Overview on the EU-IoT Hackathon

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Abstract

The EU-IoT/EFPF Hackathon was a collaborative event jointly organised by the Cooperation and Support Action EU-IoT and the Horizon 2020 Research and Innovation project EFPF. Full information on the event is available via the Hackathon DevPost platform, https://eu-iot-hackathon.devpost.com/.

The overall operational guidelines and rules of the Hackathon are described in a specific document available via the Hackathon GitLab.

The EU-IoT/EFPF Hackathon has been developed to encourage the Next Generation IoT (NGIoT) community to interact via the development of i) technical projects (based on open-source tooling and tooling suggested by next generation flagship projects); ii) training tools; iii) business ideas based on the specific domain challenges proposed and which are aligned with the CSA EU-IoT scope areas: tactile Internet/Human IoT interfaces; far Edge; near Edge; infrastructure; data spaces.

In the Hackathon EFPF had a dedicated challenge domain focused on manufacturing focused on Manufacturing.

The Hackathon took place from the 27th until the 28th of June 2022, in Munich (Germany) co-located to the IEEE co-sponsored symposium CONASENSE2022. Hybrid support has also been provided to teams in Brazil, via the support of the university UNIVESP.

Contents

1. INTRODUCTION

The EU-IoT/EFPF Hackathon was a collaborative event jointly organised by the Cooperation and Support Action EU-IoT and the Horizon 2020 Research and Innovation project EFPF. Full information on the event is available via the Hackathon DevPost platform, https://eu-iot-hackathon.devpost.com/ and also via the EFPF Deliverable D8.5 "Management and Support for Experimentation on the EFPF Platform". This section provides a summary of the content provided in the EFPF Deliverable D8.5.

The overall operational guidelines and rules of the Hackathon are described in a specific document available via the Hackathon GitLab.

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In the Hackathon, the project EFPF had a dedicated challenge domain focused on manufacturing focused on Manufacturing.

The Hackathon took place from the 27th until the 28th of June 2022, in Munich (Germany) co-located to the IEEE co-sponsored symposium CONASENSE2022. Hybrid support has also been provided to teams in Brazil, via the support of the university UNIVESP.

The teams developed their projects during the Hackathon and had to pitch their projects on the Hackathon pitching session to be held in Munich, 28th of June. The presentations were prepared to last 10 minutes, based on the proposed templates, available via GitLab.

All winning the projects are uploaded to the Hackathon GitLab repository. The contents of this repository shall be publicly available and shall last beyond the end of the Hackathon.

2. HACKATHON PREPARATION AND COMMUNITY BUILDING

The Hackathon preparation and development started in 2021, as part of a milestone of the CSA EU-IoT[1]. For the Hackathon development, fortiss proposed to jointly organize the Hackathon with the Research and Innovation project EFPF. This joint organization allowed to reach a broader community of developers, given that the CSA EU-IoT oversees and assists the coordination of 6 flagship projects in the context of Edge and IoT. EFPF brought key challenges in this context to the full end-to-end IoT spectrum with specific focus on manufacturing, as illustrated in **Error! Reference source not found.**.

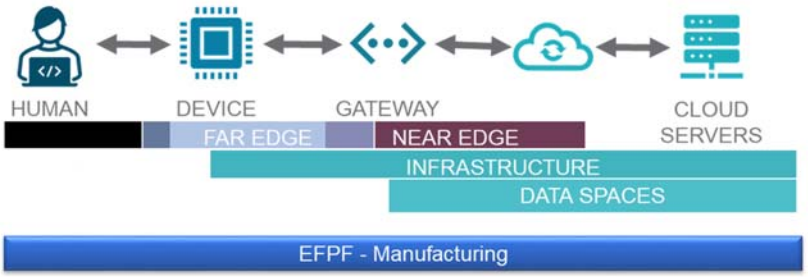

Figure 1: the overall scope of the EU-IoT/EFPF Hackathon.

The co-location to CONASENSE 2022 allowed to bring different experts and keynote speakers to the event, thus increasing the potential for dissemination across the broader European research community.

To build up the community, several actions have been developed since June 2021, as follows:

- First presentation of the Hackathon on IoT Week 2021, in August 2021.
- Regular dissemination via specific channels, to the targeted communities.

[1] https://www.ngiot.eu/eu-iot/

- Direct interaction with different entities, including presentation of the Hackathon and its call for projects in local universities by different partners of the two H2020 projects EFPF and EU-IoT.
- Several hybrid events organized by fortiss to explain the Hackathon to the community being developed.

3. FORMAT

The Hackathon has been co-located to the CONASENSE2022 symposium, starting in the afternoon of the first day of the symposium. The sessions of the Hackathon ran in parallel to the agenda of the symposium. Specific sessions with keynote speakers and project sessions were held jointly, to allow the mentors and participants to attend these sessions if desired. Moreover, several meetups with mentors have been set, given that the participants were in hybrid mode.

The event closed with a final session, where awards to the best paper, best presentation and Hackathon awards have been provided.

3.1. Organizational Structure and Support

The organizational structure of the Hackathon is illustrated in Figure 2. The Hackathon counted with an organizing committee involving EFPF members, EU-IoT members, and teachers of UNIVESP (pole to Brazilian students). This structure was extremely helpful to handle the event in hybrid mode. All the entities and respective members participated in a volunteer way, without any kind of contribution.

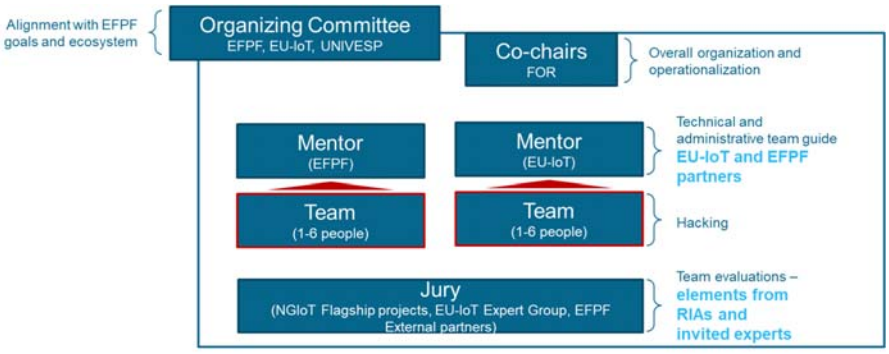

Figure 2: Organizational structure of the EU-IoT/EFPF Hackathon.

3.2. Committees

The Hackathon has been organized by fortiss and had the local support of UnternehmerTUM[2]. It counted with the following technical committees:

- **EU-IoT Committee**: Rute Sofia (fortiss), Lamprini Kolovou (Martel); John Soldatos (Intracom); Mirko Presser (Aarhus University); Brendan Rowan (Bluspecs).
- **EFPF Committee**: Mitula Donga (fortiss), Alexandros Nizamis (ITI-CERTH), Florian Jasche (Fraunhofer FIT), Ingo Martens (Hanse Aerospace); Carlos Coutinho (Caixa Mágica), Usman Wajid (Information Catalyst).
- **UNIVESP/Brazil Committee**: Sergio Galindo, Ricardo Edgard Caceffo.

The Hackathon Committees have been responsible for the overall organization and operationalization of the Hackathon and its different meetings, as well as for the development and maintenance of the different tools. The Hackathon co-chairs moderated moderate the different events, overall dissemination, and were the main contact point for all operational questions and concerns.

3.2.1. Mentors

The Hackathon Mentors, listed in *Table **1***, were volunteer elements from EFPF, EU-IoT and UNIVESP that related with the challenges proposed. The Mentors had the following responsibilities:

- Serve as the primary technical and guidance contact for the team questions and respective project guidance.
- Assist the support of the project artifacts in the Hackathon GitLab account.
- Promote the project in the NGIoT community and in the EFPF community.

Table 1: Hackathon Mentors.

Mentor	Challenge	Type	Affilitation
Florian Jasche	EFPF3: Evaluate the usability of the Data Spine for the creation of composite applications	Business Project	FhG FIT
Alexandros Nizamis	EFPF4: Analyze industrial data coming from EFPF partners and provide insights based on the EFPF analytics tools	Technical Project	CERTH
Sergio Galindo	Any, Brazil	Any	UNIVESP

[2] https://www.unternehmertum.de/

Mentor	Challenge	Type	Affilitation
Ricardo Caceffo	Any, Brazil	Any	UNIVESP
Manel Khelifi	Any	Technical Project	fortiss GmbH
Erkan Karabulut	EFPF1: Semantic matchmaking for the support of environmental monitoring of the shopfloor	Technical Project	fortiss GmbH
Dushyant Dave	EU-IoT 2: far Edge, tinyML	Technical Project	fortiss GmbH
Nikos Vakakis	EFPF4: Analyze industrial data coming from EFPF partners and provide insights based on the EFPF analytics tools	Technical Project	CERTH
Rohit Deshmukh	EFPF3: Evaluate the usability of the Data Spine for the creation of composite applications	Any	FhG FIT
Brendan Rowan	EU-IoT 1: IoT interfaces	Skills Training Project	Bluspecs
Emilie Mathilde Jakobsen	EU-IoT 1: IoT interfaces	Business Project	Aarhus University
John Soldatos	EU-IoT1: interfaces	Skills Training Project	Netsoft-Intrasoft
Victor Banos	Any	Any	Fortiss GmbH
Parwinder Singh	Any	Any	Aarhus University
Cecilia Sosa Arias Peixoto	Any, Brazil	Any	UNIVESP
Dushyant Dave	EU-IoT 2: far Edge, tinyML	Technical Project	fortiss GmbH
Roberto Massi de Oliveira	Any, Brazil	Any	UNIVESP
Higor Souza	Any, Brazil	Any	UNIVESP
Jose Avelino Placca	Any, Brazil	Any	UNIVESP

3.2.2. Jury

The Jury was composed of elements from EFPF and from the Next Generation IoT projects VEDLIoT, IoT-NGIN, TERMINET, IntellIoT, INGENIOUS, ASSIST-IoT, EFPF, and from UNIVESP (Brazil pole). The list of Jury members is provided in ***Table 2.***

Table 2: Jury members.

Name	Affiliation	Projects
Mario Porrmann	University of Osnabrück	VEDLIoT
Jens Hagemeyer	University Bielefeld	VEDLIoT
Josep Escrig	I2CAT	IoT-NGIN
Daniel Calvo	ATOS	IoT-NGIN
Jonathan Klimt	RWTH University of Achen	IoT-NGIN
Ilias Siniosoglou	University of Western Macedonia	TERMINET
Arne Bröring	Siemens AG	IntellIoT
Erin Elizabeth Seder	Nextworks	Ingenious
Ignacio Lacalle Úbeda	UPV	ASSIST-IoT
Carlos Coutinho	CMS	EFPF
Ingo Martens	Hanse Aerospace	EFPF
Alexandros Nizamis	CERTH	EFPF
Usman Wajid	Information Catalyst	EFPF
Higor Amario de Souza	UNIVESP	UNIVESP - Brazil
Ross Campbell	Information Catalyst	EFPF

The jury assessed the projects based on the criteria described in in section 3.4. For this purpose, the evaluation was supported via Google forms.

3.2.3. Teams

The rules of the Hackathon proposed a team to be formed individually or up to 6 persons. The team formation occurred before the Hackathon (due to the pandemic), in May 2022, after the selection of projects.

3.3. Typology of Projects and Pitching Material

The Hackathon, as a tool for experimentation, had the purpose to assist in experimenting and disseminating new business ideas, experiments, and prototypes as first step to best support next generation sustainable IoT solutions.

For this purpose, three types of projects have been considered:

- **Technical projects**: where the focus is on the development of a technical solution to address the challenge. The outcome shall be provided in the form of open-source code to be uploaded to the EU-IoT Hackathon git repository.
- **Training skills projects**: where the focus is on the development of a training tool to be available online which addresses the specific proposed challenge. Outcome can be a Web-based training tool; a Tutorial (e.g., PowerPoint, video), etc.
- **Prototype Business/Design ideas**: where the focus is on the development of a business framework for an IoT solution.

3.4. Evaluation Criteria

The evaluation criteria have been provided via the Hackathon operational rules document. Each member of the jury has been provided with an individual template for the evaluation and provided a grade between 1 (lower value) to 5 (higher value) to each criterium. The final grading was then the average of all jury members.

Technical projects:

- **Novelty:** How novel are the results compared to related work? **20%**
- **Reusability:** How easy is it for non-team members to replicate results? **30%**
- **Usability:** How user-friendly is the developed solution? **30%**
- **Community Impact:** In your opinion, how likely is this solution to be of interest to the community in the future? **20%**

Skills Training projects:

- **Novelty:** How novel is this tool in comparison to others that are similar? **10%**
- **Reusability:** How easy is it for non-team members to replicate results? **30%**
- **Reach:** What is the reach of the tool in terms of community range, e.g., 10 persons, 100 persons? **30%**
- **Resources:** How many trainers does the tool need? Would the training require specific equipment, software, etc.? **10%**
- **Quality:** Quality of developed material (slides, documentation, etc.) in terms of language, graphics, etc. **20%**

Business projects:

- **Value proposition:** Is the description clear? Is the product feasible and targets a real gap? How easily it can be duplicated? Is there a presence of potential substitutes for the product? **20%**
- **Market value:** Is there a genuine need for the product or service? How well

was the target market defined? What is the size and growth of the market? What is the consumers' willingness to pay for the product/service? **20%**

- **Creativity:** Is the problem addressed in a novel and creative way? **10%**
- **Feasibility:** Does the idea/proposal aspire towards clear, realistic, and achievable goals, while thinking big? Can it be implemented effectively? **20%**
- **Quality/Presentation:** Does the proposal engage the audience? Level of graphical quality? Exciting pitch/report? **10%**
- **Sustainability:** Does the proposal consider key EU sustainable goals, e.g., energy efficiency? Does it explain how it could break even or raise additional funding (economic sustainability)? Does it consider the different dimensions of financial and social sustainability in a conscientious manner? **10%**

4. CHALLENGES

The overall Hackathon challenges are provided in Table 3.

Table 3: List of challenges in the Hackathon.

Reference	Title	Description	Tooling
EFPF1	Semantic matchmaking for the support of environmental monitoring of the shopfloor.	Validate and improve the interconnection between TSMatch and the EFPF Data spine.	TSMatch
EFPF2	Evaluate the EFPF SDK in developing digital smart manufacturing applications.	Rely on the EFPF SDK to create new applications.	EFPF SDK
EFPF3	Evaluate the usability of the Data Spine for the creation of composite applications	Test the EFPF Data Spine and its usability, proposing specific improvements.	EFPF Data Spine
EFPF4	Analyse industrial data coming from EFPF partners and provide insights based on the EFPF analytics tools.	Work with open-source Machine Learning Libraries and propose applications for the visualization and analysis of industrial data.	EFPF Visual and Data Analytics Tool and Open-source ML libraries

Reference	Title	Description	Tooling
EU-IoT1	EU-IoT1, IoT Interfaces: Augmented Reality Interfaces based on the Smart Mirror concept	Work with ML open-source solutions for Smart Mirrors, to develop a user-centric interface	MichMich MagicMirror[3]
EU-IoT2	Far Edge: sustainable IoT via TinyML	Develop ML applications for embedded devices	Tensorflow Lite[4], Pytorch[5], Renode[6]., Kenning[7].
EU-IoT3	Near Edge: sustainable MEC applications	Propose novel MEC applications based on the open ETSI MEC API	ETSI MEC API[8]
EU-IoT4	Infrastructure: simulating time-sensitive and deterministic networking IoT applications	Develop novel applications based on ns-3, fortiss deterministic wireless DetNetWiFi framework	Fortiss ns-3 DetNetWiFi framework
EU-IoT5	Data spaces: sustainable, user-centric smart mobility	Play with open data sets and open ML tooling for data analysis	Open mobility data[9] Crawdad datasets[10] Microsoft Geolife[11] Open Nebula

5. COMMUNITY OVERVIEW

5.1. Registered Participants

Figure 3 provides the registrant participation per country. The 141 registrants were well distributed across the globe; 32% were in India, while 12% were in Brazil. We highlight 21% described as “unknown”. In Europe, the countries with a larger

[3] https://github.com/MichMich/MagicMirror
[4] https://www.tensorflow.org/lite
[5] https://pytorch.org/mobile/home/
[6] https://renode.io/
[7] https://antmicro.com/blog/2021/06/kenning-edge-ai-framework/
[8] https://try-mec.etsi.org/
[9] https://openmobilitydata.org
[10] https://crawdad.org/
[11] https://www.microsoft.com/en-us/download/details.aspx?id=52367

database of registrants were Germany, Denmark, Portugal, and Sweden. The type of registrants is provided in Figure 4. Others (42%) comprises registrants that did not enter a profile, or where the profile was somewhat vague, e.g., innovator, ideator, network architectures. 27% of the registrants had a profile of full stack developer, and 13% are profiled as data scientists.

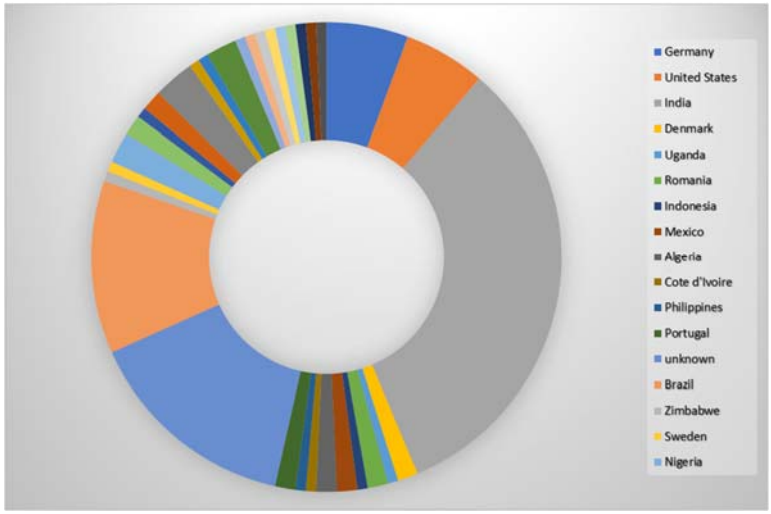

Figure 3: Hackathon Geographic community distribution.

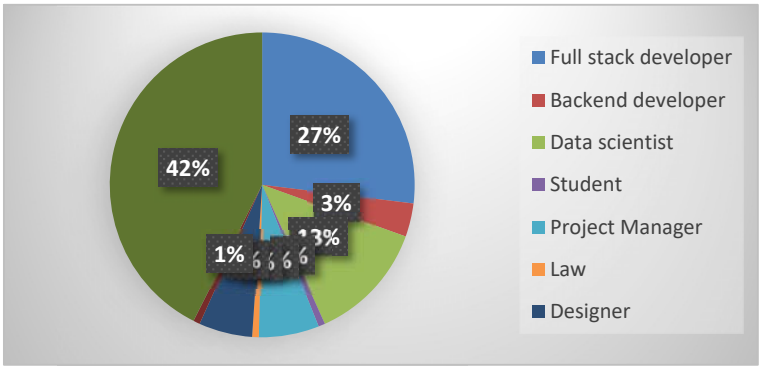

Figure 4: Participant profile.

5.2. Initial Team Formation

Out of the 141 registered participants, 31 participants registered projects having selected specific challenges to address. Out of these, 26 have been considered for team formation. The initial team formation is provided in Table 4 grouped per challenge. After the team number and name of the participant, the table lists whether the attendance is remote or not; if the participant brings a team; type of project; country and affiliation; profile of the participant. As can be seen, most participants were looking for a team.

Table 4: Initial team formation presented per challenge.

Nr	Name	Attendance	Team	Type	Country	Affiliation	Profile
EFPF1: Semantic Matchmaking with TSMatch							
1	Hassannasrallah Berguellah	Remote	Yes	Technical	Algeria		front-end developer
2	Cassio Dias	Remote	Yes	Technical	Brazil	UNIVESP	Student
EFPF SDK							
3	Sudhir Kshirsagar	Remote	No	Technical	CA, USA	University of Illinois at Urbana-Champaign	student
4	Hong Tran	Remote	No	Technical	Texas, USA	Wilmington University	Data Scientist
EFPF Data Spine							
5	Hong Tran	Remote	No	Business ideation	Texas, USA	Wilmington University	Data Scientist
EPF4: Data Analysis							
6	Bianca Gouveia Borges Rodrigues	Remote	No	Technical	Brazil	UNIVESP	Student
7	Hong Tran	Remote	No	Business ideation	Texas, USA	Wilmington University	Data Scientist

Nr	Name	Attendance	Team	Type	Country	Affiliation	Profile
8	Harsh Pandey	Remote	No	Business ideation	India	Vellore Institute of Technology	Data scientist
EU-IoT1: IoT interfaces, smart mirror							
9	Felipe da Silva Braz	Remote	Formed	Skills training	Brazil	UNIVESP	Student
	Ederson de Sordi Vigato	Remote	Formed		Brazil	UNIVESP	Student
	Gabriel Negri	Remote	Formed		Brazil	UNIVESP	Student
	José Angelo de Oliveira	Remote	Formed		Brazil	UNIVESP	Student
10	A. Kaviraj	Remote	Formed	Technical	India	sri vijay vidyalaya	Full-stack developer
	Sanijth Vishal S	Remote	Formed		India	sri vijay vidyalaya	Full-stack developer
	Narendra J	Remote	Formed		India	sri vijay vidyalaya	Full-stack developer
11	Marcelo with Alexander	Remote	Formed	Technical			
	Alexander Farias Molla Andrade	Remote	Formed		Brazil		
12	LOGESH KRISHNA R	Remote	No	Technical	India	Dr.Mahalingam College of Engineering and Technology	Data scientist
13	Nuno Edgar Nunes Fernandes	Remote	No	Business ideation	Portugal		Product Manager
14	Shahbaz Siddiqui	Remote	Formed	Business ideation	Pakhistan		
	Saif ul Islam		Formed		Pakhistan		

Nr	Name	Attendance	Team	Type	Country	Affiliation	Profile
15	Marceo Morales	Remote (Brazil)	No	Skills training	Brasil	UNIVESP	Student
16	Emerson Gomes Marques	Remote (Brazil)	No	Business ideation	Brazil	UNIVESP	Student
17	Shamaine M.		No	Technical			
	Shamaine M.		No	skills training			
EU-IoT2: Near Edge, TinyML							
18	Chongyu Zhang	Local (TUM)	Formed	Technical	Germany	TUM	Student
19	Warp Smith	Remote	No	Technical	IL, USA		
20	Paulo Furlan	Remote	No	Technical	Brazil	UNIVESP	Student
21	Ravinderdeep Singh	Remote	No	Technical	India	steppingstones sr. sec. school	Idea make, inventors, project presentation, project prototype, paper presentation
EU-IoT3: Infrastructure, ns-3 deterministic framework							
22	Muhammed S. Baldeh	Remote	No	Technical	Gambia		
EU-IoT5: Data Spaces, analysing mobility data							
23	Abhishek Gupta	Remote	No	Skills training			
24	Rohit Bazinga	Remote	No	Technical	UK		

Nr	Name	Attendance	Team	Type	Country	Affiliation	Profile
25	Bruno Lowczy	Remote	No	Business ideation	Brazil	UNIVESP	Student
26	Ishmael Ebiasah	Remote	No	Technical	Germany	University of Siegen	Designer

5.3. Final Team Formation

Each of the candidates selected has then been directly contacted several times, to assist in the team formation. The candidates were also in contact with potential mentors. The final list of teams is provided in Table 5. All of the participants confirmed their intention to participate in the Hackathon remotely or in presence. Each team has been assigned with 1 mentor and the teams in Brazil had an additional local mentor provided by partner FOR, to ensure a better technical support. The organizing team and mentors have then interacted until the Hackathon as needed.

Table 5: Final team formation.

Nr.	Name	Attendance	Team	Type	Country	Affiliation	Profile	Mentor 1	Mentor 2
EFPF1: Semantic Matchmaking with TSMatch									
1	Paulo Roberto Rodrigues Furlan	Remote	Formed	Technical	Brazil	UNIVESP	Student	Roberto Massi de Oliveira, UNIVESP	Erkan Karabulut, FOR
	Bianca Gouveia Borges Rodrigues	Remote	Formed		Brazil	UNIVESP	Student		
	Emerson Gomes Marques	Remote	Formed		Brazil	UNIVESP	Student		
EFPF2: EFPF SDK									

Nr.	Name	Attendance	Team	Type	Country	Affiliation	Profile	Mentor 1	Mentor 2
2	Sudhir Kshirsagar	Remote	No	Technical	CA, USA	University of Illinois at Urbana-Champaign	student	Miguel Tavares, CMS	
EPF4: Data Analysis									
3	Harsh Pandey	Remote	No	Business ideation	India	Vellore Institute of Technology	Data scientist	Nikos Vakakis, CERTH	Alexandros Nizamis, CERTH
EU-IoT1: IoT interfaces, smart mirror									
4	Felipe da Silva Braz	Remote	Formed	Skills training	Brazil	UNIVESP	Student	Higor Amaro de Souza, UNIVESP	Mitula Donga, FOR
	Gabriel Negri	Remote	Formed		Brazil	UNIVESP	Student		
	José Angelo de Oliveira	Remote	Formed		Brazil	UNIVESP	Student		
	Cassio Dias	Remote	Formed		Brazil	UNIVESP	Student		
5	Marcelo Moraes	Remote	Formed	Skills Training	Brazil	UNIVESP	Student	Cecilia Sousa Peixoto, UNIVESP	
	Alexander Farias Molla Andrade	Remote	Formed		Brazil	UNIVESP	Student		

Nr.	Name	Attendance	Team	Type	Country	Affiliation	Profile	Mentor 1	Mentor 2
6	Saif ul Islam	Remote	Formed	Business ideation				Emilie Jakobson, Aarhus University	
7	Nuno Edgar Nunes Fermandes	Remote		Business ideation			Product manager	Brenda n Rowan, Bluspecs	
8	Kaviraj Logesh	Remote	Formed	Technical	India	sri vijay vidyalaya	Full-stack developer	Parwinder Singh, Aarhus University	
	Sanijth Vishal S	Remote	Formed		India	sri vijay vidyalaya	Full-stack developer		
	Narendra J	Remote	Formed		India	sri vijay vidyalaya	Full-stack developer		
9	Logesh Khrishna R.	Remote	No	Technical	India	Dr. Mahalingam College of Engineering and Technology	Data scientist	Mitula Donga, FOR	
EU-IoT2: Far Edge, TinyML									
10	Chongyu Zhang	In person	Formed	Technical	Germany	TUM	Student	Dushyant Dave, FOR	

Nr.	Name	Attendance	Team	Type	Country	Affiliation	Profile	Mentor 1	Mentor 2
11	Warp Smith	Remote	No	Technical	IL, USA			Jon Soldatos, Netsoft - Intrasoft	
12	Ravinderdeep Singh	Remote	No	Technical	India	steppingstones sr. sec. school	Idea maker, inventors, project presentation, project prototype, paper presentation	Victor Banos, FOR	
EU-IoT5: Data Spaces, analysing mobility data									
13	Bruno Lowczy	Remote	No	Business ideaiton	Brasil	UNIVESP	Student	Jose Placa, UNIVESP	Victor Banos, FOR

6. HACKATHON WINNING PROJECTS AND AWARDS

The three winning projects, available via the Hackathon GitLab, were as follows:

1. **Sustainable Irrigation, skills training project**. Team 4, Cassio Dias, Felipe da Silva Braz, Gabriel Negri, Jose Angelo de Oliveira, UNIVESP, Brazil.

- Anomaly Detection. Team 2: Sudhir Kshirsagar, University of Illinois at Urbana-Champaign, USA

3. Green Backup. Team 3: Bruno Lowczy, UNIVESP, Brazil

The list of awards that has been provided is as follows:

- **First Team Awards:**
  - UnternehmerTUM TUM Award - Entrepreneurship and Incubation for 1 year, valued in 10000 Euros.
  - EFPF Challenges Award - 1st prize – 1 Google Pixel 6
- **Second team Awards:**
  - IoT Forum voucher for 1 person, IoT Week 2023, provided via the IoT Forum (Aarhus University)
  - EFPF Challenges Award, 2nd prize - Google Next HUB 2nd generation smart display and Google Chromecast Stream player, and 2 Google Nest Audio Smart Speakers
- **Third team:**
  - EFPF Challenges Award - 3rd prize, Arduino Kit Explore
  - IoT Kit (English) Education and a set of 40 sensors for Arduino projects, plus Arduino® Sensor Kit - Base with Shield and 10 Grove Sensors, Arduino® Sensor Kit - Base with Shield and 10 Grove Sensors

All teams have also been provided with the following IoT kits, sponsored by **Infineon**:

- Infineon Kit I(PSoC™ 62S2 Wi-Fi BT Pioneer Kit (CY8CKIT-062S2-43012) and IoT Sense Expansion Kit. CY8CKIT-062S2-43012 and 10x CY8CKIT-028-SENSE. The PSoC™ 62S2 Wi-Fi BT Pioneer Kit (CY8CKIT-062S2-43012) is a low-cost hardware platform that enables design and debug of the PSoC™ 62 MCU and the Murata 1LV Module (CYW43012 Wi-Fi + Bluetooth Combo Chip). The IoT sense expansion kit (Y8CKIT-028-SENSE) is a low-cost Arduino™ UNO compatible shield board that can be used to easily interface a variety of sensors with the PSoC™ 6 MCU platform, specifically targeted for audio and machine learning applications.
- Infineon Kit II CY8CPROTO-062-4343W. PSoC™ 6 Wi-Fi BT Prototyping Kit (CY8CPROTO-062-4343W) is a low-cost hardware platform that enables design and debug of PSoC™ 6 MCUs. It comes with a CY8CMOD-062-4343W module, industry-leading CAPSENSE™ for touch buttons and slider, on-board debugger/programmer with KitProg3, microSD card interface, 512-Mb Quad-SPI NOR flash, PDM microphone,

and a thermistor. It also includes a Murata LBEE5KL1DX module, based on the CYW4343W combo device.

7. HACKATHON HIGHLIGHTS

Figure 5: Hackathon mentors during the project development.

Figure 6: Hackathon mentors in Munich and remotely.

Figure 7: TSMatch demonstration at the fortiss IIoT Lab, during the Hackathon.

Figure 8: EFPF partners, Hackathon ceremony.

Figure 9: Hackathon awards.

Author Biographies

Rute C. Sofia (PhD 2004) is the Industrial IoT Head at fortiss - research institute of the Free State of Bavaria for software intensive services and systems in Munich, Germany. She is also an Invited Associate Professor of University Lusófona de Humanidades e Tecnologias, and an Associate Researcher at ISTAR, Instituto Universitário de Lisboa. Rute's research background has been developed on industrial and on academic context, and she has co-founded COPELABS (2012-2019, Lisbon, Portugal), research unit which she also steered between 2013-2017. and where she was a Senior Researcher until 2019. She has co-founded Senception Lda (2013), a start-up focused on personal communication platforms. Her current research interests are: network architectures and protocols; IoT; edge computing; in-network computation; network mining. Rute holds over 60 peer-reviewed publications in her fields of expertise, and 9 patents.

She is an ACM Senior member and an IEEE Senior Member, and an ACM Europe Councillor. She is also an N2Women Awards Co-chair. Before COPELABS/ULHT,

she was a senior researcher at INESC TEC (07-10, Porto, Portugal), where she steered the "Internet Architectures and Networking" area of UTM, team dedicated to wireless/cellular networking architectures and to user-centric networking paradigms. She was (04-07, Munich, Germany) a senior research scientist in Siemens AG and Nokia-Siemens Networks GmbH, focusing on aspects such as: fixed-mobile convergence; carrier-grade Ethernet; QoS; IPv6 interoperability. Rute holds a BEng in Informatics Engineering by Universidade de Coimbra (1995); M.Sc. (1999) and Ph.D. (2004) in Informatics by Universidade de Lisboa. During her PhD studies, she was a visiting scholar (2000-2003) at Northwestern University (ICAIR) and at University of Pennsylvania

Ramjee Prasad, Fellow IEEE, IET, IETE, and WWRF, is a Professor of Future Technologies for Business Ecosystem Innovation (FT4BI) in the Department of Business Development and Technology Aarhus University, Herning, Denmark. He is the Founder President of the CTIF Global Capsule (CGC). He is also the Founder Chairman of the Global ICT Standardization Forum for India, established in 2009. He has been honoured by the University of Rome "Tor Vergata", Italy as a Distinguished Professor of the Department of Clinical Sciences and Translational Medicine on March 15, 2016. He is an Honorary Professor of the University of Cape Town, South Africa, and the University of KwaZulu-Natal, South Africa. He has received the Ridderkorset of Dannebrogordenen (Knight of the Dannebrog) in 2010 from the Danish Queen for the internationalization of top-class telecommunication research and education. He has received several international awards such as IEEE Communications Society Wireless Communications Technical Committee Recognition Award in 2003 for making a contribution in the field of "Personal, Wireless and Mobile Systems and Networks", Telenor's Research Award in 2005 for impressive merits, both academic and organizational within the field of wireless and personal communication, 2014 IEEE AESS Outstanding Organizational Leadership Award for: "Organizational Leadership in developing and globalizing the CTIF (Center for TeleInFrastruktur) Research Network", and so on. He has been the Project Coordinator of several EC projects, namely, MAGNET, MAGNET Beyond, eWALL. He has published more than 50 books, 1000 plus journal and conference publications, more than 15 patents, over 140 Ph.D. Graduates and a larger number of Masters (over 250). Several of his students are today worldwide telecommunication leaders themselves.

Paulo S. Rufino Henrique holds more than 20 years of experience working in telecommunications. His career began as a field engineer at UNISYS in Brazil, where he was born. There, Paulo worked for almost nine years in the Service Operations, repairing and installing corporative servers and networks before joining British Telecom (BT) Brazil. Paulo worked five years at BT Brazil managing MPLS networks, satellites (V-SAT), IP-Telephony for Tier 1 network operations. He became the Global Service Operations Manager during that period overseeing BT operations in EMEA, Americas, India, South Korea, South African, and China. After a successful career in Brazil, Paulo got transferred to the BT headquarters in London, where he worked for six and a half years as a service manager for Consumers Broadband in the UK and IPTV Ops manager for BT TV Sports channel. Additionally, during his tenure as IPTV Ops manager for BT, Paulo also participated in the BT project of launching the first UHD (4K) TV channel in the UK. He then joined Vodafone UK as a Quality Manager for Consumers Broadband Services and OTT platforms, and he worked in that capacity for almost two years. During his stay in London, Paulo completed a Post-graduation Degree at Brunel London University. His thesis was entitled 'TV Everywhere and the Streaming of UHD TV over 5G Networks & Performance Analysis'. Presently, Paulo Henrique holds the Head of Delivery and Operations position at Spideo, Paris, France. He is also a Ph.D. candidate under Professor Ramjee Prasad's supervision at Global CTIF Capsule, Department of Business, Aarhus University, Denmark. His research field is 6G Networks - Performance Analysis for Mobile Multimedia Services for the Future Wireless Technologies.