

# **2011 IEEE International Symposium on Safety, Security, and Rescue Robotics**

## **(SSRR 2011)**

**Kyoto, Japan  
1 – 5 November 2011**



**IEEE Catalog Number: CFP11SSR-PRT  
ISBN: 978-1-61284-770-2**

## TABLE OF CONTENTS

<b>V-Shift Control for Snake Robot Moving the Inside of a Pipe with Helical Rolling Motion.....</b>	1
<i>Tetsushi Kamegawa, Toshimichi Baba, Akio Gofuku</i>	
<b>Semicircular Duplex Manipulator to Search Narrow Spaces for Victims .....</b>	7
<i>Yuya Simodate, Kazuyuki Ito</i>	
<b>Redesign of Rescue Mobile Robot Quince–Toward Emergency Response to the Nuclear Accident at Fukushima Daiichi Nuclear Power Station on March 2011– .....</b>	13
<i>Keiji Nagatani, Seiga Kiribayashi, Yoshito Okada, Satoshi Tadokoro, Takeshi Nishimura, Tomoaki Yoshida, Eiji Koyanagi, Yasushi Hada</i>	
<b>Use of Remotely Operated Marine Vehicles at Minamisanriku and Rikuzentakata Japan for Disaster Recovery .....</b>	19
<i>Robin R. Murphy, Karen L. Dreger, Sean Newsome, Jesse Rodocker, Eric Steimle, Tetsuya Kimura, Kenichi Makabe, Fumitoshi Matsuno, Satoshi Tadokoro, Kazuyuki Kon</i>	
<b>Lessons Learned from German Research for USAR.....</b>	26
<i>Quirin Hamp, Leonhard Reindl, Alexander Kleiner</i>	
<b>Navigation Interface for Multiple Autonomous Mobile Robots with Grouping Function .....</b>	32
<i>Noritaka Sato, Kazuyuki Kon, Fumitoshi Matsuno</i>	
<b>Robotic Control Vehicle for Measuring Radiation in Fukushima Daiichi Nuclear Power Plant.....</b>	38
<i>Kazunori Ohno, Shinji Kawatsuma, Takashi Okada, Eijiro Takeuchi, Kazuyuki Higashi, Satoshi Tadokoro</i>	
<b>Evacuation Simulation with Communication for Anti-disaster Planning.....</b>	44
<i>Masaru Okaya, Tomoichi Takahashi</i>	
<b>On the Performance and Scalability of Multi-Robot Patrolling Algorithms.....</b>	50
<i>David Portugal, Rui P. Rocha</i>	
<b>Gamma-Ray Irradiation Test of Electric Components of Rescue Mobile Robot Quince–Toward Emergency Response To Nuclear Accident At Fukushima Daiichi Nuclear Power Station On March 2011–.....</b>	56
<i>Keiji Nagatani, Seiga Kiribayashi, Yoshito Okada, Kazuki Otake, Kazuya Yoshida, Satoshi Tadokoro, Takeshi Nishimura, Tomoaki Yoshida, Eiji Koyanagi, Mineo Fukushima, Shinji Kawatsuma</i>	
<b>Using iFMI Spectral Registration for Video Stabilization and Motion Detection by an Unmanned Aerial Vehicle (UAV).....</b>	61
<i>Sören Schwerfeger, Andreas Birk, Heiko Bülow</i>	
<b>Structured Computational Polymers for Safety, Security, and Rescue Robotics.....</b>	68
<i>Robert A. Nawrocki, Richard M. Voyles, Sean E. Shaheen</i>	
<b>The 100:100 Challenge for Computing in Rescue Robotics .....</b>	72
<i>Robin R. Murphy</i>	
<b>The Next 700 Control Architectures for Rescue Robotics.....</b>	76
<i>Noury Bouraqadi, Serge Stinckwich</i>	
<b>Kinematic Analysis of Periodic Continuous Gaits for a Bio-Mimetic Walking Robot .....</b>	80
<i>Umar Asif, Javaid Iqbal, M. Ajmal Khan</i>	
<b>Prototype “RT04” That Uses Flexible Mono-Tread Mobile Track .....</b>	86
<i>Tetsuya Kinugasa, Takafumi Haji, Koji Yoshida, Hisanori Amano, Ryota Hayashi, Masatsugu Iribe, Kenichi Tokuda, Koichi Osuka</i>	
<b>Autonomous Stair Climbing for Mobile Tracked Robot.....</b>	92
<i>Qun Zhang, Shuzhi Sam Ge, Pey Yuen Tao</i>	
<b>The Concept of a Jumping Rescue Robot with Variable Transmission Mechanism.....</b>	99
<i>Dunwen Wei, Wenjie Ge, Yiyang Liu</i>	
<b>A Navigation Method of Service Robots at Shelters .....</b>	105
<i>Tomoichi Takahashi, Masaru Shimizu, Masaru Okaya</i>	
<b>Geometric-Featured Voxel Maps for 3D Mapping in Urban Environments .....</b>	110
<i>Yungeun Choe, Inwook Shim, Myung Jin Chung</i>	
<b>Heat Mapping for Improved Victim Detection .....</b>	116
<i>Ruwen Hahn, Dagmar Lang, Marcel Häselich, Dietrich Paulus</i>	
<b>Integration of Sensory Data Taken by Multiple Rescue Robots Using GIS.....</b>	122
<i>Hidehisa Akiyama, Hiroki Shimura, Eijiro Takeuchi, Itsuki Noda</i>	
<b>Prediction of Obstacle Climbing Capability for Tracked Vehicles.....</b>	128
<i>Amir H. Rajabi, Amir H. Soltanzadeh, Arash Alizadeh, Golnaz Eftekhari</i>	
<b>Autonomous Legged Hill and Stairwell Ascent.....</b>	134
<i>Aaron M. Johnson, Matthew T. Hale, G. C. Haynes, D. E. Koditschek</i>	

<b>Towards Omnidirectional Locomotion Strategy for Hexapod Walking Robot.....</b>	143
<i>Filipp Seljanko</i>	
<b>Features of UMRS2009 Special Components .....</b>	149
<i>Shigeru Kobayashi, Yoshikazu Ohtsubo, Hidetake Iwasaki, Yasuhiro Kobayashi, Toshi Takamori</i>	
<b>A Flexible and Scalable SLAM System with Full 3D Motion Estimation .....</b>	155
<i>Stefan Kohlbrecher, Oskar Von Stryk, Johannes Meyer, Uwe Klingauf</i>	
<b>Low-Cost 3D Scene Reconstruction for Response Robots in Real-time .....</b>	161
<i>Jimmy Tran, Alex Ufkes, Mark Fiala, Alexander Ferworn</i>	
<b>Initial Experiments on 3D Modeling of Complex Disaster Environments Using Unmanned Aerial Vehicles.....</b>	167
<i>Alexander Ferworn, Jimmy Tran, Alex Ufkes, Andrew D'Souza</i>	
<b>An Information-Driven Navigation Strategy for Autonomous Navigation in Unknown Environments .....</b>	172
<i>Redouane Boumghar, Simon Lacroix, Olivier Lefebvre</i>	
<b>Stereoscopic Presentation of 3D Scan Data Obtained by Mobile Robot .....</b>	178
<i>Tomofumi Fujiwara, Tetsushi Kamegawa, Akio Gofuku</i>	
<b>Simulating Range Cameras for Complex Terrain Robot Mobility.....</b>	184
<i>Raymond Sheh, Claude Sammut</i>	
<b>Teleoperation System Using Past Image Records for Legged Robot.....</b>	190
<i>Hisashi Mizumoto, Hannes Daupp, Wayne J. Book, Funitoshi Matsuno</i>	
<b>Using a Fiducial Map Metric for Assessing Map Quality in the Context of RoboCup Rescue .....</b>	208
<i>Sören Schwerdfeger, Adam Jacoff, Johannes Pellenz, Andreas Birk</i>	
<b>Range Sensors Evaluation Under Smoky Conditions For Robotics Applications .....</b>	215
<i>Vyacheslav Tretyakov, Thorsten Linder</i>	
<b>An Evaluation Test Field Design for a USAR Robot Related to a Collapsed Japanese House.....</b>	221
<i>Kentaro Shimaoka, Katsuji Ogane, Tetsuya Kimura</i>	
<b>Design, Modeling and Open-loop Control of a BCF Mode Bio-mimetic Robotic Fish.....</b>	226
<i>Abhra Roy Chowdhury, Bhuneswar Prasad, Vinoth Kumar, Rajesh Kumar, S. K. Panda</i>	
<b>Measurement Model of Barometer in Ground Effect of Unmanned Helicopter and Its Application to Estimate Terrain Clearance.....</b>	232
<i>Hiroaki Nakanishi, Sayaka Kanata, Tetsuo Sawaragi</i>	
<b>A Compound Robotic Hand with Two Under-actuated Fingers and a Continuous Finger .....</b>	238
<i>Pouya Sabetian, Amir Feizollahi, Farzad Cheraghpour, S. Ali A. Moosavian</i>	
<b>Development of Rescue Support Stretcher System with Stair-climbing .....</b>	245
<i>Yuki Iwano, Koichi Osuka, Hisanori Amano</i>	
<b>Introduction to Spatially Distributed Intelligent Assistant Agents for Coordination of Human-Agent Teams' Actions.....</b>	251
<i>Reza Nourjou, Michinori Hatayama, Hirokazu Tatano</i>	
<b>System Control Architecture for a Remotely Operated Platform for S&amp;R, IED-EOD and NBC Applications.....</b>	259
<i>Torquato Cecchini, Paolo Villella, Fabrizio Rocchi</i>	
<b>Emergence of Cooperation as the Impact of Evacuee's Solidarity .....</b>	265
<i>Hatma Suryotrisongko, Yoshiteru Ishida</i>	
<b>Behavior Navigation System for Use in Harsh Environments .....</b>	272
<i>Eimei Oyama, Naoji Shiroma</i>	
<b>A Fast, Robust and Low Bit-Rate Representation for SIFT and SURF Features .....</b>	278
<i>M. Stommel, M. Langer, O. Herzog, K.-D. Kuhnert</i>	
<b>Ensuring Ad Hoc Connectivity in Distributed Search with Robotic Darwinian Particle Swarms.....</b>	284
<i>Micael S. Couceiro, Rui P. Rocha, Nuno M. F. Ferreira</i>	
<b>Decentralized Risk Sharing in Teams of Unmanned Vehicles .....</b>	290
<i>Aditya Undurti, Jonathan P. How</i>	
<b>Multi-Robot Search and Rescue Team .....</b>	296
<i>Cai Luo, Andre Possani Espinosa, Danu Pranantha, Alessandro De Gloria</i>	
<b>Robust Discovering and Tracking in Challenging Environments .....</b>	302
<i>Bonnie Zhu, Shankar Sastry</i>	
<b>User-Friendly Security Robots .....</b>	308
<i>Gabriele Randelli, Luca Iocchi, Daniele Nardi</i>	
<b>A Survey of Animal Foraging for Directed, Persistent Search by Rescue Robotics.....</b>	314
<i>Jesus Suarez, Robin Murphy</i>	
<b>Using the PROMETHEE Multi-Criteria Decision Making Method to Define New Exploration Strategies for Rescue Robots .....</b>	321
<i>Patrick Taillandier, Serge Stinckwich</i>	

<b>A Novel Multi-Robot Exploration Approach based on Particle Swarm Optimization Algorithms</b>	327
<i>Micael S. Couceiro, Rui P. Rocha, Nuno M. F. Ferreira</i>	
<b>Loop Closure Detection Using Small-Sized Signatures From 3D LIDAR Data</b>	333
<i>Naveed Muhammad, Simon Lacroix</i>	
<b>Distributed Communicative Exploration under Underwater Communication Constraints</b>	339
<i>R. Rathnam, Andreas Birk</i>	
<b>Fast 6-DOF Path Planning for Autonomous Underwater Vehicles (AUV) based on 3D Plane Mapping</b>	345
<i>Jann Poppinga, Andreas Birk, Kaustubh Pathak, Narunas Vaskevicius</i>	
<b>A Frontier-Void-Based Approach for Autonomous Exploration in 3D</b>	351
<i>Christian Dornhege, Alexander Kleiner</i>	
<b>Author Index</b>	