Journal of Manufacturing Science and Mechanical Engineering
ISSN: 2959-989X
DOI: 10.61784/msmev2n225

ANALYSIS OF MEASUREMENT TECHNOLOGY AND ITS EVOLUTION IN SURVEYING AND MAPPING ENGINEERING

Smita Haider
Architecture & Planning Department, National Institute of Technology Patna, Patna, Bihar.

Abstract: Surveying and mapping engineering measurement technology is the direct application of surveying and mapping technology in the process of social construction and development. The application scope of traditional surveying and mapping engineering measurement technology is relatively narrow, limited to the fields of water conservancy, construction and transportation, and its main content is as follows Two aspects: mapping and setting out. With the continuous development of surveying and mapping engineering measurement technology, its application fields are becoming more and more extensive. At present, the relatively mature and widely used surveying and mapping engineering measurement technologies mainly include global positioning technology, remote sensing technology and geographical information system technology. The advantages of these three methods are relatively obvious, and in the actual application process, the accuracy of measurement work will be greatly improved. and efficiency, effectively saving the cost investment in surveying and mapping work, and playing a huge role in promoting the development of the surveying and mapping industry.
Keywords: Surveying technology; Mapping engineering; Measurement technology; Engineering

1 MEASUREMENT TECHNOLOGY IN THE SURVEYING AND MAPPING PROCESS

1.1 Global Positioning Technology

Global positioning technology (GPS) first appeared in the 1970s. The United States successfully built a navigation and positioning system that has all-round three-dimensional navigation and positioning capabilities on land, sea, and air, and can use navigation satellites to measure time and distance. In the following decades, the horizontal positioning accuracy of the global positioning system continued to improve, the software and hardware features were continuously improved, and the application fields became wider and wider[1-2]. GPS technology can work around the clock and is not affected by external factors such as weather, with a coverage rate of 98%. The accuracy of its three-dimensional fixed-point and speed-fixing function is very high, so it can accurately position objects that need to be positioned. During the measurement process, GPS technology is less restricted and can accurately obtain measurement results without having to see clearly[3]. GPS technology mainly consists of three parts: space constellation, user equipment and ground monitoring: the space constellation is composed of 24 satellites, forming a honeycomb structure, with directional solar cells installed on both sides; the user equipment refers to the GPS receiver, which uses the The signals received are used to calculate the three-dimensional coordinates of the location; ground monitoring is mainly composed of ground antenna stations, main control stations and monitoring stations, which implement comprehensive monitoring of various locations on the ground[4].

1.2 Remote Sensing Technology

Remote sensing technology is a deep sounding technology based on electromagnetic wave theory. During the actual measurement process, sensing instruments are used to collect and process electromagnetic wave information reflected or radiated by distant targets, and then imaging is performed based on the obtained data, thereby achieving Depth testing of targets. Remote sensing technology has the following advantages: First, it has a wide detection range. During aerial photography, the flying height of the aircraft can reach about 10 km, and the orbit of the Land Satellite can also reach about 910 km; secondly, the acquisition speed of information is fast[5-6]. Land satellites can cover the earth once every 16 days, the cycle is very short, and the data acquisition speed is very fast; third, there are fewer restrictions. Remote sensing technology will not be affected by environments such as glaciers, mountains, and deserts, nor will it be affected by factors such as temperature and pressure; fourth, it has a large amount of information. The information obtained by the remote sensor is closely related to the difference between the remote sensor and the band. Each band contains 7.6 million pixels. Remote sensing technology mainly consists of remote sensors, receiving devices, image processing equipment, information transmission equipment, and remote sensing platforms. It has been used in many fields such as agriculture, environmental protection, geology, oceans, forestry, surveying, geography, hydrology, meteorology, and military reconnaissance. widely used in the field.

1.3 Geographic Information System Technology

© By the Author(s) 2024, under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0).

Geographic information system technology (GIS) is a spatial information analysis technology that has only been developed in recent years. Its application in the field of environment and resources can effectively manage various resources and environmental information, and can also dynamically monitor multiple periods of time. Production activities, significantly improving work efficiency and economic benefits. Geographic information system technology is mainly used in agriculture, forestry, land resources, ecological environment, disaster warning and environmental resources, etc., and has achieved good application results. In terms of environmental resources, GIS technology is mainly applied through the establishment of information management systems. In terms of land resources, GIS technology can be applied to land use status surveys, land evaluations, land use planning, and dynamic monitoring of land cover, etc. aspect.

2 FUTURE DEVELOPMENT OF SURVEYING TECHNOLOGY IN SURVEYING AND MAPPING ENGINEERING

As the demand for engineering measurement technology continues to increase, various measurement technologies will achieve greater development in the future. The following analyzes the future development direction of surveying and mapping engineering measurement technology from four aspects.

2.1 The Data Collection and Processing Process will become more Real-time, Automated and Digital

Taking GPS technology as an example, GPS technology receivers are improving in the direction of being lightweight and portable, while wide-area and real-time differential technology and CCD technology can better meet the dynamic, static and high-precision needs of positioning technology. , and the receiver will also be lighter. As the scope of land use continues to expand, land surveying and mapping technology will gradually expand to more remote areas. This development trend determines the real-time, automation and digitalization of GPS technology. Only by making GPS technology unrestricted by geography and all-weather By controlling all areas within the measurement range, engineering measurement technology can have a wider application space.

2.2 The Management of Measurement Data will be more Standardized, Scientific and Information-based

Monitoring network optimization software will gradually be used between the engineering measurement control network and the city to realize intelligent management of measurement data. It can also make the observation and processing of control network data more standardized, scientific and information-based. 2.3 Surveying and mapping hardware facilities will become more domestic, user-friendly and intelligent. Most of the surveying and mapping technology equipment currently used in our country are imported. With the continuous advancement of surveying and mapping technology, the country’s research on surveying and mapping equipment will also increase accordingly. Realize the localization of surveying and mapping hardware facilities. In addition, the overall development trend of society will also have a certain impact on the development direction of surveying and mapping technology, such as humanization and intelligence. Under the influence of the entire society pursuing humanization and intelligence, the development of the surveying and mapping industry will naturally follow this trend. This trend realizes the humanization and intelligence of surveying and mapping hardware facilities.

2.4 “3S” Integration Technology

Global positioning system technology, remote sensing technology and geographical information system technology are the three most important technologies in surveying and mapping engineering. Each of these three technologies has its own advantages and disadvantages. In actual application, just choose the most appropriate one according to the actual situation. Future surveying and mapping engineering measurement technology will realize "3S" integrated technology - bringing together the advantages of three different surveying and mapping technologies and establishing a complementary relationship based on their common theoretical basis. Integrated technology can simultaneously cover information collection, processing and The entire process, including analysis, makes the measurement technology of surveying and mapping projects more efficient and more widely used.

3 CONCLUSION

To sum up, among the three measurement technologies commonly used in surveying and mapping projects, global positioning technology can work around the clock and is not affected by external factors such as weather. It has very high coverage and accuracy, and can accurately measure without having to see through. Results: Remote sensing technology has the advantages of wide detection range, fast information acquisition, few restrictions and large amount of information. It is widely used in agriculture, environmental protection, geology, ocean, forestry, surveying and mapping, geography, hydrology, meteorology and military reconnaissance. It has been widely used in many fields; geographic information system technology can significantly improve work efficiency and economic benefits, and is mainly used in agriculture, forestry, land resources, ecological environment, disaster warning, and environmental resources. With the continuous development of society, the data collection and processing process of measurement technology will become more real-time, automated and digital, the management of measurement data will become more

standardized, scientific and information-based, and the surveying and mapping hardware facilities will become more domestic, humane and intelligent. ization, and will also integrate “3S” technology to promote the development of China’s surveying and mapping undertakings.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

[1] B. Z. Bo Huang. Urban Land-use mapping using a deep convolutional neural network with high spatial resolution multispectral remote sensing imagery. Remote Sensing Environment. 2018, 56-67.
[2] Li Jie, Fei Xiuqi. Analysis on the development of surveying and mapping engineering technology. Heilongjiang Science and Technology Information, 2011(15).
[3] P. L. LaRocque. WetlandMapping with Landsat 8 OLISentinel-1 ALOS-1 PALSAR and LiDAR Data in Southern New Brunswick Canada. Remote Sensing. 2020, 201-212.
[4] Adamopoulos, E., Rinaudo, F. UAS-based archaeological remote sensing: Review, meta-analysis and state-of-the-art. Drones. 2020, 4(3), 46
[5] Huang Hailiang. A brief discussion of the application of digital technology in engineering surveying. Private Science and Technology, 2010(7).
[6] Wolf, P. R., Dewitt, B. A., Wilkinson, B. E. Elements of photogrammetry with applications in GIS (4th edn. [fully updated]). McGraw-Hill Education. 2014.