



2nd NEMO Day 2021

DigiFoF Project

The FoF-Designer:

Digital Design Skills for Factories of the Future

Introduction. Goals and objectives.

Latest developments and publications

Virtual meeting

16th April, 2021

<https://zoom.us/j/93405780820?pwd=U1dsWnpHTWVqSEFxbHNIN0VQNGd0Zz09>



UNIVERSITATEA
LUCIAN BLAGA
— DIN SIBIU —



Professor Adrian FLOREA, PhD
Lucian Blaga University of Sibiu

adrian.florea@ulbsibiu.ro

Technical coordinator of the Erasmus+ KA2 strategic project “The FoF-Designer: Digital Design Skills for Factories of the Future” -

<https://digifof.eu/>

Since 2019 professor Florea is leading the HPI Knowledge Transfer Centre at ULBS <http://centers.ulbsibiu.ro/itchpiulbs/en/>

DigiFoF PROJECT



DigiFoF: Digital Design Skills for Factories of the Future

- Type: Erasmus + Knowledge Alliance educational project
- Goal: **Foster knowledge transfer and cooperation between industry and academia**
- Means: through a network of training environments and training programs and teaching materials
- Start: January 1st 2019
- End: December 31st 2021
- Budget: € 999,259 (96% on staff costs – “*value for money*”)

The context: the **Digitalization of society**

Three kind of challenges due to Digitalization

1. one which **targets the companies: digitalization for innovation** (their strategy and management to revitalize existing manufacturing systems using hardware/software interconnected embedded systems, to optimize the factory floor and increase reliability, repeatability, and revenues)
 - Barriers: *legacy complexity of software applications, cybersecurity concerns, and gaps for most of employees of IT skills and competencies*
2. other which **target the employees** (and their personal interest for owning adequate digital skills needed for future jobs)
 - Challenge: *“Roughly 60% of the IT jobs that will exist in 2025 haven’t been invented yet”* - Oracle CEO Mark Hurd, June 12, 2019
3. the last one **aiming the educational system** which should include in its curricula bachelor (BSc) and master (MSc) study programs which prepare students for the following jobs: *Virtual Reality/Augmented Reality System Specialist, Digital Manufacturing Engineer, Digital Factory Automation Engineer, Chief Digital Officer, User Experience*

DigiFoF PARTNERSHIP



Type of partners:

- **9 countries / 15 Full Partners**
- **PARtners** (5 HEIs)
- **Affiliated Entities** (Enterprises, Training institutions, etc)
- **2 Associated Partner organisations**

The roles and responsibilities:

- **Egalitarian** participation and contribution in the project
- Respecting the core **competences** of the partners.

 Romania



 Finland



 Romania



 France



 Romania



 France



 Poland



 France



 Italy



 Germany



 Italy



 Poland



 France



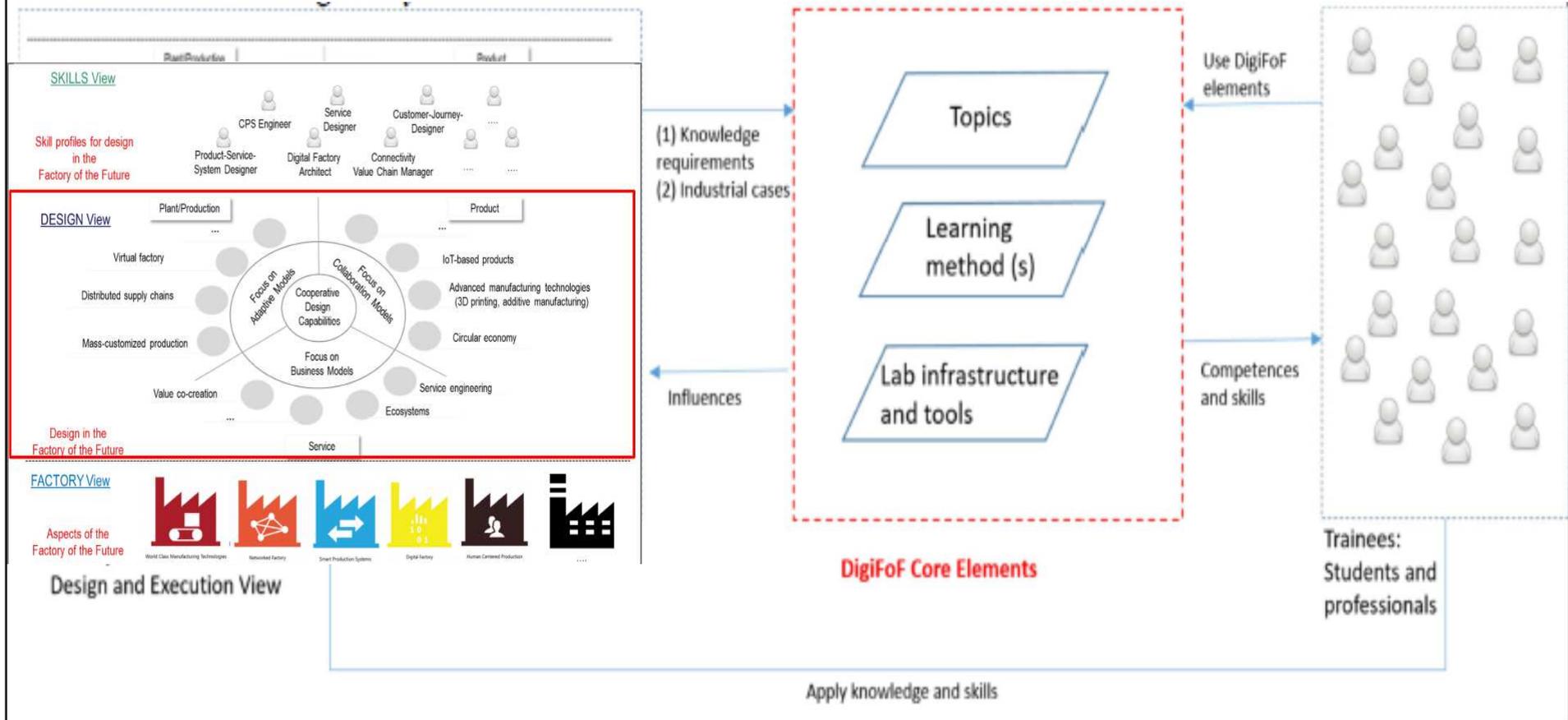
 Poland



 Portugal



DigiFoF IDEA



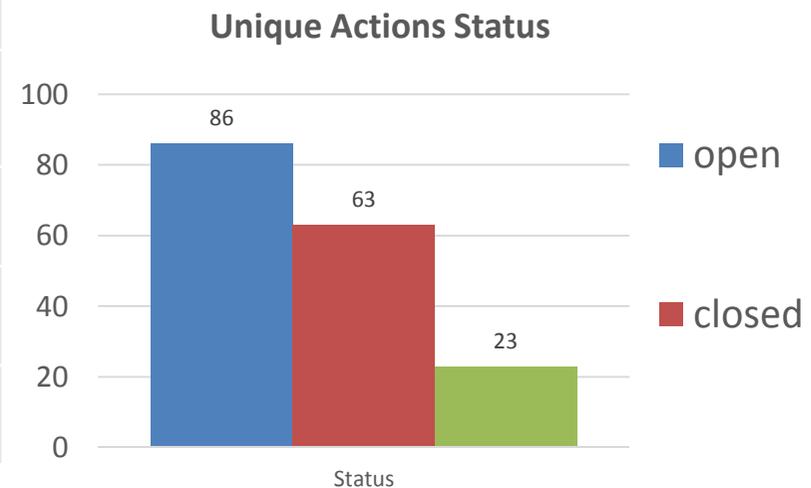
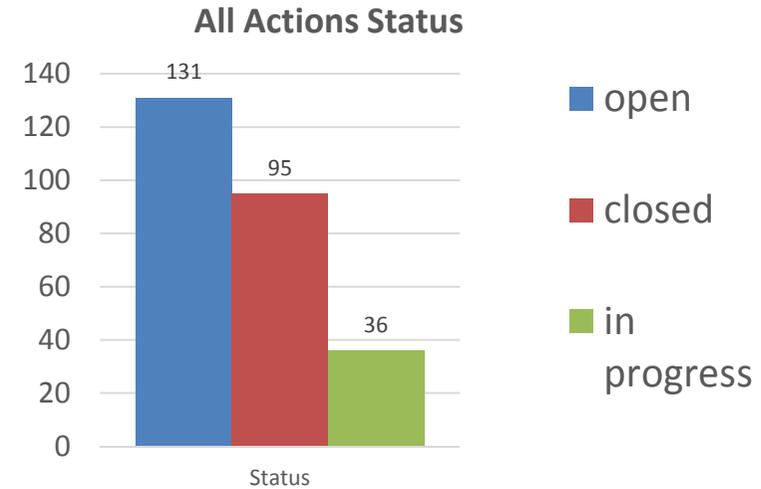
- DigiFoF proposes an **organizational platform** where **HEIs, enterprises, and training institutions** come together to develop skill profiles, trainings and teaching concepts as well as materials for different FoF-design aspects.
- The platform is completed by **5 laboratories** equipped with a variety of **open source tools**, which provide **educational and experimental environments**, where aspects of FoF can be taught practically or experimented with.



Total actions

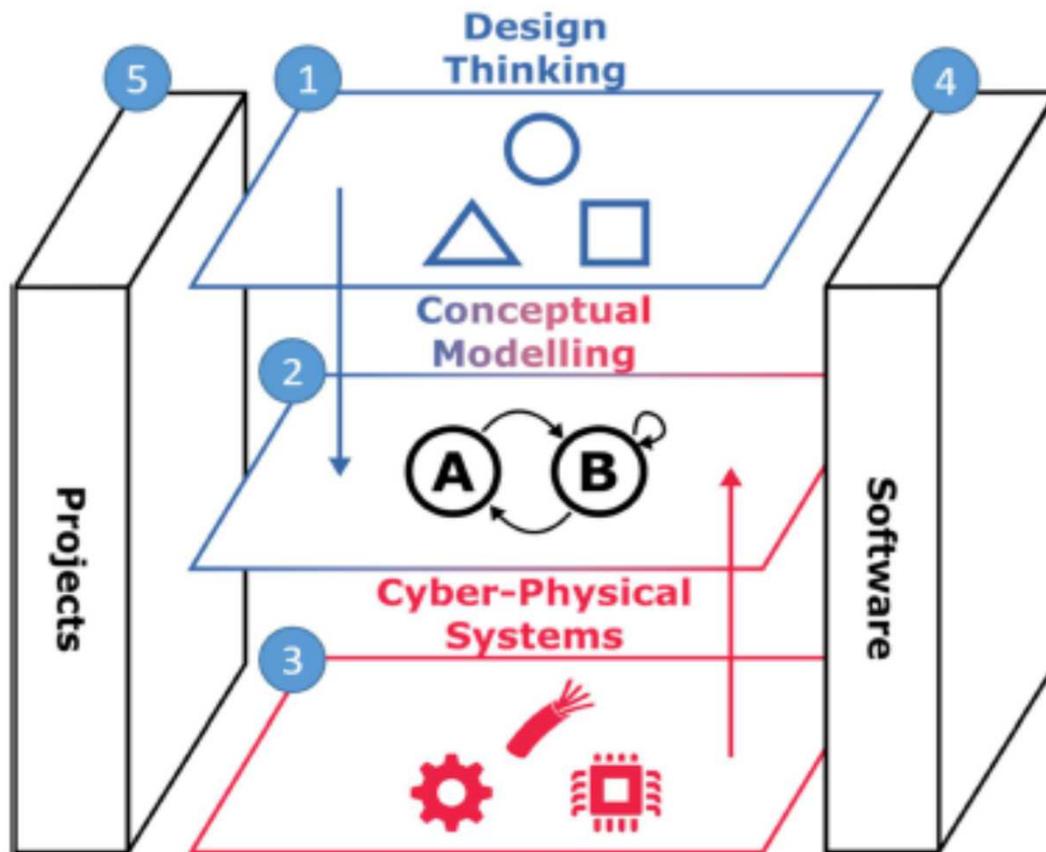


Actions in DigiFoF project period		
all	131	
closed	95	72.51%
in progress	36	27.49%
Unique actions in DigiFoF project period		
all(unique)	86	
closed(unique)	63	73.25%
in progress(unique)	23	26.75%



DigiFoF DESIGN LABS

OMLAB4FoF



1 – FoF-specific scenarios

2 – Conceptual models

3 – Scenario execution with focus on IoT and CPS

4 – IT-support

5 – (Company-specific) projects

D2.2. OMiLAB4FoFs

OMiLAB Nodes



Your OMiLAB Node

Launch your own OMiLAB and interact with our global community.

Read More



Established in: 2020

Ecole des Mines de Saint-Étienne

Our focus is on Industrial Business Model Transformation

Visit



Established in: 2019

Lucian Blaga University of Sibiu

Expertise in Embedded Systems, Smart City domain and Manufacturing Systems and Processes

Visit



Established in: 2019

University of Bergamo

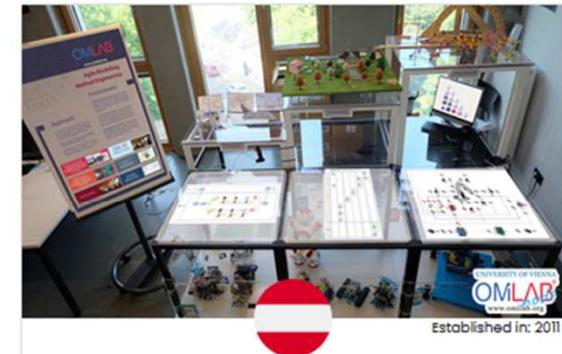
Service and manufacturing operations management



Established in: 2015

JeonBuk National University

Towards Formal Methods of IoT Application

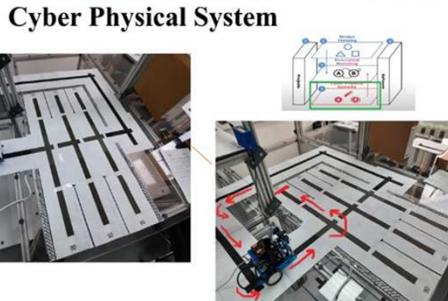
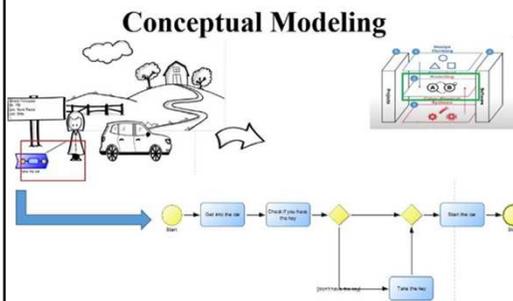
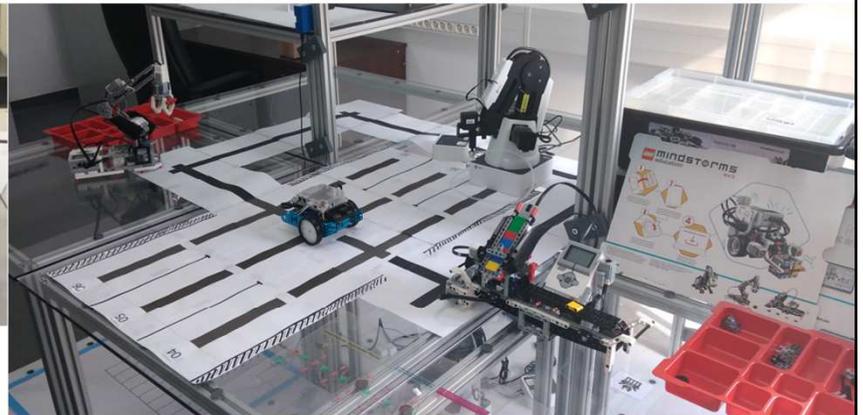
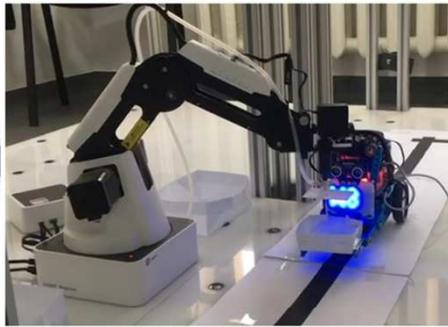
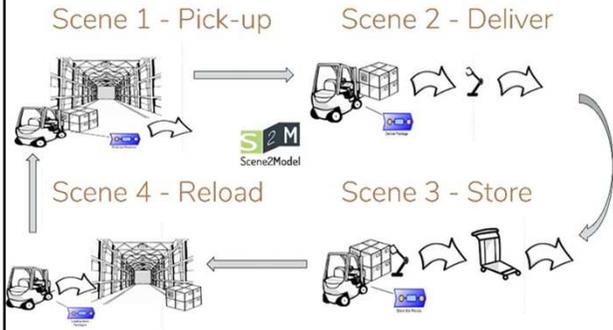


Established in: 2011

University of Vienna

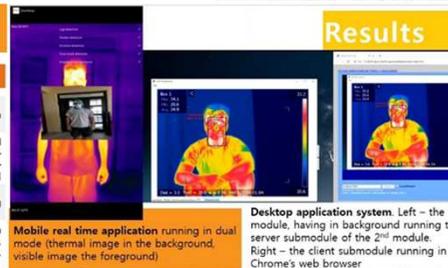
Knowledge-based methods and technologies for digitalization

OMILAB@Lucian Blaga University of Sibiu - Activities



Detection algorithms

Objective	Algorithm / Architecture	Library	Output
Face detection	Viola-Jones framework	EmguCV	Face location
Age & Gender recognition	CNN similar with AlexNet	Keras.NET	Female/Male & age interval [[0 - 2), (4 - 6), (8 - 12), (15 - 20), (25 - 32), (38 - 43), (48 - 53), (60 - 100]]
Medical mask detection	MobileNetV2	Tensorflow.Keras.NET	Binary: wearing / not wearing
Face emotion recognition	Regression Trees for facial landmarks detection & geometric appearance classification	DLIB & Own implementation	One of the 7 basic human emotions (neutral, sad, angry, surprised, afraid, happy)



PRO-VE 2020 - 21st IFIP / SOCOLNET Working Conference
Virtual Enterprises, 23-25 November 2020 - Valencia, BI: Skills for Organizations of the Future

Improving the Training Methods of Designers of Flexible Production Factories of the Future (FP2)

Ion Mironescu^{1,2}, Daniel-Cristian Crăciunean¹, Adrian Florea³

- 1) Computer Science & Electrical Engineering Department
- 2) Agricultural Science and Food Engineering Department
- 3) Industrial Engineering and Management Department

Lucian Blaga University of Sibiu, Romania

SID 2020

Sibiu Innovation Days

DIGITAL TRANSFORMATION - A ROADMAP TOWARDS A SMARTER SOCIETY

26 - 27 November, Sibiu - RO

Section 1

A CONFERENCE: MODERATE PANELS WITH REPRESENTATIVES OF COMPANIES / MUNICIPALITIES

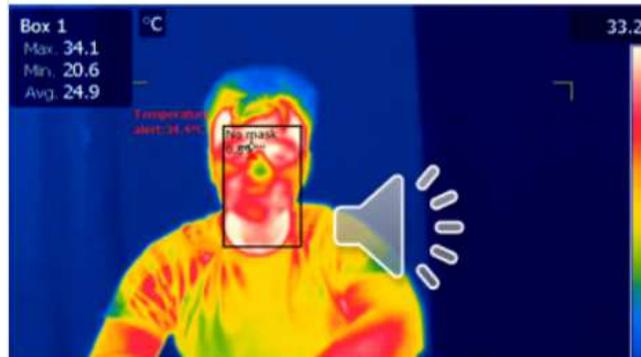
Arman Ionescu hall of the Faculty of Letters & Arts, Blvd. Victoriei, Nr. 57, Sibiu and online access

Topics

1. Autonomous driving / Challenges in automobiles
2. Digitalisation / Industry 4.0
3. Applied artificial intelligence
4. Innovative partnerships
5. Smart health applications
6. European challenges from SDI

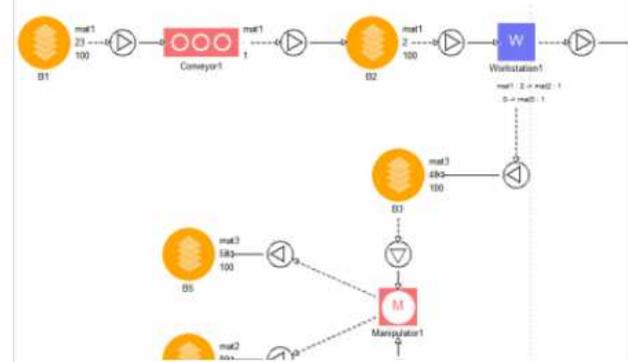
**OMILAB@Lucian Blaga
University of Sibiu -
Results**

Thermovision Camera Identification



Details

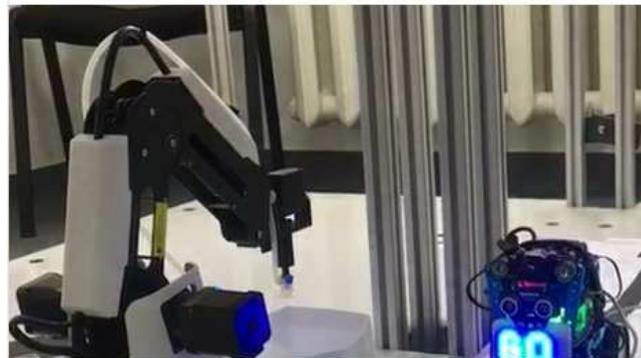
Digital Production Planner Tool



Details

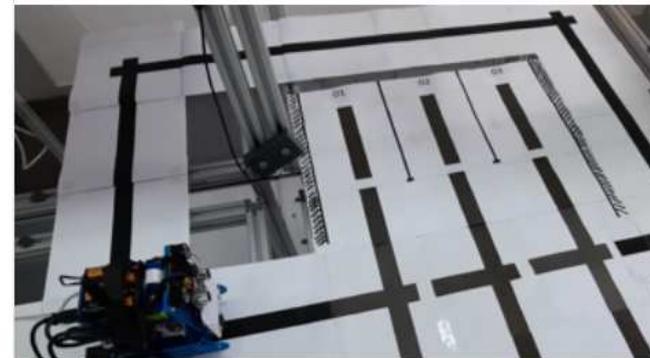
<http://digifof.omilab.ulbsibiu.ro/psm/development>

Automation of assembly lines



Details

Mobile robot parking



Details

DigiFoF TOPICS

❖ Strategy:

- **topics** like **business models**, product-service-systems, crowdsourcing
 - Customers needs' services deployment
 - Transformation of Industrial Business Model through Digitalization and Servitization
 - Sibiu – Smart City Modelling
- **methods** like design thinking, open innovation

D3.2 Teaching and training materials for the design of the Factory of the Future

https://digifof.eu/sites/default/files/d3.2_teaching_and_training_materials_for_the_design_of_the_factory_of_the_future_disclaimer.pdf

DigiFoF TOPICS

❖ Processes:

- **topics** like **business process management, IT architecture and service management, data management, cybersecurity, product/service-lifecycle-management**
 - Process modelling using BPMN
 - Process performance / Service operations monitoring
 - AI tools and modelling virtualized resources for Industry 4.0 transformation
 - Robotic applications in Virtual Laboratory
- **methods** like domain specific languages, formal languages, descriptive modelling, analytic modelling, benchmarking

DigiFoF TOPICS

❖ Systems:

- **topics** like **IoT** and **cyber-physical systems**, **digital factory** reference architecture, semantics, **production automation**, product-service-data-transmission, network security
 - Computer Vision for Manufacturing Industry Application
 - Petri Nets based automation of manufacturing systems
 - Cobots - installing and programming information needed for a rapid implementation of Cobots in industrial environment
- **methods** like computer-aided-design, model-driven software engineering, case study and lab activities



DigiFoF Main Indicators

Structured on **Categories** and **Target groups**:

- **Categories:**

- ✓ Skill requirements
- ✓ Labs
- ✓ Teaching content
- ✓ Tools
- ✓ Professional trainings
- ✓ Students
- ✓ Sustainability
- ✓ QA and Evaluation
- ✓ Dissemination/ Exploitation
- ✓ Project management

- **Target groups:**

- ✓ Students, professionals, teachers
- ✓ Enterprises
- ✓ All stakeholders
- ✓ Training Institutions
- ✓ HEIs
- ✓ All project partners

Challenges:

- **local rules and legislation affect installation of the laboratories**
- **COVID-19 pandemy affect physical participation to trainings (vocational or academic). These should be moved in online.**



Project indicators

(realized/proposed):

WP1: - 109/80 filled online questionnaires,
- 83/150 prints of FoF-design needs report
- 40/20 online downloads

WP2: - (7 HEIs+10 Companies) / 20 DigiFoF network members
- 5/5 OMiLAB4FoF labs, 223/400 lab users
- 40/50 Brokerage System (Job, trainings, thesis offers)

WP3: - 34 (32 completed)/30 learning modules
- 21/20 industry case studies
- 21/24 webinars + 3/0 NEMO DAY

https://www.youtube.com/playlist?list=PL6Bc9CUycgwbbRXU7OzDSRY8_SmL2RQIH

- 20/19 open source design tools,
- 1/1 open use platform (OMiLAB.org)

WP4: - 192/100 vocational trainees (including certificates)

<https://centers.ulbsibiu.ro/itchpiulbs/en/studies.php>

WP5: - 0/5 HEIs using guideline
- 6/22 participating teachers (NEMO)
- 3/16 participating students (NEMO)
- 0 / 8 professionals (NEMO)
- 186/100 evaluation feedback
- 1/2 summer schools
- 58/50 participating students (internship)

WP6: - 75/75 QAed materials/outputs, impact of improvements proposed on quality of results and outputs

WP7: - 30/50 evaluations by peers and external experts, relative quality to the assessment level

WP8: - 1354/1500 web-portal hits
- 15/30 press articles
- 20/10 scientific published articles
- 230/200 participants to dissemination workshops

WP9: - 1/2 EACEA reports
- 2 physical + 7 virtual/5 project meetings

DigiFoF - Latest developments and publications (I)

1. K. Medini, X. Boucher, Specifying a modelling language for PSS Engineering – A development method and an operational tool, *Computers in Industry*, Volume 108, 2019, Pages 89-103.
2. Florea, A. (2019). Digital Design Skills for Factories of the Future. In MATEC Web of Conferences (Vol. 290, p. 14002). EDP Sciences.
3. Coba, C. M., Boucher, X., Medini, K., & Gonzalez-Feliu, J. (2019). Simulation-based approach to apply uncertainty evaluation framework, for PSS economic models. *Procedia CIRP*, 83, 50-56.
4. Boucher, X., Medini, K., & Coba, C. M. (2019, September). Framework to Model PSS Collaborative Value Networks and Assess Uncertainty of Their Economic Models. In *Working Conference on Virtual Enterprises* (pp. 541-551). Springer, Cham.
5. Peillon, S., & Dubruc, N. (2019, May). Human resources barriers and drivers in sme's digital servitization: french case studies. In *The Spring Servitization Conference 2019*.
6. Butean, A., Olescu, M. L., Tocu, N. A., & Florea, A. (2019). Improving Training Methods for Industry Workers though AI Assisted Multi-Stage Virtual Reality Simulations. *eLearning & Software for Education*, 1.
7. Mironescu, I. D. (2019). An ADOxx based environment for problem based learning in manufacturing systems design. In *MATEC Web of Conferences* (Vol. 290, p. 14003). EDP Sciences.
8. Crăciunean, D. C., & Volovici, D. (2019). MM-DSL, support for implementing modelling tools for manufacturing processes. In *MATEC Web of Conferences* (Vol. 290, p. 14001). EDP Sciences.
9. Pirola, F., Boucher, X., Wiesner, S., & Pezzotta, G. (2020). **Digital technologies in product-service systems: a literature review and a research agenda**. *Computers in Industry*, 123, 103301.
10. Coba, C. M., Boucher, X., Gonzalez-Feliu, J., Vuillaume, F., & Gay, A. (2020). Towards a risk-oriented Smart PSS Engineering framework. *Procedia CIRP*, 93, 753-758.
11. Coba, C. M., Boucher, X., Vuillaume, F., Gay, A., & Gonzalez-Feliu, J. (2020, November). Value Proposition in Smart PSS Engineering: Case Study in the Residential Heating Appliance Industry. In *Working Conference on Virtual Enterprises* (pp. 431-439). Springer, Cham.
12. Paul, M., Cerqueus, A., Schneider, D., Benderbal, H. H., Boucher, X., Lamy, D., & Reinhart, G. (2020, August). Reconfigurable Digitalized and Servitized Production Systems: Requirements and Challenges. In *IFIP International Conference on Advances in Production Management Systems* (pp. 501-508). Springer, Cham.

DigiFoF - Latest developments and publications (II)

13. Nazarenko, A. A., & Camarinha-Matos, L. M. (2020, July). The Role of Digital Twins in Collaborative Cyber-Physical Systems. In *Doctoral Conference on Computing, Electrical and Industrial Systems* (pp. 191-205). Springer, Cham.
14. Graça, P., & Camarinha-Matos, L. M. (2020, July). Performance Indicators of a Collaborative Business Ecosystem—A Simulation Study. In *Doctoral Conference on Computing, Electrical and Industrial Systems* (pp. 3-17). Springer, Cham.
15. Camarinha-Matos, L. M., Farhadi, N., Lopes, F., & Pereira, H. (Eds.). (2020). Technological Innovation for Life Improvement: 11th IFIP WG 5.5/SOCOLNET Advanced Doctoral Conference on Computing, Electrical and Industrial Systems, DoCEIS 2020, Costa de Caparica, Portugal, July 1–3, 2020, Proceedings (Vol. 577). Springer Nature.
16. A. Florea and V. Fleaca, *Implementing an embedded system to identify possible COVID-19 suspects using thermovision cameras*, 2020 24th International Conference on System Theory, Control and Computing (ICSTCC), Sinaia, Romania, 2020, pp. 322-327, doi: 10.1109/ICSTCC50638.2020.9259699.
17. A. Florea, V. Fleaca, S.D. Marcu, *Innovative Solution for Parking-Sharing of Private Institutions Using Various Occupancy Tracking Methods*, *Advances in Science, Technology and Engineering Systems Journal*, vol. 5, no. 5, pp. 808-819 (2020).
18. Karagiannis, D., Buchmann, R. A., Boucher, X., Cavalieri, S., Florea, A., Kiritsis, D., & Lee, M. (2020, November). **OMiLAB: a smart innovation environment for digital engineers**. In *Working Conference on Virtual Enterprises* (pp. 273-282). Springer, Cham.
19. Mironescu, I., Crăciunean, D. C., Florea, A., & Bondrea, I. (2020, November). *Improving the Training Methods for Designers of Flexible Production Cells in Factories of the Future*. In *Working Conference on Virtual Enterprises* (pp. 283-296). Springer, Cham.
20. Grecu, V., Ciobotea, R. I. G., & Florea, A. (2020). Software application for organizational sustainability performance assessment. *Sustainability*, 12(11), 4435.

Beyond DigiFoF

- Developing a network of digital transformation laboratories around existing OMiLABs characterized by excellence in RDI. Enhancing the hardware and software portfolio of each OMiLAB node based on own or collaborative research projects.
- Engaging students and staff in mobilities between partners for good-practices exchanges.
- Strengthening the cooperation between partners
 - DoCEIS 2021 – **12th Advanced Doctoral Conference on Computing, Electrical and Industrial Systems, 2021, 7-9th July, Caparica, Portugal – ONLINE,** <https://doceis.dee.fct.unl.pt/>
 - PRO-VE 2021 – **Smart and Sustainable Collaborative Networks 4.0, 22nd IFIP Working Conference on Virtual Enterprises, 2021, 22 -24th November,** www.pro-ve.org
 - Special Session: *Knowledge transfer and accelerated innovation in FoF* https://pro-ve-2021.sciencesconf.org/data/Special_Session_DigiFoF.pdf
 - SID 2021 - **Sibiu Innovation Days, Digital Transformation - a Prerequisite for Sustainability in all Economic Sectors and for Society, 28-30th October 2021,** <https://events.ulbsibiu.ro/innovationdays/>