



Special issue on *Ambient Intelligence in the IoT: Convergence Trends and Challenges (AmIoT)*

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The Internet of Things provides a plethora of different devices interacting with people, with other devices and with the physical environment. In this sense, IoT paradigm draws a data-driven future very challenging for researchers from diverse fields and specializations, such as data scientists, communications engineers, electrical and electronics engineers and specialists in interdisciplinary areas such as sociology, health, context-aware computing, IT process or data security management, among others.

We are going through a time when we are witnessing the change from the “Age of Data”, generating an abrupt amount of data from IoT systems embedded into everyday things and activities, to the revolutionary “Age of Intelligence” where data is being contextualized for building environments that engage with their users and learn about them. The smart environments we are talking about are able to make intelligent decisions and to deliver personalized services autonomously in anticipation of the user needs, enhancing their lifestyle and wellbeing. Collection, modelling, reasoning, and distribution of context in relation to IoT sensor data plays a critical role in this intelligent awareness process. The success of future IoT will depend on the efficient integration

of AmI properties in these systems in order to address the pain points of individual users, business and society.

The overall aim of this special issue has been to disseminate the latest researches, convergence trends and challenges contributing to the successful and pragmatic deployment of Ambient Intelligence in the IoT paradigm.

The special issue includes 11 papers, in the article, “Load balanced clustering scheme using hybrid metaheuristic technique for mobile sink based wireless sensor networks” the authors propose the design of a wireless sensor network focusing on a load-balanced clustering scheme which also resolves the left-out nodes problem. Their study proposes a hybrid meta-heuristic technique where best features of Artificial Bee Colony and Differential Evolution are combined to evaluate the best set of load-balanced cluster heads. For energy efficient and load-balanced clustering, a novel objective function is derived based on average energy, intra-cluster distance and delay parameters. Performance comparison of the proposed scheme with the existing three well known schemes is evaluated under different network scenarios.

The article entitled “Privacy-aware cloud service composition based on QoS optimization in Internet of Things” by Asghari et al. presents an IoT-based cloud service composition conceptual model regarding the privacy level computing model and a novel hybrid evolutionary algorithm using shuffled frog leaping algorithm (SFLA) and genetic algorithm (GA). The proposed algorithm is applied to optimize the suggested service composition in terms of aggregation of different QoS factors as fitness value. Simulation results revealed that the proposed approach improves the fitness in comparison to other contemporary algorithms.

In the article “Analysis of notations for modeling user interaction scenarios in ubiquitous collaborative systems” the authors review the three main visual notations proposed to model computer-mediated interaction scenarios and they present an experimental study that analyses not only the usability and usefulness of these notations, but also the tensions among these aspects. The study results help designers

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identify suitable user interaction representations to support the requirement elicitation and analysis during the development of context-awareness and ubiquitous collaborative systems.

For its part, in the article entitled “Informing the design of a LoRa™-based digital bracelet for the timely assistance of indigents” a qualitative study to get a preliminary understanding of indigents needs is performed. This is done by using a LoRa bracelet prototype to carry out evaluations that help to determine user perceptions about its usefulness and to measure the performance of the LoRa’s signal propagation and the battery energy consumption.

The article entitled “eeglib: computational analysis of cognitive performance during the use of video games” by Cabañero et al. explores the use of EEG and video games together to find what are the most used techniques when analyzing the signals by means of a systematic review. From the results of that review two partial contributions are then obtained: a taxonomy of techniques to analyze EEG signals, and a ranking of these techniques based on their popularity. The partial contributions are the departure point for working in the eeglib tool, a Python library to analyse EEG which is applicable to smart environments. The library was tested technically and functionally.

In the contribution “Design of smart objects of fear with a taxonomy of factors affecting the user experience of exposure therapy systems for small-animal phobias” a taxonomy of feedback factors that affect the experience of use of mixed reality systems for small-animal phobias is presented. The taxonomy comprises feedback factors in three categories, namely realism, interaction, and intensity; while considering: auditory, haptic and visual dimensions for each. The perceived usability of this design fiction world is validated with an expert in exposure therapy for small-animal phobias, whom perceived it as useful and correct. Finally, the author show how the use of the taxonomy makes possible to discuss the features of the proposed future technologies in terms of how they furnish each of the factors of the taxonomy.

Benítez-Guijarro et al. in the paper entitled “Architecting dietary intake monitoring as a service combining NLP and IoT” present a service-based architecture that helps to contrast and complement the descriptions of food intakes by means of connected smart home devices, coordinating all the stages during the process of recognizing food records provided in natural language. Additionally, the essential services that are required to automate the recording and subsequent processing of natural language descriptions of nutritional intakes in association with smart home devices are identified.

In the article “Supporting Asymmetric Interaction in the Age of Social Media” the authors Rodríguez et al. present the social message translator (SMT), a software system that allows addressing the interaction asymmetry between ad hoc

social applications and regular social media platforms. The message translation mechanisms of SMT, its security, and the usability and extensibility of its services have been evaluated through three empirical studies. The obtained results are highly positive, showing that SMT goes one step forward in the development of socio-domestic ubiquitous computing systems to support asymmetric social interaction.

In the paper entitled “Secure Ambient Intelligence Prototype for Airports” the authors deal with real-time analysis of certain environmental variables that may favour the reduction of health risks related to the deterioration of air quality. To this respect, a particular prototype of IoT device is developed characterized by the assembly of ambient sensors capable of measuring pollutant gases, temperature and humidity in the airport environment.

The authors in the paper “Enhancing Street-level Interactions in Smart Cities through Interactive and Modular Furniture” state that the concept of a smart city is evolving fast, in terms of technology adoption and user involvement. The new interactive objects that will be deployed in those smart environments to create street-level interactions are still dubious. Hence, they propose the implementation of a multifunctional digital system, in the form of smart furniture, to be deployed in the smart cities. The proposed smart object is a modular and customizable kiosk, resembling a totem, specifically designed to fit into this digital transformation and to respond to users’ needs by offering contextualized information and services.

Lastly, the paper “A Conceptual Framework for Smart Device-based Notifications” by López and Guerrero summarizes and concludes the efforts of a research project focusing on the use of smart devices as notification mechanisms. A framework is proposed to assist researchers and developers in the conceptualization of smart device-based notifications. Furthermore, the paper presents the results of three evaluations. First, it describes the results of a survey on the need for novel notification mechanisms and the utility of smart devices as notification delivery mechanisms. Second, the results of a quantitative assessment on the impact of notifications delivered through smart devices compared with notifications delivered through smartphones. Results show that smart devices are useful to deliver valuable information and the quantitative assessment discovered that there is no significant difference between smart devices and smartphones delivering notifications. Finally (third), the applicability of the framework was evaluated and considered useful by software developers.

To conclude, as Guest Editors, we would like to take this opportunity to thank all the authors for their efforts. In addition, we wish to express our gratitude to the referees who provided very useful and thoughtful feedback and our sincere thanks go to the Editor-in-Chief and other AIHC staff members for their support and guidance. We hope that you

enjoy reading these contributions within this Special Section and that the published work is inspirational in contributing to the progression of the state-of-the-art in Ambient Intelligence in the IoT.

Guest Editors

Prof. Gabriel Urzaiz Lares—Anáhuac Mayab University

Dr. Urzaiz received his BS (1986) in Computer Engineering at the National Autonomous University of Mexico and his MS (2009) and PhD (2012) in Advanced Computer Technologies at the Castilla-La Mancha University in Spain. His research activity is focused on computer networks, mainly for the integration of heterogeneous networks and their application in Ambient Intelligence and Ubiquitous Computing, always keeping in mind the ethical dimension of his contribution. Dr. Urzaiz is an associate researcher at the Modelling Ambient Intelligence (MAmI) Research Lab of the Castilla-La Mancha University. He is the author of several conference and journal papers, and he has also participated as a reviewer and guest editor of special issues (MDPI Sensors 2011, Springer LNCS 2013). Since 2011 he has participated in the organization of the International Conference on Ubiquitous Computing and Ambient Intelligence (UCAmI) as a member of the steering committee and the program committee. He served as the local chair of the conference in 2011 at the Riviera Maya in México. He has been the Director of the Computer Science School of the Anahuac Mayab University in Mexico, Research Professor and Postgraduate Academic Coordinator. His current position is as a full-time professor in the Engineering and Exact Sciences Division, primarily focused on teaching and student mentoring.

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Iván González is assistant professor (Ph.D lecturer) and researcher at the Castilla-La Mancha University (UCLM). He received his M.Sc. (2015) and Ph.D. (2018) degrees in Advanced Computer Technologies from the same University. Member of the MAmI (Modelling Ambient Intelligence) Research Group since 2013, Dr. González has been involved in several research and development of

International and National projects and contracts. He has participated in International conferences with 18 publications to date and he is author of 11 JCR research contributions. Member of research networks and scientific platforms related to Ubiquitous Computing and Ambient Intelligence (UBIHEALTH, AIAM, RedAmITIC and GITCE-UTP). He is currently performing research efforts focused on Quantitative Gait Analysis (QGA), Frailty assessment and Mild Cognitive Impairment (MCI) screening through mobile technologies and embodied sensors. His research interests also include Ubiquitous Computing, Smart Health, Smart Environments, Artificial Intelligence, IoT and Sensor Networks. Dr. González has years of experience organizing International conferences and R&D+I activities being one of the main organizers of UCAmI annual conference (since 2014). He has participated in the scientific committee of International conferences (7) and as a regular external reviewer of impact journals from research publishers (MDPI, Springer, Hindawi, SAGE, etc.). Also, he has been guest editor of 2 JCR-indexed special issues and Volume Editor of the UCAmI 2019 MDPI Proceedings. In the Educational field, Dr. González is coordinator of the Computer Engineering Degree at UCLM. His teaching covers the following subjects: Programming Fundamentals I and II, Operating Systems, Concurrent and Real-Time Programming, Multimedia and Human–Computer Interaction.

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