

# **2021 7th International Conference on Automation, Robotics and Applications (ICARA 2021)**

**Prague, Czech Republic  
4-6 February 2021**



**IEEE Catalog Number: CFP2198E-POD  
ISBN: 978-1-6654-4645-7**

**Copyright © 2021 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:	CFP2198E-POD
ISBN (Print-On-Demand):	978-1-6654-4645-7
ISBN (Online):	978-1-6654-0469-3

**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)

# **2021 International Conference on Automation, Robotics and Applications (ICARA 2021)**

## **Table of Contents**

Preface.....	vii
Conference Committee.....	viii

---

### **Mobile Robots and Motion Planning**

An RRT-Based Path Planning Strategy in a Dynamic Environment.....	1
<i>Yijing Li</i>	
Kinematic Redundancy Resolution for Baxter Robot .....	6
<i>Luong A. Nguyen, Khoa D. Le, Thomas L. Harman</i>	
The Design of a Scissor Stair Climbing Robot .....	10
<i>Dong Zhang, Junpeng Xuan, Yansen Yang, Zhongyi Guo</i>	
A Mean Shift-Based Pattern Formation Algorithm for Robot Swarms.....	16
<i>Chase Vickery, Sayed Ahmad Salehi</i>	
Deep Reinforcement Learning Based Online Area Covering Autonomous Robot .....	21
<i>Olimpiya Saha, Guohua Ren, Javad Heydari, Viswanath Ganapathy, Mohak Shah</i>	
Sensor-Based Obstacle Avoidance for Autonomous Mobile Robots: Experimental Study .....	26
<i>Ahmed A. A. Elhag, Mohammed I. A. M. Osman, Nihad A. A. Elhag, and Mahmoud A. Manzoul</i>	
Long-Term Exploration in Unknown Dynamic Environments .....	32
<i>Rodrigue Bonnevie, Daniel Duberg, Patric Jensfelt</i>	
Online Area Covering Robot in Unknown Dynamic Environments.....	38
<i>Olimpiya Saha, Guohua Ren, Javad Heydari, Viswanath Ganapathy, Mohak Shah</i>	

### **Intelligent Robot Design and Control**

A Deep Learning Short Commands Recognition for MCU in Robotics Applications .....	43
<i>Ivana Guarneri, Giuseppe Messina, Arcangelo Bruna, Davide Giacalone</i>	
Obtaining Robust Control and Navigation Policies for Multi-robot Navigation via Deep Reinforcement Learning .....	48
<i>Christian Jestel, Harmut Surmann, Jonas Stenzel, Oliver Urbann, Marius Brehler</i>	
Self-Repairing Line of Metamorphic Robots.....	55
<i>Nooshin Nokhanji, Nicola Santoro</i>	
Who Controls Your Robot? An Evaluation of ROS Security Mechanisms.....	60
<i>Niklas Goerke, David Timmermann, Ingmar Baumgart</i>	

Coinbot: Intelligent Robotic Coin Bag Manipulation Using Artificial Brain .....	67
Aleksei Gonnochenko, Aleksandr Semochkin, Dmitry Egorov, Dmitrii Statovoy, Seyedhassan Zabihifar, Aleksey Postnikov, Elena Seliverstova, Ali Zaidi, Jayson Stemmler, Kevin Limkailassiri	
BeeGround – An Open-Source Simulation Platform for Large-Scale Swarm Robotics Applications .....	75
Sean Lim, Shiyi Wang, Barry Lennox and Farshad Arvin	
Laser Beam Deflection of a 2D LiDAR for Canopy Detection on an Autonomous Spraying Robot .....	80
Christophe Cariou, Jean-Christophe Roux, Roland Lenain	
Towards Pick and Place Multi Robot Coordination Using Multi-agent Deep Reinforcement Learning .....	85
Xi Lan, Yuansong Qiao, Brian Lee	
Advanced Rubik's Cube Algorithmic Solver .....	90
Vasile Dan, Gabriel Harja, Ioan Nașcu	

## **Unmanned System and Control Engineering**

A Particle Swarm Optimization-Based Cooperation Method for Multiple-Target Search by Swarm UAVs in Unknown Environments.....	95
Aniket Gupta, Aman Virmani, Parth Mahajan, Raghava Nallanthigal	
A Symbolic-AI Approach for UAV Exploration Tasks .....	101
Yixin Zhang, Joe McCalmon, Ashley Peake, Sarra Alqahtani, Paul Pauca	
Small Commercial UAVs for Indoor Search and Rescue Missions .....	106
Hartmut Surmann, Tiffany Kaiser, Artur Leinweber, Gerhard Senkowski, Dominik Slomma, Marc Thurow	
A Novel Approach to Computationally Lighter GNSS-Denied UAV Navigation Using Monocular Camera.....	114
Joyraj Bhowmick, Anurag Singh, Harshit Gupta, Raghava Nallanthighal	
An Approach of Scenario-Based Threat Analysis and Risk Assessment Over-the-Air updates for an Autonomous Vehicle .....	122
Marzana Khatun, Michael Glaß, Rolf Jung	
Nonlinear Model Predictive Control for Trajectory Tracking of a Hexarotor with Actively Tilttable Propellers.....	128
David Shawky, Chao Yao, Klaus Janschek	
Autonomous Surface Inspection of Airplanes with Unmanned Aerial Systems.....	135
Mark Tappe, Daniel Dose, Mirco Alpen, Joachim Horn	
Iterative Learning for Model Reactive Control: Application to Autonomous Multi-agent Control.....	140
Omar Shrit, David Filliat, Michèle Sebag	
Hardware in the Loop Simulation of Aircraft Inspection by an Unmanned Aerial System.....	147
Daniel Dose, Mark Tappe, Mirco Alpen, Joachim Horn	

## **Mechanical Design and Control System**

Modeling and Simulation of a Point to Point Spherical Articulated Manipulator Using Optimal Control .....	152
Prathamesh Saraf, Ponnalagu R. N.	

Robust State Feedback H-Infinity Controller Design for Bilateral Teleoperation System Having Saturated Actuators.....	157
<i>Bilal Gormus, Hakan Yazici</i>	
Towards a Highly Integrated 3D Printed Soft Continuum Manipulator .....	163
<i>João M. Salgueiro, João C.P. Reis</i>	
Adaptive Control of Ball and Beam System Using Knowledge-Based Particle Swarm Optimization .....	168
<i>Yunyi Jiang, Jingyu Li, Yuxuan Lv, Runsen Wang</i>	
Stability Analysis for T-S Fuzzy Semi-Markovian Switching CVNs with Mixed Delays and General Uncertain Transition Rates .....	173
<i>Qiang Li, Jinling Liang</i>	
DAIMM Simulation Platform for Dual-Arm Impedance Controlled Mobile Manipulation .....	180
<i>Tomasz Winiarski, Jakub Sikora, Dawid Seredyński, Wojciech Dudek</i>	
Towards Situation-Aware Decision-Making for Automated Driving .....	185
<i>Maximilian Gerwien, Alexander Jungmann, Rick Voßwinkel</i>	

## **Computer and Information Technology**

Accurate Gridless Indoor Localization Based on Multiple Bluetooth Beacons and Machine Learning .....	190
<i>Konstantinos Kotrotsios, Theofanis Orphanoudakis</i>	
Low Cost Point to Point Navigation System .....	195
<i>Giuseppe Spampinato, Arcangelo Bruna, Davide Giacalone, Giuseppe Messina</i>	
Dynamic Cognitive-Social Particle Swarm Optimization .....	200
<i>Khelil Kassoul, Samir Brahim Belhaouari, Naoufel Cheikhrouhou</i>	
Deep Learning Localization with 2D Range Scanner .....	206
<i>Giuseppe Spampinato, Arcangelo Bruna, Ivana Guarneri, Davide Giacalone</i>	
Robust Approaches for Localization on Multi-camera Systems in Dynamic Environments .....	211
<i>Marco Sewitz, Xiaozhou Luo, Johannes Landgraf, Tim Bodenmüller, Rudolph Triebel</i>	
A Novel Haptic Based Guidance Scheme for Swarm of Magnetic Nanoparticles Steering .....	216
<i>Chayabhan Limpabandhu, Ali Kafash Hoshiar</i>	
Twin Delayed Hierarchical Actor-Critic .....	221
<i>Mihai Anca, Matthew Studley</i>	
Self-Organised Swarm Flocking with Deep Reinforcement Learning .....	226
<i>Mehmet B. Bezcioglu, Barry Lennox, and Farshad Arvin</i>	
Aspects of Analysis of Engineering Data of a Capital Construction Facility Based on an Engineering Digital Terrain Model .....	231
<i>Pavel Chelyshkov, Denis Lysenko</i>	

## **Image Processing and Application**

Image-Based Visual Servoing of Rotationally Invariant Objects Using a U-Net Prediction .....	235
<i>Norbert Mitschke, Michael Heizmann</i>	

YOLOv3-Based Human Activity Recognition as Viewed from a Moving High-Altitude Aerial Camera .....	241
<i>Wazha Mmereki, Rodrigo S. Jamisola, Jr., Dimane Mpoeleng, Tinao Petso</i>	
Towards Next Best View Planning for Time-Variant Scenes .....	247
<i>Embla Morast, Patric Jensfelt</i>	
An Improved Indoor Map Construction Method Based on Millimeter-Wave Radar.....	253
<i>Fei Li, Xinfu Wang, Shuo Li, Xin Gu, Kai Gao, Aina Qin, Zhiwu Huang</i>	
DOC-SLAM: Robust Stereo SLAM with Dynamic Object Culling.....	258
<i>Lin Lyu, Yan Ding, Yating Yuan, Yutong Zhang, Jinpeng Liu, Jiaxin Li</i>	
Improving Deep Multi-modal 3D Object Detection for Autonomous Driving.....	263
<i>Razieh Khamsehashari, Kerstin Schill</i>	
ECascade-RCNN: Enhanced Cascade RCNN for Multi-scale Object Detection in UAV Images .....	268
<i>Qizhang Lin, Yan Ding, Hong Xu, Wenxiang Lin, Jiaxin Li, Xiaoxiao Xie</i>	