Workshop Proceedings of the 9th International Conference on Intelligent Environments
J.A. Botía and D. Charitos (Eds.)

doi:10.3233/978-1-61499-286-8-673

Towards the Sociable Smart City

Eleni CHRISTOPOULOU[a,1] and Dimitrios RINGAS[b]
[a] *Department of Computer Engineering & Informatics, University of Patras, Greece*
[b] *Department of Informatics, Ionian University, Greece*

Abstract. In this paper we present our vision on the Sociable Smart City. In our view cities are the people that inhabit them, their memories, stories, concerns and the culture that develops through their social interactions. The application of urban computing has a significant social and cultural impact on the city and on city life. Attempting to realise our vision, we designed and deployed CLIO, an urban computing system aiming to allow people to interact with the collective city memory. Our findings revealed that a system that exploits city infrastructure and both people's and artificial intelligence in order to empower and engage them in social activities may enhance citizen participation and sense of belonging as well as it may enable urban social interactions.

Keywords. Sociable smart city, urban informatics, mobile computing, smart city

1. What is a City?

A city can be regarded as a permanent installation, large enough and structured in order to facilitate the collective and social life.

A radical change in human evolution came when human selected to live in permanent settlements and early forms of cities started to appear. From a demographic perspective a city is defined by four characteristics: permanence, large population size, high population density and social heterogeneity [9]. A distinct characteristic of each city is its relation with the physical landscape; the surrounding environment and the way a city is structured and evolved, affect the unique character of a city. All cities offer certain functionalities; they may serve as political, religious and economical centres.

The diffusion of ubiquitous computing into modern cities and the massive use of mobile devices have shifted researchers vision to explore ideas about the cities of tomorrow; terms as "smarter cities", "iphone city", "sentient city", "digital cities", "intelligent cities" have emerged.

A city can be defined as smart when investments in human and social capital and transport and ICT communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement [2].

The characteristics of a smart city can span across all activities that occur in city life [4]:

[1] Corresponding Author: Eleni Christopoulou, Department of Computer Engineering and Informatics, University of Patras. Email: hristope@ceid.upatras.gr

- **smart economy** focusing on competitiveness, entrepreneurship and ability to transform
- **smart mobility** focusing on innovative and safe transport systems and availability of ICT infrastructure
- **smart environment** focusing on sustainable resource management and environmental protection
- **smart people** focusing on social and ethnic plurality, human capital and participation in public life
- **smart living** focusing on quality of life, social cohesion and cultural and educational facilities
- **smart governance** focusing on participation in decision-making and public and social services

A city can be regarded as intelligent when it combines the following three dimensions [6]; the *invidividuals' intelligence* and creativity, the *collective intelligence* of the city population as well as the *artificial intelligence* embedded into the city.

There is a wealth of paradigms applying ubiquitous, pervasive and mobile computing to urban spaces focusing on providing new services to citizens and enhancing their daily routine; many attempts envision and gain inspiration from the cities of the future. However, as urban computing lies on the intersection of architecture, social interaction and design of computer systems for use in urban areas [5], it does not plan the city of the future but it allows people to interact with their cities in novel ways aiming to shape and decide the future of their city.

2. Reaching the Sociable Smart City

Sociable: willing to talk and engage in activities with other people; friendly
(Oxford dictionary)

Sociable is a place that is friendly and attracts people to spend time on it. It is a place that encourages communication among people and fosters a convivial mood. It is a place where people can be extrovert and engage in outgoing activities. It is open and welcome, approachable for all.

The sociable space concept [1] relates the physical structure, the functions and the activities in an urban environment. The structure and infrastructure of a city determine connectivity and accessibility; the design of structure makes it possible for functions to be established. The space functions in various forms; it provides communal, public and commercial services, it offers greenery and recreational facilities, it presents historical and aesthetical elements. Functions act as catalysts, attract people, encourage activity and movement and enhance quality of life and culture.

Activities that occur in a space reflect its sociable character. A public open space invites people to spend their leisure time: discuss the news, share a meal, linger and meet, play a game. Unexpected activities happen breaking the routine and providing variety; on a scheduled route one can meet unexpectedly a friend and chat for a minute or witness a street art performance. Occasional events, like personal or public celebrations, festivals and cultural events, markets and fairs, intervene the daily activities and the space is transformed to adapt. A responsive and creating environment can provide a fertile ground for learning and challenge experiences. A calm and harmonious space allows for spending some comfort and resting time.

Activities occurring in an urban setting are the catalysts for social interactions. Interactions among people and between people and the physical space in a modern city shape the unique character of each city. Cities are not just infrastructure and services; while all modern cities share the same infrastructure and offer similar functions, each and every one has evolved a unique character reflected in everyday life and culture. Cities are the people that inhabit them, their memories, stories, concerns and the culture that develops through social interaction.

A sociable smart city by definition should offer a wealth of novel infrastructure and services, however the focus should not be on technology, but on people. ICT infrastructure and digital technologies may empower people to participate and engage them to act on collectively shared issues. Such a city assists people to develop a shared sense of belonging and a feeling of ownership and responsibility to improve their city. Digital tools and new media can connect people and their experiences with the city. City infrastructure may enable game activities, learning processes and cultural events. A primary definition for the sociable smart city follows.

A sociable smart city is one rich in infrastructure, which combines and exploits both people and artificial intelligence, empowering and engaging people in activities where urban social interactions thrive aiming to advance the quality of life and culture.

3. CLIO: A Case Study on Sociable Smart City

In this section we present CLIO, acronym for ColLective cIty memOry, an urban computing system aiming to invite people to share personal memories and allow them to interact with the collective city memory [8], [3]. Our aim was to study how urban computing alters the city, the perception of people about the city, the communication and interaction among people and the social and cultural impact on the city and on city life.

The collective city memory is a form of collective memory that is created through the interaction among individual memories attached to the city landscape; however it is the interaction among people and memories that is the most important factor in this process. In social groups this interaction is taking place with conversations and exchange of narratives, which lead to identifying common views and to creating groups of relevant memories. To achieve this on computer systems, memories have to be related to each other based on content, context or narrator. Collective memory is then transformed to collective city memory when it is attached to the urban landscape and acquires points of reference.

Memories shared on CLIO consist of content like photos, audio or video clips and text, and context information like place and time it refers to, relevant events, ratings, tags and comments. Memories context categorises them in themes and the user context is exploited to match users to memories and provide intelligent recommendations. CLIO is an urban computing system open to everyone who wishes to share personal memories and to place them on a map in order to contribute to the collective memory of a city. In order to successfully blend the collective city memory with the city landscape, CLIO has been offered via several interfaces.

A familiar web-based interface was initially used; this was suitable for the general public enabling people to browse memories based on web-based map applications and tag cloud views. In order to enable people to interact with the collective city memory in its physical space, while following the pace of a user traversing the city, we released an

Android-based mobile application. In Oulu we exploited the city's public ubiquitous infrastructure that included an array of public interactive displays [7], in order to blend the collective city memory into the city landscape and attract people to interact with it. An off-the-self augmented reality browser was exploited aiming to offer the users of CLIO an immersive experience.

3.1. Impact on social and cultural life of a city

Regarding CLIO as a system of a sociable smart city empowering and engaging people in activities involving social interactions, we assessed its social and cultural impact on the city life. Field experience from the in-the-wild deployment of CLIO in two different cities, Corfu and Oulu, proves its benefits to a city community regarding participation, engagement, sense of belonging, social interactions and intergenerational dialogue, as well its contribution to cultural heritage preservation [3], [8].

We approached participation studying first whether people share their personal memories. Field experience shows that people who interact with CLIO start conversations and exchange similar personal memories; those who are fluent with mobile technology may share their comments and memories on the system. This exhibits the need for novel means of collecting memories, simulating the traditional human-to-human communication in society. Additionally, the pattern of interaction positively indicated community appeal and engagement.

Interviews and observations revealed that CLIO might enhance the sense of belonging in a community. People are initially hesitant to interact with CLIO, however, once they get familiar with it they rate, comment and share similar memories thus expressing their need to share their attachment to a memory, a location or an event.

Both the variety of user interfaces and the city infrastructure affected the social interactions we witnessed. Most people experienced strong emotions like laughing or arguing, as they often felt connected with the memories they viewed. The existence of public displays as anchors in the physical space attracted people and facilitated social interactions. Another positive outcome was the promotion of intergenerational dialogue, as groups of different ages often compared their memories and experiences. Finally, interviews recorded many positive comments about the idea of capturing personal memories and preserving this part of city culture.

4. Realising the Vision of the Sociable Smart City

Experience with CLIO has shown that a system that exploits city infrastructure and both people's and artificial intelligence in order to empower and engage them in social activities may advance the quality of life and culture.

The city infrastructure has a vital role in empowering and engaging people in activities involving urban social interactions. Our case study shows that the lack of reliable communication infrastructure in Corfu often broke the user experience and discouraged further adoption. On the other hand, the plethora of communication and interaction means in Oulu attracted people and enhanced their experience with CLIO. These demonstrate that modern cities should invest in deploying infrastructure; open communication systems should be offered ensuring people's right to access and cloud based solutions should be adopted providing a number of services and applications.

In a sociable smart city both people and artificial intelligence is combined and exploited to leverage new forms of social interactions. In CLIO we have came across the need of adopting semantic web technologies for representing and reasoning on large amount of data. Particularly, contextual information poses the need for distributed and dynamic aggregation and interpretation of heterogeneous data. A well-suit solution when developing context-aware urban computing systems seems to be the adoption of semantic web and linked-data technologies for processing vast amount of information.

Urban social interactions reflect the sociable qualities of a city; rich social interactions strengthen the community. A sociable smart city seeks to promote such interactions aiming to advance the quality of social and cultural life. CLIO, a context-aware urban computing system that encompasses intelligent data management and smart exploitation of a city infrastructure, attracts and persuades people to participate in a social process of the public life, involves them in an engaging procedure of preserving a part of the city culture and strengthens their bonds with the community. The wide adoption of social networks exhibits the wish of people to share and communicate; the CLIO case study reveals that this is also feasible in the context of a city. Therefore, the introduction of innovative applications in social life has the potential to promote citizen participation, develop a shared sense of belonging, assist decision-making and organise people into collective goals.

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