Progress of Surveying and Mapping Science and Technology in the Information Age

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Abstract: With the further improvement of my country's current information technology level, the development of China's surveying and mapping has inevitably shifted from digital mapping to computerized information mapping. This article expounds the important role of surveying and mapping science and technology in the construction of the country and society, and from this leads to a better construction of national security and convenient governance system. Then information-based surveying and mapping will be the future development prospect of surveying and mapping. From the perspective of informatization surveying and mapping, this article expounds its characteristics, development trends and application status, and explains the basic role of informatization surveying and mapping in my country's surveying and mapping industry.

1. Introduction
The development of social economy is inseparable from the basic support of traditional surveying and mapping. As a basic means to grasp the national conditions, surveying and mapping can help decision-makers improve the management level of the country and society. The development of surveying and mapping in my country has gone through three stages, namely, traditional basic surveying and mapping, digital surveying and mapping, and informatized surveying and mapping. Nowadays, the surveying and mapping technology at home and abroad is changing with each passing day and developing rapidly. The development status and trends of modern surveying and mapping science and technology are mainly supported by modern surveying and mapping technology represented by 3S technology, and the development of automation, rapid, intelligent and integrated management of spatial data acquisition, so as to promote my country's Surveying Engineering which is based on the development of science and technology industry.

2. Development characteristics of surveying and mapping technology
As the 21st century has entered the information age, accelerating the informatization process has become a new strategy for the development of various countries, which has promoted the development of surveying and mapping informatization and optimized and upgraded the surveying and mapping business. The traditional surveying and mapping technology in the past has great limitations, and can only perform surveying work in a certain area. At the same time, it takes a long time to take data, and the data taken is low in accuracy, which consumes manpower and material resources. With the mutual penetration and integration of surveying and mapping science and technology and information technology, it has provided surveying and mapping personnel with a convenient and reliable source of
data acquisition and the scope of data acquisition can cover the world. The current surveying and mapping technology is mainly manifested in the ability to quickly obtain geospatial data, integrated management and processing of data, and conduct cyberspace analysis on geospatial data [1].

3. Application of surveying and mapping technology in urban construction

3.1. Global satellite positioning technology
Global satellite positioning and navigation technology [2] plays a very important role in the construction of the national economy, and is directly related to national security and stable economic development. Global satellite positioning and navigation technology is mainly to provide users with real-time and accurate positioning data and time information. The global satellite navigation and positioning systems currently in operation or under construction mainly include the United States' Global Positioning System (GPS), Russia's GLONASS system, the European Union's Galileo system (GALILEO) and Beidou satellite positioning system. The ability of satellite positioning and navigation to provide accurate location and time information makes it the most important space information infrastructure and the main supporting technology for space environment detection, crustal movement and marine environment detection. Satellite navigation and positioning technology has significant advantages: coverage reaches the world and real-time continuous positioning and navigation; provides high-precision three-dimensional position, three-dimensional speed and time information; The pseudo-code spreading technology adopted makes the signal sent by GPS satellites have good anti-interference and strong confidentiality.

3.2. Remote Sensing Science and Technology
Remote sensing technology[3] is the use of aircraft, satellites and other tools to bring sensors into the air to receive and record electromagnetic radiation signals emitted and reflected from ground objects, and finally perform image processing or analysis to extract useful geospatial information, and then combine with other information Sources cooperate to realize various remote sensing detection functions. Remote sensing data acquisition is actually a process of acquiring remote sensing data of ground objects with the support of a data acquisition technology system composed of remote sensing work platforms and sensors. To complete a complete remote sensing application technology, it is necessary to complete the three links of first obtaining remote sensing data, secondly extracting useful information, and final application.

3.3. Car navigation system
Navigation is the process of assisting the object from the starting point to the target point. Generally speaking, a car navigation system consists of five parts: a microcomputer part, a vehicle position monitoring system, a display device, a navigation electronic map and an operation part. In car navigation systems, accurate positioning is the basis and prerequisite of navigation. Among them, there are three main methods for positioning: independent measurement, satellite positioning and wireless measurement. Generally, in actual application operations, these methods will be used at the same time to achieve better positioning requirements.

3.4. Public safety
Maintaining public security [4] in the current society is also maintaining the stability and long-term public security of Shooting Tiger. In the field of public safety, early scientific warnings, surveillance, and emergency decision-making are also important. GIS has the ability to integrate multiple data types, the dynamic potential of spatial analysis, and the ability to predict future risks. In fact, it is the collection of system information based on resources, formats, functions, and attributes, and then a data set is formed. The organic integration of GIS and public security greatly guarantees the stability of public security, maintains national stability and the sound development of social economy.
4. Information surveying and mapping
Information-based surveying and mapping uses automated and intelligent data processing as the main means to turn a single surveying and mapping product into a shared surveying and mapping product that can serve the entire society, the entire industry, and all fields, while providing more diversified and humanized services[5].

Information-based surveying and mapping contains very rich content. The content of information surveying and mapping includes network infrastructure, platform builders, platform users and service registration centers. In the future, the most valuable informatization surveying and mapping is the real-time service of spatial information. Informatization surveying and mapping aims to provide more refined, standardized and transparent spatial information services for multiple users. Spatial information will move from professional services to Internet services and Internet of Things services, realizing true on-demand measurement and active services.

5. The application status of surveying and mapping technology in the information age

5.1. Mobile road measurement system based on 3D laser point cloud technology

5.1.1. Principle introduction
In the mobile road surveying system based on optical imaging and lidar technology, with its high-precision all-weather implementation services, it has successfully improved the working mode of traditional surveying and mapping. Zhang [6] introduced a road holographic modeling method based on 3D laser point cloud technology. The main working mode is to dynamically scan through a mobile road measurement system to obtain road panoramic image data, laser scanning data, and system positioning data, and then process these data together. Get the laser point cloud of the entire scene.

5.1.2. Scene construction
In order to construct the real scene of the road, the scene can be realized by means of the spline modeling method. The general procedure is to first import the original laser point cloud data into the modeling software. In order to ensure the authenticity of the data restoration, it is necessary to refer to the point cloud elevation data for construction; when analyzing the small road parts in detail, line modeling and polygon modeling should be used comprehensively. It is realized with three methods of composite object modeling, such as the construction of street lamp model as shown in Figure 1.

![Figure 1 Construction of street lamp model](image)

Finally, the model of each part of the road is loaded into the road scene according to the real scene. This step determines the authenticity of the finally generated road and the reasonableness of the three-dimensional topological relationship of the road model.

5.1.3. Model summary
This method uses three-dimensional mapping software to obtain three-dimensional geographic information, and then performs basic operations such as cropping and format conversion based on
modeling software, and finally uses spline modeling to build a model of real road scenes. This method can meet the requirements of road holographic modeling, and is of great significance to the construction of a "digital city" in the future.

5.2. Spatial information services based on measurable real-world images

5.2.1. Principle introduction
Measurable real-life image [7] is based on a mobile road measurement system to solve the problem of surveying and mapping data collection in a moving state. Sun [8] proposes a DMI-based semi-automatic vectorization method data collection based on road traffic sign marking data collection based on measurable real images, forming a rich road spatial information database. At present, spatial information services based on real-view images on both sides have been widely used in multiple scenarios and systems, such as disaster relief, land and resources management, urban construction and planning, etc., making outstanding contributions to modern social enterprises, individuals and the country, Lay a good data foundation for the further construction of smart cities.

5.2.2. System introduction
In order to sort out the complex and diverse road component data, firstly use the geographic information public platform as the basis to generate DMI from the original road data, and then use the corresponding customized tool software to collect road component data based on DMI, and then combine GIS, database and other technologies. The construction of the system forms a rich road spatial information database.

5.2.3. Algorithm summary
Conventional manual vectorized data collection has obvious shortcomings, low efficiency, and incomplete data recording. The DMI-based road facility collection method can overcome the above problems, achieve rapid acquisition of urban road specific small parts, and improve the geographic information space of urban traffic management.

6. The inevitability of information surveying and mapping to replace digital surveying and mapping
After decades of development, my country's surveying and mapping technology has completed the transformation from traditional surveying and mapping to digital surveying and mapping [9]. At this stage, various researchers are working to turn digital surveying and mapping into information-based surveying and mapping. That is to say, through a completely networked operating environment, the surveying and mapping methods and functional forms of comprehensive geospatial information services are effectively provided to various users in the society in real time [10]. Security and other related issues in information sharing will gradually move toward standardization and standardization.

Basically, the main characteristics of digital surveying and mapping are still semi-automated production, digitization of geographic information products, and magnetic semi-medium storage methods. However, these characteristics are compared with fully automated information-based surveying and mapping production. The results of information-based surveying and mapping make geographic information products more diversified and information services more networked. In general, its weakness is obvious. Obviously, information-based surveying and mapping is based on digital surveying and mapping through a completely networked operating environment, using the surveying and mapping method of comprehensive geospatial information services to effectively provide services to all kinds of users in society in real time.

7. Conclusion
From the reform and opening up in the late 1970s to the beginning of this century, my country's traditional geodesy gradually turned to digital surveying and mapping. Since then, my country has
begun to establish an informatized surveying and mapping system supported by computer networks, and has entered a new stage of development in informatized surveying and mapping. Establishing an informatization surveying and mapping technology system is a hot topic in today's surveying industry and the sharing of geospatial resources. It is precisely because it is not easy to establish an information surveying and mapping technology system supported by a fully automated network environment, so scholars from all walks of life are required to participate. In the future, my country's information-based surveying and mapping service system will achieve a comprehensive improvement of surveying and mapping guarantee capabilities and service levels, realize the comprehensive, coordinated and sustainable development of surveying and mapping undertakings, and promote the overall level of my country’s surveying and mapping undertakings to be among the world's advanced.

References
[1] Introduction to Geographic Information System M, 2017.7. Beijing Higher Education Press: Zhang Xinchang. (2017) China Version Library CIP Data Core WordNo. 091070;
[2] Wu Chengliang, Ni Ming. 2019(33) Basic technology and development trends of geographic information system J. Science and Technology Innovation and Application.
[3] Xu Jianying. (2018) New progress of surveying and mapping science and technology facing the information age J. Information and Digitalization.
[4] Hua Xianghong, Xu Caijun, Zou Jingui, et al. (2013), 32(7) Innovative experimental platform for information-based surveying and mapping J. Laboratory Research and Exploration.
[5] Zhou Dejun. (2000) Prospects of Surveying and Mapping Information J. Surveying and Mapping Technology and Equipment.
[6] Zhang Tengfei, Liu Nian. (2020)Road holographic modeling based on 3D laser point cloud data J. Technical Equipment of Surveying and Mapping.
[7] Guo Kui. 2006 Geospatial data processing technology of boundary information system D. Zhengzhou: PLA Information Engineering University.
[8] Sun Long. (2019)Study on data collection and management methods of road traffic signs and markings based on measurable real scene images J. Engineering Technology Research.
[9] Zhang Jiaqi. (2018) Research on BIM and GIS Data Fusion Method [D]. Changchun: Changchun Institute of Technology.
[10] Ning Jinsheng. (2017) The evolution from surveying and mapping to geospatial informatics J. Journal of Surveying and Mapping.
[11] Li Deren, Wang Yanjun, Shao Zhenfeng. (2012) Informationized surveying and mapping in the new geographic information era J. Journal of Wuhan University Information Science Edition.
[12] Liu Nengcheng, Liu Yingbing, Sheng Hao, et al. (2018) Key technologies and systems for comprehensive decision-making on spatio-temporal information in smart cities J. Journal of Wuhan University Information Science Edition.
[13] Yang Mei, He Huagui, Wang Mingsheng, et al. 2019(09) Research on land surveying and information system of state-owned enterprises in Guangzhou J/OL. Geospatial Information.
[14] Ma Yuhang. 2014(29) Research on the basic technology and development trends of geographic information system J. Heilongjiang Science and Technology Information.