CHAPTER 3

Pervasive Computing in Smart Cities

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3.1 INTRODUCTION

Pervasive computing is not a single technology, but a state. In the pervasive computing environment, with the help of various emerging science and technology, everything is interconnected, computing equipment and the environment are also integrated. These technologies provide technical support for the development of smart cities. People can participate more and better in the construction of smart cities. In this book chapter, the concept of smart city is introduced, including the four layers architecture of smart city and pervasive computing technology in smart city. Then the challenges and limitations in the current smart city projects are discussed. Finally, we summarise the development trends and future work of pervasive computing in smart cities.

3.2 RELATED WORKS

Against this backdrop, this section discussed several related works that contribute to pervasive computing in smart cities.

3.2.1 Pervasive Computing

Pervasive computing is also known as ubiquitous computing. It's not a single technology. It is very broad. Pervasive computing technology involves many communication technology, Internet of Things (IoT) technology, operating system, cloud computing,

big data analysis, artificial intelligence and other technologies (Rath, 2018). When we mention to connected devices, the first thing that comes to our mind are computers and mobile phones. In fact, various sensing devices are the most widely devices used in pervasive computing. These devices don't attract your attention in everyday life. Pervasive computing is just like that, every device can be used, with unlimited computing power, people can easily get the information they need. It serves you, but you don't notice its existence. Just like we need "electricity" anytime and anywhere, but you needn't to notice the existence.

3.2.2 Smart City

"Smart City" was first proposed by IBM. In 2008, IBM proposed the concept of "Smarter Planet" (Lenssen & Smith, 2019). The U.S. government elevated the "Smarter Planet" strategy to a national strategy (Wu, 2018). Smart cities are an integral part of realizing the "Smarter Planet". IBM believes that "smarter" refers to the application of a new generation of IT technology and sensing equipment to various fields such as government affairs, people's livelihood, medical care, education, transportation, etc. So that they can fully function, develop collaboratively, interact in real time, and generate wisdom, and finally make the world "smarter".

Many countries are carrying out the practice of "Smart City" projects. So far, more than 1,000 smart city projects have been launched worldwide (Law & Lynch, 2019). In the construction of smart city projects, IT infrastructure network construction is the foundation. In addition, countries have different key points and challenge according to the position and function of different city.

The construction of smart cities in Japan and Europe pays more attention to the protection of ecology and environment, and their vision is to build ecological smart cities through renewable energy and low carbon. Southeast Asian countries focus on high-tech industries. In 2006, Singapore launched the Intelligent Nation 2015 (iN2015) program. iN2015 hopes to

make the whole country "smart" through information technology. Malaysia builds the Multimedia Super Corridor project in smart city program (Yigitcanlar & Sarimin, 2015).

In smart city program, Singapore and Sweden have made great achievements in the field of intelligent transportation (Law & Lynch, 2019). In 1988, Singapore developed the Electric Road Pricing System, hoping to alleviate the problem of road congestion by charging traffic congestion charges. Later, Intelligent Traffic Monitoring System (ITMS) was developed to monitor road conditions in real time through devices such as sensors and cameras and predict traffic flow based on historical data and information collected in real time. Residents can obtain the prediction of traffic flow in the future and choose a more appropriate way to travel. In 2006, IBM cooperated with Stockholm, the capital of Sweden, designed and developed an intelligent charging system. By installing roadside control stations and IoT devices, the Highways Authority automatically charges vehicles entering and leaving the city centre during business hours. Through this policy, traffic congestion in the city of Stockholm has been reduced by a quarter, and queue times have been cut in half. More than that, due to the reduction of traffic flow, the emission of road traffic has also been significantly reduced, and the emission of carbon dioxide and other greenhouse gases has been greatly reduced. In 2010, it was named "European Green Capital".

The challenges and goals of smart city construction in different countries in the world are different, but all countries are trying to find better solutions.

3.2.3   Four Layers of Smart City

Smart cities take information as the core, and use cloud computing, big data, and other technologies to integrate and analyse the information collected in various ways, thereby providing more decision-making support for city managers and better services for residents. The perception layer for acquiring