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APPLICATION OF COMPUTER GRAPHICS IN SURVEYING AND MAPPING

Qing An[a,b,c], Jiangtao Hou [c], Yuhua OuYang[a]

[a]*School of Urban Construction, Wuchang University of Technology, No. 16 of Jiang Xia Avenue, Wuhan, Hubei 430223, China*

[b]*Wuhan Huagong Cloud Technology Co., Ltd.，No. 133 Tangxunhubei Road, Wuhan, Hubei 430223, China*

[c]*Hubei Zhongtu survey planning and Designing Co., Ltd.， No. 11 Wudayuan 1st Road, Wuhan, Hubei 430223, China*

Abstract

China's surveying and mapping discipline is in the opportunity period of geographic information development, the critical period of Surveying and mapping construction and the key period of digital construction. With the development of Surveying and mapping discipline, the surveying and mapping mode gradually changes from digital direction to information direction. Digital surveying and mapping technology has been widely used in the world. Taking the application of computer digital surveying and mapping technology in engineering surveying and mapping as an example, this paper summarizes the advantages of this technology, such as high automaticity, fast data arrangement, high surveying and mapping accuracy, rich graphic attribute information, convenient graphic compilation, etc.

Keywords: Computer; Mapping; Fusion and Utilization

With the rapid development of computer information technology, the production level of all kinds of hardware has been continuously improved, and the world has entered the information and digital era. In the field of Surveying and mapping, the continuous application of all kinds of new technologies and equipment has changed the traditional surveying and mapping methods (such as flat mapping, simple plotting). With the development of computer information technology, the digital way of work is becoming more and more mature. It not only reduces the workload and intensity of Surveying and mapping staff, but also improves the scope and accuracy of Surveying and mapping. It has gradually become the mainstream way of Surveying and mapping.

1. BRIEF INTRODUCTION OF COMPUTER DIGITAL MAPPING TECHNOLOGY

1.1 Global Satellite Positioning Technology

Global positioning system (GPS) was invented by the US Department of defense. This technology is to use synchronous satellite to realize the positioning all over the world, and the positioning is accurate. At present, the number of GPS satellites is very large. There are at least four satellites at all angles in the world, realizing global 24-hour positioning. It has the characteristics of high positioning accuracy and convenient operation, so it has been widely used. Global positioning technology mainly includes: static positioning technology (GPS) and time dynamic positioning technology (RTK).[1]

1.1.1 Static positioning technology

GPS positioning technology needs 12 hours to achieve synchronous observation. With the continuous improvement of GPS technology requirements, this traditional way can not meet people's needs, so the static positioning technology comes into being. This technology has the characteristics of strong adaptability, not affected by weather and type structure, and can solve the problem of point and point cannot be indivisibility, which is usually used in large-scale control measurement.

1.1.2 Real time dynamic positioning technology (RTK)

RTK, also known as real-time kinematic, is a real-time dynamic difference method. This method is a new GPS measurement method commonly used at present. Traditional dynamic measurement, fast static measurement and static measurement need to be calculated after measurement to obtain centimeter level accuracy. 2. RTK uses carrier phase dynamic real-time difference method to obtain centimeter level accuracy measurement results in the field in real time.[2]

RTK working form: send the observation value and the coordinate information of the station to the mobile station at the same time with the electromagnetic signal through the data ingot and modem reference station. The mobile station receives data and collects GPS satellite signals at the same time to obtain the observation data. In the system, differential observation values are formed for real-time processing, and the mobile station position coordinates with centimeter accuracy are given in time. RTK is widely used in line alignment and land survey. (**Figure 1**)

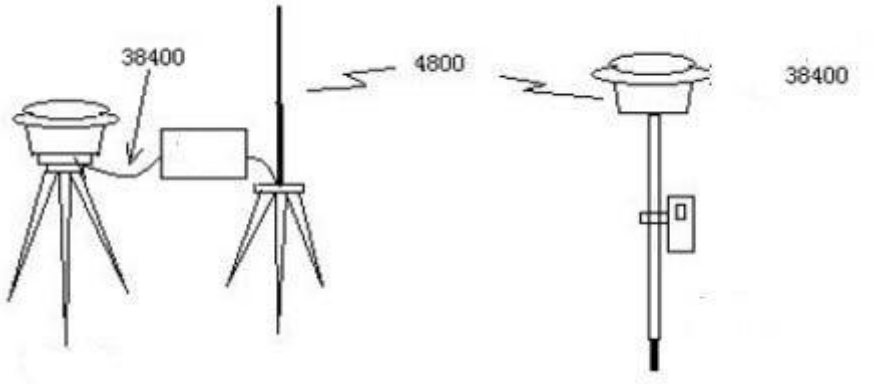

Fig. 1 GPS Dynamic Positioning

1.2 Photoelectric Ranging Technologies

The carrier of this technology is a technology that uses infrared light or visible light to calculate the distance by measuring the time between two points along the line. This technology is mainly used in electronic level, total station and other equipment. 1.2.1 Electronic level

Electronic level is also called digital level. Invented by Zeiss in the 1990s and developed on the basis of the automatic level, the automatic level is used as the basis to add mirrors and detectors in the optical path of the telescope, and the high-tech product of the integration of optical, mechanical and electrical measurement composed of the image processing electronic system and the bar code scale is adopted. This technology effectively complements the defects of GPS positioning technology, and has the advantages of fast measurement speed and high accuracy. Electronic level plays an important role in digital measurement.[3]

1.2.2 Total station

The full name is electronic total station. It is a measuring instrument that can integrate electricity, machine and light. It has the advantages of fast measurement speed, convenient operation and high accuracy. It can be realized that all the measurement work on the measuring station can be completed by placing the instrument once. It is usually used in deformation monitoring and precise engineering survey of large-scale buildings and underground tunnels.

2 MAIN PROBLEMS OF TRADITIONAL SURVEYING AND MAPPING TECHNOLOGY

2.1 Low Working Efficiency

The traditional way of mapping is instrument mapping. The commonly used instruments are: level, plate, theodolite, etc. Use the instrument to measure the plane coordinate or horizontal angle of the point to determine the position of the point, and then the drawing staff can calculate the three-dimensional coordinates, and expand the point to the drawing according to the coordinates. According to the actual terrain, the running ruler reports to the draftsman what points are measured, and what points should be connected with, etc. the draftsman draws the figure on the spot with schematic symbols according to the relationship between the points of the exhibition and drawing. In this way, not only field work time but also internal work workload are increased, and errors may occur in the operation process.[4]

2.2 Poor Mapping Accuracy

The error of the plane position of the traditional surveying points is mainly affected by the following errors: the error of drawing, measuring, and the error of the points occupied by the objects on the topographic map. At present, although infrared distance measuring instruments and electronic speed measuring instruments are widely used, the accuracy of distance measurement and angle measurement has been greatly improved, but the topographic map drawn with the method of white paper mapping cannot show the accuracy of the instrument, and the accuracy of its graphical topographic map has not been improved.

2.3 Insufficient Capital Investment

In engineering survey, some construction units adopt traditional vehicle technology in order to reduce the engineering cost, which cannot match the current engineering practice, and cannot meet the needs of the construction units for the accuracy of survey data, which has caused some negative effects on the planning, design, construction and other aspects of the project. At present, many innovative engineering measurement technologies are emerging. Due to the lack of capital investment, these new technologies cannot be applied in the measurement work, which is not conducive to the sustainable development of construction engineering.

2.4 The Professional Quality Of Measurement Technicians Is Relatively Low

Many construction projects are lack of professional surveyors. Some of the surveyors work part-time by the designer of the design unit. The quantity and quality of professional surveyors are limited to a certain extent. Some surveying and mapping units do not employ enough professional and technical personnel, which makes surveying work inconsistent and inaccurate. In other construction units, the professional quality of measurement technicians is too low, which makes the measurement work slow and the measurement results are not very accurate.

2.5 Relatively Backward Measuring Equipment

With the rapid development of science and technology, the measurement equipment has also achieved innovation and development, but some construction units still use relatively old measurement equipment, the test results can not reach certain accuracy, and can not

achieve information-based data management, which brings some negative factors to the project construction. In the process of operating the equipment, many measuring technicians did not use the measuring equipment according to the operation specifications, which caused the equipment to suffer different degrees of damage, and its accuracy and sensitivity could not meet the requirements of the project quality.

3 ANALYSES OF THE APPLICATION CHARACTERISTICS OF COMPUTER TECHNOLOGY IN SURVEYING AND MAPPING

Compared with the traditional survey technology, the digital survey technology has the following characteristics in the application of engineering survey;

3.1 High Degree of Automation

The digital surveying and mapping system is a comprehensive surveying and mapping system which takes the computer as the core, total station, GPS, digital photogrammetry digitizer as the data acquisition t-tool, with the support of external input and output software and hardware, to collect, input, map, draw, output and manage the digital space of terrain. Adopting digital surveying and mapping technology can reflect the main points of things intuitively, which greatly improves the automation degree of engineering surveying. Traditional engineering drawings and large-scale maps need complex field mapping, which has a long working period. Because of the use of digital surveying and mapping technology, it can greatly reduce the labor and intensity of field surveying and mapping personnel.[5]

3.2 Quick Data Sorting

The graph formed by data mapping carries a large amount of information, and different data can be stored in layers. Data mapping is very convenient. Portable computer application can make part of the mapping complete through external data collection such as palmtop computer, and make data sorting or updating fast and convenient. Surveying and mapping personnel only need to save some modifications of human data to get new food data graphics.

3.3 High Mapping Accuracy

Digital mapping can be easily and simply completed by computer, and complex record, examination and calculation are avoided. Digital mapping is realized by self updating of digital technology, which is not affected by human factors and has a small probability of error. Digital mapping can reduce the error in the process of data transmission and obtain accurate measurement results.

3.4 Rich Graphic Attribute Information

In digital mapping, it is not only to determine the coordinates of the topographic points, but also to know what the attributes of the measured points are. At that time, it is necessary to record the coding of the measuring points of this point and display the connection information into a map by using the schema symbol library in the mapping system, and only need to know the coding to find the corresponding schema symbols from the library to complete the map.

4. INTEGRATION AND DEVELOPMENT OF COMPUTER TECHNOLOGY AND SURVEYING AND MAPPING TECHNOLOGY

As the current core technology, computer technology has made great contributions to data acquisition and conclusion analysis of Surveying and mapping. With the continuous development and improvement of GPS global positioning technology, the work requirements of all-weather, automation and high precision have been fully realized in engineering surveying and geodesy, which makes the surveying and mapping industry further improve on the road of intelligence.

4.1 Application of Computer Technology in Measuring Instruments

In the development of measuring instruments, electronic total station realizes the electronic and intelligent operation of measurement based on the traditional level and theodolite measurement principle and computer technology. Firstly, the measurement range is more extensive, including distance measurement, angle measurement, coordinate measurement, area measurement resection measurement, etc., and electronic operation is implemented uniformly. Secondly, the total station is more conducive to the storage and reference of measurement data. In the process of measurement, the annotated data and station data can be stored in a unified way by using the system file. When necessary, the data can be searched and consulted in the system file according to the point number. In addition, the edit and delete operation of the data file of the electronic total station is further simplified to realize the fast management of the data. Thirdly, the intelligent control in measurement is realized. In the measurement process, the surveyor can set the parameters of the current measurement mode according to the work requirements, so as to improve the accuracy of the measurement results, and can connect with the electronic computer to control the measurement progress and data transmission according to the instructions issued by the computer.[6]

4.2 Development of Computer Technology in Control Measurement

In the control survey, the extensive application of computer technology is reflected in the control survey of GPS positioning technology on the ground. The collection and analysis of data in the survey process are dependent on the support of computer technology. GPS positioning technology has the advantages of fast speed, high precision and simple operation. With the continuous development of technology, a relatively complete geodetic control network, referred to as GPS network, has been established. According to the distribution area, GPS network is mainly divided into global or national high-precision GPS network, regional GPS network and local small GPS network.

The global GPS network has a high precision, and its adjacent nodes are thousands of kilometers apart. The work of coordinate framework provides services for the scientific research of space science and global dynamics, which is of great significance for the research of crust and continental plate movement. Through GPS network, the measurement error of Astrogeodetic network in

China is further reduced and the measurement accuracy is more uniform. The adjacent nodes of the regional GPS network are about tens of kilometers, which mainly serve the national economic construction of our country. Based on the characteristics of high precision, fast speed and low cost, the existing ground control network in our country is improved and encrypted, and the overall coverage of the geodetic control network in most areas of our country is realized. Local small-scale GPS network mainly plays a role in specific small-scale projects, such as the planning and survey of the community, urban road pipeline reconstruction and so on. The small-scale network can fully meet the needs of the project for the point density, effectively avoid the human damage caused by the excessive network side length, and ensure the smooth implementation of the surveying and mapping work.

4.3 Development of Computer Technology in Topographic Mapping

In topographic mapping, RTK technology is more accurate, which can achieve centimeter level accuracy in the process of real-time positioning. In addition to fully controlling the positioning accuracy, it can also understand the positioning results, so it is often used in real estate mapping and topographic cadastral mapping. In the process of traditional topographic mapping, we must first draw the topographic map on the control points by using the theodolite mapping method according to the encrypted map and the control points. The limitation of this method is that it needs many people to operate together, and it also needs to realize the communication between the survey station and the surveyed landform and other detail nodes. Compared with the traditional method, RTK technology only needs one person to input the feature code of the control point to be measured in a short time in the surveying and mapping engineering. Using notebook computer or electronic hand book, as long as the point accuracy meets the measurement requirements, it does not need to realize the indivisibility of the control point. After the measurement of all the control points is completed, the topographic map can be drawn by professional surveying and mapping software, greatly The efficiency and quality of Surveying and mapping are improved. In addition, using RTK technology, according to the number of datum control points, the mapping of topographic map can still be completed at one time, which effectively reduces the setting of control points.

4.4 Practical Application of Computer Technology in Engineering Survey

GPS relies on its static relative positioning technology, and it can be used for ground settlement detection, dam deformation, high-rise building and tunnel measurement and other projects by setting up a precise control network for the project. In addition to the mapping of topographic map, RTK technology is widely used in the survey, design and geological survey of highway and power industry. The effective combination of GPS and GIS technology has an important practical significance for the survey and design of construction engineering and construction management. (**Figure 2**)

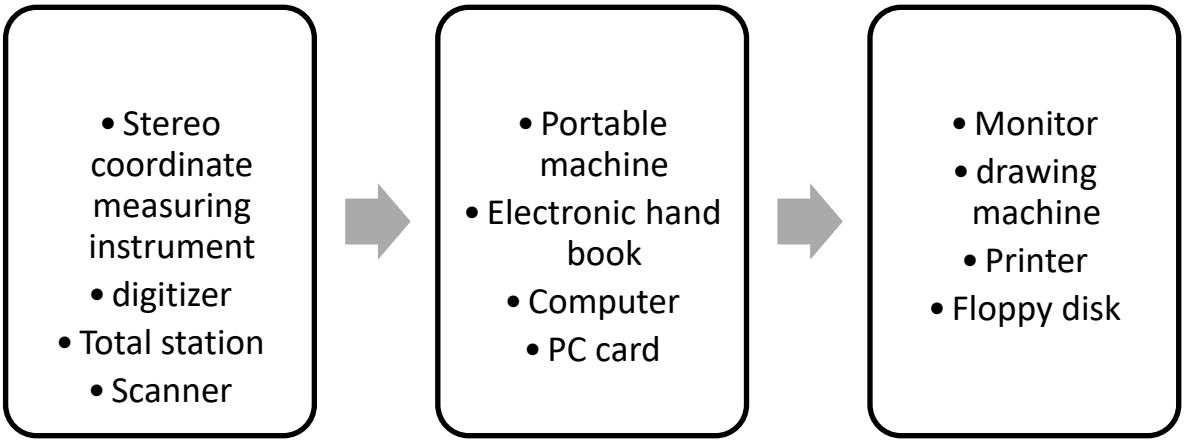

Fig. 2 Integration of Computer Technology and Mapping Technology

4. CONCLUSION

At present, surveying and mapping technology and instruments are developing in the direction of digitalization and automation, breaking through the original traditional set of digital surveying and mapping technology. However, there are still some problems in the application of the current surveying and mapping technology in Geological Engineering Surveying and mapping, which need the joint efforts of Surveying and mapping workers to actively study and solve new problems and technologies, and constantly promote the sustainable development of Surveying and mapping. At present, the traditional positioning and mapping of digital surveying and mapping technology is still an important social demand, but the society has put forward a new demand for the surveying and mapping department, and the information collection, compilation, analysis and utilization that has nothing to do with the surveying and mapping department or has little to do with it before have also begun to be undertaken by the surveying and mapping department. Because all kinds of information of social development and people's life are based on spatial positioning, digital mapping technology

will be more widely used due to the continuous improvement of market demand.

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