

技术辅助工程造价管理后，造价从业人员可以避免繁重的计算造成的错漏，并且还可以实现不同时空维度的统计分析，从而辅助项目管理人员进行决策，确保了数据的准确性。

**结语**住房和城乡建设部明确要在建筑工程领域大力推动 BIM 技术在工程建设全过程的集成应用，目前我国的 BIM 技术的应用已经逐步从设计环节向施工环节发展，并开展了运维环节的探索，因此结合不同项目的特点，发挥 BIM 技术的优势，重点关注施工环节的 BIM 技术应用，为今后建筑业信息化、低碳化转型提供了重要助

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### 冶金工艺——密闭黑暗空间内腔成像的开发

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*Summary. There will be a large amount of ash accumulation in the mineral heating furnace when preparing products, but due to the harsh internal environment of the mineral heating furnace [1], it is difficult to directly observe the situation in the furnace. This project uses the inner cavity imaging system to reconstruct the situation in the furnace through computer three-dimensional, so as to better control the situation inside the furnace and effectively extend the life of the furnace.*

This project team originally planned to use C language to design software programs, because the project program is more complex, C language is a difficult structural language, so in the process of project implementation gradually found that it is difficult to write the interface through C language. To this end, we decided to modify the original plan, after searching for information and consulting teachers, we decided to adopt the method of front-end and back-end separation, the main language is JavaScript, and the flat canvas Canvas is used for drawing. And use Vue.js on the front end to build an operable visual interface for users to use, its flexible, easy to use and superb performance characteristics make this framework has become the mainstream front-end framework, we use the back-end framework for Node.js, Node.js is an open source, cross-platform JavaScript runtime environment, often used for cross-platform development or building lightweight servers, although Node servers are not as good as the commonly used Java+ when processing huge amounts of data Spring's back-end development approach, large projects are still Java domain, but in small projects, Node.js better performance due to its three major features, single-threaded, non-blocking I/O and event-driven, while using MySQL, one of the most widely used database systems to store images.

Since the measurement of this system is controlled by horizontal rotating transmission device and vertical rotating transmission device, the main structure of both transmission devices is rotary, so the most suitable measurement coordinate system is the spherical coordinate system, first, the point data collected by the laser rangefinder is imported into the computer, and the point coordinates are solved according to the geometric relationship of the space vector. And through the two measurement methods of curve measurement and point cloud measurement designed by the system, the single-point measurement mode and continuous measurement mode of the laser rangefinder are respectively corresponded, and then the least squares method or B-spline interpolation is used to fit it into a curve. The user can import the Excel file generated by the laser rangefinder externally through the import file button, which is parsed into an array recognized by the system. The defect analysis button can analyze the coordinate data through the curve fitting algorithm to obtain the coordinates of the bumps and concave points, so as to accurately find the location of dust accumulation and eliminate hidden dangers in time

At this stage, the main research problem of the project team is: how to observe the slag hanging situation inside the high-temperature ore heating furnace in real time, and finally, our project team reached an agreement and decided to design a set of devices that can rotate 360 degrees and can image the collected point data through the computer in real time for project research. On

the confined dark space cavity imaging device, we completed the three-dimensional drawing and assembly of the monitoring imager parts through the SOLID WORKS2020 version, and performed explosion view operations on the completed parts to obtain simple equipment explosion drawings and equipment disassembly and installation animations, so that the structure can be more concise and convenient to understand, which is conducive to future production and installation. Understand the principle of rotating operation of the device, the determination of the measurement coordinate system and the coordinates of the origin, the measurement path planning, and carry out 360° data collection without dead angle through the motor drive and gear transmission of the device.

In the problem of selecting the best laser rangefinder, we comprehensively compare the laser rangefinders of five manufacturers, based on range, accuracy, price, and intuitively compare the cost performance of each rangefinder through curve fitting, so as to ensure the authenticity and reliability of project data and optimize the selection of laser rangefinders. In the end, it was decided to purchase a red laser rangefinder-keyence laser sensor with a detection distance of 60–5000 mm and a variable diameter of less than 40mm.

The system is equipped with an all-round automatic rotation device that can be equipped with a laser rangefinder, which can freely adjust the length of the robotic arm in extremely harsh environments that cannot be directly detected by artificially such as closed high temperature, and extend the laser rangefinder into the furnace, rotate in all directions according to the planned path, and automatically complete the measurement of the distance from the origin of the laser rangefinder to each point of the furnace. Therefore, compared with the manual detection of the mine furnace, this system can not only ensure the safety of the staff but also ensure the recovery of valuable energy in the furnace, reducing the cumbersome operation process and errors in manual calculation.

This project will develop a lightweight 3D reconstruction software and design a system based on laser ranging technology and grid imaging technology. Through the computer processing of the point data collected by the laser rangefinder real-time imaging and three-dimensional reconstruction, constitute a closed inner cavity shape, and then carry out data analysis, at the same time the user can operate the canvas to zoom in, zoom in, translate and rotate, etc., clearly and clearly observe the structure of the inner cavity of the mineral heating furnace.

In the processing of point data, we chose B-spline curves with excellent properties such as geometric invariance, convexity, convexity, variation reduction, and local support. Although the least squares method is simple and easy to implement, if the fitting mode is not selected properly, it will produce a large deviation.

This system and device are widely used and universal. The project concept is derived from common problems in industrial production, and the results obtained by the experiment can be widely used in various fields and can significantly improve its work efficiency.

## References

1. Basic parameters in the operation and design of submerged arc furnaces, with particular reference to production of high-silicon alloys[J]. Journal of the Southern African Institute of Mining and Metallurgy,2018,118(6).

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赤泥联合钢渣的铁铝分离技术

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**Summary.** *This project provides the theoretical and experimental basis for the industrial production of Weiqiao alumina red mud, and at the same time fundamentally solves a series of problems such as waste of resources, environmental pollution and storage costs caused by red mud stockpiling, so as to truly achieve sustainable economic development.*