

# The Application of Big Data Technology in Smart City

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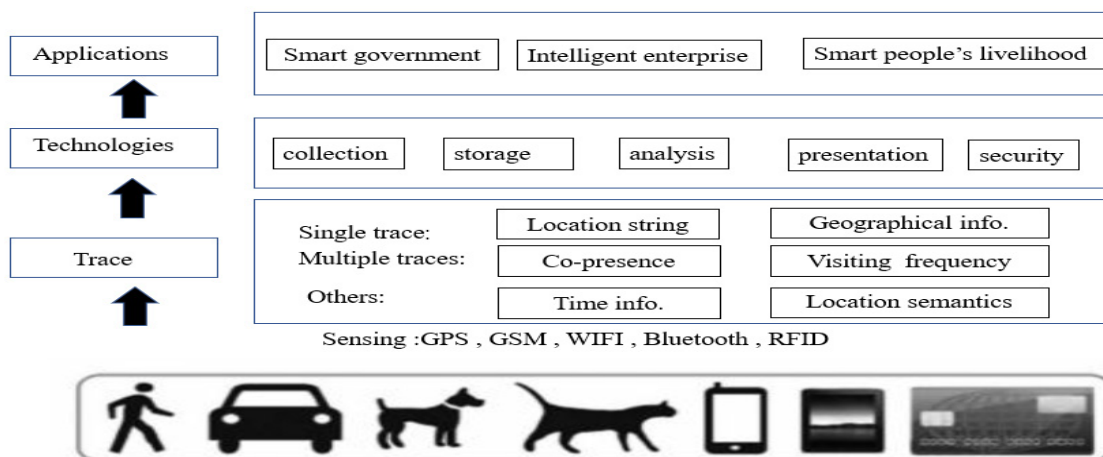
**Abstract.** With the wide application of mobile Internet,Internet of Things and social media,the era of big data has come."Smart city" is the trend of urban development and the integration of urbanization and informatization.Although it is still in the pilot stage,it has broad prospects.This paper discusses the application fields and implementation methods of big data technology in"Smart city",and puts forward suggestions for the construction of smart city,which is helpful to improve the wisdom level of the city.

## 1 Introduction

With the popularity of the Internet of Things,intelligent terminals,mobile Internet and social media,the amount of data produced by governments,enterprises and individuals has increased exponentially.At the same time, the expansion of big data and the development of Internet of Things (IoT) technology have played an important role in the implementation of smart cities.Big data provides smart cities with the potential to dig out valuable information or knowledge from a large amount of data collected from various ways.The Internet of things is the"Internet of Things",which is an important part of the new generation of information technology. With the rapid development of economy,the continuous progress of science,technology and the continuous improvement of the level of urbanization,big data and Internet of Things technologies have become the

important technical support for the construction of smart cities.

The combination of IoT and big data is an unexplored area of research that brings new challenges to achieve the goal of smart cities in the future.These new challenges mainly focus on business and technology related issues,as datas and the Internet of Things have not yet been well integrated,so it is impossible to further promote the construction of smart cities.To solve these problems,it is necessary to improve the application level of big data and Internet of Things technology in smart city construction,so as to improve the intelligent level of urban construction.Starting from the concept of smart city,this paper discusses the characteristics and key technologies of big data,and elaborates the specific application of these technologies in the construction of smart city.The research framework of this paper is shown in Figure 1.



**Figure1** Framework of this paper

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## 2 The concept of smart city

What is the smart city?The smart city,which originated from the field of media,refers to the use of Internet of Things,cloud computing,big data,spatial geographic information and other new generation of information technology to promote the wisdom of urban planning,construction,management and service[1].Based on the background of the knowledge society,smart city can innovate the advanced form of urban informatization, realize the deep integration of informatization, industrialization and urbanization,help to alleviate the metropolitan disease,then it can improve the quality of urbanization,achieve fine and dynamic management, finally,by these we could enhance the effectiveness of urban management,and improve the quality of life of citizens.

## 3 Features and key technologies of big data

### 3.1 The features of big data

Big data is a natural product of advanced digital products and their application.It refers to a collection of data that cannot be captured,managed and processed by conventional software tools within a certain period of time[2].Mobile phones,sensors and social media networks are examples of modern digital technology penetrating into our daily lives.The popularity of these technologies in daily life has raised the human-to-human,human-to-machine,machine-to-machine interaction to an unprecedented level,resulting in massive data know as"big data".However,the amount of data is not the only feature of big data.The big data has five Vs:volume,velocity,variety,value,veracity,showing in Table 1.

**Table1** the characteristics of big data

Feature	Interpretation
Volume	The amount of data collected,stored,managed and analyzed is very large
Velocity	The rapid growth of data requires real-time analysis,data processing and discarding
Variety	Data types and sources are diverse,including all kinds of structured,semi-structured and unstructured data
Value	The value density of mass information is relatively low,so it needs to be aggregated by data mining and analysis technology
Veracity	The quality of big data is closely related to the real world

### 3.2 Key technologies of big data

Smart city is the product of the combination of sustainable urban development and the new generation of information technology.The construction of big data has found an outlet for the development of smart city.Big data mainly includes five key links,such as collection,storage/management,analysis and mining,data presentation,data security and privacy protection (as shown in Table 2).In addition to big data processing,the key technologies also involve cloud computing,mobile Internet and other aspects[3].

#### 3.2.1 Data collection

Data collection is mainly from the Internet,IoTs, communication network,traditional database and other different data sources to quickly collect the required information,through ETL(extraction,conversion,loading data pretreatment),and finally loaded into the data warehouse(DW) or data mart(DM).

#### 3.2.2 Data storage

Compared with traditional local data storage,the storage of big data also faces two problems:scalability of capacity and reduction of construction and operation cost.At present,the distributed document management based on cloud computing and processing,data management(such as NewSQL) can effectively solve the

above problems,to provide high speed operation,then improve the utilization rate of resources,and ensure the security of data at the same time.It greatly reduces the cost of construction,operation and maintenance,making the long-term preservation and rapid use of big data possible.

#### 3.2.3 Data analysis

The value of mining big data only can be reflected through analysis and mining.At present,the key technologies of big data analysis are mainly derived from statistics and computer science and other disciplines,including data processing,data statistics and analysis,data mining and model prediction.

#### 3.2.4 Data presentation

Data presentation is to visually and quickly present the results of data analysis and mining to users by using visualization software,so as to provide a basis for scientific decision-making.At present,visualization technology can quickly display data processing results on the Web,mobile phones,smart terminals and other terminals through charts,maps,animations and physical phenomena or physical quantities that change with time and space in a more intuitive and vivid form,so as to facilitate people's understanding of data and improve decision-making efficiency[4].

### 3.2.5 Data security

Big data security still inherits the three characteristics of traditional data security: confidentiality, integrity and availability. It is necessary to ensure that a secure closed loop is formed in the three links of server, transmission and communication and terminal. The characteristics of

big data, such as massive volume, multi-source, heterogeneous and dynamic, lead to the complex storage structure, openness, distributed computing and efficient and accurate service of big data system. These special requirements cannot be solved by traditional security measures.

**Table 2** Different aspects and functions of big data technology

Technology	Function
Data collection	Collect distributed and heterogeneous data sources and store them in data warehouse
Data storage	Using various database files to store and manage the massive data collected
Data analysis	Data Analysis Based on Machine Learning, Artificial Intelligence and Data Mining Algorithms
Data presentation	The results are presented in a visual way to understand and analyze data
Data security	Mining valuable information and taking into account personal privacy protection and data security

## 4 Application of big data technology in smart city

With the construction of smart cities, the Internet of Things, the Internet and mobile Internet terminals have brought a large amount of data, resulting in an increasing scale of data and complex and diverse forms of data. The generation process of wisdom in smart city is the process of data processing.

### 4.1 Smart government

Applying big data and cloud computing technology to smart government can effectively support the transformation of government functions, improve the level of collaborative office and the efficiency of serving enterprises/the public. By sharing data, it can reduce data barriers and data islands, and give full play to the value of government information.

#### 4.1.1 E-government.

The construction of e-government cloud platform provides the ability to screen and mine comprehensive information such as government information, Internet information and public opinion. The results of scientific analysis are displayed quickly and intuitively, which improves the scientificity and accuracy of government decision-making, improves the prediction/early warning ability, response ability and service level of the government in social management, macro-control and social services, and reduces decision-making costs. The big data technology is used in e-government, and gradually realizes the three-dimensional, multi-level and comprehensive e-government public service platform and data exchange center, promotes information disclosure, promotes online one-stop, all-weather, department collaborative processing, feedback online unified query and other service functions, and reduces the cost of enterprises and the public[5].

#### 4.1.2 Public security

In the era of big data, public security is not only about cameras and monitoring equipment throughout the city, but also about the monitoring of public opinion on the Internet, media, SMS and other multimedia. More importantly, through the analysis and mining of massive data, timely discovery of safety risks, man-made events or natural disasters, to provide cross-departmental, cross-regional, efficient comprehensive emergency handling capabilities, safety prevention capabilities, and the ability to crack down on illegal crimes.

#### 4.1.3 Urban operation

We should make full use of a large number of geographic, meteorological, environmental and spatial geographic information, economic, social and other valuable data accumulated over the years. Though the mining and analysis of big data, then we can provide important decision-making basis for urban planning and infrastructure, and strengthen the scientific and forward-looking nature of urban management services.

### 4.2 Intelligent enterprise

Smart companies can leverage data to gain smart insights, use tools to automate workflows and innovate. The construction of smart enterprises could not only promote the transformation and upgrading of the internal production relations of enterprises, complete the harmonious docking with the "Internet+" social productivity, but also further release the innovation and efficiency vitality of employees, and provide the source power for the sustainable development of enterprises. Smart companies use data to gain smart insights, and utilize tools to automate workflows and innovate[6].

#### 4.2.1 Wisdom manufacturing

An industrial cloud platform with local characteristics is constructed to provide enterprise users with one-stop service from design, supply chain management,

manufacturing, marketing and enterprise management. Through in-depth mining and comprehensive analysis of purchasing, inventory, energy, consumption, logistics, trade and other related information in the process of production and sales, it can provide economic trend prediction for enterprises, and support scientific decision-making, industrial upgrading and transformation of enterprises.

#### 4.2.2 Intelligent logistics

The data sources of smart logistics include RFID, sensors, GPS, Internet, mobile Internet, etc. The adoption of big data technology can not only realize the effective management of logistics information, further reduce logistics costs, but also further explore customer business opportunities and provide satisfactory services.

#### 4.3 Smart people's livelihood

Smart people's livelihood is a key issue in the construction of smart city, which directly affects the effect of smart city construction, not only relates to people's vital interests, but also the key to success. Smart people's livelihood is mainly to increase investment, continuously improve government service ability and social public service level, and provide convenient and good services for the public in clothing, food, housing and transportation. The construction content mainly includes smart social security, smart health care, smart education, smart living, smart community service and other public services[7].

##### 4.3.1 Intelligent transportation

Big data technology comprehensively processes and mines the massive image information, vehicle exercise information, road information, GIS information, meteorological environment information collected by a large number of cameras, sensors, GPS and other equipment, analyzes and predicts the statistical and predictive data such as traffic flow and travel law, and displays them through visual means, which can improve the management efficiency of transportation departments and the corresponding speed of emergencies, alleviate the degree of urban congestion and reduce the incidence of accidents. The direction of traffic, the number of vehicles, traffic congestion, parking space information, travel plan and so on are provided to the public in a timely manner, which will effectively improve the travel efficiency of the public and quickly alleviate the common urban diseases of 'difficult driving and parking'.

##### 4.3.2 Smart healthcare

At present, the annual data volume of large hospitals has exceeded the PB scale. Big data not only has great advantages in the storage, processing and analysis of large amounts of data, but also has great application space in online booking, disease prediction, electronic medical records and their sharing, one-card

payment, medical insurance networking and other aspects, so as to alleviate the difficulty of seeing a doctor by scientific and technological means[8].

## 5 Conclusion

The key to the success of smart cities lies in wisdom, interconnection and collaboration, and the core of which is the full application of data. Big data has become one of the key factors to determine the degree of city intelligence. Facing the coming of the era of big data, we must attach great importance to, pay close attention to its development direction and keep innovating, so as to take the lead in the construction of smart cities.

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## References

1. M. Fugini, J. Finocchi, P. Locatelli, (2021) A Big Data Analytics Architecture for Smart Cities and Smart Companies. *Big Data Research*, 24:1-12.
2. E.A. Nuaimi, H.A. Neyadi, N. Mohamed, J.A. Jaroodi. (2015) Applications of big data to smart cities. *Journal of Internet Services and Applications*, 6:1-15.
3. J. Kandt, M. Batty, (2021) Smart cities, big data and urban policy: Towards urban analytics for the long run. *Cities* 109:1-10.
4. G. White, A. Zink, L. Codecà, S. Clarke, (2021) A digital twin smart city for citizen feedback. *Cities* 110:1-11.
5. R. Nateghi, T. Aven, (2021) Risk Analysis in the Age of Big Data: The Promises and Pitfalls. *Risk Analysis*, 0:1-8.
6. A. Cacciola, A. Conti, F. Tomasello. (2020) Big Data Analysis: The Leap into a New Science Methodology. *World Neurosurgery*, 133:97-98.
7. V. Chang, (2020) An ethical framework for big data and smart cities. *Technological Forecasting and Social Change*, 165:1-11.
8. A.P.P. Kasznar, A.W.A. Hammad, (2021) Multiple Dimensions of Smart Cities's Infrastructure: A Review. *Buildings*, 73:1-27.