ambitious goals of 6G. By dynamically tuning a massive number of low-cost passive reflecting elements, IRS is able to smartly control and configure wireless channels for enhancing the communication performance significantly. In this talk, we first present the fundamentals of IRS including its hardware architecture and communication models, its main applications in wireless networks, and its cost and performance advantages as compared to existing wireless technologies. Next, we introduce the main design challenges in efficiently integrating IRSs into future wireless networks such as 6G, including passive reflection optimization, IRS channel acquisition and IRS deployment, as well as overview their state-of-the-art solutions. Finally, we discuss open problems and point out directions worthy of investigation in future work.

Professor Zhaoyang Dong

Nanyang Technological University, Singapore



Biography: Prof. Dong is a Professor at Nanyang Technological University, Singapore. His previous roles include SHARP professor and Director of UNSW Digital Grid Futures Institute at the University of New South Wales, and Director of Australian Research Council Research Hub for Integrated Energy Storage Solutions. He also worked as Ausgrid Chair Professor and Director of the Ausgrid Centre for Intelligent Electricity Networks providing R&D support for the AUD500m Smart Grid, Smart City national demonstration project of Australia. His research interests include power system planning and stability, smart grid and smart cities, renewable energy systems, electricity market, and computational methods for power engineering applications. He has served/is serving as an editor for a number of IEEE Transactions and IET journals. He is an international scientific advisory board member of the African Center of Excellence in Energy for Sustainable Development (ACE-ESD). He is a Fellow of IEEE.

**Speech Title: Electric Vehicle Charging Infrastructure Planning and Management
Considering Grid Impact and Market Opportunities**

Abstract: As the 2nd largest emission sector in many countries, the transportation sector is undergoing a transition towards green transportation system with electric vehicles and digitalization technologies. In the transition, the massive increment of EVs and their charging load poses major challenges to the power grid and the economic model remains open for more opportunities to explore. In this talk, EV infrastructure planning and charging management technologies will be presented from the technical perspective, together with a sharing model to promote the uptake of electric vehicles with useful case studies. Shared mobility facilitates better social, environmental and mobility benefits in a smart city. Optimal mobility planning requires a wholistic approach to consider siting and sizing of charging facilities in power distribution networks while trying to maintain system stability and reliability with high EV penetration. Modelling of the uncertainties associated with EVs is included in this framework. The planning problem is formatted as a multi-objective optimization problem which can be solved effectively with mixed integer nonlinear programming optimization and stochastic dynamic discrete simulations.



Professor Ruqiang Yan
Xi'an Jiaotong University, China

Biography: Ruqiang Yan is a Full Professor of the School of Mechanical Engineering, Xi'an Jiaotong University, China. His research interests include data analytics, AI, and energy-efficient sensing and sensor networks for the condition monitoring, fault diagnosis and prognosis of large-scale, complex, dynamical systems. Dr. Yan is a Fellow of IEEE (2022) and ASME (2019). His honors and awards include the IEEE Instrumentation and Measurement Society Technical Award in 2019, the New Century Excellent Talents in University Award from the Ministry of Education in China in 2009, and multiple best paper awards. Dr. Yan is the Editor-in-Chief of the IEEE Transactions on Instrumentation and Measurement, an Associate Editor of the IEEE Sensors Journal, and Editorial Board Member of Chinese Journal of Mechanical Engineering. Ruqiang Yan received the M.S. degree in precision instrument and machinery from the University of Science and Technology of China, Hefei, China, in 2002, and the Ph.D. degree in mechanical engineering from the University of Massachusetts at Amherst, Amherst, MA, USA, in 2007. He was a Guest Researcher at the National Institute of Standards and Technology (NIST) in 2006-2008 and a Professor with the School of Instrument Science and Engineering, Southeast University, Nanjing, China from 2009 to 2018. He joined the School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an, China, in 2018.

Speech Title: Explainable AI for Machine Intelligent Diagnosis

Abstract: The new generation AI technology, especially deep learning, has shown great advantage in feature learning and knowledge mining, which provides a new way for machine intelligent diagnosis. This talk first provides a brief overview of deep learning. Then applications of some typical deep network models in intelligent diagnosis are discussed, followed by a wavelet-driven explainable deep learning model for aero-engine intelligent diagnosis.

Professor Zhongsheng Hou
Qingdao University, China



Biography: Zhongsheng Hou (SM'13, F'20) received the B.S. and M.S. degrees from Jilin University of Technology, Jilin, China, in 1983 and 1988, respectively, and the Ph.D. degree from Northeastern University, Shenyang, China, in 1994. From 1997 to 2018, he was with Beijing Jiaotong University, Beijing, China, where he was a Distinguished Professor and the Founding Director of Advanced Control Systems Lab,

and the Head of the Department of Automatic Control. He is currently a Chair Professor with Qingdao University, Qingdao, China. His research interests are in the fields of data-driven control, model-free adaptive control, learning control, and intelligent transportation systems. He has authored two monographs, *Nonparametric Model and its Adaptive Control Theory*, Science Press (in Chinese), 1999, and *Model Free Adaptive Control: Theory and Applications*, CRC Press, 2013. His pioneering work on model-free adaptive control has been verified in more than 230 different field applications, laboratory equipment and simulations with practical background, including wide-area power systems, lateral control of autonomous vehicles, temperature control of silicon rod. Prof. Hou is the Founding Director of the Technical Committee on Data Driven Control, Learning and Optimization (DDCLO), Chinese Association of Automation (CAA), and is a Fellow of CAA. Dr. Hou was the Guest Editor for two Special Sections on the topic of data-driven control of the IEEE Transactions on Neural Networks in 2011, and the IEEE Transactions on Industrial Electronics in 2017.

Speech Title: The Control Theory under the Age of Big Data/AI

Abstract: Professor R. E. Kalman was the founder and visionary intellectual leader of the field of mathematical system theory. His contributions to optimal control, optimal estimation and filtering, realization theory, and mathematical system theory are at the foundations of these fields. They have significantly influenced much of the subsequent developments. Their influence transcends well beyond system and control into diverse fields of engineering, mathematics, physical sciences, social sciences, and others. However, there have been very significant developments in science, engineering, technology, and society in the last few decades. It is clear that change will accelerate further in the coming decades. Thus, thinking about the relevance and implications of the Kalman's paradigm of the control theory under the big data or the AI age, that might illuminate the path of the system and control research for the future.

This talk includes five parts. What is the Kalman's Paradigm; The Challenges under the Kalman's Paradigm the Problems We Face under the Big Data/AI Age; The Possible Solutions for the Post-Kalman Era _Taking MFAC as an example; and Conclusion.



Instructions for Presentations

Oral Presentations

1. File format: MS-PowerPoint (*.ppt) or Adobe PDF (*.pdf)
2. Time: About 15mins, including Q/A time.
3. Language: English
4. Fonts: Arial or Times New Roman
5. Dress code: Formal clothes
6. Facility: Presenters need to use own laptop, please notify conference secretary via e-mail in advance and test the connection before session start.
7. Video conference software: Zoom

Poster Presentations

1. Poster Size: 1m*0.8m (height*width).
2. Language: English.
3. Poster format: jpg/pdf
4. The poster should include: Paper ID, Conference Name's Acronym, Significance of the research, the methods used, the main results obtained, and conclusions drawn.
5. Posters are required to be condensed and attractive.
6. The conference organizer won't send/keep any posters after the conference.

Program Overview

Date	Time	Content	Location
Dec. 16th, 2022 Friday	9:00-9:10	Welcome Message	Zoom
	9:10-9:50	Keynote Speech I Professor Rui Zhang	
	9:50-10:30	Keynote Speech II Professor Zhaoyang Dong	
	10:30-10:40	Short Break	
	10:40-11:20	Keynote Speech III Professor Ruqiang Yan	
	11:20-12:00	Keynote Speech IV Professor Zhongsheng Hou	
	12:00-13:30	Lunch Time	
	13:30-15:10	Oral Presentation I	
	15:10-15:30	Short Break	
	15:30-17:30	Oral Presentation II	

Detailed Schedule

Online Meeting | 9:10am-12:00am

< Keynote Speeches >



Time	Content
09:10-09:50	 <p>Speaker: Professor Rui Zhang Affiliation: The Chinese University of Hong Kong (Shenzhen), China</p> <p>Title of Speech: Intelligent Reflecting Surface (IRS) Empowered 6G: Fundamentals, Applications and Challenges</p> <p>Abstract: While 5G wireless networks are being deployed globally, wireless communication researchers have started to investigate the next-generation 6G wireless networks, which are expected to achieve even higher spectral and energy efficiency over 5G. In this talk, we introduce a new promising wireless technology, named Intelligent Reflecting Surface (IRS), which has been identified by wireless industry as a potential key technology to achieve the ambitious goals of 6G. By dynamically tuning a massive number of low-cost passive reflecting elements, IRS is able to smartly control and configure wireless channels for enhancing the communication performance significantly. In this talk, we first present the fundamentals of IRS including its hardware architecture and communication models, its main applications in wireless networks, and its cost and performance advantages as compared to existing wireless technologies. Next, we introduce the main design challenges in efficiently integrating IRSs into future wireless networks such as 6G, including passive reflection optimization, IRS channel acquisition and IRS deployment, as well as overview their state-of-the-art solutions. Finally, we discuss open problems and point out directions worthy of investigation in future work.</p>
9:50-10:30	 <p>Speaker: Professor Zhaoyang Dong Affiliation: Nanyang Technological University, Singapore</p> <p>Title of Speech: Electric Vehicle Charging Infrastructure Planning and Management Considering Grid Impact and Market Opportunities</p> <p>Abstract: As the 2nd largest emission sector in many countries, the transportation sector is undergoing a transition towards green transportation system with electric vehicles and</p>



	<p>digitalization technologies. In the transition, the massive increment of EVs and their charging load poses major challenges to the power grid and the economic model remains open for more opportunities to explore. In this talk, EV infrastructure planning and charging management technologies will be presented from the technical perspective, together with a sharing model to promote the uptake of electric vehicles with useful case studies. Shared mobility facilitates better social, environmental and mobility benefits in a smart city. Optimal mobility planning requires a wholistic approach to consider siting and sizing of charging facilities in power distribution networks while trying to maintain system stability and reliability with high EV penetration. Modelling of the uncertainties associated with EVs is included in this framework. The planning problem is formatted as a multi-objective optimization problem which can be solved effectively with mixed integer nonlinear programming optimization and stochastic dynamic discrete simulations.</p>
10:40-11:20	<div data-bbox="847 645 1023 880" data-label="Image"> </div> <p>Speaker: Professor Ruqiang Yan Affiliation: Xi'an Jiaotong University, China</p> <p>Title of Speech: Explainable AI for Machine Intelligent Diagnosis</p> <p>Abstract: The new generation AI technology, especially deep learning, has shown great advantage in feature learning and knowledge mining, which provides a new way for machine intelligent diagnosis. This talk first provides a brief overview of deep learning. Then applications of some typical deep network models in intelligent diagnosis are discussed, followed by a wavelet-driven explainable deep learning model for aero-engine intelligent diagnosis.</p>
11:20-12:00	<div data-bbox="831 1361 1034 1568" data-label="Image"> </div> <p>Speaker: Professor Zhongsheng Hou Affiliation: Qingdao University, China</p> <p>Title of Speech: The Control Theory under the Age of Big Data/AI</p> <p>Abstract: Professor R. E. Kalman was the founder and visionary intellectual leader of the field of mathematical system theory. His contributions to optimal control, optimal estimation and filtering, realization theory, and mathematical system theory are at the foundations of these fields. They have significantly influenced much of the subsequent developments. Their influence transcends well beyond system and control into diverse fields of engineering, mathematics, physical sciences, social sciences, and others. However, there have been very significant developments in science, engineering, technology, and society in the last few decades. It is clear that change will accelerate further in the coming decades. Thus, thinking about the relevance and implications of the Kalman's paradigm of the control theory under the big data or the AI age, that might</p>

illuminate the path of the system and control research for the future.
This talk includes five parts. What is the Kalman's Paradigm; The Challenges under the Kalman's Paradigm the Problems We Face under the Big Data/AI Age; The Possible Solutions for the Post-Kalman Era _Taking MFAC as an example; and Conclusion.

Online Meeting | 13:30-15:10

< Oral Presentation I >
Session Chair: Dr. Ayush

Number	Content
C7	 <p>Presenter: Naixuan ZHU Affiliation: Zhejiang University, China</p> <p>Title of Speech: The Optimal Operation of Honeycomb Distribution Network With Multi-agent System</p> <p>Abstract: Growing renewable energy access poses serious challenges for traditional distribution network, especially from the point of view of uncertainty and volatility. In this paper, a new type of distribution network structure called honeycomb distribution network (HDN) is introduced, as well as the core device smart power/information exchange station (SPIES), which performs as the agent for power exchange and electricity trading. Firstly, the characteristics and benefits of HDN are described. Then the mathematical physics models of HDN system with the functions of multi-agent system are established. The two-level optimization operating model of HDN with multiagent system is proposed and then solved and verified through a numerical simulation of simplified HDN system. The optimal results show that HDN with multi-agent system can realize the economic operation of the distribution network and the consumption of renewable energies, which reveal the potential of HDN in the future new power network.</p>
C10	 <p>Presenter: Yujing Li Affiliation: Zhejiang University, China</p>

	<p>Title of Speech: Consumer-transformer Relationship Identification Based on UMAP and Mini Batch K-Means</p> <p>Abstract: The accuracy of the relationship between single-phase users and transformers in low-voltage areas has an important impact on the analysis of line loss management. At the moment, the identification of consumer-transformer relationship mainly relies on manual checking, which is lack of efficiency. Therefore, an efficient and reliable method for identifying the relationship between consumer and transformer is urgently needed. In this paper, a consumer-transformer relationship identification method based on voltage data recorded by a smart meter is proposed, which provides a reference for the line loss analysis in low power distribution network. Firstly, the UMAP technique is chosen to reduce the dimensionality of the voltage data to deal with the redundancy caused by the high dimensionality of the original load characteristics of the users in the station area. After that, the mini batch K-means algorithm is applied to realize the identification of the consumer-transformer relationship in the low-voltage area. Finally, the proposed method is validated in simulation models. The results indicate that the method works.</p>
C02	 <p>Presenter: Junseok Seo Affiliation: Korea University, Korea</p> <p>Title of Speech: Single-view, video-based diagnosis of Parkinson's Disease based on arm and leg joint tracking</p> <p>Abstract: Automatic diagnosis of Parkinson's Disease (PD) from sensor data is an important topic given the growing numbers of patients, and the increasing costs to the quality of life of an aging society. Several approaches have been proposed aimed at such an automatic diagnosis, but often suffer from complicated sensor setups or setups ill-fitting for the limitations in clinical settings. Here, we present a system that uses frequency-based analysis of joint data from both arms and legs from a single, frontally-viewed video of people walking towards a camera. We evaluate three machine-learning models on frequency-based features extracted from the joint dynamics on two larger datasets containing a total of N=300 videos of over 50 PD patients and healthy control people. Results confirm typical clinical expectations (leg frequencies are slower in PD patients) and in addition show excellent generalizability even across datasets with performance of up to 97% for an Ensemble classifier.</p>
C08	 <p>Presenter: Marco Castillo Cervera Affiliation: Universidad Continental, Perú</p>

	<p>Title of Speech: Data glove-based sign language translation with convolutional neural networks</p> <p>Abstract: This research was carried out because of the communication barriers that currently exist between hearing impaired and hearing people. These barriers hinder their integration into society and affect their interpersonal relationships. The objective of the study was to propose the development of a stationary assistive robot capable of displaying sign language interpretation through the combination of data gloves and the D-CNN and LSTM algorithm to facilitate the communication of hearing-impaired children in Huancayo. The triple diamond research design was used, where the mind map and the lotus diagram were used for the delimitation and definition of the problem. In addition, the IDEF0 technique was used to obtain a structured design of the project system. A morphological matrix was also used to choose the best solution for the problem. The chosen design contemplates the use of an Arduino UNO, flex sensors, accelerometers and gyroscopes for sign detection. The main algorithm consists of the union of a deep convolutional neural network and a LSTM for a correct sign classification module. The proposed design proposes to visualize the conceptual development of the project mentioned above.</p>
C14	<div data-bbox="853 846 1034 1070" data-label="Image"> </div> <p>Presenter: Patricia Pamela Sotelo De la Cruz Affiliation: Universidad Continental, Perú</p> <p>Title of Speech: Mechatronic design of an intelligent road for accident prevention on the Qatac route, Aija-Peru</p> <p>Abstract: In recent years, different studies have shown an increase in accidents on Peruvian highways due to different causes such as: fog, carelessness, collisions and run over, whose main contributing factors are drowsiness, carelessness and lack of visual stimulation. One of the roads with the highest number of accidents is the highlands, with 52.2%, making the Ancash region the second most accident-prone. For this reason, this study was carried out with the objective of reducing these accidents by employing a mechatronic design for intelligent roads on the Qatac route, Aija, Ancash-Peru. Using DIAASTHO 93 software, a 2" asphalt layer and a 4" granular base were calculated, which will house the ultrasonic sensor on the edges of the roads to ensure their protection, alerting with light signals (red and green) and sound when detecting a vehicle with a proximity of 5 cm, preventing such accidents.</p> <p>The favorable study will considerably reduce road accidents, not only in Peru, but also to take it to large international scales obtaining a positive scope in the future by the same fact that it means a breakthrough in the design of intelligent roads, thus strengthening road safety.</p>

C15	<div data-bbox="828 230 1029 445" data-label="Image"> </div> <p>Presenter: CAO Yu Affiliation: Zhejiang University, China</p> <p>Title of Speech: 5G-based Intelligent Distributed Feeder Automation Strategy for Distribution Network with DG</p> <p>Abstract: With the connection of Distributed Generations (DG) in distribution network, intelligent distributed feeder automation (IDFA) faces challenges of more sophisticated fault handling procedures and tighter deadlines. Unfortunately, the topology of distribution networks cannot be reliably identified using current techniques. In this work, this paper proposes an intelligent distributed feeder automation strategy for distribution network with DG based on 5G, with the capability of real-time topology automatic identification, and taking into account the technical benefits of low latency of 5G. The new essential topology information required for IDFA, named as fault-affected ports, is proposed for rapid power recovery. According to the above strategy, the PSCAD simulation model is built in this paper to verify the fault location and isolation strategy.</p>
C17	<div data-bbox="823 1043 1062 1294" data-label="Image"> </div> <p>Presenter: Pedro Daniel Laureano-Villanueva Affiliation: Universidad Continental, Perú</p> <p>Title of Speech: Automated system for the control and supply of rainwater in the district of Iquitos</p> <p>Abstract: In the province of Loreto only 56.3% have access to the public water network and only 8.2% of the population is stored 24 hours a day. Generating a problem for the inhabitants in the capital called Iquitos due to climate change and rapid population growth being a very important priority for life, however, rainwater in this area has an average rainfall of 7.07 mm / month, with a contact area of 28.15 km² producing 199038.87 m³ / month of rainwater, currently the storage of this rainwater is controlled and monitored manually. This research shows the automation of the rainwater filling control for the supply by means of a filter to prevent damage to the components, in addition to low- and high-level indicators in the tanks as a safety and control measure. The automatic transport is carried out by means of a D04CA-L-8.6T pump to raise the water pressure to the elevated tank from the cistern tank. The final process is obtained by means of an electronic valve to close and open the flow of water stored with a strong pressure due to the elevated tank by means of an HMI control for the operation of the motor, the valve and level indicators by means of the LadVIEW program, besides the structural design was made in sap 2000 considering the dynamic models for elevated tanks.</p>

Online Meeting | 15:30-17:30

< Oral Presentation II >

Session Chair:

C20	<div data-bbox="818 456 1023 705" data-label="Image"> </div> <p>Presenter: Alexis Salvador Zambrano Serrano Affiliation: Universidad de las Fuerzas Armadas ESPE, Ecuador</p> <p>Title of Speech: Development of a 3d virtual environment of the ammonium nitrate granulation process and automatic control using the hardware in the loop technique and integration of the industrial network as-interface</p> <p>Abstract: This article presents the control and virtualization of an ammonium nitrate granulation process using the Hardware In the Loop (HIL) technique and the implementation of an industrial AS-Interface (AS-i) network. A virtual process with similar characteristics is implemented using CAD tools and the Unity 3D graphics engine, with the aim of simulating the behavior of an industrial process; which by using Arduino cards allows the generation and reception of standard electrical signals, which enable direct connection to an AS-i network. The result is an interactive and immersive virtual environment between the user and the industrial process, as well as successfully achieving the connection of the simulated process with an AS-i network and with a Programmable Logic Controller (PLC), until it ends in a supervision system. The dynamic modelling of a complete ammonium nitrate granulation process is incorporated into the virtual environment, as well as the virtualization of sensors and actuators typical of an industrial process, so that the virtualization is faithful to a real process.</p>
C21	<div data-bbox="847 1503 1034 1747" data-label="Image"> </div> <p>Presenter: Milton Fabian Condor Taco Affiliation: Universidad de las Fuerzas Armadas ESPE, Ecuador</p> <p>Title of Speech: 3D virtual environment of the sugar refining process and automatic control using the hardware in the Loop technique</p> <p>Abstract: This paper has proposed the design of a 3D virtual environment of the sugar re-fining process for the implementation of the Hardware in the Loop (HIL) technique and the design of PID controllers by means of a commercial programmable logic controller (PLC), developing operation and control tests in the plant. The 3D modeling</p>

	<p>of the virtual environment is developed from the P&ID diagram of the process, which indicates the arrangement of equipment and instruments with-in the virtual environment, the mathematical models of the process were developed from base equations, theorems and experimentation to determine the dynamics of operation of the sugar refining process, while the animations and realism were designed in the Unity 3D graphics engine. The interchange of information between the virtualized plant and the PLC, using the Modbus TCP/IP protocol, determined a fast and reliable communication. Finally, different control tests were developed, allowing to demonstrate that the HiL technique presents a complete control over the virtual plant as if it resembled reality.</p>
C23	<div data-bbox="837 481 1013 716" data-label="Image"> </div> <p>Presenter: Jaime Toaquiza Affiliation: Universidad de las Fuerzas Armadas ESPE, Ecuador Title of Speech: HiL Virtual System for an Industrial Process, Control and Monitoring: Sulfuric Acid Production</p> <p>Abstract: Virtual environments allow the incorporation of new forms of study in process control. Thus, the Hardware in the Loop takes shape in training fields. In this article, a virtual environment of the sulfuric acid production process is developed. The three-dimensional model of the system is based on a natural system that is replicated in Blender software, and the virtual system is implemented in Unity 3D to simulate its behavior. This system is developed in the Hardware in The Loop approach, in which a process is simulated, and real devices perform the control. The interaction with the outside is a Human Machine Interface; this interface allows control and monitoring. In addition, the system provides support in the learning process of an operator in the process control area because interacting with a PLC in a physical way and applying tuning methods in real control loops without running risks brings the user closer to the work environment. The main result of this project is to obtain professional training tools in the field of process control.</p>
C24	<div data-bbox="834 1406 1026 1664" data-label="Image"> </div> <p>Presenter: Salma Elsaid Affiliation: University of Nottingham Malaysia, Malaysia</p> <p>Title of Speech: Detection of Oil Palm Fresh Fruit Bunches (FFBS) with Computer Vision Models</p> <p>Abstract: Fresh Fruit Bunches (FFBs) are an important agricultural asset for countries such as Malaysia as they are used to obtain oil palm which contributes to a large portion of the countries' GDP. However, the current FFBs harvesting process requires a significant amount of manual labor and may cause injuries or damage to the FFBs which must be avoided to ensure the oil produced does not get affected. Therefore, an automatic harvesting system needs to be developed to help avoid such issues. An important part of</p>

	<p>the harvesting system would be a vision system for the detection and localization of the fruits and involves the usage of computer vision models. In this paper, a comparison is performed between four different models: Support Vector Machine (SVM) which uses the Histogram of Gradients (HOG), Faster R-CNN, YOLOv4 and YOLOv5. The models were tested by the metrics of mean average precision (mAP), precision, recall and F1 score and their detection speed. The results showed that the SVM + HOG model had the worst performance with a mAP of 89% and the YOLOv4 model had the best performance with a mAP of 98.5%. However, the YOLOv5 model provided the best results in terms of speed with a detection speed of 11.4 ms and its mAP was 96.4% making it the best model for use in a harvesting system for the detection of FFBs as it provides both speed and accuracy.</p>
C012	<div data-bbox="826 577 1018 831" data-label="Image"> </div> <p>Presenter: Wendi Shen Affiliation: Shanghai Jiao Tong University, China</p> <p>Title of Speech: An error neighborhood-based detection mechanism to improve the performance of anomaly detection in industrial control systems</p> <p>Abstract: Anomaly detection for devices (e.g, sensors and actuators) plays a crucial role in Industrial Control Systems (ICS) for security protection. The typical framework of deep learning-based anomaly detection includes a model to predict or reconstruct the state of devices and a detection mechanism to determine anomalies. The majority of anomaly detection methods use a fixed threshold detection mechanism to detect anomalous points. However, the anomalies caused by cyberattacks in ICSs are usually continuous anomaly segments. In this paper, we propose a novel detection mechanism to detect continuous anomaly segments. Its core idea is to determine the start and end times of anomalies based on the continuity characteristics of anomalies and the dynamics of error. We conducted experiments on the two real-world datasets for performance evaluation using five baselines. The F1 score increased by 3.8% on average in the SWAT dataset and increased by 15.6% in the WADI dataset. The results show a significant improvement in the performance of baselines using an error neighborhood-based continuity detection mechanism in a real-time manner.</p>
C29	<div data-bbox="842 1563 1050 1809" data-label="Image"> </div> <p>Presenter: Nataly Cecilia Perez-Curi Affiliation: Universidad Continental, Perú</p> <p>Title of Speech: Vehicle counting system for pavement damage evaluation</p> <p>Abstract: The rapid growth of vehicular flow of light and heavy vehicles increased by 7.2% with respect to the year 2021, consequently the damage on the pavement increases if a proper vehicle count is not performed. This work develops the vehicle counting and</p>

	<p>classification of vehicles through a simulation which is controlled by a HMI and then evaluate the damage caused on the pavement by the type of vehicle axle through the ESAL. For the simulation of the automatic vehicle counting, we used the Factory IO and TIA Portal software where we have a vision sensor that sends to the interactive screen of the HMI, to then evaluate the damage caused on the pavements through the ESAL. Obtaining that in the simulations of 5 minutes, 6 minutes, 10 minutes for the vehicle count and its classification of round trip in the lanes of the road was obtained an efficiency of 100%, which allowed to determine that the buses are the vehicles that represent more damage in a round trip road.</p>
C30	<div data-bbox="858 533 1046 786" data-label="Image"> </div> <p>Presenter: Haru Helen Mallco Segura Affiliation: Universidad Continental, Perú</p> <p>Title of Speech: Automation system for the cleaning of yellow corn in the company "Inversiones Santana"</p> <p>Abstract: The rapid growth of vehicular flow of light and heavy vehicles increased by 7.2% with respect to the year 2021, consequently the damage on the pavement increases if a proper vehicle count is not performed. This work develops the vehicle counting and classification of vehicles through a simulation which is controlled by a HMI and then evaluate the damage caused on the pavement by the type of vehicle axle through the ESAL. For the simulation of the automatic vehicle counting, we used the Factory IO and TIA Portal software where we have a vision sensor that sends to the interactive screen of the HMI, to then evaluate the damage caused on the pavements through the ESAL. Obtaining that in the simulations of 5 minutes, 6 minutes, 10 minutes for the vehicle count and its classification of round trip in the lanes of the road was obtained an efficiency of 100%, which allowed to determine that the buses are the vehicles that represent more damage in a round trip road.</p>

MEMO

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