

# Smart city and Internet of Things: Possible changes in the public space

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**Abstract.** This work aims to investigate the concept of smart city within the Internet of Things (IoT), and analyses possible transformations of urban space in areas of surveillance and control. As already seen regularly in the media, surveillance and control of data on the internet is a problem that affects personal freedom. If similar surveillance system is applied in the Internet of Things, where people, objects and environments are interconnected, exchanging a huge volume of data, the problem substantially increases due the possibility of more control over various aspects of people's lives. The purpose of this paper is to do a critical reflection about the consequences of the smart city regarding the public space and privacy of the inhabitants.

**Keywords:** smart city, internet of things, public space, privacy.

## Introduction

In the last two decades, the internet promoted several social, technological and economic changes, enabling new ways of communication in time and space. When it was restricted in the digital domain, the internet has caused a revolution in communication. Now that it is coming into the physical things and environments, the changes will be deeper and have even more impact. The new networks that gathers objects, spaces and people all connected are the so called Internet of Things (IoT), and it has just begun.

On the Internet of Things, physical objects and places are endowed with informational capacity and interconnected in digital networks of communication. Subcutaneous sensors, power management, wearable devices, such as clothing, watches and glasses, appliances, home automation, automobiles, bicycles, and streets and public spaces are able to collect and send data on the Internet.

It is a reality that is already visible in the present and it is expected to grow more and more in the next ten years. According to the Pew Research Center (Anderson and Rainie, 2014), in 2025 the Internet of Things should be part of everyday life. The “*info-communicative power*” of IoT “*widens its influence on the world and this on it, from anywhere. This produces a change in their behavior from this relationship. The object gain, so to speak, ‘life’*” [1].

It is noticeable that one of the concepts underlying the IoT is the ability to use resources and make intelligent decisions in a global field of information. This concept is evidenced in the use of the term “smart” to designate intelligent objects and applications related to the Internet of Things. Usually the smart objects or systems are associated with the incorporation of a processor, a unique identity, ability to connect and be controlled, so they can collect data and communicate in the digital networks. However, the digitization of everything opens up possibilities that deserve to be investigated, says Giselle Beiguelman:

*‘This will require profound technological changes and imposes a wide range of ethical and political discussions, since the idea that IP address (Internet Protocol) will be related to everything – from places to consumer objects - presupposes a tracking scale, and a degree of creative interconnectivity, unprecedented.’ [2]*

These issues bring an incisive debate about the definition of the limits between public and private spaces, since the current digital media already caused a blurring of places, when everything is connected to each other will be much more complex to realize the edges and distinguish the private from the public.

The reports of WikiLeaks and the experience with the web have shown that surveillance and collection of personal data by national security agencies and information companies have the capacity to monitor all activity in the digital environment. When this problem is extended to the Internet of Things the control and access to private information can be totalizing and a risk of a serious problem on personal freedom by making public the intimate life.

In this context in which objects, equipment, environments are interconnected through multi-sensory forms, the body's relationship with the networks will be more immersive, and truly the internet will be embedded in a more visceral way in the human life. Therefore it is necessary to rethink the relations that things will perform on other objects, places and people, operating remotely, and what political and ethical problems may surface. The most obvious problem is the production of emotional and personnel input that may be used in targeted advertisements or forms of governmental control and monitoring, as stated:

*‘There’s simply no way to forecast how these immense powers -- disproportionately accumulating in the hands of corporations seeking financial advantage and governments craving ever more control -- will be used. Chances are Big Data and the Internet of Things will make it harder for us to control our own lives, as we grow increasingly transparent to powerful corporations and government institutions that are becoming more opaque to us.’ [3]*

In the sense it is opportune to think about the presence of digital networks operating for the sake of the city. Information technology companies aligned with

polity are developing gadgets, instruments and tools of monitoring, surveillance and management of resources to be embedded in the urban structure. These apparatus are the keystones behind the controversial concept of *smart city*, advertised as a technological hope for a better life of the citizens.

### The proposal of the intelligent city

If the technological city of the future is called smart, the *normal* and traditional cities of nowadays lack for intelligence. So, what relies on the concept of a smart urban environment? There are many definitions of smart city, but the ideas of optimization and efficiency are common places in their descriptions.

The Intel Collaborative Research Institute investigates the “developing and deploying adaptive technologies that can optimize resource efficiency” [4] of the cities. The electronic company Siemens offers solutions to “optimize existing infrastructure, increase efficiency” of the urban space. The information technology company Cisco talks about “mutual and recurring solution improvement to optimize city operations and spending”, and aims to “deliver superior services with far greater efficiency” [5]. The project Microsoft CityNext is “designed to empower governments to create more-efficient city operations” and “to enable government administrators to optimize their citizen-centric services” [6].

It seems that the modernist *Charte d'Athènes* and its proposal of functional city still echoing in the desire for optimization and efficiency, which could only be achieved by digital technologies devices and services in the domain of smart cities. This ideal project of the city has autonomous decision-making process that knows exactly what to do in the correct time, and it is powered by IoT, where all systems are integrated. Water and energy management, traffic jam, accidents, crimes, riots, air pollution, climate, and all sort of events are intermediated by interconnected digital networks that process the better options to solve problems, regulating and keeping the city under control.

But this attempt of perfection achievement goes against the nature of human behavior that is influenced by all kind of unpredictable circumstances. The urbanist Adam Greenfield highlights that the smart city concept gives no space for spontaneity, the whole city and citizens are subject to follow strictly a master plan of efficiency:

*[...] everything those residents ever do — whether in public or in spaces and settings formerly thought of as private — can be sensed accurately, raised to the network without loss, and submitted to the consideration of some system capable of interpreting it appropriately. And furthermore, that all of these efforts can somehow, by means unspecified, avoid being skewed by the entropy, error and contingency that mark everything else that transpires inside history. [7]*

The fast growth of the urban population is a repeated argument used to justify the implementation of smart city technologies. The crescent rate of the world population

living in an urban space, will impact in more people using natural resources, more consumption of energy, production of waste, increase of transportation, and other basic needs, making more pressure on the city infrastructure and organization. So here comes into play the role of smart city, as stated by Smart City Institute of HEC-Ecole de Gestion de l'Université de Liège: *'The concept of "smart city" emerges more and more as a strategy to limit the problems inferred by the growth of the urban population and to find innovative solutions to meet this challenge'* [8]

Find out the innovative solutions can be understood as possibility of entrepreneurship. The smart city becomes a fertile ground for companies and business of information technology to implement their systems. The ambition of IBM does not seek a city market, but globally, as its campaign says: *"let's make a smarter planet, city by city."* It may sound strange that a single company could be a city administration partner everywhere in the world, with access to a large amount of data, including personal information. It is an enormous power concentrated in the hands of a few. Multinational corporations already mentioned before, like Cisco, Siemens, IBM, Microsoft, among others have developed products to transform the *normal* city into a sophisticated and interconnected city.

### **Big brother effect**

In Brazil there are two ongoing projects led by government and big information technology companies that are a clear example of IoT resources applied into the city environment: the *Operation Center* in Rio de Janeiro was developed by IBM; and *Detecta* in São Paulo was developed by Microsoft.

The Operation Center in Rio de Janeiro was built to monitor flood and rain problems that seasonably cause landslide and human loss, but has evolved to a more complex center of information to work during the Soccer World Cup in 2014 and the Olympic Games in 2016. There are 30 government agencies, like civil defense, transit department, security forces, police, fireman, urban cleaning, and concessionaires like subway, energy, road company, and others working together and integrated in the same place. These agencies share in real time the images of about one thousand surveillance cameras spread all over the city of Rio de Janeiro. There are sensors in the city to collect climate data. The Operation Center gets satellite information and meteorological data. Google has developed an especial map system that helps to cross the data and visualize geolocated events. Everything is displayed in the huge screen of the control room, round the clock, seven days per week (Fig. 1).



**Fig. 1.** The room of control at Operation Center of Rio de Janeiro

The website interface of Operation Center has indicators of the normality level of the city, bulletin updated regularly for download, traffic jam alerts, weather forecast, security guides, meteorological maps, and the user can view living cameras (Fig. 2). All these data are published in real time. The mobile app *Olhos da cidade* (Eyes of the city) allows the users to share information about incidents and problems on the city.

It looks like an amazing technological control room with integrated services, all connected in digital networks. It is a complex infrastructure. The operators can see the traffic light colors, send text information to the electronic-message sign. When there's rain with risk of landslide they can play an alarm, send SMS to the residents. The Operation Center has indeed a great capacity of control and surveillance.



Fig. 2. The web interface of Operation Center of Rio de Janeiro

*Detectais* based in the security program Digital Awareness System (DAS) developed by Microsoft and New York Police Department, and last year was installed in São Paulo. The system can identify thousands of crime patterns and track suspects, read car's license plate, with a crossed database from the different police forces and from emergency telephone callings (Fig. 3). The DAS has image algorithms to do a filter search of suspects, for instance the color of clothes and personal characteristics. It looks for abandoned packages, suspect behavior, and like in the science fiction movie *Minority Report*, could avoid a crime to happen.



**Fig. 3.**Police operation center of São Paulo. Photo: Diogo Moreira

The project *Detecta* has hundreds of surveillance camera from the police and public institutions and will be integrated with cameras from shops, residential condominium and private organizations. The police agents operating on the streets have computers that receives reports about suspects, robbery, crime, missing people, riots, protests, and once again, all the information are connect in digital networks of communication.

The eye of the State are becoming more present in the daily life, with a more sharp view to observe what the citizens are doing, and eventually take action to restrain their rights. In the name of the order, of the security and efficiency, it is consented that the privacy can be violated. And these issues are not only present in the government domain.

The polemic smart meter (of energy, water and gas) is facing resistance, among other reasons, because it shares thru a radio frequency network reports that could be recognized behavioral patterns, without resident's permission, and also run the risk to have the energy hacked. Another example, a practice already common for auto loans is to use engine interruption devices, "*technology that allows them to remotely disable a car*" in case of missing payment [9]. Using a mobile telephone or web browser in a computer, lenders can track where the car is, its movement, and interrupt the engine with a touch on the screen. The car owners have to be submitted to these procedures otherwise they can't get the car.

Antoni Martínez-Ballesté, Pablo A. Pérez-Martínez, and Agusti Solanas emphasize the importance of privacy on smart city because personal and sensitive information could be disclosed:

*'The fundamental rights of citizens should be guaranteed at all times. [...] Legislation is essential to guarantee the achievement of privacy within smart cities. Individuals must be aware of the ability of smart cities to silently gather a variety of information about them.'* [10]

## Conclusion

It is comprehensive that technology could be used to improve the quality of life and of the built environment. But the fundamentals rights of the citizens should not be forgotten. The excessive control of everything under a script of surveillance should not be a part of a city that is intended to be intelligent.

The smart city concept brings the question about what is left from private space. It is an important topic that should be discussed by architects, urban planners and students. The wall in the architecture design that was meant to divide the private and public spaces is no longer sufficient to establish such differentiation of space. When one thinks about the IoT systems and devices there's no boundary to avoid the algorithms search for private information.

The Internet of Things needs to be constantly criticized to ensure that the smart city is not about data collection to feed the surveillance systems. The digital networks of communications should be used to develop resources of creativity in the urban space. In this sense, architects and urban planners shall realize that the materials of construction in the smart city domain may be more than bricks and stones, but the focus of space design must remain on the people.

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