



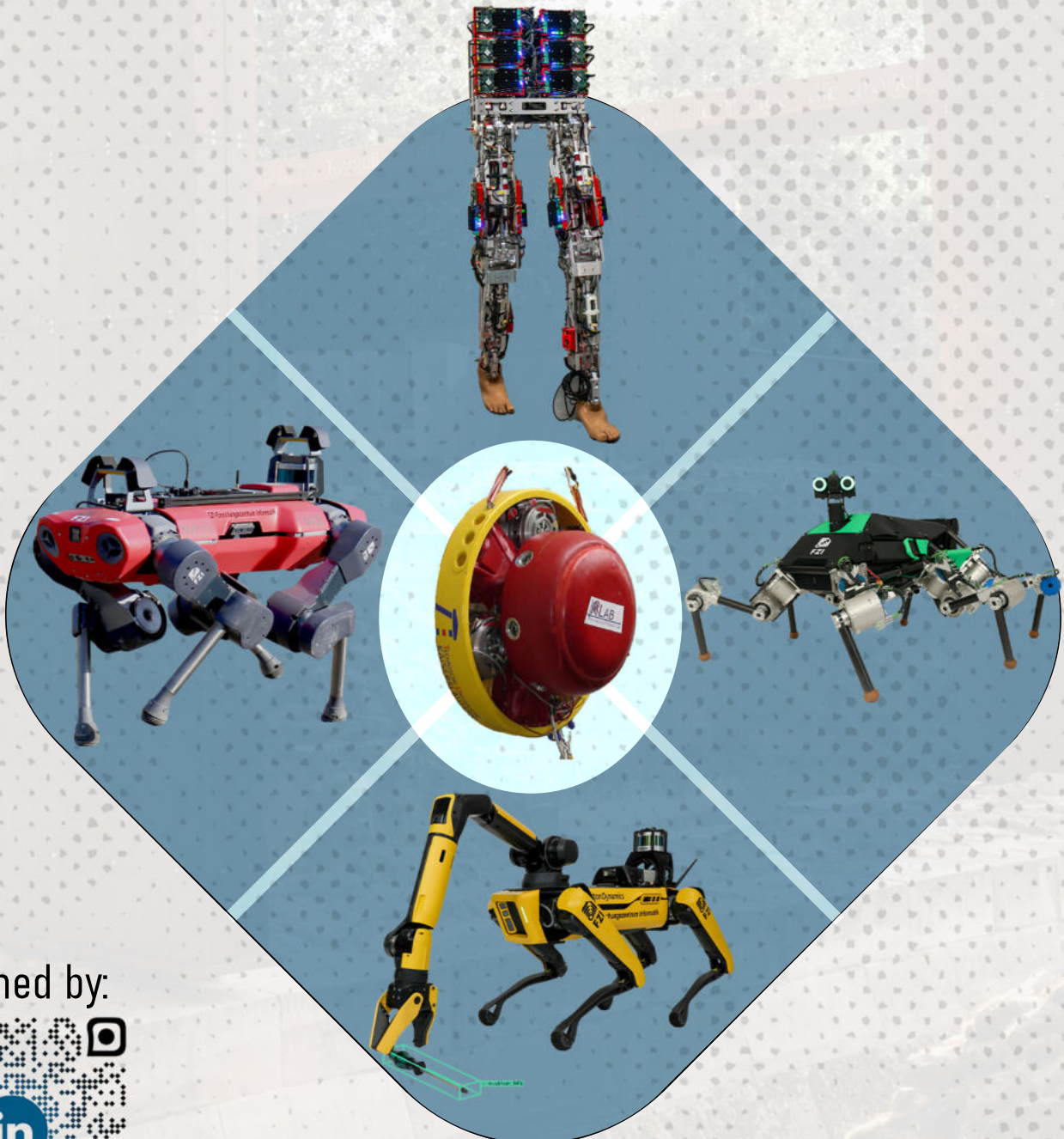
CLAWAR

04 SEPT — 06 SEPT 2024 KAISERSLAUTERN, GERMANY

WELCOME TO CLAWAR 2024

WALKING ROBOTS

INTO REAL WORLD



Designed by:



Program at a Glance

Wednesday, 4 th of September		Thursday, 5 th of September		Friday, 6 th of September	
8:00 - 9:00 Registration					
9:00 - 9:30 Opening Ceremony (Room LAURON)		9:00 - 9:30 Keynote - Creating a Workforce of Autonomous Robots Benjamin Mottis (Room LAURON)		9:00 - 9:30 Keynote - <i>Bipedal Locomotion in Humanoid Robots and Exoskeletons - from Benchmarking Frameworks to Efficient Controllers</i> Katja Mombaur (Room LAURON)	
9:30 - 10:50 Technical Session 1 Planning and Control (Room LAURON)	9:30 - 10:50 Technical Session 2 AI-based Systems and Solutions (Room BISAM)	9:30 - 10:50 Technical Session 7 Human-like Robots (Room LAURON)	9:30 - 10:50 Technical Session 8 Planetary Exploration (Room BISAM)	9:30 - 10:50 Technical Session 11 Innovative Grippers (Room LAURON)	9:30 - 10:50 Technical Session 12 Prosthetics and Rehabilitation (Room BISAM)
10:50 - 11:50 Exhibition & Coffee Break		10:50 - 11:50 Poster Session & Coffee Break (Room AIRBUG)		10:50 - 11:50 Exhibition & Coffee Break	
11:50 - 12:50 Technical Session 3 Innovative Robot Design I (Room LAURON)	11:50 - 12:50 Technical Session 4 Biologically-inspired Systems and Solutions I (Room BISAM)	11:50 - 12:50 Technical Session 9 Application II (Room LAURON)	11:50 - 12:50 Technical Session 10 Biologically-inspired Systems and Solutions II (Room BISAM)	11:50 - 12:50 Plenary Talk - <i>Two, Four, or Six ? Legged Robots for Exploration and Inspection in the Real World</i> Navinda Kottege (Room LAURON)	
12:50 - 13:50 Lunch Break		12:50 - 13:30 Lunch Break		12:50 - 13:30 Lunch Break	
13:50 - 14:50 Plenary Talk - <i>27 Years of Climbing and Walking Robots – Are we there ?</i> Marco Hutter (Room LAURON)		13:30 - 14:30 Plenary Talk - <i>Torque Controlled or Intrinsically Compliant ?</i> Alin Albu-Schäffer (Room LAURON)		13:30 - 14:30 Technical Session 13 Application III (Room LAURON)	13:30 - 14:30 Technical Session 14 Innovative Robot Design II (Room BISAM)
14:50 - 15:20 Poster Session (Room LAURON)		14:45 - 19:30 Visit of World Heritage Site Völklinger Hütte		14:30 - 14:45 Closing Ceremony (Room LAURON)	
15:20 - 16:40 Technical Session 5 Quadruped Robots (Room LAURON)	15:40 - 16:40 Technical Session 6 Application I (Room BISAM)			17:00 - 24:00 Wine Festival Tour – Wurstmarkt	
17:00 - 18:00 Demonstration at RRLab		20:00 - 23:00 Gala Dinner & Award Ceremony			
18:00 - 19:00 Welcome Cocktail at RRLab					

Conference Location
Fraunhofer Institute



Technical Program

Wednesday, 4th September

	Technical Session 1 Planning and Control	Room LAURON	Wednesday, 4th Sept. 9:30 - 10:50
Chair: Osman Tokhi			
9:30 – 9:50	<i>Intelligent PID Controller for Vibration Suppression of Horizontal Flexible Plate Based on Social Spider Optimization</i> Muhamad Sukri Hadi, Latifah Kamilah Jamal Abdul Hekim, Annisa Jamali, Intan Zaurah Mat Darus and Mohammad Osman Tokhi		
9:50 – 10:10	<i>LAURON VP, a Six-Legged Walking Robot, with a new ROS 2-based Behavior Control</i> Carsten Plasberg, Hendrik Nessau, Kantesh Sinha, Imama Hafeez, David Kubeneck, Georg Heppner and Rüdiger Dillmann		
10:10 – 10:30	<i>Development of Gait Rehabilitation Robot to Promote Voluntary Movements for Normal Walking</i> Daisuke Chugo, Yuya Miyazaki, Honoka Kubo, Satoshi Muramatsu, Sho Yokota, Jin-Hua She, Keio Ishiguro and Hiroshi Hashimoto		
10:30 – 10:50	<i>Humanoids Operating Mobility Devices Designed for Humans: Experiments on a Segway</i> Vidyasagar Rajendran and Katja Mombaur		

	Technical Session 2 AI-based Systems and Solutions	Room BISAM	Wednesday, 4th Sept. 9:30 - 10:50
Chair: Genessis Perez Rivera			
9:30 – 9:50	<i>Efficient Stream-Based Active Learning Initialization for Legged Robots based on a PCA/K-Means Image Selection Approach</i> Niklas Spielbauer, Andrey Tkachenko, David Oberacker, Arne Roennau and Ruediger Dillmann		

9:50 – 10:10	<i>Precision Vehicle Pose Estimation with Uncertainty-aware Neural Network</i> Tomasz Nowak and Piotr Skrzypczynski
10:10 – 10:30	<i>Earth-shaping with Heterogeneous Robotic Teams: from Sim to Real</i> Federico Oliva, Tom Shaked, Karen-Lee Bar-Sinai, Omer Shalev, Oren Elmakis, Ari Meles-Braverman and Amir Degani
10:30 – 10:50	<i>Neural-based Self-Collision Checking for a Quadruped Robot</i> Bartłomiej Kulecki and Dominik Belter

	Technical Session 3 Innovative Robot Design I	Room LAURON	Wednesday, 4th Sept. 11:50 - 12:50
Chair: Krzysztof Mianowski			
11:50 – 12:10	<i>Magnecko: Design and Control of a Quadrupedal Magnetic Climbing Robot</i> Stefan Leuthard, Timo Eugster, Nicolas Faesch, Riccardo Feingold, Connor Flynn, Michael Fritsche, Nicolas Hürlimann, Elena Morbach, Fabian Tischhauser, Matthias Müller, Markus Montenegro, Valerio Schelbert, Jia-Ruei Chiu, Philip Arm and Marco Hutter		
12:10 – 12:30	<i>Development of a Flapping Micro Flying Robot Using Micro Ultrasonic Motors</i> Ryo Watanabe, Naoki Yoshiwaki and Tomoaki Mashimo		
12:30 – 12:50	<i>An Approach to Soft Jumping Robots</i> Eduardo Navas, Kai Blanco, Daniel Rodríguez-Nieto and Roemi Fernández		

	Technical Session 4 Biologically-inspired Systems and Solutions I	Room BISAM	Wednesday, 4th Sept. 11:50 - 12:50
Chair: Tristan Schnell			
11:50 – 12:10	<i>POMA: Propagation-based Obstacle Negotiation Control for Multi-Segmented Robot Adaptation</i>		

	Worameth Nantareekum, Binggwong Leung, Arthicha Srisuchinnawong, Jettanan Homchanthanakul, Suppachai Pewkliang and Poramate Manoonpong
12:10 – 12:30	<i>Self-organized Locomotion with Multiple Stepping Frequencies in an Insect-like Robot under Decentralized Adaptive Neural Control</i> Thirawat Chuthong and Poramate Manoonpong
12:30 – 12:50	<i>Using a Human-like Double Support Force Distribution for Locomotion in Humanoid Robots</i> Francisco Javier Andrade Chavez, Vidayasagar Rajendran, and Katja Mombaur

	Plenary Talk	Room LAURON	Wednesday, 4th Sept. 13:50 - 14:50
Chair: Arne Roennau			
13:50 – 14:50	<i>27 Years of Climbing and Walking Robots – Are we There?</i> Marco Hutter		

	Technical Session 5 Quadruped Robots	Room LAURON	Wednesday, 4th Sept. 15:20 - 16:40
Chair: Manuel Silva			
15:20 – 15:40	<i>High-Speed Quadruped Walking in Constant-Posture/Velocity by Counterweight Legs</i> Yuta Miura and Ikuo Mizuuchi		
15:40 – 16:00	<i>SLOT: A Soft-Legged Omnidirectional Tetrapod</i> Saumya Karan, Harikrishnan R, Yukta Dodia, Tanish Phopalkar, Suraj Borate and Madhu Vadali		
16:00 – 16:20	<i>Comparative Analyses of ROS Local Planners for Quadrupedal Locomotion: A Study in Real and Simulated Environments</i> Gabriel Bermudez, Gabriel Duarte Gonçalves Pedro, Vivian Suzano Medeiros and Thiago Boaventura		

16:20 – 16:40	<p><i>A Hybrid Force/Impedance Motion Controller for Robust Quadruped Locomotion on Sandy, Slippery, and Collapsing Terrains</i></p> <p>Alex Tanapon Leonardi, Vivian Suzano Medeiros, Claudio Semini and Victor Barasuol</p>
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	Technical Session 6 Application I	Room BISAM	Wednesday, 4th Sept. 15:40 - 16:40
Chair: Giovanni Muscato			
15:40 – 16:00	<p><i>Omnidirectional climbing robot for maintenance services on hard to reach places of ship hulls</i></p> <p>Felipe Faria, Marco Machado, Cesar Meira, Valéria Luz, Verônica Pazda, Douglas Negri, Diego Souza, Ismael Secco and Luís Gonzaga Trabasso</p>		
16:00 – 16:20	<p><i>Demonstration of a Micro Wall-Climbing Robot Moving on Metal Surfaces</i></p> <p>Takuro Akadochi, Mohamed M Khalil and Tomoaki Mashimo</p>		
16:20 – 16:40	<p><i>Linkage Length Optimization of a Climbing Inspection Robot Using an Area Overlap Method</i></p> <p>Shijia Wu, Linyan Han, George Jackson-Mills, Andrew Barber and Robert Richardson</p>		

	Poster Session	Room LAURON	Wednesday, 4th Sept. 14:50 – 15:20
Chair: Patrick Vonwirth			
14:50 – 15:20	<i>2 min Introduction for each Poster</i>		

Thursday, 5th September

	Keynote	Room LAURON	Thursday, 5 th Sept. 9:00 – 9:30
Chair: Arne Roennau			
9:00 – 9:30	<i>Creating a Workforce of Autonomous Robots</i> Benjamin Mottis		

	Technical Session 7 Human-like Robots	Room LAURON	Thursday, 5 th Sept. 9:30 - 10:50
Chair: Carsten Plasberg			
9:30 – 9:50	<i>Intuitive Motion: Acceleration-based Inverse Kinematics on Arbitrary Coordinates</i> Patrick Vonwirth, Axel Vierling, Oleksandr Sivak and Karsten Berns		
9:50 – 10:10	<i>Lightweight Bi-articular Human-Like Robotic Leg with Four-Bar Joints.</i> Oleksandr Sivak, Krzysztof Mianowski, Patrick Vonwirth and Karsten Berns		
10:10 – 10:30	<i>Proposal for a Series-driven Catapult Using Soft Actuators to Increase the Jumping Height of Hyper Jumping Humanoid Robot</i> Takeshi Itsuno, Yusuke Ishii, Masahiro Doi, Hiroyuki Kondo, Fumio Ito and Taro Nakamura		
10:30 – 10:50	<i>Learning Velocity-based Humanoid Locomotion: Massively Parallel Learning with Brax and MJX</i> William Thibault, William Melek and Katja Mombaur		

	Technical Session 8 Planetary Exploration	Room BISAM	Thursday, 5 th Sept. 9:30 - 10:50
Chair: Marvin Grosse Besselmann			
9:30 – 9:50	<i>Verification of decreasing bearing capacity while imparting vibration to ground in DEM simulation for underground moving robots</i> Watanabe Tomohiro, Kojiro Iizuka and Dai Watanabe		

9:50 – 10:10	<i>Soft Gripping System for Space Exploration Legged Robots</i> Arthur Candalot, Malik-Manel Hashim, Brigid Hickey, Mickael Laine, Mitch Hunter-Scullion and Kazuya Yoshida
10:10 – 10:30	<i>Admittance Control-based Floating Base Reaction Mitigation for Limbed Climbing Robots</i> Masazumi Imai, Kentaro Uno and Kazuya Yoshida
10:30 – 10:50	<i>Advantages of Active and Passive Suspension Systems in Obstacle Negotiation for Planetary Rovers</i> Malte Wirkus, Jonathan Babel and Christian Backe

	Poster Session	Room AirBug	Thursday, 5th Sept. 10:50 - 11:50
Chair: Karsten Berns			
	<i>Sparsity in Social Robotics Experiments</i> João Sequeira		
	<i>Intelligent Rising Sprawl Tuned Autonomous Robot</i> Tomer Siboni		
	<i>Amphibious Wave Robot for Monitoring Fish Farming</i> Nisim Kachlon and David Zarrouk		
	<i>Autonomous landing pad with a closed cover for a medium-sized drone to support typical research and reconnaissance tasks in the local environment</i> Krzysztof Mianowski, Robert Głębocki, Antoni Kopyt, Tomasz Barczak, Mateusz Strachowski, Dawid Florczak and Tomasz Krakowiak		
	<i>Towards 3D Path Planning for Free Climbing Robots</i> Friedrich Graaf, Tristan Schnell, Georg Heppner and Ruediger Dillmann		
	<i>Foundations of Probabilistic Behavior Networks - Structured, Distributed Control of Complex Systems like Legged Robots</i> Patrick Vonwirth		

	<i>The GreenAuto mobile robots fleet management and scheduling system</i> Manuel F. Silva
	<i>High-level teleoperation system for autonomous forklifts using VR over the 5G public network</i> Manuel F. Silva
	<i>LAURON VI: A Six-Legged Walking Robot for Dynamic Walking</i> Christian Eichmann, Georg Heppner, Arne Roennau, Ruediger Dillmann
	<i>A Benchmarking and Test Lab for Legged Robots</i> Sabine Bellmann, Martina Overbeck, Tristan Schnell, Arne Roennau
	<i>Quantum Algorithms for Trajectory Optimization Problems, a Robotist Guideline</i> Feline Pirchmoser, Genessis Perez Rivera, Ruediger Dillmann
	<i>Legged Probing of the Immediate Environment</i> Lennart Puck, David Schwarze, Tristan Schnell, Georg Heppner, Ruediger Dillmann
	<i>Morphological Environment Analysis of High-Resolution Volumetric Maps</i> Marvin Große Besselmann, Lennart Puck, Ruediger Dillmann
	<i>Evaluation of the Unitree Go2 as an Education and Development Platform</i> Roberto Corlito, Amer Sawan, Arne Roennau

	Technical Session 9 Application II	Room LAURON	Thursday, 5th Sept. 11:50 - 12:50
Chair: Lennart Puck			
11:50 – 12:10	<i>Rotary Push-in Mechanism for Variable Outer Diameter PIGs with Multiple-Connected Using Pneumatic Artificial Muscles</i>		

	Kana Hiromoto, Yuta Naruse, Fumio Ito, Jun'ichi Watanabe and Taro Nakamura
12:10 – 12:30	<i>Proposal of a Peristaltic Motion-type In-pipe Inspection Robot Using a Hyper-Extension Unit - Basic Study on Application of Hyper-Extension Unit to Improve Inspection Speed</i> Ryusei Okuma, Sogo Matsuo, Fumio Ito and Taro Nakamura
12:30 – 12:50	<i>Evaluation of Cleaning Performance of Square-Duct Cleaning Machine with Multistage Planetary Gear Mechanism - Evaluation of Cleaning Rate by Grease Cleaning Experiment and Proposal of Operation Methods of the Cleaning machine</i> Yosuke Momma, Fumio Ito and Taro Nakamura

	Technical Session 10 Biologically-inspired Systems and Solutions	Room BISAM	Thursday, 5th Sept. 11:50 - 12:50
Chair: Patrick Vonwirth			
11:50 – 12:10	<i>Concept of Pneumatic Soft Robot: Suction-Driven Locomotion</i> Soham Parlikar, Teresa Zielińska and Konrad Gumowski		
12:10 – 12:30	<i>Climbing Robot Inspired by Inchworms: Adaptable for Tubular and Flat Surfaces with Multi-Plane Work Capability</i> Saulo Melotti, Brenno Domingues, Eduardo Kamitani, Verônica Pazda, Thamiris Costa, Amanda Fusinato, Douglas Negri, Diego Souza, Ismael Secco and Luís Gonzaga Trabasso		
12:30 – 12:50	<i>High Propulsive Trunk Flexion-extension Mechanism using Cheetah-inspired S-shaped spine</i> Shoei Hattori, Akira Fukuhara, Takeshi Kano and Akio Ishiguro		

	Plenary Talk	Room LAURON	Thursday, 5th Sept. 13:30 - 14:30
Chair: Rüdiger Dillmann			
13:30 – 14:30	<i>Torque Controlled or Intrinsically Compliant? DLR's perspective on robust and efficient biped and quadruped locomotion</i> Alin Albu-Schäffer		

Friday, 6th September

	Keynote	Room LAURON	Friday, 6 th Sept. 9:00 – 9:30
Chair: Karsten Berns			
9:00 – 9:30	<i>Bipedal Locomotion in Humanoid Robots and Exoskeletons - from Benchmarking Frameworks to Efficient Controllers</i> Mombaur, Katja		

	Technical Session 11 Innovative Grippers	Room LAURON	Friday, 6 th Sept. 9:30 - 10:50
Chair: Krzysztof Mianowski			
9:30 – 9:50	<i>Universal Wearable Haptic Glove for Force Measurement During Object Manipulation</i> Ksawery Giera, Mikolaj Nowacki and Dominik Belter		
9:50 – 10:10	<i>A Soft Robotic Gripper for Pancake Handling: Design, Modelling, and Experimental Assessment</i> Ser Vin Chan, Behnaz Sohani and Khaled Goher		
10:10 – 10:30	<i>Optimization of an Underactuated Two Finger Robotic Hand Using Genetic Algorithms</i> Dylan Denizon, Sedat Dogru and Lino Marques		
10:30 – 10:50	<i>Development of a Flexible Propulsion Mechanism Using a Braided Structure of Metal Plate for a Lunar Exploration Drilling Robot</i> <i>Ryunosuke Sawahashi, Hiroto Nagashima, Chikage Fujikawa, Takashi Kubota and Taro Nakamura</i>		

	Technical Session 12 Prosthetics and Rehabilitation	Room BISAM	Friday, 6 th Sept. 9:30 - 10:50
Chair: Rüdiger Dillmann			
9:30 – 9:50	<i>Omni-Directional Mobile Wheelchair Capable of Ascending Stairs Using Only Wheels</i>		

	Yuki Ueno and Haruto Homma
9:50 – 10:10	<i>Enhancing Knee Arthroplasty Precision: Design and Evaluation of a Parallel Kinematic Robotic Assistance System</i> Amir Rahmani, Sylvester Ndidiamaka Nnadi, Kieran Mercer, Owen Nelson-Smith, Charlotte Butcher, Scott Hazell, Aliyu Aliyu, Behnaz Sohani and Khaled Goher
10:10 – 10:30	<i>Study of Electric Wheelchair Enabling Ascend and Descend a Spiral Stair Using Crawlers and Wheels</i> Keiji Akasaki and Yuki Ueno
10:30 – 10:50	<i>Adaptable Segmented Straps with Anti-slip Pads for Modular Assistive Knee Exoskeleton Enhancement</i> Kanut Tarapongnivat, Sanpoom Punapanont, Run Janna, Matas Manawakul, Chaicharn Akkawutvanich and Poramate Manoonpong

	Plenary Talk	Room LAURON	Friday, 6th Sept. 11:50 - 12:50
Chair: Karsten Berns			
11:50 – 12:50	<i>Two, Four, or Six? Legged Robots for Exploration and Inspection in the Real World</i> Navinda Kottege		

	Technical Session 13 Application III	Room LAURON	Friday, 6th Sept. 13:30 - 14:30
Chair: Lino Marques			
13:30 – 13:50	<i>HAPmamba: Linear-Time Sequence Modeling for Terrain Classification by Legged Robots</i> Wilinski Michal, Mikolaj Lysakowski and Krzysztof Walas		
13:50 – 14:10	<i>Mobile Victim Signs Monitoring through Non-invasive Robotic System</i> David Rolando Orbea Jerez, Christyan Cruz, Jaime Del Cerro and Antonio Barrientos		
14:10 – 14:30	<i>Multi-UAV Coverage Path Planning for agricultural applications</i>		

	Marco Frau, Dario Calogero Guastella, Giovanni Muscato and Giuseppe Sutura
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	Technical Session 14 Innovative Robot Design II	Room BISAM	Friday, 6th Sept. 13:30 - 14:30
Chair: Tristan Schnell			
13:30 – 13:50	<i>Addressing Foot Geometry Trade-offs to Achieve Amphibious Surf Zone Transitions with a Crab Robot</i> Nicole Graf, John Grezmaek, Nathan Carmichael, Yifeng Gong and Kathryn Daltorio		
13:50 – 14:10	<i>Modern methods of designing and producing elements for walking robots working in highly dynamic conditions</i> Krzysztof Mianowski, Karsten Berns, Patrick Vonwirth and Oleksandr Sivak		
14:10 – 14:30	<i>3D-printed Robust Ground Contact Sensors for Haptic Feedback using Functional Materials</i> Matthias Hering, Simon Höving and Malte Schilling		

RRLAB DEMO AND WELCOME COCKTAIL

Date: Wednesday, 4th of September, 17:00-19:00

Location: RPTU Kaiserslautern-Landau, Gottlieb-Daimler-Str. Building 48, Room 260

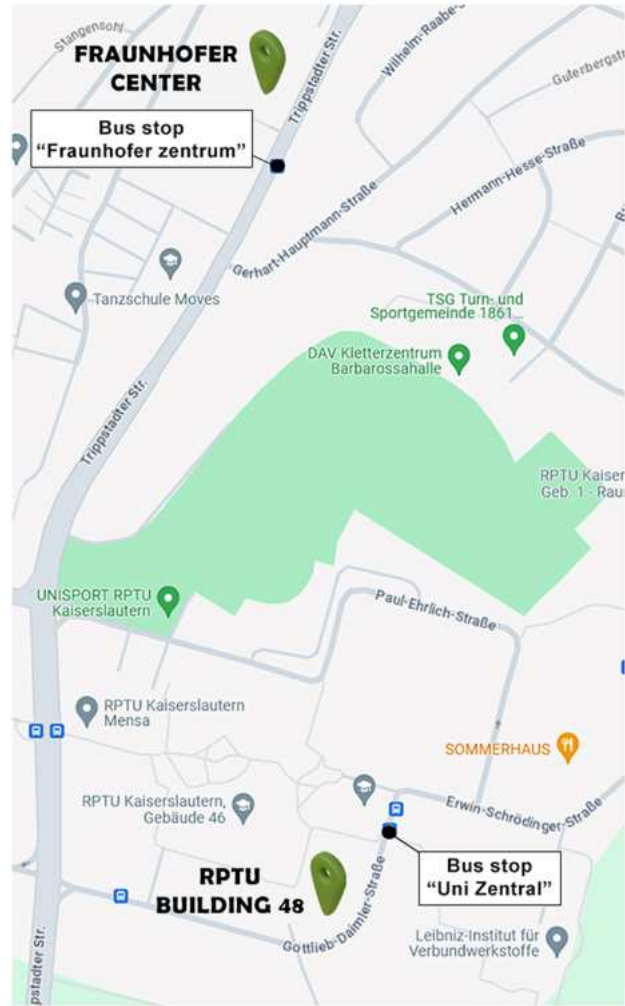
We kindly like to invite all the attendees of CLAWAR 2024 together with the accompanying guests to come together at our RRLab demo and welcome cocktail. As shown in the map it is a 10 min walk from the Fraunhofer center.

SOCIAL EVENT

Date: Thursday, 5th of September, 14:45 at Fraunhofer Center

Location: World Cultural Heritage Site "Völklinger Hütte"

CLAWAR 2024 conference attendees and their accompanying guests are invited to attend the guided tour to the "Völklinger Hütte". Please register your attendance to the Registration desk. The "Völklinger Hütte" is located in Völklingen in the state of Saarland. In 1994 it was the first monument of heavy industry to be classified by UNESCO as World Cultural Heritage Site. The tour of the "Völklinger Hütte", with more than 7000 meters of exciting walkways. The bus will drive back to Kaiserslautern at about 18:15 and will take you directly to the gala dinner.



GALA DINNER

Date: Thursday, 5th of September, 20:00

Location: At the brewery "Das Brauhaus" at "Gartenschau"

"Das Brauhaus" is located in Forellenstraße 6 near to the "Gartenschau".

It can be reached

a) by taxi (5 minutes from city center)

b) by bus from the bus station "Stadtmitte" bus stations near to the location: "Kammgarnstraße" -> bus no. 101 from platform B or "Kaiserslautern-West/ Westbahnhof" -> bus no. 112 from platform B

c) on foot (16 minutes from city center)

Your personal badge serves as ticket for the gala dinner, please take care to carry it with you to the dinner location.



Robot Exhibition is supported by:



Boston Dynamics Spot with Arm from FZI



UniTree Go2 from KIT



ANYbotics ANYmal C from FZI



ANYbotics ANYmal D with Arm from ETH



Bert from DLR Oberpfaffenhofen



Honey Badger 4.0 from MAB Robotics



ANYbotics ANYmal D from KIT



Hexapod LAURON VI from FZI



ETH Magnecko



ETH Minimal from ETH



CARL from RPTU



ETH SpaceHopper (Foto: Credit Novespace)

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