Delivering Smart City Experience

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Abstract: In this paper, we briefly mention the problems that are led by urban development. We discuss the key concepts that is going to make a city smart and the fundamental components that have to be considered to deliver the smart city experience. We take Singapore as a case study to examine what kind of smart city practices are in action.

Keywords: Smart Cities, Pillars of Smart Cities, Singapore

1. Introduction

While the world population remains less than one billion until 1804, it increases dramatically in the following years [2]. Agricultural and Industrial Revolution, which began in England, was one of the reasons of this population growth by increasing the life expectancy of children and Industrial Revolution also accelerated the urbanization with the emergence of factories that contributed to the migration of vast number of labors from rural areas into cities in search of work in the factories [3]. Now, according to the United Nations World Urbanization Prospects report, more than half of the world population lives in cities [4]. Urban population growth led to the challenges, which affects the quality of life of the people living in cities, such as urban density, aging population, environmental impact, increased traffic congestion, overburdened healthcare system [10] [11].

We need to approach these problems differently. For example, one of our recourses to traffic congestion is adding the additional lanes, but it turned out that it does not work. Because more cars fill in that new lanes causing more congestion. This is the 20th century solution. In 21st century, we need to think differently about cars. Do we need to own car? Can cars drive themselves? Will we use cars on demand? These are the 21st century solutions [9].

2. What do we need to make a city smart?

What is a smart city? Today, in 2017, there is no agreed definition [9]. According to Wikipedia, the smart city is "an urban area that uses different type of electronic data collection sensors to supply information used to manage assets and resources efficiently" [1].

There is something really obvious in delivering smart city experience that the solutions are very specific to the city. Because every city has own problems and the solutions should be specific and localized [9]. However, regardless of the way how the solutions are implemented, there are some essential Information and Communication Technology (ICT) requirements to make a city smart [8]. These are [8] [12]:

- Fiber optic or wireless broadband internet should be available to all citizens and accessible across the city. Broadband internet connectivity is significant because it will be enabled to continuous data transmission between devices, data-centers and the digital applications that are built upon these exchanged data.
- Smart devices, agents, and sensors should be used to supply real-time data that will help the city make informed decisions.
- Web-based applications and e-services utilizing the data that is collected by the city-wide-sensors should be developed. Besides, e-services developed by various sectors such as local business, transportation, health services etc. are critical to creating smart urban spaces, energy-efficient buildings, safety and security services, traffic management.
- The data that is collected should be opened up to everyone who may want to consume it. Sharing the data can lead to helping smart city evolution by creating a competitive environment and delivering more social services.

To make a city smart, we need to consider about another most common term, Internet of Things (IoT). Because IoT is one of the technologies that is going to form our world and of course our cities. IoT integrates physical infrastructure with digital systems. In the context of smart cities, it plays a significant role in the applications of monitoring and data collection such as habitat monitoring, indoor and outdoor environmental monitoring, human health and well-being monitoring etc. [7].

In the cities, data can be produced by the variety of the sources such as smartphones, computers, environmental sensors, cameras, and even people. We call that data as big data. Big data has a great potential to find out problems directly from data itself through data analytics techniques. Furthermore, big data systems, which stores, processes, and mines the data in an effective manner to produce information, can be used to supply information that will allow to come out the better smart city applications [13].

3. How can we deliver the smart city experience?

Smart city developments have the trends as shown in Figure 1. There are also applications and services for the smart cities such as healthcare, transportation, smart education, and energy [13].
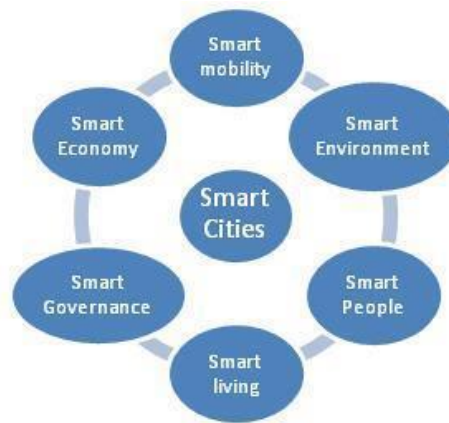

Figure 1 Six main pillars of smart cities [5]

Smart Mobility

When people began to give priority to their comfort, they started using cars to get around. The result of this trend is the traffic congestion in the urban areas. To solve this urban issue, optimizing only public transport is not enough, all transportation services need to be optimized within the city [14] and be simplified for city dwellers and visitors. This can be achieved by focusing on the basic transportation elements such as routes, travel information, shared transportation etc. [7]

Smart traffic management is one type of the implementation of smart mobility that utilizes the data, which is collected through various channels such as GPS-enabled devices, CCTV cameras etc., to reduce traffic congestion, to increase traffic safety and to detect suspicious car activities [7].

Smart People

People living in cities are a crucial parameter for smart cities to thrive because they have to possess the sufficient technical skills to benefit from the facilities provisioned by their smart cities [7]. Smart people means the improvement in the competence, lifelong learning, and developed educational system for city dwellers [5].

Smart people are also the people that participate in the sustainable development and the management of their cities, and they try to make their cities better places to live [16].

Smart Environment

Urban population growth exacerbates CO2 emissions levels, consumption of environmental resources and waste discharge. That's why, one of the greatest challenges of urban areas is supplying the environmental services, which are vital not only for the people living in cities but also for the people in rural areas, such as water, electricity, waste management etc. in a sustainable manner [15].

The smart environment can improve the quality of the environment, conserve natural sources, enhance pollution management, and adapt climate change impacts by benefiting from renewable energy sources, reducing the carbon emissions, and developing energy efficiency [5].

Smart Living

Smart living is about performing some fundamental factors such as health, housing, culture, safety, and education to develop greater places to live and work [7]. The idea of smart living is also related to making the buildings that we live in more harmonious with the people and environment [5].

Smart Governance

Smart governance encompasses giving people high-quality public services with the involvement of the public in the decision-making process, which is the main feature of smart governance, and doing government actions transparently [5].

In the concept of smart governance, government practices are focused on the elements such as openness, participation, accountability, effectiveness, and coherence. ICT plays a significant role in accomplishing these elements to deliver smart governance experience to the society [7].

Smart Economy

A smart economy is an economic approach whose drivers are innovation, art, culture, and cutting-edge technologies [5] [7].

In the smart economy model, the inhabitants of cities struggle to keep their natural sources management sustainable and they know without this its economy will not work expectedly [16].

4. What cities are delivering the smart city experience?

There are several cities that can be considered as the smart city around the world. Singapore is the most spectacular among them.

Singapore

Singapore is a city-state and an island nation situated in South-East Asia. After being assessed by eight different parameters, which are used to determine how smart a city is, such as CO2 emissions, energy consumption, environmental friendliness of buildings, transportation, water management, waste management, air quality and environmental governance, the city of Singapore deserves to be one of the smartest cities of the world. Singapore does not have the issue of traffic congestion that suffers many cities around the world, thanks to early planning, timely implementation of the projects and a large number of investments among the transportation modes [17].

Urban designers in Singapore utilize ICT, IoT and data analysis to deliver smart city experience to its citizen. They also have the ability to simulate their work on the 3D virtual design of Singapore in a computer. This enables urban designers to see what will happen when they apply their project to the city itself. Designers in Singapore use this virtual Singapore in many ways from determining the places where children care can be localized, to determining where would be better for solar panels, to modeling wing flow through the city. [6].

They take advantages of all features of sensors as much as they can. In Singapore, the whole city is covered with the sensors like it is in the human body and these sensors transmit the data that they collected to a central computer system to validate assumptions and to make more accurate decisions [6].

Designers in Singapore draw on a system called as smart elderly monitoring alert system to care elderly citizen when they are at home. This system benefits from multiple sensors and it can learn the movement patterns of the elderly person inside the home and if it detects a discrepancy between actual movements and the learned pattern, it will generate an alert by sending a notification to children or relatives of that elderly person [6].

What's more, Singapore realizes a healthcare service called telehealth. In the concept of this health service, patients do not have to go to the hospital. For example, they can perform their

physiotherapy sessions at home interactively with a nurse and with this healthcare service, it is possible to monitor heartbeat and blood pressure remotely [6].

5. Conclusions

Urban development cannot be stopped. Therefore, it seems that we will hear the word "smart city" much more in the ensuing years. Big data, data analysis, IoT, internet infrastructure and the people living in the city (smart people) are indispensable investments that must be done by governments to deliver the smart city experience. If we want a world greener, more livable in future, we have to work hard to deliver more "smart city experience" to city dwellers in advance.

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