Smart Citizen

Open data, knowledge and production platforms in cities

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Abstract. **The relationship between technology and humans has been continuously changing in time. Since early ages humans created technologies in order to obtain resources, improve the conditions of their life, or adapt to changes in the environment. The first computers and CNC machines were invented in the middle of the XXth century, personal computers became commercial products on the 70’s, the Internet became a civilian tool in the 80’s, smartphones are becoming a massive product today; all these tools produced an evolution on how and for what we are using extended capabilities to relate ourselves with our environment and other humans. New tools are part of our everyday activities, giving us a vast access to the production (and consumption) of knowledge as never did before, and at the same time the opportunity to share that knowledge (information) from/to anywhere, at anytime, and by/for anyone. As we became information producers in the last decades, we will turn back into physical objects producers, turning bits into atoms through accessible and democratized means. The provision of tools for citizens could change the dependency of technology, in order develop a closer relationship between humans and machines, working together for a common purpose, both in the physical and the digital world, if its separation is not yet obsolete [2].**

**How we can cities create tools for the citizens to participate in the “production” of it?**

**How can we understand a new urban ecosystem in which the cycle of the matter is part of the inner city fabric?**

**Are we in the beginning of a second renaissance, or a high tech medieval age?**

Keywords:Personal fabrication, do it yourself (DIY), do it with others (DIWO), fab labs, smart cities, 3d printing, real time data, personal data collection, crowdsourcing.

Technology and Humans

From the early civilizations, technology has provided to humans an extension of their capabilities. From the first tools to acquire food (energy), produce fire, construct shelters, to the Greek Athenaeums, the first steam engine or the Sputnik, technology has extended exponentially our capabilities to study and understand our surrounding environment at different scales, from the microscope to the Hubble telescope. Nevertheless, humankind is becoming the biggest agent of change in the planet; acquiring capabilities to modify ecosystems as never before.Internet, ubiquitous computing and fabrication technologies advances are building up new ecosystems in the urban environment. Computers started to be transformational when they became personal and accessible to common people (at late 70’s and early 80’s). We certainly embedded personal computation in our lives by the use of devices, which have small computers to develop tasks in order to make our systems work. Internet was invented during the cold war for military and security reasons, which it was never used for; it became the most important invention during the last decades when it turned accessible and available to be used by anyone. PCs with Internet connectivity constructed the digital and informational era we are living in today [3]. The formula does not work when all these tools are just used for entertainment, advertising or to conquer other countries, porn industry helped to make the major improvements in live streaming and changed the online video industry, many other innovations were based on our basic instincts as humans like sex, food or war, and most of them coming from the development of the military industry [6].

Open source hardware and software are opening up innovative processes in cities, driven by citizens that become main actors in it by using real-time connected computation devices, and a new set of tools for invention and local production. Citizen self-empowerment through technology is playing a key role on the development of future cities and communities. The do it yourself (DIY) movement, collaborative invention (DIWO, do it with others), open hardware and open software are bringing a fascinating set of tools for everyone with a computer and connectivity. In this sense, the tools that have been used to go in and out of the digital world are now the main channels to act in the physical world, by connecting computers with machines that are able to transform bits into atoms in short periods of time. Distributed manufacturing is accelerating the process of industrial production from weeks to hours and minutes, but still in a lower scale in quantity. Low cost and easy to use minicomputers with sensors and actuators equipped with connectivity capabilities, which are sending real-time data of our environment and making it available to others; 1.5k USD 3D printers connected to our computers making objects in our living room; online open APIs for anyone to connect different online platforms in a single solution for specific needs are just examples of how we are in front of the most fascinating times for creation and innovation coming from ordinary people and not from NASA, DARPA or MIT engineers, or the military industry, as it happened in the past.

Smart Citizen. A Person and a Microcontroller Doing Things Together

We are in the times of Smart Cities, or at least this is what IBM, CISCO, ERICSSON or city councils are telling us in any large fair, congress or expo. Driverless cars, intelligent stoplights, expensive sensor networks, or buildings that talk to other buildings are just very few examples of the whole new market and business places that are being promoted in any major city in wealthy countries. The Smart City model is aiming the creation of new services and products to be delivered to the citizen, in closed packages that just need to be unwrapped to be used. The new Smart Cities industry is opening big business for big companies and governments, by the addition of new infrastructures, intelligent equipment and high-tech solutions for cities’ needs. The question comes when we stop for a second about the role of any citizen in a Smart City:

Should citizens be consumers of a new set of products and services?

Will citizens be able of understanding Smart Cities’ technologies when taking them from companies and governments as services?

Can citizens participate in a productive way in cities, by the use of ICT?

Those questions came out inside Fab Lab Barcelona and IAAC, and have been the inspirational causes for the development of the Smart Citizen project.

Smart Citizen is a platform for citizen’s participation in the production of cities based on open source tools for data capturing and sharing, distributed production systems based on 3d printing, and recycling and sharing obsolete products between citizens. The Smart Citizen project has being launched in July 2012 on a crowd-funding campaign by Fab Lab Barcelona, the Institute for Advanced Architecture of Catalonia, Hangar art production center, and Goteo crowd-funding platform, and has been successfully funded to be deployed in Barcelona in April of 2013.

The Smart Citizen project begins with the assumption that intelligent cities ("Smart Cities") have to be produced by intelligent citizens ("Smart Citizens"). The reason to fund collectively this project was basically to justify its own goal; if the project would not have any reception from the citizens then it would not be possible to develop it. The project achieved the development of the Smart Citizen Kit (SCK): an electronic board and shield based on Arduino (Open Hardware) that can capture environmental data and broadcast it to an online platform using Internet. It consists of a set of sensors, battery and WiFi antenna, and can be used by any citizen with no experience in electronics to understand the performance of its environment and share it with other citizens. At the same time, the kit has been designed to allow advanced users to add features and capabilities, depending on their needs, since it is adaptable and customizable according to each situation. Additional shields could be designed by any user and attach it to the main board.

For its first release, the SCK has been designed with a set of environmental sensors embedded in a shield. The separation of the board from the shield allows other collaborators to design new sets of shields which can have additional sensors, not considered in this iteration. The sensors available on the Smart Citizen Kit are:

-Humidity

Temperature

Nitrogen Dioxide

Carbon Monoxide

Sound pollution

Solar radiation (Solar Panel as a sensor)

Wavelength exposure (WiFi antenna as a sensor)

Battery charge level.

Considerations on platform’s implementation include the ownership of the data. At the moment the data architecture of Smart Citizen resides in COSM (former Pachube), which allows the free use of the API for the generation of optimized backend processes for data visualization and sharing. The ownership considerations include the distribution of the data in the city, by having a distributed version control system of that data in people’s houses, and not in centralized data rooms. These features will be included in future versions of Smart Citizen, now under development.

Locality: making the cloud to rain in my backyard. There are several projects related with personal data collection and sharing, or the Internet of Things, which can be found through the Internet and ordered from almost everywhere in the world. Some examples are: Twine, Ninja Blocks, Air Quality Egg or Sensor Drone; all these projects are brilliant examples of the possibilities of technology today, and how we can develop advanced tools that are not only coming from the industry but from enthusiasts scientists, who take their extra hours to develop technology and then make it economically available through different crowd-funding campaigns, disrupting into the traditional innovation processes and industries. All these projects are available online, they are in the cloud, but one single criticism we can make to them is the lack of community and localization, in a metaphor: the cloud does not make it rain on my backyard, or my front door. The geo-localization and community sense of the Smart Citizen project aims to locate users within a few kilometers radius, which can exchange and meet in the city, and compare their data or devices in order to improve the project in a larger scale. 200 backers supported the project in Barcelona through the crowd-funding campaign, finished on September 2012; additional kits will be distributed during 2013, and the aim is to make them permanently available through different open source hardware distribution platforms.

The project has been directed to Barcelona active citizenship (in the first phase), people with interests in the use of open source hardware and software, people with ideas to change the productive and management models which operate in the city, and institutions which want to investigate about new models of city dynamics. The goal is to extend the project beyond Barcelona city, and make it available to other cities in Spain and the world. In 2013, the project will be implemented in Santiago de Chile, Malaga, Lima, Caracas, and other cities of the world.

Smart Citizen will be extended to applications involving distributed 3D printing and manufacturing, and will add options to register resources like Fab Labs, Maker Spaces, Hacker Spaces, MakerBot 3d printers (www.makerbot.com/) or RepRap (reprap.org/wiki/RepRa/es), among others, and make them available as a service to manufacture in the city, understanding the city as a distributed production facility.

Cities and Crisis: The Fab City

Future development of cities should not only rely on the Smart City concept. The application of ICT in cities for its optimization has to be closely related with the citizen participation, in different scales. The appropriation of technology in people’s everyday life is a reality today; all our communications are based on mobile information through the use of smartphones. If we look back in 20 years, we will find out that the irruption of ubiquitous communication have created a new set of relations between people in cities. Today a phone is not only a phone, it is also a word processor, a blog publication tool, a video and photo camera, a journalism tool, or a geo-location tool, among many other applications. If we can use these tools to create impact around us, then the results will be unpredictable. Air quality awareness, sound pollution, fixtures on the streets and public services, efficiency in mobility, etc, all crowdsourced by the development of tools which can be embedded in our existing ones, without having to make major investment on infrastructures, expensive devices and unknown experts. The cities’ strategies should be focused to the delivery of platforms for active citizen participation, by the use of existing technology, and not high-tech fairy tales.

The XXth century industry development created a clear separation between production and consumption, producer and consumer, designer and user [5]. Nowadays we are hybridizing more and more all these concepts, by the introduction of production tools in our everyday lives [3]. Today, every major city has a Fab Lab, a MakerSpace, a TechShop or a HackerSpace within its borders. All these organizations are basically places, machines and people available for everyone to make whatever they want, in an individual basis or community scale. Fab Labs have been developed and curated by MIT and a worldwide network of institutions in all continents (there are around 150 Fab Labs in 35 countries in the world, doubling next year); Fab Labs have a curated inventory with digital fabrication machines and tools which allow everyone to share anything within the network, they are equipped with similar equipment and a set of components which allow to exchange files in bits format which actually represent atoms; the network is developing its own university through the Fab Academy, and is designing its own mechanisms of regional organization; Fab Labs are organized through communities, institutions and other organizations. Hacker Spaces and Maker Spaces are more free organization than the Fab Labs; they are more community based, and have not content curation, they serve as platforms for hackers and makers around the world to organize events, workshops and activities. Tech Shops are fabrication facilities, which work in gym format, in which members pay a monthly fee to have access to equipment and knowledge to develop design and fabrication projects. All these platforms are providing to anyone the means to make anything anywhere, and are growing in an exponential way in different countries of the world; these phenomena is similar to the appearance of personal computers, now named personal fabrication machines, which can lead the change of a productive model, from a centralized one to a distributed one [4]. If we consider the existing crisis in job creation, and the elimination of many traditional entities, which make the world to exist as we know it, about to collapse, then we can say that Jeremy Rifkin in *The end of work* was right [5]. Rifkin explained in 1995 how the massive unemployment by the replacement of the work of the man by the machine, is going to create the conditions for the reconstruction of society by community based self-organizations. According to Rifkin this will create the third sector, which is going to be able to provide new jobs based on services associated to the improvement of our everyday life.

The combination of an existing crisis situation in the western world with the appearance of this new movement of DIY and DIWO, is creating an ecosystem for the active participation of citizens in the production of their cities, using technology as means for the production of wealth. If we are able to produce our own tools to improve our lives, then we can be the Smart Citizens.

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