

# **2024 10th International Conference on Mechatronics and Robotics Engineering (ICMRE 2024)**

**Milan, Italy  
27-29 February 2024**



**IEEE Catalog Number: CFP24W13-POD  
ISBN: 979-8-3503-9428-3**

**Copyright © 2024 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP24W13-POD
ISBN (Print-On-Demand):	979-8-3503-9428-3
ISBN (Online):	979-8-3503-9427-6

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# **2024 10th International Conference on Mechatronics and Robotics Engineering**

## **ICMRE 2024**

### **Table of Contents**

Preface .....	viii
Committees .....	ix

---

#### **Sensor Based System State Monitoring and Reliability Analysis**

Low-Cost Multispectral Sensor for Detecting Adulteration of Onion Powder with Machine Learning .....	1
<i>Ravipat Lapcharoensuk, Thayanont Lunvongsa, Phanchay Suntisakoonwong, Agustami Sitorus, Wutthiphong Boodnon</i>	
Design and prototyping of a 4-axis CNC machine for the manufacturing of small accessories.....	5
<i>Carlos Andres Junior Sahuanay Taipe, Eber Huanca Cayo</i>	
Enhanced Time-Optimal Filter-Based Point-to-Point Trajectory Generation with Vibration Suppression.....	10
<i>Rajanya Yalamanchili, Stefan Schlee, Markus Märkl, Frank A. King</i>	
Water jet cut detection sensor system.....	18
<i>Mike Duddek, Benjamin Driën, Saulo H. Freitas Seabra da Rocha</i>	
Application of Artificial Intelligence Techniques to a Sensorial Module .....	22
<i>João C. Pimentel, Artur F. Gonçalves, Vítor H. Pinto, Gil Gonçalves</i>	

#### **Design and Development of Functional Robots**

Exploring a Novel Rehabilitation Soft Robot Design for Stroke Patients With Clenched Fists.....	28
<i>Matthew Baysa, Samuel Lund, Yen-Lin Han</i>	
Development and Implementation of a Robotic Bartender for Automatic Pisco Sour Preparation.....	33
<i>Jorge Ramirez, Christihian Laurel, Mayli Tafur, Michel Sigüenza</i>	
Exploiting the possibility of integrating External Sensors with the programmable interfaces of Franka Emika Panda robot .....	39
<i>Ehtisham ul Hasan, Seif-El-Islam Hasseni</i>	

Modulating the Dynamic Response of a Redundant Robot: a 3D Linear Displacement Study.....	45
<i>Luis Hernán Campos, Marcelo Fajardo-Pruna, Francisco Yumbla, Carlos Saldarriaga</i>	
Compliant Control using Force Sensor for Industrial Robot .....	51
<i>Mahfud Jiono, Hsien-I Lin</i>	
Robust and Scalable Swarming of Quadruped Robots for Chemical, Biological, Radiological, and Nuclear Source Localisation .....	56
<i>Rafiqul Islam, Sreenatha Anavatti, Kathryn Kasmarik, Matt Garratt</i>	
Design and Experimental Validation of Brain-Computer Shared Control of a Robotic Arm Based on Motion Intention Prediction.....	63
<i>Juan Liu, Xuanqi Yu, Ping Liang, Jialiang Zhang</i>	
Development of a Standing Support Arm with PPO Method for a Robotic Wheelchair.....	68
<i>Daifeng Wang, Wenjing Cao, Atsuo Takanishi</i>	
Accelerated Life Test of Intelligent Harmonic Reducer for Robot .....	74
<i>Shuo Zhang, Bin He, Fuze Xu, Rui Yu</i>	
<b>Kinematic Analysis and Path Control of Mobile Robots</b>	
Localization Based on Floor Line Map Using Monocular Camera for Factory Autonomous Mobile Robot.....	80
<i>Daiki HIRAYAMA, Shinji HAGIO, Kimiya MURASE, Katsuya SUGIURA, Kazuhiko KUNO, Masahiro NOBA, Akihisa OHYA, Takashi TSUBOUCHI, Ayanori YOROZU</i>	
Real-Time Semantic Segmentation for Autonomous Scale Cars using Mixed Real and Synthetic Data.....	86
<i>Steffen Ehrenfeuchter, Roberto Corlito, Reiner Marchthaler, Markus Enzweiler</i>	
Tilting Measurement and Compensation in Robotic Joints.....	92
<i>Christian Brunner, Rainer Hagl</i>	
Experimental Investigation of Relationship between Inner Ground Resistance Force and Vibration Kinds for Underground Moving Robots .....	99
<i>Tomohiro Watanabe, Kojiro Iizuka</i>	
Pre-planning of trajectory and orbiting around greenhouses to shorten operation time for fruit-set-reagent spraying robot.....	105
<i>Yusuke OIKAWA, Akihisa OHYA, Ayanori YOROZU</i>	
An Error Correction Method for MRI-HIFU Robot Based on Dynamic Optical Tracking System.....	110
<i>Depeng Liu, Ruirui Huang, Guofeng Shen</i>	
Non-Line-of-Sight Footstep Localization for Autonomous Mobile Robots.....	114
<i>Moeka Yoshinari, Masaki Takahashi, Yusuke Hioka</i>	

## **Performance Analysis and Functional Testing of Intelligent Mechanical Systems**

Development of a Cable-Driven Upper Limb Exosuit for Both Pulling and Lifting.....	120
<i>Songhao Guo, Tianjiao Zheng, Haotian Ju, Jie Zhao, Yanhe Zhu</i>	
Simulation of Coupled Analysis for Crane Ship and Suspended Load in Waves .....	125
<i>Shinji KAJIWARA, Yuki OMORI</i>	
Design and Testing of Bio-inspired Flexible Skin Variable Sweep and Flip Wing .....	130
<i>Yue Bai, Guang Yang, Hong Xiao, Hongwei Guo, Rongqiang Liu</i>	
Development of Motorized Wheelchair Bearing Safety Feature in Electronic Control Module .....	136
<i>Tushar Tiwari, Chiranjib Rudra, Abha Mathur, Pranab K. Dan</i>	
Design and Analysis of Cellular Multidimensional Morphing Linkage of Aircraft Fuselage.....	143
<i>Hualiang Liu, Hong Xiao, Guang Yang, Hongwei Guo, Rongqiang Liu, Zongquan Deng</i>	
A numerical algorithm for optimal selection of the driving mechanisms for ExoReha exoskeleton .....	149
<i>Piotr Falkowski</i>	
Passive Suspension Design and Dynamics Analysis of Manned Lunar Rover .....	155
<i>Junyang Zhang, Zhen Liu, Zhonghao Qin</i>	
Development of an Endoskeleton-type Lumbar Assistive Suit .....	161
<i>Keita Takayama, Takuya Hashimoto, Kenta Matsumoto, Hiroshi Kobayashi</i>	

## **Intelligent Autonomous Systems and Collaborative Control**

Development and Implementation of Drone Attachment Tank Sprayer (D.A.T.S) .....	166
<i>Anthony James Bautista, Cheska De Sagun, Patrick Allian Diaz, Vincent Especi, Gerard Emilson Tenedero, Asuka Watanabe</i>	
UAV Cargo Prototype Design - Educational Small Payloads Transport Use-Case .....	170
<i>João Rosendo, Vitor H. Pinto, Gil Gonçalves</i>	
Intelligent Control System for Ground Vehicles .....	177
<i>Yok Tungthamrongkul, Asanka Perera, Rafiqul Islam, Sreenatha Anavatti</i>	
Structural Design of a Semiautomatic Position Laser Therapy Equipment.....	183
<i>Maria Felix-Torre, Juan Martinez-Carrillo, Mittchel Gavancho-Alanya, Frank Zárate-Peña</i>	
Self-supervised Dock Pose Estimator for Unmanned Surface Vehicles Autonomous Docking .....	189
<i>Yijie Chu, Ziniu Wu, Xiaohui Zhu, Yong Yue, Eng Gee Lim, Paolo Paoletti</i>	
Comprehensive Testing Methodologies and Metrics for Reliable Autonomous Driving.....	195
<i>Astha Kukreja</i>	

# **Parameter Measurement, Fault Diagnosis, and Maintenance Strategies in Digital Mechanical Systems**

Influence of digital infrastructure, data integration & ethical dimension on artificial intelligence in product development ..... 201

*Anuj Bhowmick, A. Seetharaman*

Acoustic Energy Transfer through Skin Using Capacitive Micromachined Ultrasonic Transducers..... 209

*Paul Roche, Kevin Nadaud, Guylaine Poulin-Vittrant, Samuel Callé, Dominique Certon, Jean-Charles Le Bunetel*

Optimizing Electric Vehicle Efficiency with Real-Time Telemetry using Machine Learning ..... 213

*Aryaman Rao, Harshit Gupta, Parth Singh, Shivam Mittal, Utkarsh Singh, Dinesh Kumar Vishwakarma*

Roll Angle Error Measurement of Linear Guideways Using Mini Autocollimators..... 220

*Habtamu Dagne, Zhifeng Lou, Jiyun Zhang, Zhou Jingjie*

Investigating the Influence of Helix Micro Swimmer's Rotation Rate and Fluid Viscosity on Swimming Speed..... 228

*Zheng Peng*

Fault Diagnostics of 3-phase Induction Motor using CNN with Park's Vector Approach Input Data Configuration ... 234

*Yeong-Jin Goh*

## **Artificial Intelligence and Image Processing**

Harnessing the Power of Ray Tracing for Enhanced 3D Map-based Localization using NanoVDB..... 240

*Andrea Maybell Peña Echeverría, Paul Kemppi*

Fragile and Robust Dual Image Watermarking based on DWT-SVD ..... 247

*Ferda Ernawan, Lim Chen Gen, Suraya Abu Bakar, Liew Siau Chuin, Azamuddin Ab Rahman*

Synthetic data enables faster annotation and robust segmentation for multi-object grasping in clutter ..... 253

*Dongmyoung Lee, Wei Chen, Nicolas Rojas*

Image Processing Using Shepard Local Approximation Operators Defined in Riesz MV-Algebras..... 260

*Dan-Cătălin Noje, Ovidiu-Gheorghe Moldovan, Dan-Ioan Țarcă, Radu-Cătălin Țarcă*

Improvement of Lane-Level Lateral Position Estimation for Ego Vehicle From Front Camera Data ..... 265

*Syafril Bandara, Punit Galav, Takehiko Nagano, Yoshitaka Atarashi, Tetsuya Nishida, Trongmun Jiralerspong*

Tracking System for Heavy Transport with Sensors and IOT ..... 271

*Piyabut Watson, Eakkachai Pengwang*

Advancing Fall Detection in an Autonomous Bus - Examination of LSTM Technique ..... 277

*Amey Ajit Dakare, Yanbin Wu, Toru Kumagai, Takahiro Miura, Naohisa Hashimoto*

Combining Transfer Learning and Genetic Algorithms for Real-Time Gesture Recognition using EMG Signals..... 282

*Genci Capi, Kazuma Iizawa, Shin-ichiro Kaneko*

Do Applications of Artificial Intelligence (AI) Contribute to the Mitigation of Hazardous Environments? An Analysis Based on Various Pillars of AI .....	287
--	-----

*Hui Shan Lee, Kee Seng Kuang, Ping Xin Liew, Wai Mun Har*

## **Data Measurement and Security Management in Modern Information Systems**

A Two-Stage Clustering Method for Point Clouds Based on Cooperative Perception of Vehicle-to-Vehicle.....	293
---	-----

*Shuai Han, Huawei Liang, Zhiyuan Li*

Global Convergence Detection in Decentralized IoT Networks based on Epidemic Approach.....	299
--	-----

*Pasu Poonpakdee, Ananyalux Pongnukrohsiri, Chaiyaporn Santangjai*

Presence in Multi-Presence: Analysis of multitasking ability according to high or low presence based on working memory.....	304
---	-----

*Ayumu Tsuji, Yukiko Iwasaki, Kouta Suzuki, Nonoka Nishida, Hiroyasu Iwata*

Smart Suitcase for Visually Challenged Individuals in Airport Environments using UWB and LiDAR Fusion SLAM: Morocco Case Study.....	311
---	-----

*Zineb Marihi, Alae Saïh, Imane Fakir, Yassine Salih-Alj*

Towards Federated Learning by Kernels.....	317
--	-----

*Kilho Shin, Takenobu Seito, Chris Liu*

The Mountain Car Problem with a Dynamical and Finite Energy System.....	324
---	-----

*Eero Immonen, Hashem Haghbayan*

## **Author Index**