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Elena Navarro · Pascual González  
Davide Carneiro · António Pinto  
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# Ambient Intelligence – Software and Applications –, 9th International Symposium on Ambient Intelligence

# **Advances in Intelligent Systems and Computing**

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# Preface

This volume contains the proceedings of the 9th International Symposium on Ambient Intelligence (ISAmI 2018). The Symposium was held in Toledo, Spain, on June 20–22 at Campus Tecnológico de la Fábrica de Armas, University of Castilla-La Mancha.

ISAmI has been running annually and aiming to bring together researchers from various disciplines that constitute the scientific field of Ambient Intelligence to present and discuss the latest results, new ideas, projects, and lessons learned, namely in terms of software and applications, and aims to bring together researchers from various disciplines that are interested in all aspects of this area.

Ambient Intelligence is a recent paradigm emerging from Artificial Intelligence, where computers are used as proactive tools assisting people with their day-to-day activities, making everyone’s life more comfortable.

After a careful review, 48 papers from 15 different countries were selected to be presented in ISAmI 2018 at the conference and published in the proceedings. Each paper has been reviewed by, at least, three different reviewers, from an international committee composed of 165 members from 23 countries.

June 2018

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- Ambient Intelligence for e-Healthcare (AIfEh)
- Blockchain Technologies and Security (BTS)
- Non-intrusive Acquisition and Fusion of Context Information in Ambient Intelligence (Ni-AFCiA)
- Teaching and Learning with Ambient Intelligence Systems (TLAmIS)

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# Guimarães: Innovative and Engaged City

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**Abstract.** This paper addresses the theme of smart cities and all their influence on citizens. The concept of intelligent city is diverse, as it is influenced by the different technologies and solutions that provide citizens well-being. The solutions presented intend to go beyond the smart city definition, focusing on issues of citizen engagement, commitment and participation, walking towards the happy city definition. Artificial Intelligence, Cognitive Computing and IoT as basis for integrating innovative solutions.

**Keywords:** Smart cities · Information technology · Participation · Engagement Governance · Citizen · Citizenship

## 1 Introduction

More than half the population (54%) of the planet Earth lives today in urban areas. It is estimated that by 2050, 66% of the world's population lives in urban areas [1] and many of these urban areas of these urban areas are modern cities that face ever more challenges and opportunities because of this. Thus, all of us, as citizens and human beings, are increasingly observing an evolution of information technologies exponentially since the beginning of the 21st century using more and more information technologies to communicate and interact with the world around us, we are thus “techno-logical beings.”

A smart city uses information and communication technologies to improve the quality and performance of urban services, reduce costs and consume resources, but the most important thing is to engage more efficiently and actively with their citizens [2].

Through the combination of new technologies with the need to make cities more efficient and dynamic, citizen participation becomes vital to make cities more self-sustaining, that is, greater involvement of citizens in data collection and in providing support for specific tasks and the cooperation of human communities at the intellectual level to respond to challenges or to resolve certain more complex contexts [3].

A smart city implies intensive high technology and an advanced city that connects people, information and resources of the city using the new technologies in order to create a sustainable, competitive and innovative city for a recovery of the quality of life through a simple administration and efficient maintenance [4].

In the abstract thought, we can say that a smart city is a smart community, that is, a community where government, business, and residents understand the potential of information technology and make conscious decisions to make technology change their lives in a meaningful and positive way [5].



It's perfectly clear that the initiatives of an intelligent city are based on the improved functioning of urban performance through the use of data, information and information technologies that provide efficient services to its citizens [6].

Being a Smart City is to be a city open to citizens, businesses, science, innovation and the future. The Guimarães Smart City strategy has framed these different perspectives. The initiatives in Guimarães testify to this. The adhesion, reception, participation of both companies and academia, as well as the citizens and their associations are a manifestation of this.

This paper follows an organic orientation, allied to a thread that demonstrates city profile aligning it with innovation policies. The city presentation section, reveals that Guimarães has a strong momentum for innovation digital and smart city strategy and Industry 4.0.

The innovative and engaged city chapter shows that Guimarães is developing an integrated strategy as a digital and smart sustainable city. The basis for this strategy relies on city engagement and citizen participation concepts.

## **2 Guimaraes a Smarter City**

With a strong focus on the requalification of its territory and heritage, Guimarães is recognized as the birthplace of nationality and plays a central role in the history of the construction of Portugal, is internationally recognized as an example in the rehabilitation and preservation of its Historic Centre, having been distinguished in 2001 as Cultural Heritage of Humanity by UNESCO.

In 2012, Guimarães had the opportunity to show the world its history and culture, after being selected as European Capital of Culture. In the same year Guimarães obtained the Perfect City Award in connectivity and innovation promoted by Siemens and Vision Magazine. In 2013 received another distinction, as European City of Sport, the first in Portugal, a year where, in addition to promoting sports practice, it encouraged its citizens to become healthier, increasing their quality of life. In 2017 Guimarães was awarded ACEPI Navegantes XXI - Best Digital City Award, the Most Sustainable City in Portugal award.

The creation of a Mission Structure for Guimarães Sustainable linked City Hall, Universities, Institutions and people, resulting in an action plan for sustainable development, under the initiative of the Covenant of Mayors, has indelibly marked our future. Today, this is the hallmark of local political and governmental action - that institutions replicate and citizens interiorize on a daily basis – its purpose being to construct a greener and more sustainable territory. In 2017 Guimarães was considered, the most sustainable city in Portugal combining economic development with greening policies. In fact the City's Footprint calculation showed that Guimarães is becoming richer, greener and more sustainable.

With projects like “Guimarães Marca” that was launched to promote local industry internationally, by associating it to cultural heritage and environmental sustainability, Guimarães is becoming one of the most enterprising, innovative and industrial cities in

Portugal, showing a growth rate of around 10% and placing it in has fifth largest national exporter.

With this three vectors in mind, Guimarães has an objective of creating an incubator for the industry, creating a business development center for new entrepreneurs and industries wishing to develop innovative ideas, to work at the intersection between innovation and entrepreneurship by supporting industrial growth based on the added value of innovative ideas, to support technological startups and the industry, to work in the transformation of ideas into products and in the development of products and the scale-up phases. On the other hand, Guimarães industry incubator, wants to contribute to innovation in industry, creating laboratories open to universities and companies, with the objective of developing new ecosystems, helping to create new forms and methodologies for design and development, certification and manufacturing of materials and processes industries.

Energy efficiency measures also takes part of Guimarães vision. With the process of developing a Smart City strategy, to be submitted under H2020, Guimarães desires to leverage energy efficiency projects, like DREAM application that aims reduction of the use of fossil fuels, use of smart grids, efficient public lighting, among others, helping our city to develop and build on its strategic priorities. The Smart City strategy goal is to demonstrate district-wide solutions integrating smart homes and buildings, smart grids, energy storage, electric vehicles and intelligent charging infrastructures as well as the latest generation of ICT platforms based on open specifications. This is accompanied by energy efficiency measures and the use of large amounts of renewables at district level aiming to facilitate a successful transformation towards intelligent, user-oriented and demand-driven infrastructures and city services.

This strategy was designed with the objective of achieving sustainable development in the social, environmental and economic spheres. Thus, it attempts to identify, develop and enable the replication of balanced and integrated solutions. In order to manage the lines of action of the strategy, it was divided into three pillars depending on each other, namely: Structure, movement and environment. Guimarães digital strategy also targets problems that involve citizens, giving the opportunity for their voices to be heard by decision makers.

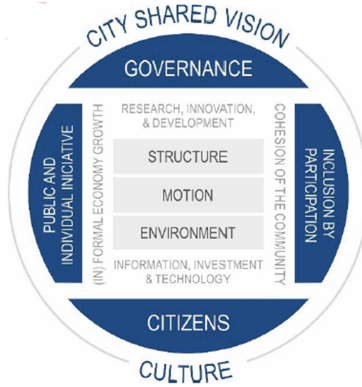
### **3 Innovative and Engaged City**

#### **3.1 Innovative City**

Guimarães has now a strong momentum for innovation and digital & smart strategy. This strategy aims to provide a sophisticated and technological innovation initiatives as a way to establish the common points so that, through them, it can emerge a better governance and dialogue with citizens in which urban reinvention, mobilization, equity, initiative, diversity, integration, attractiveness, investment and growth are the success factors. This allows the creation of policies and regulations, attracting investment, promoting the interest of potential stakeholders for the developing and continuously

revitalizing economic growth. Thus, the objective of achieving inclusion through participation in all spheres of initiative, brings benefits to the city and to improving its cohesion, involving citizens and making cities more resilient.

In the other hand, the Eco-Innovation and circular economy program demonstrates the city’s ability to reinvent itself even in times of crisis. This was achieved in the last five years, with the implementation of several innovative projects targeted at the management of the territory, cooperation and sharing of knowledge along with the definition of priorities based on sustainability and innovation (Fig. 1).



**Fig. 1** Innovation ecosystem

Guimarães was able to prepare infrastructures for the future and to align itself with the new European policies for the protection of the environment: DREAM H2020 candidacy, Gymnastics Academy, Guimarães for Circular Economy and R&D projects funded by PORTUGAL 2020 aiming to deal with waste on a large scale trough an integrated consortium of which the Guimarães Municipality is a part of.

With focus in all entrepreneurs who have an idea or business plan in a rural-based economic activity and who want to implement it in the county, Guimarães has created a Rural Base Incubator, which is a support service to early stage startups or companies especially dedicated to rural-based initiatives such as agriculture, agro industry, forestry or other services and technologies.

The City Hall promotes an Ecosystem of Innovation and Entrepreneurship, through the incubation of creative companies and industries in the so-called Creative Labs, or through the direct management of AvePark-Science and Technology Park, that includes: Discoveries Centre for Regeneration and Precision Medicine and Spin-off Park of Minho University among others.

Guimarães is a case study on this by the first joint strategy for preventive conservation of built cultural heritage within the South-West Europe Heritage care promoted by Institute for Science and Innovation for Bio-Sustainability.

It promotes knowledge transfer by being a strategic partner in Minho University center for technology transfer, as well as for the advanced qualification of employment in the region, setting up several cooperative projects.

In 2014, Guimarães created the Association for Sustainable Development - Landscape Laboratory, in partnership with two Universities. This R&D center, unique in the country – promotes knowledge and innovation, research and scientific dissemination in: Ecology, Hydraulics, Geography and Urban Environment, thus contributing to an integrated action for environmental policies and Sustainable Development.

Today, it is also a center of excellence in environmental education, also being the coordinator of PEGADAS (Education Project for Environmental Sustainability), headquarters the Mission Structure and promotes “Guimarães mais Verde” commitment.

Guimarães innovation ecosystem relies on knowledge as the driver for development. Therefore it is the municipality goal to improve the quality of life and urban environment, attractiveness (talent, resources, ideas, innovation, jobs, and entrepreneurship), openness to innovation, fostering creativeness, quality of public services, security and safety of public realm, intra-community dialog as keystones of success for the city. This can only be possible with an integrated approach supported by a solid strategy namely at the digital level.

Under transformation – at micro scale, every time a city function is transformed or upgraded – value is generated and innovation opportunities are fostered. Generating value from transformation makes cities to be an active (and not passive as in past) generator of economic added-value. Relying on innovation to achieve those urban functions transformations, cities are also providing industry, services and business with new opportunities of offering communities solutions that add even more value. This double added value generates economic growth acceleration and simultaneously consolidates the sustainability of increasing quality of life standards – for all citizens and needs.

For that reason, it has become clearer the importance of making research results more accessible to all, contributing to better and more efficient data, and to innovation in the public sector. With the innovation ecosystem along with a strong digital strategy including ICT tools, networks and media Guimarães will be able to be even more open, global, collaborative, creative and closer to society, which means more reproducibility, more transparency and more impact. This can be achieved with a process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools.

### **3.2 Engaged City**

Guimarães engaged city initiatives intends to plan, organize and implement municipal policies in urban and public space, social and community intervention, education, environment, culture and sport, providing services to citizens. In order to bring citizens closer, Guimarães created a set of digital initiatives [7], pointed towards transparency, simplicity and speed of access to the services provided by the municipality.

Making use of pioneering services, this ecosystem values the proximity relationship with citizens, reinforcing citizen interactivity, granting them tools to have access to the municipal services without having to go to the City Hall building.

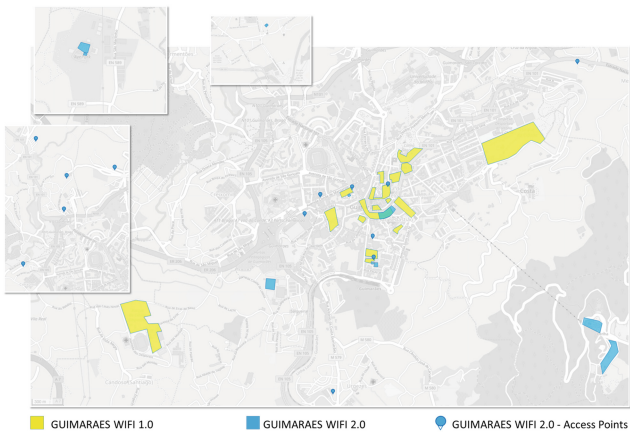
Guimarães engaged city objective is to develop innovative technological solutions and digital/social innovations, which tackle challenges faced by the daily difficulties of our citizens.

This framework is based on four important dimensions: social, digital, mobility and environment. This vectors should take benefits from technology, such as efficient and effective public services, innovation, sustainable growth, energy efficiency, environmental strategy, circular economy, optimization and efficient management process, better mobility solutions and better living environments for everyone, addressing and prioritizing it to real community problems and citizen’s empowerment.

Ensuring that a digital matured government is the future, and the use of electronic communications devices, computers and the Internet to provide public services to citizens, this framework intents to use digital interactions between a citizen and government to create a pioneer model that can be broken down into the following initiatives:

**Guimarães à Boleia** is a free car sharing platform that aims to contribute to a better environment, shaping the future of transportation, enabling users to gain short-term access to transportation on an as-needed basis, allowing citizens significant savings in mobility costs and gain a number of benefits, reducing costs related to transportation, decreasing the amount of time wasted trying to find park and allowing fewer cars to circulate on roads and consequently fewer CO2 emissions into the atmosphere.

**Guimarães Wi-Fi**, is a network of internet propagation, offering free access, with user registration, emerging as an innovation for the future, towards citizens and urban innovation. This project goals are to implement a set of state-of-the-art technological solutions related to the Wi-Fi network technologies in an urban context, making them accessible to citizens and tourists. In phase one, 23 hotspots were already implemented, covering the main areas of public interest, in phase two, Guimarães Wi-Fi will implement 20 more hotspots, covering more areas and extending the scope to the 9 villages (Fig. 2).



**Fig. 2** Guimarães Wi-Fi coverage area

**MyCity** platform is a web and mobile service that revolutionizes the notification and occurrence management process, allowing citizens to report the most varied situations related to the city public spaces. This model of civic participation enables citizen

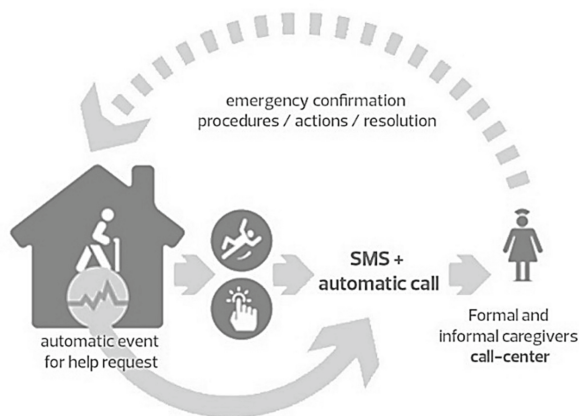
involvement in municipality management, allowing it to consult the evolution, follow up and be notified when occurrence status changed.

**Biodiversity GO!** it's a web and mobile platform, that aims to involve the entire community, both in conservation and in promoting the natural heritage of Guimarães, thus contributing to environment. It aims to engage the entire community, with a citizen-science concept it intends to catalogue and preserve the existing biodiversity helping the construction of the Guimarães Biodiversity Database.

**Guimarães Mobitur** is a mobile application that accompanies visitors in a visit to the city of Guimarães. With a radar navigation based on the current location, it provides a selection of points of interest and events in an interactive and different way. The new already in progress version will perceive the movement of users in physical space, integrating time-based georeferenced data monitoring framework providing a powerful tool in the decision-making processes of analysis, planning and tourism management [8].

**E-paper** is a dematerialization of urban operations, procedures and processes platform. E-paper gives citizens the possible to present in digital format, requirements/communications of allotment operations, urbanization processes, construction or demolition authorizations and other relevant licenses/authorizations.

**Guimarães 3000**, it's the first European project in the permanent elderly monitoring that aims to cover all the isolation situations identified in the "Guimarães 65+" program that aims to reduce sense of isolation, and increase the safety and active solidarity of elderly living alone. Provided with mobile communication and equipped with an SOS system, this device accompanies elderly promoting quality of life and well-being [9] (Fig. 3).



**Fig. 3** Guimarães 3000 system

**Allparking** system is a cooperation project with Guimarães Municipality and Quadri-látero Urbano, and consists on the installation of different parking sensors, which enables the collection of a large amount of information that can be used to improve mobility and quality of service, while at the same time raising the quality of life of citizens.