


Research Group in Interaction Design

Contact details.

Name	Research Group in Interaction Design
Acronym	IxD
Logo	 Interaction Design Research Group
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Areas of expertise

We conduct interdisciplinary research into products, services, processes, and environments to ensure they meet the needs of their users. We investigate various topics on **human-machine interaction, industrial robotics and automation, servitization, robotic exoskeletons for cardiac rehabilitation, industrial software design, and aesthetics and usability**. We're also interested in **operations research** and **technical project management**.

Team and key skills

The Research **Group in Interaction Design** is a multi-disciplinary research unit that explores the possibilities of integrating the new technologies into practice through development of industrial robotic systems, rehabilitation robots, mechatronic and software products that focus on aesthetics, usability, and user experience.

The Research Group is composed of academics – **prof. Bogdan MOCAN, PhD. habil.**; **assoc.prof. Mircea FULEA, PhD. habil.**; **lecturer Mircea MURAR, PhD** – with a strong practice-oriented approach, an industrial research and development expert – **eng. Cosmin IOANES, Phd** – and research students: **eng. Dominic Schreiner, eng. David Cherecheș, eng. Alexandru Moldovan** - with a high interest in theory and practice of human-machine interaction, industrial robotics, cardiac rehabilitation robots, servitization, and aesthetics and usability. Within the research group, the synergy operates at all levels, fostering a flexible, dynamic, and adaptive approach to user interaction design.

Bogdan Mocan is specialized in mechatronics applications. He has led a PNIII grant, managed two PNII and CEEEX grants, and participated in six CEEEX, PNII, FP6, FP7, H2020 projects. With 46 peer-reviewed publications in high-impact journals, two patents in 2021 and 2023, and authorship of 11 books or chapters on robotics and innovation, he has received over 40 international IP awards.

Mircea Fulea is specialized in Human-Machine Interaction, Usability, Product-Service Systems, and Operational Research. He has 36 ISI-indexed publications with 117 citations. He has led a PCCA grant and one international R&D project in robotic palletizing with an industrial partner (CSi Industries Netherlands). He was a key member (software architect & developer) in 2 FP7 research projects, one CEEEX, one PNII, and one H2020 project. He coordinates the Technical Project Management master program at the Technical University, run in strategic partnership with Emerson.

Mircea Murar is specialized in industrial process integration for Industry X.0, connected workers, and process control, has contributed to a research project and a bridge grant. With 23 ISI-indexed papers, 100 citations, an H-index of 6, one patent, and several book chapters, he has extensive experience in Siemens automation technology through over 150 projects.

Development strategy

Our mission is to explore the why's, what's and hows' of interaction design, to shape products and services that provide meaningful and relevant experiences to their users.

Our development strategy is to contribute with both theoretical knowledge and applied research in the areas of human-machine interaction, cardiac rehabilitation robotics, product-service systems, and operations research. We also aim to support our industrial partners to deliver impactful design solutions via servitization and superior user experience, and thus improve their customer retention. We also aim to expand the research group's infrastructure into a state-of-the-art laboratory of interaction design.

Representative projects

- **Radio-Frequency Identification System for Enhanced Laparoscopic Detection of Small-Dimension Colorectal Tumours**, research project, PN-IV-P7-7.1-PED-2024-0959
- **Optimizing the control algorithm of an exoskeleton intended for post-operative rehabilitation processes**, national RD grant, GNaC ARUT 2023, Grant Agreement no. ARUT 12/2024
- **New Assistive VR-enhanced Robotic Exoskeleton for Cardiac Rehabilitation**, research project, PN-III-P2-2.1-PED-2019 -1057, nr. 535PED/2020.
- **innDrive - Integrated Innovation Management System for SMEs**, research project, 2014-2017, PCCA2013 no. 341/2014
- **Intelligent human-robot interfaces for intuitive programming of industrial robots**, postdoctoral research program, POSDRU/159/1.5/S/137516 „Parteneriat interuniversitar pentru excelență în inginerie - PARTING”
- **Smart command and control architectures for reconfigurable robotized manufacturing cells**, postdoctoral research program, 2014-2015, POSDRU/159/1.5/S/137516 „Parteneriat interuniversitar pentru excelență în inginerie – PARTING”
- **Non-invasive Intraoperative Detection of Small Endoluminal Digestive Tumors and their Margins using Magnetic and Proximity Sensors**, medical RD project, 2014-2015, Grant Agreement no. nr. 11740/09.07.2014
- **Innovative design of the robotic security fences for fast assembly and installation**, industrial RD project, 2015-2017, CSi Industries B.V. Netherlands, Grant Agreement no. 28343/10.11.2015
- **Expert System for Smart Robots**, industrial RD project, 2013-2016, CSi Industries B.V. Netherlands, Grant Agreement no. 2013111901/2013

Significant results

The most representative publications of the past 5 years:

1. Mocan, B.; Schonstein, C.; Murar, M.; Neamtu, C.; Fulea, M.; Mocan, M.; Dragan, S.; Feier, H. Upper-Limb Robotic Exoskeleton for Early Cardiac Rehabilitation Following an Open-Heart Surgery - Mathematical Modelling and Empirical Validation. *Mathematics* 2023, 11(7), 1598; <https://doi.org/10.3390/math11071598>. (IF: 2023 2,59, Q1)
2. Fulea M, Mocan B, Dragomir M, Murar M. On Increasing Service Organizations' Agility: An Artifact-Based Framework to Elicit Improvement Initiatives. *Sustainability*. 2023; 15(13):10189. <https://doi.org/10.3390/su151310189> (IF: 2023 3.889, Q2)
3. Bogdan Mocan, Mihaela Mocan, Mircea Fulea, Mircea Murar, Horea Feier, Home-Based Robotic Upper Limbs Cardiac Telerehabilitation System. *International Journal of Environmental Research and Public Health*. 2022; 19 (18):11628, <https://doi.org/10.3390/ijerph191811628> (IF 2022 4,614, Q1)
4. Calborean, A., Macavei, S., Mocan, B. *et al.* Non-invasive laparoscopic detection of small tumors of the digestive tract using inductive sensors of proximity. *Sci Rep* 12, 760 (2022). <https://doi.org/10.1038/s41598-022-04822-x>; ISSN: 2045-2322; Nature-Scientific Reports, IF 2021 4.380, Q1; CiteScore: 5.134, Q1).
5. Mocan, B.; Schonstein, C.; Neamtu, C.; Murar, M.; Fulea, M.; Comes, R.; Mocan, M. CardioVR-ReTone—Robotic Exoskeleton for Upper Limb Rehabilitation following Open Heart Surgery: Design, Modelling, and Control. *Symmetry* 2022, 14, 81. <https://doi.org/10.3390/sym14010081>;_ISSN: 2073-8994; (IF 2021 2,713, Q2; CiteScore: 3.4, Q1).

6. Mocan, M., Vlaicu, S.I., Farcaș, A.D., Feier, H., Dragan, S., and Mocan, B., Cardiac Rehabilitation Early after Sternotomy Using New Assistive VR-Enhanced Robotic Exoskeleton—Study Protocol for a Randomised Controlled Trial, *Int. J. Environ. Res. Public Health* 2021, 18, no 22, 11922. <https://doi.org/10.3390/ijerph182211922>, 2021, EISSN 1660-4601 (IF 2021 3.390, Q1).
7. Bîntînțan, V., Calborean, A., Mocan, M., Macavei, S., Cordoș, A., Ciuce, C., Bîntînțan, A., Chira, R., Nagy, G., Surlin, V., Timofte, D., Nickel, F., Mueller, B., Dindelegan, G., Ciuce, C., Brad, S., Murar, M., Mocan, B., New inductive proximity sensor platform for precise localization of small colorectal tumors, *Materials Science and Engineering: C - MATERIALS FOR BIOLOGICAL APPLICATIONS*, Volume 106, Article 110146, 2020, ISSN 0928-4931, <https://doi.org/10.1016/j.msec.2019.110146>, (IF 2019 5.88, CiteScore 10.2, Q1).
8. Calborean, A., Macavei, S., Mocan, M., Ciuce, C., Cordos, A., Bîntintan, A., Chira, R., Pestean, C., Pop, O., Barbu-Tudoran, L., Dindelegan, G., Surlin, V., Nickel, F., Mocan, B., Bîntintan, V., Laparoscopic compatible device incorporating inductive proximity sensors for precise detection of gastric and colorectal small tumors, *Surgical Oncology*, V. 35, pp. 504-514, <https://doi.org/10.1016/j.suronc.2020.10.012>, December 2020, ISSN 0960-7404 (IF 2019 2.521, CiteScore 3.7, Q2).

Our offer to the economic environment

Research & development in core areas	R&D in User Experience Design R&D in Industrial Robotics and Automation R&D in Robot-Assisted Medicine
Research & development in applied fields	R&D in servitization, R&D in industrial software design, R&D in industrial automation; R&D in robotic cardiac rehabilitation, R&D in operations management
Consulting	Consulting in the field of: <ul style="list-style-type: none"> ▪ Design and development of industrial robotic systems. ▪ Design and development of industrial automation systems. ▪ Design and development of user control interfaces for smart robotized systems. ▪ Design and development of mechatronic products for medical use. ▪ Design and development of robotic exoskeletons for cardiac rehabilitation. ▪ Solving the Facility Layout Problem and developing the risk assessment analysis for industrial robotic systems.
Applied engineering services	Automation and commissioning the industrial robotic manufacturing systems. Design the user control interfaces for smart robotized systems. Optimising the industrial robotic manufacturing systems.
Training	Trainings in UxD, industrial software design, automation and robotisation of industrial processes, operations management.

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