The positioning principle of global positioning system and its application prospects

Yingchun Wang, Yuan Li *

School of management, Tianjin University of Technology, Tianjin, China

*Corresponding author e-mail: liyuan@tjut.edu.cn

Abstract. Due to the continuous advancement of science and technology, more and more construction fields have realized the transformation from science and technology to productivity. Including GPS positioning technology. GPS (Global Positioning System) is a system that uses positioning satellites to achieve precise global positioning and can also navigate. The United States developed and used a satellite navigation and positioning system in 1994. The application of this technology has basically covered all areas of the national economy. GPS is widely used in ground surveying, engineering surveying, aerial photogrammetry, topographic surveying, etc. in the field of surveying. The application prospect of GPS system is introduced.

1. Overview of GPS

GPS is the abbreviation of "Global Positioning System". Such a global navigation and positioning system was originally developed and applied, and is by far the most popular and widely used. At the same time, this is also the most mature extensive navigation and positioning system currently in use. It was originally planned to use 21 working satellites and 3 spare satellites to form the space constellation of the GPS system, and now there are 31 orbiting satellites [1]. Among them, 12 GPSIIr satellites, 7 GPSIIr-M satellites, and 12 GPSIIIf satellites are distributed on 6 orbital surfaces. The 31 satellites can cover the whole world. Provide accurate timing, positioning and navigation services for military and civilian sectors. The ground monitoring part of the GPS system mainly includes a main control station, four ground antenna networks and a global monitoring station network. Prior to this, the United States has been promoting the development and research of the gps-ii program. GPS III optimized design plan, abandoned the existing 24 medium orbit satellites, and newly adopted 33 high-orbit geostationary orbit satellite networks [2]. Compared with the existing GPS, the signal transmission power of GPS-ii is increased by 100 times, the positioning accuracy is increased to 0.2-1.5m, and its positioning, navigation and timing capabilities are greatly improved. As shown in Figure 1:
2. GPS positioning principle
Determine the distance between the satellite and the user's receiver, and then integrate the data from multiple satellites to determine the specific location of the receiver. To achieve this goal, the position of the satellite can be found in the ephemeris. The satellite depends on the time, which is recorded by the star catalog. The distance between the user and the satellite is achieved by recording the time interval and multiplication of the satellite signal. Due to atmospheric ionospheric disturbances, this distance is not the true distance between the user and the satellite, not a false distance. To calculate the user's three-dimensional position and time deviation from the receiver, at least four satellites need to receive signals to measure the false distance. The time difference, through the receiver's watch, allows you to know the exact distance of the four signals from the satellite to the receiver (including the same error value caused by the receiver time error), and construct four equations [3]. With these four imprecise distances and accuracy of the four satellites, and solve the equations to obtain the receiver position. As shown in Figure 2:
3. GPS application

3.1. The application of GPS in positioning and navigation
With the rapid development of urban construction and transportation, more and more car navigation and the popularization of tourism information, the emergence of the global positioning system is very convenient. Then download the map from Java. Start Java Communication Control and send the position measurement request to the GPS module of the user terminal. The user can request the location server to provide additional measurement data. The measurement through the Java interface protocol is transmitted to the map through communication control [4].

3.2. Application of GPS in cadastral and real estate surveying and mapping
Cadastral surveying is based on cadastral surveying, using surveying technology as a means to accurately measure the location and size, boundaries, ownership boundary point coordinates, parcel area and cadastral maps of various types of land from control to segmentation. Real estate surveying and mapping is a professional surveying and mapping branch established to meet the needs of land administration departments and other departments of national economic construction. In other words, real estate surveying and mapping is a professional surveying and mapping that uses surveying and mapping instruments, technologies and methods to determine the natural conditions, ownership, location, quantity, quality, and utilization of houses, land, and real estate. GPS can quickly measure the coordinates of control points at all levels. After the application of the new RTK technology, there is no need to set all levels of control points. Only through a certain number of control points can the coordinates of high-precision and rapid warning points, topographical points and ground objects be measured. The electronic map is made in the field by drawing software, printed by computer and plotter, and output various size adjustments. Maps and GPS are applied to land and land use.

3.3. Application of GPS in Geodesy
Because GPS has the advantages of high accuracy, fast speed, low cost, convenient operation, etc., GPS has replaced the general geodetic surveying and geodetic network construction tools. In 1996 and 1997, GPS networks were established and put into use in Class A and Class B countries. Composed of 30 points, the horizontal repetition accuracy is 2*10^(-8), and the vertical repetition accuracy is not less than 7*10^(-8). The B-level network consists of 800 points, and the accuracy is 4*10^(-7), which is higher than 8*10^(-7). To this end, a set of high-precision three-dimensional geodetic coordinates was established, which laid the foundation for a sustainable economic and social development map. According to reports, in the second phase of construction, a global positioning system was established in the three canyons. Established Nanjing City System Construction Management Network [5].

4. Conclusion
Global positioning system provides a wide range of application opportunities for mining surveying, transportation selection and other engineering fields. However, global positioning systems such as urban construction are expensive and are not widely used in the construction of civil and transportation facilities. They are only used for control purposes. For example, in the initial During the construction phase, some GPS control points were exposed on the basic lines of the conductor. After 90 years, based on the static positioning system and dynamic RTK map of the global positioning system, the triangulation network and encryption points were moved or used as a common station. Base use, after more than 30 years of practice, the global positioning system is highly accurate. It is an all-weather global multi-functional wireless navigation, positioning and time system. The global positioning system technology has become multi-level, medium-module, multi-functional and multi-module. It has become an international cutting-edge technology. Industry, expanded to all sectors of the national economy, gradually integrated into people's daily lives [6].
Acknowledgments
The work was sponsored by the School of Management, Tianjin University of Technology.

References
[1] Zhou Wei. Basic Geographic Information System [M]. Beijing: Science Publishing House, 2006.
[2] Shen Tao, Li Chengming, Zhao Yuanchun. Research on Quality Inspection Technology of Urban Basic Spatial Data [J]. Science of Surveying and Mapping, 2005, 30(5): 48-49.
[3] Peng Liang, Li Jun, Xu Tao. Research on data quality control in transferring AutoCAD drawings into GIS system [J]. Surveying and Spatial Geographic Information, 2005, 28(4): 23-25.
[4] AutodeskInc. AU Technical Community [EB/OL]. [2011-09-02]. http://www. Autodesk. com.
[5] Zhu Xinghua. The method of data conversion between AutoCAD file and Mapinfo [J]. Journal of Huaihai Institute of Technology: Natural Science Edition, 2010, 19 (SO): 106-107.
[6] Wang Xiaoxin, Wang Rui, Li Yan. Analysis on the construction of the public service platform of digital city geographic information [J]. Journal of Huaihai Institute of Technology: Natural Science Edition, 2010, 19 (SO): 7-8.