Research on Computer-Aided Road Landscape Design

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Abstract. The road landscape computer aided technology in China's engineering survey in the development and application, and in road mapping, building survey has an important role, its development and promotion of China's building construction of far-reaching significance. This paper describes the current road landscape, the practical application of computer aided technology for computer aided technology, the principle of road landscape is analyzed, and puts forward the ground of the stationary road landscape of computer-aided technology in actual production process, the application of technology is analyzed, put forward the road landscape trend of computer aided technology application in the engineering survey, in order to offer reader reference.

Keywords: Data Acquisition and Analysis, Road Mapping, Engineering Survey, 3 d Modeling

1. Introduction

The road landscape computer aided technology is based on the laser ranging principle, using the scanning scope of the scanning mirror and point cloud density to obtain the three-dimensional coordinates of each point on the target surface, which can obtain the texture information of the target point position in turn, and restore the three-dimensional scene. In recent years, road landscape computer-aided technology has been paid more and more attention, and many scholars even think that it is a new revolution of engineering survey after GPS technology, which plays an important role in data collection and data analysis [1-3]. As a new surveying method, the road landscape computer-aided technology has been widely used in the construction of various projects at home and abroad. In foreign countries, it is more widely used in engineering design and surveying, and in China, it is more widely used in the protection and surveying of cultural relics. The road landscape computer-aided technology has important applications in topographic map mapping, earthwork measurement, road and bridge measurement and modeling [4-6].

2. Principle and application classification of road landscape computer aided technology

2.1. Principles of point cloud data Technology in engineering Measurement

The application of road landscape computer aided technology can be divided into fixed point cloud data analysis system and mobile point cloud data analysis system according to the different measurement methods. The former is similar to traditional engineering survey of total station, but is different from total station: fixed point cloud data analysis system by the point cloud data analyzer,
control system, digital cameras and post processing, the collection is not a discrete single point coordinate, but to build a system of "point cloud", a scan range, the characteristics of quick speed, high precision, in the wild have larger operating space. On the other hand, the traditional mobile engineering survey is based on the vehicle-mounted platform, which is combined by THE GLOBAL positioning system (GPS) and the inertial navigation system (IMU), and integrated with the fixed-point cloud data analysis system technology to collect and summarize data. Mobile point-like cloud data analysis technology can obtain more reflected lasers and carry out gray matching for scanning points. Generally speaking, the data analysis technology of mobile point cloud is still unstable, and the data collection and analysis of point cloud are more stable and effective to a certain extent.

2.2. Application classification of point cloud data technology in engineering survey

2.2.1. Practical application of point cloud data technology

The practical application of road landscape computer-aided technology in engineering survey includes four aspects: topographic map mapping, earthwork calculation, completion survey and 3D modeling. The computer-aided work of fixed road landscape includes preparation before scanning, data acquisition and processing of point cloud, etc. Before scanning, it is necessary to make an overall investigation of the environment in the computer-aided area of fixed road landscape and determine the position of scanner and target. Ensure that the scanned data can effectively represent the measured area, and selects as few stations as possible to reduce the amount of raw data processed. During the scanning and measurement, the unique terrain in the measured area should also be photographed and recorded, so that the later data processing can be more effective and the investigation can be carried out more comprehensively. The overall planning of computer-aided road landscape design is shown in Figure 1 below. As shown in Figure 1 below, computer-aided application of road landscape can start from "uploading photos, feature tagging, deep learning, testing and verification, model downloading":

![Figure 1. The overall flow of computer-aided road landscape.](image)

The indicators in Figure 1 are derived from current industry standards, the data acquisition of point-like cloud needs to be acquired by the fine scanning of the measurement station, and the target center is taken as the control center, and the three-dimensional structure of the target center is accurately measured by the total station without reflection. Not only can the coordinates of the target center be accurately obtained, but also the subsequent multi-station data can be better registered. The setting of the target should be evenly distributed and the distance from the scanner should be adjusted.
and improved. The matching criteria of point cloud data need to set corresponding targets for control in different scanning areas, so that the adjacent scanning point cloud can control multiple targets and be used for point cloud data in different areas. The relative and absolute atmosphere of the matching criteria are two parts. More importantly, the accurate measurement of the total station or other instruments should be established based on the coordinate system of a certain scanning station. The purpose is to obtain the precise coordinates of the target. After the collection, summary and registration of point cloud data, the most important operation is the data processing, and the processed point cloud data is conducive to the precision of topographic map mapping, road and bridge completion survey, 3D modeling and other engineering applications.

2.2.2. Application of point-like cloud data acquisition technology
From the perspective of practical application, the problems of point-like cloud data acquisition technology mainly include two aspects: the problem of road landscape computer-aided equipment and the problem of professional personnel.

On the one hand, with the continuous advancement of China's new industrial situation, China's engineering precision measurement has been visible improvement and progress. For example, engineering precision measurement enterprises develop relevant engineering precision measurement control systems and optimize the design of engineering precision measurement with the concept of "New Moore Law". But on the whole, the project accurate measurement control mechanism of our country is still immature, largely fiber optimization application control system cannot implement, the staff was not established in the process of work more good engineering accurate measurement control consciousness, appear even the sense of responsibility is not strong, work careless, and so on and so forth. Due to the fact that the work of accurate measurement and control of engineering is neglected to a certain extent, the manpower and material resources invested by enterprises in accurate measurement and control of engineering are insufficient, leading to the failure of timely and effective cleaning and maintenance of data analysis equipment, and turning a blind eye to violations.

The operation of the accurate measurement in engineering aspects, on the other hand, remain scarce phenomenon of professional management talents, most of them because the job is difficult, is not to choose further study in this respect, leading to counterpart quality is low, the number of professional management talents that increased the accurate measurement in engineering in the process of running safety accident risk.

There are many reasons for this problem. First of all, most of China's accurate engineering measurement enterprises have not formed a reasonable and perfect measurement talent management system. For those who do not have professional management ability, it is risky to inspect and supervise the accurate engineering measurement. Secondly, as for industrial measurement, the management mechanism of most accurate engineering measurement is too rigid, which does not meet the needs of the development of the current era. At the same time, it lacks certain binding force and reward system, which is a great limitation for the development of professional management talents and is not conducive to the maximum development of measurement talents.

3. Application of road landscape computer aided in engineering survey

3.1. Application in topographic map mapping
Topographic map mapping is the overall topographic mapping of a certain area, which may include cliffs, broken walls and other areas that are difficult to be measured by conventional measurement methods. The topographic mapping of these areas can be done by using the point-like cloud data analysis technology, and the topographic mapping can be done without the traditional contact measurement. The process includes the collection, summary and processing of point-like cloud data as well as the extraction, editing and processing of topographic features, which are integrated into topographic maps.
3.2. Application in earthwork calculation

Traditional earthwork calculation uses the instrument measurement of engineering mapping such as GPS and level to calculate the 3D coordinates of the characteristic points of surface roughness and construct the calculation template of earthwork. The disadvantage of this method is that the workload is huge, which requires workers to collect a large number of scattered points and make data statistics in the field. The collection interval is also large, and the accuracy is low. The fixed road landscape computer-aided technology can make the calculation of earthwork more convenient and accurate, effectively reduce the intensity of field work, and improve the accuracy of calculation. The process includes the processing of point cloud data, the construction of a certain earthwork base level, and the removal of characteristic landforms and features, so as to generate DEM and further measure earthwork.

3.3. Application in road and bridge completion survey

Road landscape computer-aided technology also plays an important role in the completion measurement of road and bridge. It can effectively obtain the sample diagram and vertical and horizontal section of road and bridge, and check their stability and stability (as shown in Figure 2 below). The traditional measurement method has a large workload in the survey of road and bridge completion, and the data processing automation degree is low, which also reflects the road landscape computer-aided technology for the contemporary road completion survey has an important role.

![Figure 2. Three-dimensional mapping of horizontal and vertical sections of road landscape.](image)

Can make use of road landscape computer-aided technology field nearly four times the work efficiency of ascension, but its application is also deficiencies: first point cloud data analysis technology development time is short, the corresponding equipment are more expensive, difficult to popularize, a wide range of application and the application of point cloud data analysis in all fields is still in the exploration; Secondly, there is still no uniform rotation shafting parameters in the use of road landscape computer-aided equipment, and its correction system and error are difficult to define. In addition, road landscape COMPUTER-aided technology is very rapid in data processing and has a large amount of data processing capacity. However, the corresponding software has the compatibility of error and instability in data processing. If road and bridge only rely on road landscape computer-aided technology, the processing cycle may be longer.

4. Conclusion
As one of the most advanced technologies for obtaining 3D spatial data in the world, the road landscape computer-aided technology can supplement the traditional engineering survey, and has the characteristics of higher accuracy, faster speed and longer distance. It can process information more quickly and effectively improve the work efficiency in the field. The point cloud data analysis technology can be used to map and map the topographic map which is difficult to reach by traditional measurement. Road landscape computer-aided technology including topographic map surveying and mapping, the calculation of earthwork quantity and complete measurement and 3d modeling aspects of content, as well as the axis of rotation system parameters uncertainty and its correction system and the error is difficult to define faults, so the road landscape computer aided technology in engineering survey still needs further research and development.

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