



TOWARDS SMART CITY DEMOCRACY



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In this article, we discuss the current state of smart cities from a technological perspective. We argue that smart city developments are in a state of transition going from being technology-focused to now putting emphasis on the humans living in the cities. The transition is still latent in the smart city deployments, and we argue that quite a few existing as well as new smart city deployments are still relying on the old technology-focused approach to smart cities. We elaborate our own experiences in this particular field, and provide two concrete cases on how we are approaching citizen-empowering smart city technologies. Finally, we discuss how smart city technologies should respond to citizen needs.

Keywords: IoT, Smart city, empowering citizens, empowerment

INTRODUCTION

The Smart City concept has been around for some years now, aiming at establishing a digital layer alongside the urban infrastructure to make data about the city available to citizens, city authorities and industry. This digital layer allows the different city stakeholders to improve and create new innovative city services that ultimately aim at improving the experience and the way citizens live in the city context. The core digital layer is important as it gives the basis for building and improving these city services. The process



of creating these services must be as “democratic” as possible, i.e. with the close involvement of the city stakeholders including its citizens. This way, the impact of the envisioned services is optimised as we are addressing the real needs of the end-users of such digital services.

HUMANS EMERGE IN SMART CITIES

In recent years, the term smart city has emerged and is now widely (world-wide) used as a branding and marketing concept. The Smart City Expo in Barcelona is the latest example of this trend (Expo 2015). Up until now, the concept of smart city has primarily been evolving around technology, where

deployment of sensors and building of IT infrastructures has been in focus. This approach can be seen in cities like Barcelona in Spain, Chicago in US, and Songdo in South Korea. However, this technology-driven approach has proven not to reach its expected impact, as it lacks a bottom-up approach where the city stakeholders have a much more close involvement in this process. Cities should not just be instrumented with sensors or smart technological infrastructures, if there is no assessment of the citizens’ needs/barriers and therefore no certain impact on their quality of life.

Lately, this technology-focused approach has been shifting its focus into including the citizens

as a key element causing a change in the way we understand and approach smart cities. In essence, we have begun to initiate smart city activities by approaching citizens, and take this point of departure in a citizen participation paradigm. This particular approach is already on the European agenda, and several EU projects are now getting funding for doing research into this neo smart city approach. The Horizon2020 project OrganiCity (OrganiCity 2015) is a relevant example.

In the early days of smart city development, a large number of sensors have been deployed for the typical Smart X application, e.g. smart parking, smart irrigation or smart transportation (eg. around 20.000 sensors in the city of Santander in Spain), and numerous IT infrastructures have been built. Some people have marked this “first wave” of smart cities as “smart city classic”, and it actually seems that quite a few cities now have a valuable Internet of Things (IoT) infrastructure. Recognising that a lot of effort has been put into deployment, we can now move into the domain of how to actually exploit the smart cities for the common good. As a consequence, we have chosen to focus on the the human-centered approach to smart cities in this article. We argue that we are currently in a transition phase, where the smart city classic approach is still prevalent in most of the existing and new smart city initiatives. In the following we elaborate this argument further, and discuss pitfalls and opportunities.

HUMANS IN CYBER PHYSICAL SMART CITIES

In the neo smart city paradigm, one of the main points is citizen empowerment – how do we make cities better for citizens on their terms. Looking at existing smart city technologies that have found its way into the built environment, like intelligent street lighting and trash bins, it becomes clear that the smart city classic approach has been the way to go. A trash bin do not take humans into account, it only focuses on whether it is full or not, and sends a notification to the utility when it should be

emptied. Intelligent street lighting is all about reducing municipal costs, by replacing light bulbs with LEDs, and sensing people roaming the streets. The latter is another cost reduction feature, that makes lampposts only use electricity when it is mostly needed, i.e. when a human is near.

One could argue that the existing smart city infrastructures act mostly as cyber physical systems (a network of interacting technological devices reacting to in- and output from each other), where the only innovative part is that technology has succeeded in reducing humans to objects that can be measured, and used as inputs for the system to react according to a predefined behaviour. A natural consequence of this is that citizens actually become disempowered. Before intelligent street lighting was deployed, citizens could rely on lighting; if the street was lit, then it would stay that way, and if it was dark it would stay like that. As a human, it was possible to make a decision based on the visual information, and one could decide whether one would take the risk of walking in the dark – or one would maybe even prefer walking in the dark (for some this might feel more secure – ‘if I cannot see them, then they cannot see me either’). This type of decision-making is no longer possible. The street can be pitch dark when looking at it from a distance, but it will light up when a human approaches – the city becomes completely unreliable, as the system reacts in a default way without taking into account the preferences of each of the citizens. And, what about the person who wanted to walk in the dark? He would be “caught” by the light. Being placed at the epicentre of a light source can actually make you more vulnerable, because it becomes harder to see what is going on in the dark while people in the dark easily can locate you.

This is of course an extreme view of the smart city deployments, but most of the current deployments primarily consider humans as binary inputs to the system - not necessarily adding direct value to the citizens’ everyday life. Our critique is not a novel discovery, and Rob Van Kranenburg already



in 2008 referred to the tale of two cities: The story elaborates two possible outcomes of instrumenting the city with technology. One is how technology can be used to create a city of surveillance – the all-seeing eye – which monitors and autonomously adjusts the society. The other is about how technology is used as a support and help for the citizens themselves – e.g. they can access street cameras directly and scout for missing kids or check if someone is hiding around the corner (Kranenburg 2008).

Researchers and companies have started working on solutions that fit better the human-centric smart city approach. Concrete examples are the open source Geiger counter from Safecast (Safecast 2015), which empowers citizens to measure and make background radiation from e.g. Fukushima publicly available, and the recent emergence of open data platforms (Ckan 2015). Despite the fact that the human-centric approach of smart cities is emerging and becoming stronger, we still see quite a few technology deployments that adhere to the smart city classic approach. In the following section, we will discuss how to move

into the realm of humans, and provide two examples of our approach.

POWER TO THE PEOPLE

As already discussed in the previous sections, citizen empowerment has come into focus, but technology developers are still caught up in the smart city classic paradigm. We therefore have a gap between smart city deployments, and citizen empowerment. From our experiences we have learned that user empowerment emerges through transparency, flexibility, and adaptation to individuals' needs. This means, that a user should be able to understand what is going on, the technology should be capable of taking into account the heterogeneity of the environment, and it should be possible for the user to adjust a specific technological deployment. The latter is not just about enabling users to change color on a screen or subscribe to a newsletter - it is way more profound. Users should be able to make the technology support their explicit needs here and now. This means that a user should be able to turn on or off the street lighting, right now at this

specific location. He should be able to get the route home following the path of least pollution (not predicted pollution, the actual real-time pollution measurements). And it should be possible for him to seamlessly tap into the abundance of infrastructures and services right at hand (ex. using car sharing or couch-surfing).

We need to go to the next level of smart city technologies and now focus on citizens as being a rich reflective resource, and we need to co-create future solutions with them, not for them. It is the citizens who constitute the cities, and they should also have the key to unlock and manage it. At the Alexandra Institute, we are focusing on how to empower users through technology, and we are actively engaged in creating applications that foster real power to the people. In the following sections, we will elaborate further on two examples of projects and applications that demonstrate the work that has been carried out in the scope of our smart city activities.

SmartSantander

As mentioned above, SmartSantander is an FP7 EU project (SmartSantander 2015b) proposing a city-scale experimental research facility that also supports applications and services in a smart city context. The project envisioned the deployment of 20.000 sensors among different cities such as Belgrade (Serbia), Guildford (UK), Lübeck (Germany) and Santander in Spain. Different services and applications have been developed during the project. The different covered use cases (Santander 2012) include for instance smart parking, environmental monitoring and augmented reality scenarios.

One of its most relevant services that has had a large impact has been the "Participatory Sensing Service" (Gutiérrez et al. 2013). In this service, mobile phones of citizens are considered as resources that can both provide sensory data, such as accelerometer, noise, temperature and location, but also the users can feed the system with their input/knowledge, all in a fully anonymised way. In

this particular case, users can participate by sharing and being notified of events happening in the city (Pulse of the City), as an example sharing information about a cultural event in a particular location in the city, a traffic jam or even a problem that needs to be fixed. Also connected to this event-based platform are the Municipality of Santander and a local newspaper, which in the first case are connected to the platform in order to collect information about complaints/problems happening in the city and react upon it by sending someone to investigate and fix it. For the second case, the newspaper uses the platform both to publish the local news, as well as to retrieve the information of relevant events published by others as sources of information that can lead to new news articles. This application, called "Pace of the City" (SmartSantander 2015a), is available for both Android and iOS platforms and has been used actively by many citizens of Santander. What is most interesting and unique about this approach is the involvement of the citizens by giving them a voice to participate in the city's maintenance and development. They are essential in the smart city context and have the empowerment and the responsibility of participating in a democratic way in their cities.

Vote a lamppost

The concept Vote a lamppost (vlp) evolves around citizen empowerment, and our preliminary prototype is evolving around a voting system. A user can connect to the Vlp system, and provide a suggestion for changing the state of a lamppost. All other users can then vote the suggestion up or down. If more than 50% votes up, the lamp will change state. By empowering citizens through providing a democratic ability to control street lighting, the aim of vlp is to foster a different way of thinking about and acting in the city. It transforms the existing street lighting infrastructure from something that just exists in the background to an active platform that shifts the current municipality-citizen relationship, and in this manner moves away from the service provider-

consumer relation to making it more equal (Brynskov et al. 2014), which again fosters hyper-local social engagements. When people get power they also get responsibilities, which forces them to reflect and act intelligently (Foucault 1977). Since vlp is democratic there has to be an agreement on the state of a unique lamppost. One neighbor might want the light turned off (he is going to bed) while another wants it turned on because her daughter is coming home late. Decision-making is not only a question about optimization (reducing power consumption or making the streets safer), but also about human convenience.

Vote a lamppost is yet another intelligent street lighting application. The difference is that we have chosen to move the intelligence away from the lamppost, and instead put it into the hands of the citizens. We argue that street lighting should respond to immediate needs of citizens, and not just an intelligently thought out algorithm. Now that street lighting is becoming truly intelligent we can hand over the power to citizens – they can decide when they want their hyper local lamppost to be on, off or just dimmed.

TOWARDS TECHNOLOGICAL DEMOCRACY IN SMART CITIES

The two above-mentioned applications are examples of developments that focus on the citizens as being reflective individuals who act and live in the city. What has become clear to us during our work is that there might be a gap between how decision-makers and citizens perceive the city. From the municipal perspective, it seems that focus is on efficiency – how to reduce costs. From the citizens' perspective, it seems to be more about convenience and liveability. Through different smart city projects, we have seen that citizens actually care about their city, and they like participating in the making of the city if it creates an actual impact. By giving citizens a voice in the city, they become more engaged. This also puts quite a lot of responsibility back on the municipality, since citizens need to feel that they are making a difference. If a citizen reports a crack

in the asphalt of a bike lane, the municipality need to act reasonably fast and fix the problem. This trust and credibility relationship needs to be built (this is especially the case in southern Europe) and is paramount for the future developments of smart cities.

As an addition to the citizen-municipality relationship, smart city technologies can be seen as support for the citizen engagement. By adapting to individual needs, and by providing direct control to the citizens, ownership and responsibility will emerge. A consequence is a shift in the municipality-citizen relationship, which results in leveraging the, yet unexploited, resource of reflective and acting citizens.

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