

# Smart City of Wuxi: Current Situation and Future Plan

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**Abstract---**Based on the analysis of the global development of smart city and the demand of constructing smart city of Wuxi, the smart city of Wuxi is introduced from two perspectives: the current situation and future plan. The construction of smart city in Wuxi will focus on three fields, which are smart transportation, smart environmental protection and smart health. The development plan of these three fields is presented by considering the actual demands of Wuxi.

**Index Terms---** smart city, smart transportation, smart environmental protection, smart health, development planning

## 1. Introduction

Smart city refers to the new generation of information technology, synthetically using the internet of things (IoT), cloud computing, spatial information integration, etc. Its main features are digitization, intelligence, networking, interaction, collaboration and convergence. Through overall perception and interconnection among people and things along with their behaviors, it substantially optimizes and promotes the efficiency and effectiveness of city running system, creating a sustainable city with a better environment, more convenient life and more resource-saving.

City is the place where the essence of human civilization is gathering. In 1990, only 13% of the global population lived in cities and estimated reaches to 70% in 2050 [1]. The fast growth and gathering speed of population is bound to bring lots of challenges to city's traffic, environment, service, economy, etc. Nowadays, the cities in the world are facing many 'urban diseases', such as traffic jams, environmental degradation and medical treatment difficulties, etc. Smart city is a new idea and a new pattern to promote the intelligence of city planning, construction, management and intelligent service. It will promote the urban development more scientifically and more sufficiently and help to make people's life better, and to deal with a series of urban diseases, and to accelerate the harmonious development of city and society.

## 2. The construction situation of smart city in global

Since the concept of 'smart city' was proposed by IBM in 2008[2], the global development of smart city construction has been accelerated. Currently, more than

200 ‘smart city’ projects are being carried out. During the process of industry transformation and social development, developed countries and regions realized the prospective and advance feature of ‘smart city’, they proposed the strategic measure of constructing smart city. Now, some countries and regions, such the United States, Europe and Asia, are putting more efforts to construct smart city and opening a new mode of city development [3-5].

## **2.1 The development of smart city in the United States**

The U.S. is the initiator and forerunner of the smart city construction. Sooner after the concept of “smart planet” was proposed by IBM, the U.S. government raised it to the national strategic level.

### **2.1.1 Dubuque City**

Dubuque City, which lies in Iowa State, is an important railway junction city in the U.S.. The city signed a cooperation agreement with IBM in September 2009 and announced to construct the first city of “smart planet” in the U.S.. The city cooperates with IBM in the internet, IoT, the next generation of communications technology and some other fields. In public services like the public infrastructure of water, electricity, gas and traffic lights, the city’s overall perception and interconnection by information technology has been realized, which helps to collect the data of the usage and consumption of all kinds of resources. Based on the collected data, and the technique of data mining, resource supply and management pattern was improved in order to use and monitor the resources effectively.

### **2.1.2 Boulder City**

Boulder City in Colorado early started the smart power grid city project. The city upgraded the existing transformer substation in order to be monitored remotely and collect and publish the real-time information. Therefore the consumers can operate the family resources automatically. The city also upgraded the power grid access to support the independent power generation and energy storage devices, such as solar panels, batteries, wind turbine, hybrid vehicle, etc., making the power grid transfer the power to these devices conveniently. Meanwhile, the city established a new measurement system, which not only measures electricity consumption, but also interconnects information with power grid in a real-time, high speed and bi-direction way. Families in Boulder City can connect to the power grid interactively and each of them installed the smart meters, which help the families know the real-time electricity price and reasonably arrange to use the electricity. Boulder City constructed the first smart grid city in the U.S.

## **2.2 The development of smart city in the European Union (EU)**

In 2007 the EU proposed a set of criteria to evaluate the smart city. In June 21, 2011, Günther Oettinger, EU energy commissioner, released “EU’s New Smart Cities and Communities Initiative”. The report pointed out that it is the best time to construct the smart city and smart community. Both city and industrial sector hope to find a synthesized and sustainable solution so that they can provide clean, safe and affordable energy to the residents. Smart cities in the EU pay more attention to the form of ecological environment and smart economy.

### **2.2.1 Stockholm**

Stockholm is the capital of Sweden and the center of national politics, economy and culture. With the rapid development of the urbanization, Stockholm is facing the growing serious problem of traffic jams. Therefore the construction of smart city is proposed with the emphasis on the improvement of traffic running and management system. Stockholm takes smart traffic as the core of smart city and extends to the other fields, including energy saving, environment protection, etc.

### **2.2.2 Amsterdam**

Amsterdam, the capital of Netherlands, is the model of European smart city construction, and also one of the earliest cities in the world to construct the smart city. Its original smart city construction consisted of four themes:

- a. Sustainable Living: the West Orange Project and the Geuzenveld Project;
- b. Sustainable Work: the Intelligent Building Project;
- c. Sustainable Transport: the Energy Dock Project;
- d. Sustainability of Public Space: The Climate Street.

In 2011, an extra construction theme was added, which is Municipal Office Building using digital monitoring facilities, Solar Sharing Program, Smart Pool Plan, Smart Home Charger and Full Use of Solar Energy-Saving Plan in Business Office. All these plans will be completed by 2015, when Amsterdam will be a real green energy saving smart city.

## **2.3 The development of smart city in Asia**

Nowadays, some countries and regions in Asia are fostering emerging industries by constructing smart cities. Meanwhile they are paying more attention to protecting environment and providing high-quality service for the public.

### **2.3.1 Singapore**

Singapore is the earliest country in Asia proposed to construct the smart city. In 2006, it started the plan named “Intelligent Nation 2015”, which aims to make a smart country driven by information and communication through the strategic planning in many aspects, including infrastructure, industrial development, personnel training, economic sector transition, etc.

### **2.3.2 Japan**

In 2009, Japanese government released the “U-Japan strategy 2015”. This strategy is based on the national information strategy of the IoT and hope IoT be the representation of the new generation of information technology to promote the smart city construction. Yokohama, one of the four pilot cities of this strategy, intensifies efforts to promote and popularize the electric vehicles by using renewable energy and clean energy, and carries out smart energy management for families, buildings and communities at the same time. In Spain, December 2011, Yokohama won the “Smart City Award”.

### **2.3.3 China**

With the acceleration of China’s urbanization, Chinese cities are facing many increasingly serious problems (traffic jams, environmental pollution, resources scarcity), just like the other countries. People hope to improve living environment and quality through constructing smart city. Smart city has become the internal actual demand of urban development. The development of smart city in China has a favorable policy environment as the concept of smart city has been universally recognized. Besides the requirements of urban economic, social development and the basic support of science and technology, the most important driver is vigorously support in policy and scientific action from the government. In December 2012, the Housing construction ministry of China released the first batch of national pilot smart city. The number of smart city has been increasing since 2013. Furthermore, China government hope to build a number of distinctive smart cities by 2020.

So far, China cities like Beijing, Shanghai, Wuxi, Hangzhou and Nanjing have started the “Smart City” strategy, with relevant plans, projects and activities, which cover several aspects, such as social management, application services, infrastructure, smart industry, security, construction mode and standard system.

### **3. The situation and planning of smart city construction in Wuxi**

Society in the post-industrial era is based on the service, with the important characteristic depending on the information technology instead of on the labor or resources. Now, Wuxi is in the post-industrial era. In order to further improve the efficiency of urban operations and management and provide better urban public services in Wuxi, it is important to strengthen the integration, excavation and decision-making of all aspects of information in urban transportation, environment, service and economy, achieving the overall perception and interconnection between things and people. This will promote the quality of substance and cultural life of urban residents and construct a new dynamic urban development in Wuxi.

In August 2009, Mr. Jiabao Wen, who was the Prime Minister of China, suggested to build Wuxi as the center of internet of things. After that, Wuxi started to construct smart city. In 2013, Wuxi won the “Outstanding Achievement Award of China Promoting Smart City” and continued to win the first place in Chinese Smart City Development Assessment. In 2014, Wuxi was successfully selected by IEEE and became the only city in China to take part in the IEEE smart city initiative because of the leading edge from technology research and development to industrial scale and its outstanding achievements in smart city construction.

With the help of relevant government policies, considering the previous serious problems of Wuxi, which include traffic jams, environmental degradation and medical treatment difficulties, Wuxi focuses on the transportation, environmental protection and medical treatment for the construction of smart city, and has made outstanding progress[6]. The Three Years Plan of Smart Wuxi Construction (2014-2016), which was released by Wuxi government, points out that Wuxi should make persistent efforts in the next few years in the fields of transportation, environmental protection, medical treatment, etc., and strive to become an active leader of smart city construction at home and abroad. Wuxi also would like to share the excellent construction experience for the other cities globally.

#### **3.1 The situation and planning of smart transportation construction in Wuxi**

The urban traffic management, bridge and tunnel detection, public scheduling, parking guidance and traffic information service are the main components for the smart transportation. With respect to the perception and collection of traffic information, data fusion, push and application of services, the technique of IoT is hoped to be used in smart transportation in order to promote the transportation in a safe, unblocked, green and energy-saving way.

(1) Build the integrated management system for smart transportation. Based on the technique of IoT, sensor, radio frequency identification, video detection, multi-source

heterogeneous data integration approach and multiply interaction models, the local government hopes to build the integrated management system for smart transportation. The system can help for the traffic control, emergency treatment, treatment of peccancy, traffic lights control, report processing, etc.

The current situation and planning of construction: The integrated transportation management system, which covers the main urban areas and the main roads in Wuxi, has been built by the end of 2013. The system has also covered the inner ring and key areas in Wuxi by the end of 2014. At the end of 2015, the system will cover the whole city and then the efficiency of the vehicle traffic will be improved significantly.

(2) Construct the smart Bus Dispatch System. The smart Bus Dispatch System is expected to be constructed based on the technique of IoT. All the city buses can be monitored by the system through the GPS positioning technology, 3G and 4G communication technology, radio frequency identification technology, geographic Information technology, etc. The system will help to achieve the real-time bus status, bus position information. The system will also support the daily bus scheduling, the bus driver arrangement, and emergency plans.

The current situation and planning of construction: The smart Bus Dispatch System has covered the main bus routes in urban district of Wuxi by end of 2014. In 2015, the system will cover the peripheral lines around the urban district in order to cover the whole city. The travel efficiency of passengers will improve significantly at that time.

(3) Construct the smart Parking Guidance System. The smart Parking Guidance System is based on the IoT technology. The parking management for office buildings, commercial centers and public parking can be managed through the system by the dynamic space information acquisition technology, real-time information collection technology and smart parking management technology

The current situation and planning of construction: The smart Parking Guidance System for downtown has been built in 2013, which mainly solves the parking problem in the city center. The system has been used in 2 public parking. The business model of the smart parking will formed and the main parking in the city center will be networked by the end of 2014. In 2015, the smart Parking Guidance System will be extended to non-downtown district of Wuxi.

(4) Construct the smart Traffic Information Service System. The smart Traffic Information Service System is built by several techniques, such as cloud computing, high-speed bus technology, geographic information system, and traffic data fusion technology under complex situation. The system can provide the integrated real-time traffic information and location information. The system also helps to reduce vehicle energy consumption and the environment pollution, and realize the green construction.

The current situation and planning of construction: The smart Traffic Information Service System for the central urban area and the main trunk has been realized in 2013. At the end of 2014, the system has linked with the smart Parking Guidance System and the smart Bus Dispatch System. An efficient and intelligent traffic information service platform covering the whole city will established at the end of 2015.

(5) Construct the smart Bridge and Tunnel Monitoring System. A cloud service platform for monitoring the road, bridge and tunnel is expected to be built based on the IoT technology. The platform can provide the early warning of bridges, history data tracking, and decision support by the intelligent inspection for bridge problems and bridges dynamic parameters, intelligent management for bridge collision and WIM road load determination.

The current situation and planning of construction: The cloud service platform for monitoring the bridge and tunnel has started to develop from 2013 and conducted 5 to 10 bridges and tunnels for pilot verification in the whole city. The platform will be expanded to the whole city's key bridge's and tunnel's range by the end of 2014. In 2015, the platform will include all the roads, bridges and tunnels in Wuxi.

### **3.2 The current situation and planning of smart environmental protection construction in Wuxi**

The water quality of Lake Tai monitoring, online monitoring of pollution sources, air quality monitoring and noise monitoring are the key points for constructing the smart environmental protection. This will help to improve the environment and construct the ecological civilization city.

(1) Construct the dimensional and intelligent monitoring system for water quality of Lake Tai. The system can realize the comprehensive, real-time and continuous supervision and remote monitoring for water quality of Lake Tai through the electronic fence technology, intelligent video identification technology, water quality monitoring of UAV technology, underwater ecological monitoring chromatographic technique and satellite remote sensing technology. The goal of this system is to know the water quality in time, warning and forecasting in time and providing decision support.

The current situation and planning of construction: Two electronic fences for water monitoring have been built in 2013. It is helpful for achieving the precise management of the drinking water and strengthening the forecasting and warning ability. The buoy stations on the Lake Tai have been settled by the end of 2014, which can form the multi-parameter, real-time, synthesized and smart perception system. In 2015, the local government will carry out the detection of water surface globally which adopts altitude UAV monitoring system and underwater ecological chromatography monitoring system. The dimensional monitoring system for Lake Tai from multi-direction of underwater, surface of the water, sky and shore will be constructed in 2015.

(2) Construct online intelligent monitoring system for pollution source. The system contains the functions of data collection, transmission, storage, management and application based on the IoT technology. The system can monitor the key pollution sources, high-risk pollution sources emissions and pollution control facilities automatically. Through the system, the environmental protection department can know the pollution situation precisely, comprehensively and timely and provide

support to environmental monitoring, assessment, enforcement and decision.

The current situation and planning of construction: The online monitoring system for pollution source has upgraded in 2013. 10 sewage treatment plants, which deal with more than 20 thousand tons of polluted water, and 2 power plants have been connected to the online monitoring system in 2013. In 2015, the unified video surveillance system for environmental will be constructed in order to monitor the key pollution sources in the whole city

(3) Construct the intelligent ambient air quality monitoring system. The air quality monitoring system can collect the real-time data remotely and provide the scientific analysis of air pollution status, characteristics, regularities and tendency. An integral and scientific ambient air monitoring and warning system are also included in the system.

The current situation and planning of construction: In 2013, Wuxi has completed the renovation and expansion of automatic ambient air monitoring sites. The ambient air quality monitoring network has been established at that time. Based on the air quality monitoring system, the volatile organic compound monitoring was added to the ambient air monitoring system in 2014, which realized the remote monitoring of special ambient air pollution factors and could reflect the monitoring quality more comprehensively and faithfully. In 2015, the automatic ambient air haze monitoring system will be established.

### **3.3 The current situation and planning of smart medical field in Wuxi**

Taking hospitals and the health management system as the entry points, the resident's health management and service, diagnosis and treatment of common diseases in community, emergency rescue, hospital treatment, medicines and medical equipment management are included in the construction of smart medical in Wuxi. This can enhance the service management capabilities in the health care system and improve the level of medical security, treatment of recovery health protection for the public.

(1) Construct the smart hospital. Taking smart material, smart mobile medical supervision, recognizing the important patient intelligently as breakthrough points, the medical supplies supervision platform is hoped to be built based on the technology of IoT. The platform can realize the visual identification monitoring, tracking and positioning during the whole process. The smart hospital in Wuxi is being built in the aspects of medical supplies supervision, mobile medical service and coordination, identification and tracking the important patients, remote medical treatment, etc.

The current situation and planning of construction: At the end of 2013, the platform, which includes the municipal medical supplies supervision, mobile medical service and coordination, intelligent identification of patient tracking service, imaging center area, has been basically constructed. 2-3 municipal hospitals have been connected to the platform and realized the intelligent monitoring, analysis and assistant decision-making and business collaboration. 8 municipal hospitals have been brought into the imaging center of regional management platform. In the end of 2015, all the

municipal hospitals and the second class hospitals or above will connect to the platform. The imaging center will cover the community service centers.

(2) Construct the smart health management system. Taking the health care, chronic disease care as the breakthrough points, the home health care and remote monitoring are the key applications in the smart health management system. The medical care environment, which is virtual, home-based and community-type, is hoped to be built with the help of health information system and digital medical equipment and the hospital resources in order to provide personalized remote monitoring service.

The current situation and planning of construction: The health care and chronic disease monitoring service platform has been constructed in 2013. In 2014, 8 city hospitals have connected to the health care service platform. All the community service centers and 2-3 municipal hospitals for chronic disease were linked to the chronic disease monitoring service platform for the purpose of realizing the remote monitoring service management. At the end of 2015, health care and chronic disease service platforms will cover all the second class (or above) hospitals.

#### **4. Conclusion and Perspective**

For the construction of Smart city in Wuxi, several guidelines have been drawn up as the following: “Sensing China, Smart Wuxi” is the main line. “Benefiting people, making enterprise strong, optimizing administration” is the purpose. “Making the city more livable, making the industry more developed, making life more convenient, making people happier, making the society more harmonious” is the direction. Taken the smart transportation, smart environmental protection, and smart medical as the preferred fields for the smart city construction in Wuxi. And then the smart applications in the other fields are hoped to be developed. The construction of smart city in Wuxi can not only ease the urban diseases such as traffic jams, environmental degradation and medical treatment, but also accelerate the transformation and upgrading of traditional industries, foster the development of emerging industries, and promote the development the city in the postindustrial era.

Apart from the three priority areas of Wuxi’s smart city, Wuxi will enhance infrastructure, improve government administration, optimize urban management, promote livelihood, and accelerate the development of industry for the construction of the smart city according to the recent plan of Wuxi municipal government.

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