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Retraction

Retracted: Intelligent Cost Accounting Optimization System of Building Engineering Materials Based on Ant Colony Algorithm

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Security and Communication Networks has retracted the article titled "Intelligent Cost Accounting Optimization System of Building Engineering Materials Based on Ant Colony Algorithm" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

[1] Xue Ma and M. Sohail, "Intelligent Cost Accounting Optimization System of Building Engineering Materials Based on Ant Colony Algorithm," *Security and Communication Networks*, vol. 2022, Article ID 7942341, 8 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

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Research Article

Intelligent Cost Accounting Optimization System of Building Engineering Materials Based on Ant Colony Algorithm

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To save money on labour and keep track of the expenses of building engineering materials. This study provides an intelligent accounting and optimization system for building materials costs based on the ant colony algorithm. In the hardware, three relays are used to achieve open phase protection and convert the voltage signal into current signal; in the software, distinguish the material characteristics, identify the material types, use the virtual governance cost method, optimise the cost intelligent accounting mode, and design the software integration management function using integration technology and the ant colony algorithm; and in the hardware, use the virtual governance cost method. The average labour cost of the intelligent building material cost accounting and optimization system in this paper and the other three systems is 1924 (RMB 10,000), 2749 (RMB 10,000), and 2744 (RMB 10,000), respectively, demonstrating that the intelligent building material cost accounting and optimization system integrated with the ant colony algorithm has a better overall performance.

1. Introduction

The construction unit has traditionally been thought of as a mix of operations, management, and operations. Furthermore, in the construction industry, all production workers, construction machinery, and revolving materials are considered to be owned by the construction company, so the construction unit uses cost accounting for self-owned production workers, self-owned machinery, and self-purchased materials. However, as the market economy evolves, labour subcontracting, rotating material leasing, and equipment leasing become more common, requiring the construction unit, labour company, and leasing firm to collaborate to complete the project. The real labour, materials, and machinery are provided via enterprise ownership and social leasing. First, the pricing quota defines the project's worth, taking into consideration that the construction unit's production employees, construction machines, and rotating materials are all self-owned, and the quota is based on the construction unit's cost accounting. As the market economy grows, labour subcontracting, rotating material leasing, and equipment leasing are all becoming more prevalent. To guarantee the project's success, the construction firm, labour company, and leasing company all work together. Labour, building supplies, and construction equipment are all secured in genuine construction projects via firm ownership and social leasing [1–3]. As a result, there must be a gap between the theoretical construction engineering price created in the preceding planned economy era based on valuation quotas and the real construction engineering price established in the market economy. Second, the cost accounting item for the construction unit is a single project (or unit project), which is not unique to divisional and subdivisional works, but the price components are separated between them. When pricing the bill of quantities, the construction business should accomplish cost accounting at the divisional and subdivisional levels and reflect the company's operational strength. Collect and analyse cost data at the divisional and subdivisional levels, compile historical cost data, and provide data support for labour and

material quotas and bidding quotations. As a consequence, under the current bidding contract system, the list pricing technique is often used. Costs of labour, materials, and machines must all change. Enterprise quotas must be popularised and pushed to supplement and improve the pricing system, encourage construction units to establish labour and material quotas, and build a pricing system that can better adapt to the market, lead the market, serve the market, and standardise the market. The employment of an ant colony algorithm in combination with intelligent cost accounting for constructing engineering materials is presently absent in the academic literature, and there is still room for development.

2. Hardware Design of Intelligent Cost Accounting Optimization System for Building Engineering Materials

In the intelligent cost accounting optimization system of building engineering materials, it is necessary to design the system hardware according to the characteristics of building engineering. This paper mainly designs the hardware of the terminal of the intelligent accounting optimization system for the cost of building materials. The building engineering materials intelligent cost accounting optimization system receives and analyses numerous status signals from the construction process. It also includes wireless signal transmission between tower cranes, anti-collision, and terminal signal upload management center. The overall block diagram of the system is shown in Figure 1.

According to Figure 1, the whole system integrates various sensors and signal acquisition and processing systems. Sensor signals include horizontal displacement, vertical displacement, lifting weight, rotation angle, wind speed, and inclination data. The system selects TI MSP430 MCU as the core processing chip of the hardware system. The intelligent cost accounting optimization system of building engineering materials requires direct power supply from AC power supply, a certain level of anti-interference ability to surge and group pulse interference, and lightning protection for lightning in nature. Therefore, the AC power filter circuit is designed, and the 220V AC to 24V DC power module is selected to supply power to the whole system, as shown in Figure 2.

The AC filter circuit, as shown in Figure 2, uses a three-way relay to provide open phase protection, a varistor, and discharge tube to achieve lightning protection, and filters the input voltage to lower the series interference potential. The system selects the single chip microcomputer msp430f5438a of Texas Instruments (TI) as the core processing chip of data acquisition. MSP430 adopts 16 bit processing unit. The MCU integrates rich resources: timer, counter, serial port, SPI interface, on-chip AD conversion, and rich interrupt resources. The minimum system circuit is simple. The signal range is 4~20 mA. The axle pin sensor whose output signal is current signal is directly selected as the lifting load sensor, and the signal range is also 4~20 mA. Therefore, the signal acquisition circuit of three analog signals is similar. A

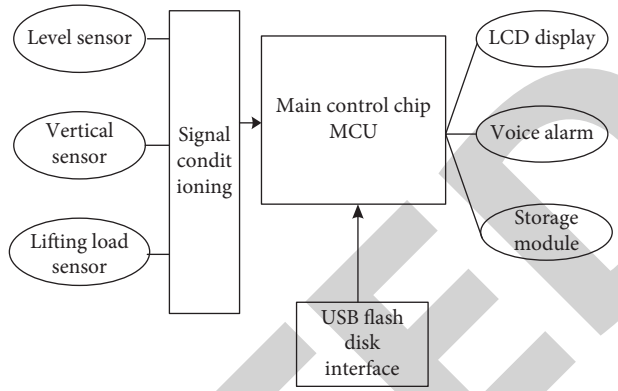

Figure 1: Structural block diagram of intelligent accounting optimization system for building engineering material cost.

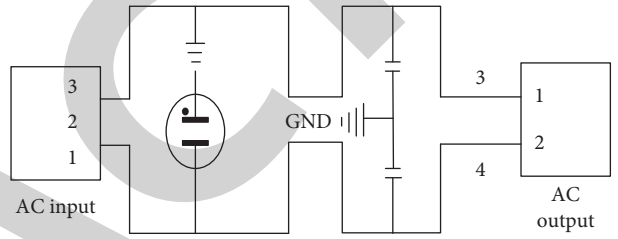

Figure 2: Schematic diagram of AC filter protection circuit.

current loop conversion circuit for converting current into voltage is designed at the signal receiving end of the system to restore the signal into voltage signal. In order to standardise the management of operators and clarify the person responsible for tower crane accidents, the system provides a fingerprint identification circuit to record the operators of construction tower cranes. Meanwhile, for the reading of operating parameters stored in ferroelectric and flash chips, the system designs a U-disk reading circuit to facilitate data reading and analysis, as shown in Figure 3:

As can be seen from Figure 3, the module is a contact single fingerprint identification device, which is composed of optical path, imaging, and fingerprint identification processing. The steps include simple calculations for the acquired data, control of the LCD display screen for real-time display, data storage in ferroelectricity through the synchronous serial port (SPI), and comparison with the preset alert and early warning value. For the parameters exceeding the set value, trigger the voice alarm through the I/O port to give voice prompt for the corresponding dangerous operation. Based on this, the hardware design steps of intelligent accounting optimization system for building material cost are completed.

3. Software Design of Intelligent Cost Accounting Optimization System for Building Engineering Materials

3.1. Identifying Types of Construction Materials. Architecture is one of the oldest and most dynamic products of mankind. Buildings have developed from the earliest stone masonry to

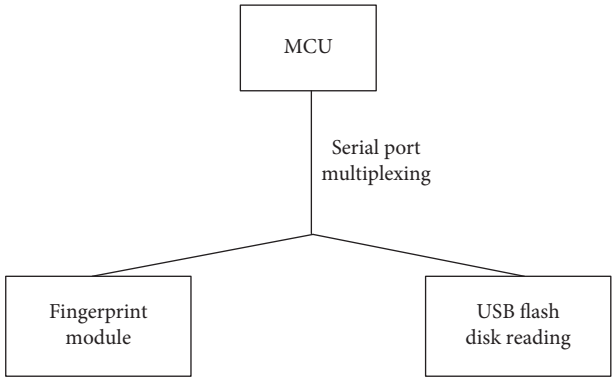

Figure 3: Structure diagram of fingerprint and USB flash disk.

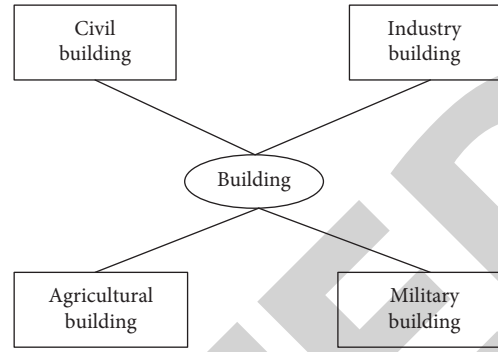

Figure 4: Building classification.

brick burning and tile covering, and then to modern reinforced concrete pouring, all steel structure super high-rise buildings and so on. It can be said that architectural activities run through the whole history of human civilization. Up to now, people are still used to referring to or distinguishing different cities and regions with some landmark buildings. Public buildings refer to the buildings used by people in various social activities, such as gymnasiums, schools, hospitals, shopping malls, hotels, libraries, airports, and railway stations. According to the nature of use, buildings can be divided into industrial buildings, agricultural buildings, military buildings, civil buildings, etc., as shown in Figure 4.

According to Figure 4, civil buildings have the largest volume and are the most representative in buildings. Public buildings have the characteristics of large space, dense flow of people, high energy consumption, and often undertake social service functions, which is conducive to the promotion and practice of the concept of green building through government policy guidance and actual investment. Residential buildings are inconvenient for policy promotion due to the features of privatisation, and residential buildings have numerous users who do their own thing, making unified design and execution difficult. The most often utilised civil buildings are separated into two categories: residential structures and public buildings. Residential buildings mainly refer to family buildings focusing on daily life, such as apartments and villas. According to the use of building materials, building materials can be divided into special materials for structure, decoration, and other special materials [4–6]. Building engineering materials have experienced strong wind, sun, rain, friction, and corrosion for a long time, and the performance of building engineering materials will gradually change. The appropriate selection of building engineering materials is very important [7, 8]. First, it should be very safe and durable. The use of building materials is very huge, which will directly affect the cost of construction projects. Therefore, when analyzing the technical capacity of engineering building materials, we must take into account the cost performance of engineering building materials [9–11]. Building materials are used to maintain various civil work projects, so as to improve the actual use and beauty of the work projects to a certain extent, and protect the integrity and stability of the main composition of the project. Facing the limitations of various environmental principles in the project, we can enhance the stability and durability of engineering materials. This kind of engineering building materials is called decoration building materials, also known as decoration building materials or finishing building materials [12–14]. They include cement, commercial alkali, alkali components, admixtures, bricks and blocks, sand, stone, ash, wood, bamboo, hemp, grass and products, metal profiles, metal pipes and pipe fittings, PVC pipes and pipe fittings, PVC composite pipes and pipe fittings, valves, flanges, blind plates, and other building materials. Building materials can be divided into inorganic building materials, organic building materials, and composite building materials according to their properties. Metal building materials and non-metallic building materials are two types of inorganic construction materials. Organic building materials are mainly natural building materials. Composite building materials are synthetic building materials. Inorganic building materials are mainly composed of inorganic materials, most of which are inorganic building materials. Common inorganic building materials in the market include cement, commercial alkali, alkali components, bricks and blocks, sand, stone, ash, wood, bamboo, hemp, grass and products, natural stone, keel and accessories, building hardware accessories, metal profiles, metal pipes and fittings, valves, flanges, blind plates, wires, cables, and municipal special materials. Organic building materials are organic building materials. Common organic building materials in the market include glass, artificial stone, floor, carpet, floor mat, paint, coating, putty, welding, cutting and polishing, electricity, water, power, fuel, industrial gas, PVC pipes and pipe fittings, PVC composite pipes and pipe fittings, and water stop building materials. Through the fusion of molecules and particles, they become building engineering materials with opposite structures with many product characteristics [15, 16]. Steel plastic pipe, aluminium plastic pipe, steel mesh skeleton pipe, steel plate network management, resin well cover, castor, and other composite construction materials are common on the market. It is separated in the construction cost according to the various applications of building engineering materials. In theory, construction engineering materials can be divided into main construction engineering materials, auxiliary construction

engineering materials, turnover construction engineering materials, and secondary construction engineering materials. Based on this, complete the steps of identifying the type of building engineering materials.

3.2. Optimizing Intelligent Cost Accounting Mode. Cost intelligent accounting is a process of comparing the actual cost generated by the process of production and operation with the cost plan based on the existing cost plan and combined with advanced technologies such as big data and artificial intelligence. Cost accounting has two aspects: mastering the actual situation and controlling the abnormal situation [17]. The price of engineering building materials refers to the comprehensive cost of a series of fully produced and half produced building materials required for each project, from dealers at all levels to project implementation sites or warehouses. It is usually calculated by unit project, and sometimes by project body or subitem. It is mainly divided according to the project organization structure, considering the needs of cost management. Cost accounting is the main basis for all aspects of cost management. Generally, it shall include labour cost, material cost, machinery cost, measure cost, indirect cost, and other subitems. Generally speaking, the price of building materials is composed of four aspects, namely, the supply price of building materials, the transportation miscellaneous expenses of building materials, the consumption expenses of traffic losses of building materials, and the collection, purchase, and warranty management expenses. At the same time, sometimes the inspection and test fee is added. If the material requires inspection, the inspection and test fee shall be recorded in the material price, and a separate project shall be established in the record form. Cost is the product of production. In the process of completing a production, certain resources must be consumed, which can be human, material, financial, time, and so on. In the field of cost optimization, the cost can be divided into estimated cost and actual cost according to different times [18, 19]. The estimated cost is the cost estimated before the occurrence of production and operation activities. It is often given in the form of quota, plan, index, etc. Its main purpose is to serve the formulation of cost plan or cost target. The virtual treatment cost approach is used to calculate the particular value of pollutant emissions throughout the course of a building's life cycle, as well as the unit treatment cost necessary to remediate certain pollutants. The pollutant emission in the construction stage mainly comes from two processes: construction and transportation of building materials. The energy consumption during building construction is directly related to the construction technology and quantities. The expression formula of energy consumption during construction is as follows:

$$H = \sum_{q=1}^{p} L_q \times W_q. \tag{1}$$

In formula (1), q represents the construction method, L represents the unit energy consumption of main construction methods, W represents the total construction amount of construction methods, and p represents the types of main construction methods. Based on this, the expression formula of total gasoline consumption of building materials is obtained:

$$E = \sum_{e} \beta_e \times U_e \times \alpha. \tag{2}$$

In formula (2), β represents the quality of building materials, U represents the transportation distance of building materials, α represents the amount of gasoline required for the transportation of building materials per unit mass per unit distance, and e represents the type of building materials. After the total amount of gasoline required for the transportation of building materials is obtained according to the above formula, the total amount of pollutants discharged by gasoline during transportation can be known according to the environmental impact list of common building energy. The key issue in the operating stage is the resources and energy utilised by the building's interior equipment, which mostly includes electricity, natural gas, and other forms of energy. For commercial buildings, if they are in operation, statistics can be made by the electricity, natural gas, water consumed, and domestic waste generated during the actual operation. If it has not been put into operation, it can be calculated according to the indicators such as distribution power, heating and refrigeration design and water supply design on the design drawings, and estimated based on the amount of domestic waste generated by commercial buildings of similar scale in operation per unit time. For coal-fired central heating, the calculation formula of building heating coal consumption index is as follows:

$$R = \frac{24 \cdot \varepsilon \cdot g}{(s \cdot \gamma_1 \cdot \gamma_2)}. \tag{3}$$

In formula (3), ε represents heating days, g represents building heat consumption index, s represents calorific value of standard coal, γ_1 represents transmission efficiency of outdoor pipe network, and γ_2 represents boiler operation efficiency. The virtual treatment cost of air pollution and water pollution in the building life cycle can be calculated quantitatively according to the pollutant emission. The calculation formula is:

$$T_\eta = \sum_{\eta} Z \times V. \tag{4}$$

In formula (4), Z represents the virtual treatment cost of air pollution, V represents the emission of major pollutants of air pollution or water pollution, and η represents the unit treatment cost corresponding to major pollutants of air pollution or water pollution. If the method of open stacking or landfill is adopted for simple treatment, the dust generated in the process of cleaning, transportation, and stacking will cause serious environmental pollution. The calculation formula of construction solid waste treatment cost is as follows:

$$Q = l \times \varphi. \tag{5}$$

In formula (5), l represents the total amount of construction solid waste generated by the building in its life cycle, and φ represents the unit treatment cost of

construction solid waste. With the development of urbanization in China, most domestic waste will be treated innocuously, rather than directly discharged into the natural environment without treatment. Therefore, the calculation method of environmental cost caused by domestic waste is different from that of air pollution and water pollution. The treatment cost of domestic waste is related to the treatment mode of domestic waste. The calculation formula of treatment cost of domestic waste is as follows:

$$\mu = d \times h + \sum d_c \times h_c. \tag{6}$$

In formula (6), d represents the total amount of domestic waste generated in the building life cycle, h represents the unit removal cost of domestic waste, d_c represents the amount of domestic waste with different treatment methods, and h_c represents the unit treatment cost of different treatment methods of domestic waste. Actual cost refers to the cost incurred in the process of project implementation, which is often paid in the form of accounting, audit, and so on. It can also be divided into direct cost and indirect cost according to the impact of cost occurrence. Direct cost is an inevitable cost and a factor that cannot be ignored. Although indirect costs also occur, but the quality and quantity often have great flexibility, which can be used as a breakthrough in cost management. Moreover, from the perspective of authority management, we must also distinguish between controllable costs and uncontrollable costs. Defining the idea of controllability aids in determining the authority and duty of key departments or persons, increases cost management controllability and landing, and enables post-supervision. In the construction stage, the prefabricated components are mainly assembled into a complete prefabricated building entity. Among them, in the installation process, the costs include labour cost, vertical transportation cost of prefabricated components, amortization cost of installation machinery, connecting parts in node area, material cost of embedded parts, management fee, etc. Based on this, complete the steps of optimizing the cost intelligent accounting mode.

3.3. Ant Colony Algorithm Design Software Integrated Management Function. Ant colony algorithm is an optimization algorithm that simulates the habits of ants in nature. We can emulate the intelligent behaviour of an ant colony thanks to the fast development of computer bionics technology. This is a new technology and idea, which breaks through the bionics discipline of artificial intelligence. Every ant releases a substance called pheromone on the path from one city to another, and the basis for ants to choose the next city is a probability problem. In the ant colony algorithm, when the ants have passed through each city, a complete feasible solution is constructed [20, 21]. However, if pheromones are accumulated continuously, there will be too many pheromones, which will affect the role of heuristic information. Therefore, the pheromones on the path should be updated to avoid the impact caused by pheromones. In the intelligent cost accounting optimization system of building engineering materials, the goal of system software integration is based on a variety of integration technologies such as system integration, function integration, network integration and software interface integration, and follows the principles of openness, efficiency, reliability, economy. and practicality. Through the public high-speed communication network, build a network platform with reasonable structure, good performance and reliable operation, realize the sharing of information, resources and tasks under the unified man-machine interface environment, and complete the monitoring. Integration integrates the functions of each subsystem, organically interconnects and integrates the decentralized subsystem intelligence, so as to improve the overall intelligence, enhance the comprehensive management and disaster prevention and resistance ability, and realize the optimization of energy-saving management. In order to measure the environmental degradation cost, this paper will convert the environmental degradation cost by using the proportion of environmental pollution virtual control cost and environmental degradation cost in macro data. The estimation formula of environmental degradation cost is as follows:

$$F = \sum_{n=1}^{m} X \times Y. \tag{7}$$

In formula (7), X represents the total environmental degradation cost in the building life cycle, Y represents the virtual treatment cost of atmosphere, sewage and solid waste in the building life cycle, m represents the estimation coefficient of environmental degradation cost, and n represents the construction cycle. To sum up, based on the constituent elements of environmental cost, the calculation formula of building life cycle environmental cost is:

$$MI = MI_A + MI_B + MI_C + MI_D. \tag{8}$$

In formula (8), MI_A represents the environmental cost in the production and processing stage of raw materials, MI_B represents the environmental cost in the construction stage, MI_C represents the environmental cost in the operation and maintenance stage, and MI_D represents the environmental cost in the demolition stage. In the intelligent cost accounting system of building engineering materials, in addition to the relevant contents of cost accounting, it is also necessary to monitor the operation status of each subsystem equipment in real time and display it on the map. Open the relevant page to see the status of any equipment or key point of any managed subsystem in real time. This information is displayed in the form of graphics, text, and animation on the page. Each subsystem's operation status history is recorded in a database, which can be used to produce different statistics charts and evaluate the operation status trend as needed by the administrator. The system needs to realize the interoperability, rapid response, and linkage control among various professional subsystems in the building. Cross system linkage control is also more and more reflected in energy saving. For example, large energy consuming households such as lighting, air conditioning, and elevator can realize regular opening and closing, or opening and closing when certain events occur, or even more detailed

Table 1: Labour cost for 4 weeks of project cycle (ten thousand yuan).

Number of experiments	Intelligent cost accounting optimization system of building engineering materials based on genetic algorithm	Intelligent cost accounting optimization system of building engineering materials based on BIM	The intelligent cost accounting optimization system of building engineering materials in this paper
1	1.552	1.451	1.102
2	1.364	1.336	0.987
3	1.281	1.258	1.033
4	1.410	1.367	0.985

Table 2: Labour cost for 8 weeks of project cycle (ten thousand yuan).

Number of experiments	Intelligent cost accounting optimization system of building engineering materials based on genetic algorithm	Intelligent cost accounting optimization system of building engineering materials based on BIM	The intelligent cost accounting optimization system of building engineering materials in this paper
1	2.312	1.984	1.464
2	1.994	1.808	1.344
3	2.106	2.226	1.458
4	2.054	2.031	1.317

Table 3: Labour cost for 12 weeks of project cycle (ten thousand yuan).

Number of experiments	Intelligent cost accounting optimization system of building engineering materials based on genetic algorithm	Intelligent cost accounting optimization system of building engineering materials based on BIM	The intelligent cost accounting optimization system of building engineering materials in this paper
1	2.948	2.885	1.997
2	3.277	2.901	2.116
3	2.697	3.642	2.031
4	3.102	3.204	2.212

and accurate control through the automatic linkage control of the system. When an abnormality or other important event occurs to a certain equipment or key point, the system shall timely display it on the page in the form of alarm and event in the form of graphics, text, animation, sound, etc. It can also put forward the importance of the event according to the nature of the event, put forward the impact scope of the event and the impact degree on other subsystems according to the principles of data sharing and system linkage, and give corresponding solutions and schemes. The integration function combines intelligent equipment and network equipment, provides an integrated high-speed information exchange network, and lays a physical foundation for system integration and function integration. The open network structure is adopted to facilitate the system upgrade and expansion in the future. The system integrates all subsystems on a unified computer platform and uses a unified man-machine interface environment. The system operation control software must include a comprehensive Chinese graphical interface with features such as electronic map and virtual visuals for equipment. The platform needs to run on the mainstream Chinese operating system to facilitate user use and management. Based on this, complete the steps of designing software integration management function.

4. Experimental Test

4.1. Experimental Environment. This system uses the visual studio development platform. In the development process, it needs to link SuperMap, so it is equipped with SuperMap Objects and net component package. The C/S architecture is selected in the system design, the c# language is selected in the development language, and SQL server is used in the database. SQL server is a relational database management system developed and promoted by Microsoft. Under the same platform, the security can strengthen the protection of data, and can improve the efficiency of data retrieval by creating a unique index. At the same time, the database is comprehensive, large in capacity, flexible, and scalable. The above is the development and operation environment of the system.

4.2. Experimental Result. In this paper, the intelligent cost accounting and optimization system of building engineering materials based on genetic algorithm and the intelligent cost accounting and optimization system of building engineering materials based on BIM are compared experimentally to the intelligent cost accounting and optimization system of building engineering materials. The better the optimization impact is proven, the cheaper the cost. The experimental results are shown in Tables 1–4:

Table 4: Labour cost for 20 weeks of project cycle (ten thousand yuan).

Number of experiments	Intelligent cost accounting optimization system of building engineering materials based on genetic algorithm	Intelligent cost accounting optimization system of building engineering materials based on BIM	The intelligent cost accounting optimization system of building engineering materials in this paper
1	4.558	5.257	3.022
2	4.336	4.205	3.115
3	5.228	4.313	3.456
4	4.157	3.978	3.140

According to Table 1, the average labour costs of the intelligent cost accounting optimization system of building engineering materials in this paper and the other two systems are 1.027 (ten thousand yuan), 1.402 (ten thousand yuan), and1.353 (ten thousand yuan). According to Table 2, the average labour costs of the intelligent cost accounting optimization system of building engineering materials in this paper and the other two systems are: 1.396 (ten thousand yuan), 2.117 (ten thousand yuan), and 2.012 (ten thousand yuan). According to Table 3, the average labour costs of the intelligent cost accounting optimization system of building engineering materials in this paper and the other two systems are: 2.089 (ten thousand yuan), 3.006(ten thousand yuan), and 3.158 (ten thousand yuan). According to Table 4, the average labour cost of the building engineering material cost intelligent accounting optimization system and the other two systems is 3.183 (ten thousand yuan), 4.570 (ten thousand yuan), and 4.438 (ten thousand yuan). The labour cost of the building engineering material cost intelligent accounting optimization system in the statement is lower.

5. Conclusion

This study gets the required cost accounting factors and does a complete computation by examining the utilisation of labour, materials, and machines in the present market. It completed the study of project cost data, investigated the link between prefabrication rate and key indicators such as material, total cost, and labour cost, and contributed to the academic literature in relevant disciplines. However, because of the constrained study settings, this report does not go into great depth about the disparities in building prices across various locations; this issue will be addressed in the future research phase.

Data Availability

Data are available on request from the corresponding author.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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