EMPATHY: Third International Workshop on Empowering People in Dealing with Internet of Things Ecosystems

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Abstract
Preface of the third International Workshop on Empowering People in Dealing with Internet of Things Ecosystems. The EMPATHY project has been funded by the Italian Ministry of Education, Universities and Research (MIUR) through a three-year basis research projects of national interest (PRIN) in 2017.

The environment in which we live is becoming more and more filled with smart objects and smart devices, able to exploit the Internet of Things (IoT) paradigm with low-cost sensors and actuators, linking the physical and the digital world. This phenomenon allows end-users to personalize automations and behaviours, generating opportunities but also issues due to the complexity of such systems and related to their customization and security.

The End User Development (EUD) approach concerns methods, techniques and tools that allow users who are nonprofessional software developers, to create, modify or extend their applications; in this way, by directly involving people that use IoT in their environments will bring out the empowering factors needed to design automations and manage dynamic combinations of sensors, objects, services, devices and people. It emerges the need to investigate different aspects of EUD, considering challenges presented by the level of control that a user can express when interacting with such technologies, ranging from the completely automated approach fostered by AI to the possibility to personalize the behaviors with different graininess, taking into account differences and needs related to each user and each application.

To support EUD in the IoT setting satisfying end-users needs, tailoring frameworks easy to learn that allow configuration and customization of applications must be studied and developed, with the aim to improve the user experience. Solutions that employ visual trigger-action programming have proven suitable for user-centric approaches, however, critical aspects remain to be investigated such as complex dynamics understanding by non-programmer users; moreover, the large and continuous data flow coming from IoT sensors poses privacy and security issues involving connected systems that impact on the well-being and livability of our lives.

The EMPATHY project, funded by the *Italian Ministry of Education, Universities and Research* (MIUR) in 2017, aims at exploring solutions to personalize IoT environments and provide users with control of the automation in their everyday life; under this project, a namesake workshop was held co-located with AVI 2020 conference followed by its second edition held in conjunction with IFIP INTERACT 2021 conference. Following the success of the two previous editions, this third edition held in conjunction with AVI 2022 conference aims at further investigating such topics, for opening the discussion to all interested researchers and practitioner and to serve as a venue for sharing ideas on solutions to personalize the behavior of IoT systems.

This third workshop received 10 valid submissions that involve more than 35 researchers and sees a conspicuous participation of foreign researchers, in fact, six papers come from Italian universities and research institutions and four belong to the University of Bristol (United Kingdom), University of Calgary (Canada), University of Jena (Germany) and Maynooth University (Ireland). The 10 accepted short papers are published in these proceedings after being presented in presence featuring fruitful discussions among authors and attendees. The order in which they are presented below reflects the two macro themes with which they were organized in the workshop program, i.e. six papers concerning the development of IoT systems and smart objects and four papers related to the user's role and his interactions within the IoT environments.

The work of *Fabrizio Balducci, Paolo Buono, Maria F. Costabile, Giuseppe Desolda, Rosa Lanzilotti, Nicole Novielli and Antonio Piccinno* introduces an IoT-based game for cultural sites which aims to improve the visitors' User eXperiences through tangible interaction with 'smart' artifacts that help to engage visitors and encourage their attention;

Benedetta Catricalà, Davide Coffaro, Marco Manca, Andrea Mattioli, Fabio Paternò and Carmen Santoro exploit Ambient Assisted Living (AAL) solutions to stimulate the cognitive resources of older adults developing a serious game useful for training human memory, attention, processing, and planning activities delivered through humanoid robots based on IoT technologies;

The *Lorans Alabood and Frank Maurer* work exploits IoT for creating a customized smart home system for seniors with neurocognitive disorders (SwNCDs) such as dementia and Alzheimer, using an immersive hands-free and head-mounted mixed reality device that supports the daily living activities completion while interacting with smart objects;

Azeema Yaseen and Joseph Timoney introduce the Internet of Musical Things (IoMusT) paradigm that uses technology to support novel musical and artistic experiences and, within the context of healthcare, they remodel IoT devices and exploit ubiquitous musical interaction design for music therapies;

Bernardo Breve, Gaetano Cimino and Vincenzo Deufemia enable end-users to create Event-Condition-Action (ECA) rules and exploit classification models to identify security risks also providing explanation facilities;

With their paper, *Ren Manfredi, Margherita Andrao, Francesco Greco, Giuseppe Desolda, Barbara*

Treccani and Massimo Zancanaro propose a pilot study about strategies used by non-programmer users to detect and solve errors on trigger-action rules when customizing an IoT device;

The position paper by *Andrés Domínguez Hernández* considers that IoT nonexperts have become developers so that researchers must problematise considering users as a trivial and universal category, developing frameworks to grapple with the emerging actor ecologies;

Federica Cena, Cristina Gena, Claudio Mattutino, Michele Mioli, Barbara Treccani, Fabiana Vernero and Massimo Zancanaro inquire how personality traits such as Need for Cognition, Locus of Control, Mindset and Self-efficacy could impact the perception, acceptance and appreciation of recommendations when provided to support configuration tasks in the EUD context;

Thomas M. Prinz argues that, in the IoT environment, languages for non-technical users should create correct processes avoiding deadlocks and abundances at runtime; learning from business process management and compiler theory, loop decomposition and a process query language become necessary allowing reuse and share;

Finally, *Diego Morra and Mehdi Rizvi* investigate the need of educating young generations to a reflective attitude toward technology through IoTgo, an end-user development design toolkit that helps young generations to become protagonist in the design of inclusive smart things.

We plan to organize a new edition of the EMPATHY workshop in the near future with the aim to present the final results at the natural conclusion of the project, continuing the exploration and discussion of novel solutions, perspectives and challenges in empowering people in dealing with internet of things technologies and ecosystems.

The workshop organizers,

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- Bernardo Breve, University of Salerno
- Federica Cena, University of Torino
- Andrea Mattioli, CNR-ISTI
- Mehdi Rizvi, Politecnico of Milano