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Retraction

Retracted: Discovery and Discrimination of Bridge Engineering Safety Issues by BIM Virtual Scene Combined with Robotic Mapping

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] G. Gong, S. Zeng, J. Gao, Q. Zhang, and X. Wang, "Discovery and Discrimination of Bridge Engineering Safety Issues by BIM Virtual Scene Combined with Robotic Mapping," *Journal of Robotics*, vol. 2023, Article ID 3028505, 12 pages, 2023.

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Research Article

Discovery and Discrimination of Bridge Engineering Safety Issues by BIM Virtual Scene Combined with Robotic Mapping

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All along, safety accidents in the field of bridge construction have continued to arise, costing society's development financial and material resources and taking away people's personal safety, turning into an urgent need for safety managers in the field to solve the subject research. Researchers look forward to continued innovative exploration to find new ways of working safely and using them in the construction industry. On this basis, BIM virtual scenes are introduced to create a universal scene specification dataset in the field of bridge construction and a dataset of unsafe potential hazard characteristics in the field of bridge construction. Nanobots are artificial intelligence systems built to simulate biological nanomachine constructions in life activities and important biological events in life processes. In this paper, BIM virtual scenarios incorporating intelligent nanomaterial robot mapping technology are migrated to bridge engineering safety management. According to the collected construction scene images and BIM (building information model) virtual scenes, build the construction scene dataset, use intelligent robots to obtain construction scenes, and load them into the trained construction on-the-spot neural network modeling to complete the bridge construction scene identification safety discrimination to select more comprehensive and more stringent management solutions as safety management personnel management methods on-the-spot.

1. Introduction

In recent years, with the implementation of construction projects as an important component of the bridge span, bridge pile height, and bridge bearing capacity needs have also been rising, and the construction of bridges with engineering precision and high efficiency has also been subject to more regulations. So we want to reasonably carry out all aspects of bridge engineering under the new standards and the new mandatory requirements to further strengthen the bridge engineering mapping work, enhance the bridge mapping work on a variety of resource integrations, and actively explore and improve the various aspects of professional technology. Mapping work can effectively promote the establishment of road bridges and improve the overall quality of bridge engineering [1]. Figure 1 shows the discovery and discrimination of safety problems at the construction site.

Nanorobotics is an emerging technology in robotics engineering. The development of nanorobots belongs to the category of molecular nanotechnology, which designs and manufactures "functional molecular devices" that can operate in nanospace based on biological principles at the molecular level. As a prototype, nanorobot technology has been applied to bridge mapping technology, early design and planning stage mapping, middle and late engineering construction stage mapping, and late operation and management stage mapping. This method can effectively ensure the overall quality and accuracy of bridge projects, but in practice, bridge mapping cannot be reasonably carried out due to the influence of various factors. Therefore, in bridge construction, the world's leading surveying and mapping technology and mechanical equipment should be actively introduced, for example, through the introduction of nanorobotic surveying and mapping technology, integrate road and bridge construction rules, reasonable mapping

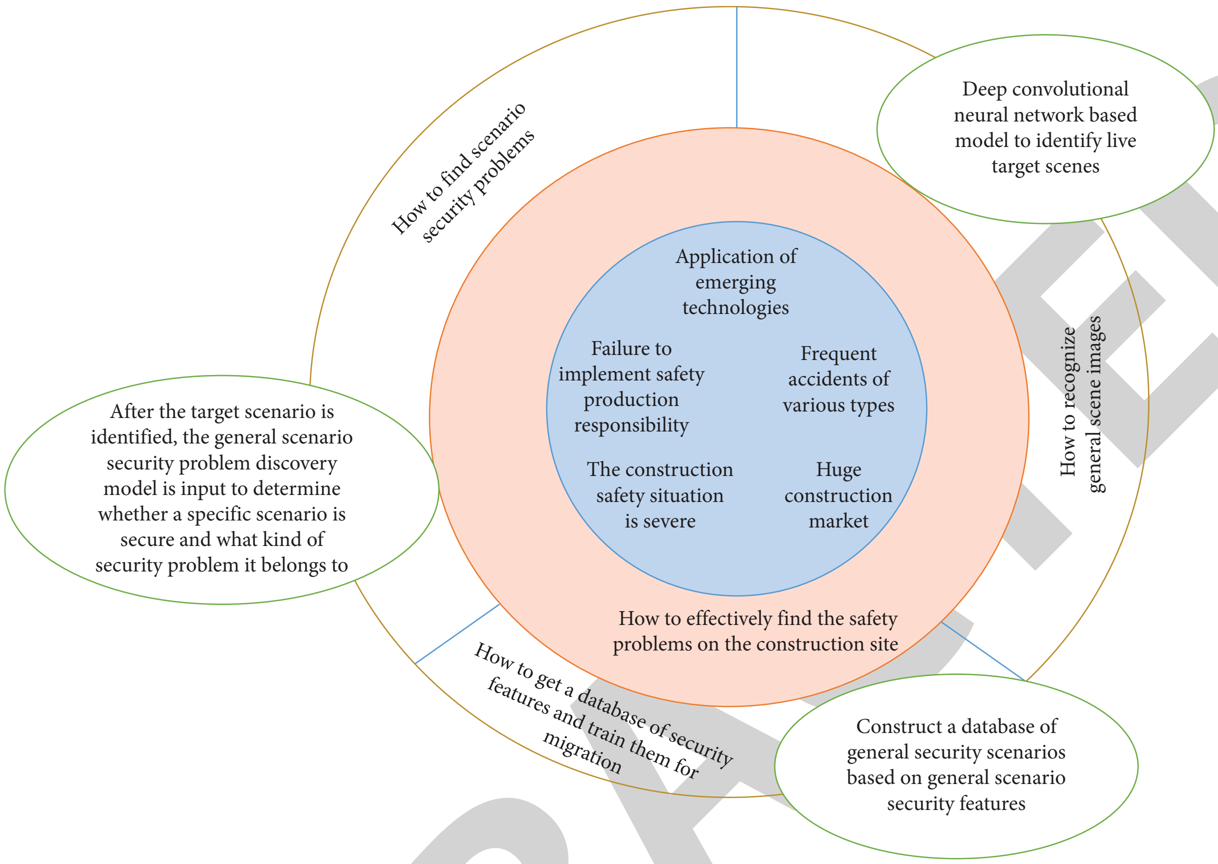

Figure 1: For the construction site safety problem detection and discrimination.

work, and the basis for the construction of high-quality, high-level bridge projects.

"BIM," that is "building information modeling," is Chinese for "building information model." BIM is used for engineering construction. BIM is a 3D digital technology used for the whole life cycle of a project building. In all life cycles, it applies public data types to establish and collect all information about the building and develop a solid model of information integration based on the information as a network resource for project decision-making and information interoperability. The BIM entity model overcomes the problem of sharing information in multiple technical work types and dimensions throughout the project construction life cycle, yet there are also problems [2].

In other words, the lack of three-dimensionality and modernity prevents bidders or lay staff from visualizing, systematically cognizing, and understanding the design intent of the architects. Applying only 3D images and animation may lead to "not getting the results." Robotic remote sensing technology is slowly replacing traditional surveying and mapping technology in the engineering measurement process. The use of robotic remote sensing technology can not only greatly accelerate the progress of engineering measurement but also realize the premise of information collection and processing upgrades and quickly and easily obtain the most accurate information, analysis, and storage. Thus, the application of robotic remote sensing technology must be analyzed.

2. Theory and Method

2.1. Research on the Application of BIM + VR Technology in Architectural Planning and Design

2.1.1. BIM Platform. 3D model data information model according to Revit, BIM platform is shown in Figure 2 below. The platform is used to build a platform based on the cooperation and sharing of the model database, with architectural wood templates as the project model [3]. The platform contains: (1) parametric modeling of 3D information model; (2) visualization of data to see and dynamic interaction (3) project progress and process simulation; (4) 3D rendering of 3D model design effects and other services. Excellent adaptation with Unity3D of Revit VR module, Unity3D is applicable to FBX file format exported from Revit, which can realize unhindered connection between BIM 3D model and VR scene and ensure the integrity of model grain to the maximum.

2.1.2. VR Simulation Platform. Figure 3 shows the application of VR simulation platform, "VR" in Chinese means "virtual reality." It is a technology that creates interactive 3D animation effects in the virtual background and environment with the help of electronic computer technology, so that participants can interact with the experience in virtual reality instantly. Participants are able to explore the exterior interior spaces inside the virtual-like architectural modeling

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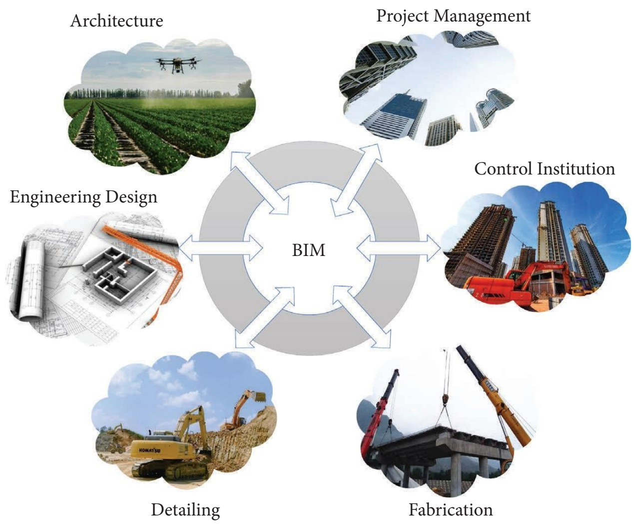

Figure 2: BIM platform.

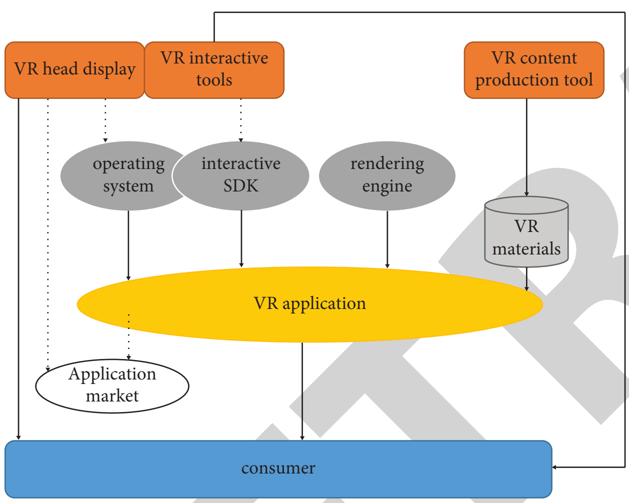

Figure 3: Application of VR simulation platform.

by assembling VR hardware configurations [4]. After the release of Cardboard at the GoogleI/o exchange in 2014, VR is rapidly coming into the lives of the general public, and its hardware and software are moving toward the lighter side. In the architectural planning industry, the introduction of virtual reality technology has built a highway bridge between design teams and bidders.

The pairing of BIM VR and BIM VR completes a mutually beneficial win-win situation. As opposed to interior designers, rendering BIM solid models with VR animation reduces redundant workload and enhances the coordination of BIM design. For consumers and owners, VR technology can be more realistic to feel the effect of architectural planning and design with and the cost of communication between workers in the field. In addition, the application of BIM VR technology can be effective resource integration, resource application efficiency, beneficial to the rapid development of the engineering and construction industry [5].

2.2. Measuring Robots

2.2.1. Introduction to Robotic Surveying and Mapping Technology. Figure 4 shows the most basic performance parameters of the surveying and mapping UAV. The measurement intelligent robot is an intelligent electronic device that can replace people to automatically search, identify, track and get accurate perspective, spacing, coordinates, and images. Its use of hazard sensors and other related sensors can also accurately identify the overall target in geomorphological surveys and quickly carry out specific analysis. It can realize intelligent practical operations such as automatic control, fully automatic photographing of geomorphological information content, and data acquisition, and can well replace manual control.

At this stage, there are three main types of nano-type surveying intelligent robots [6]. (1) Active triangulation or polar coordinate method is chosen to measure the geomorphology. In other words, the corresponding mark is set on the object to be measured and the reflection prism is applied to carry out the measurement. (2) Active triangulation method is selected, in which the structured light is used as the viewpoint, consisting of the generator in the sensor, software and hardware warp, and the viewpoint rendezvous method is used to clarify the precise coordinates. (3) Single overall target measurement is the main feature of the old revolutionary object, using digital image processing to carry out automatic retrieval, find the precise marker point, and use the principle of indoor spatial rendezvous to get the three-dimensional coordinates.

The measurement nano-type intelligent robot carries out automatic retrieval using the rotation of the telescope of the motor look-alike section and the measurement using the look-alike prism. The important principle of measurement is that the instrumentation shoots a laser data signal to the destination part, which is reflected by the prism and accepted by the sensor in the instrumentation [7]. Subsequently, the position of the reflected light is measured and the adjusted special data information is obtained. Later, the motor is turned on and the measuring intelligent robot is pointed at the prism to clearly aim at the target.

2.2.2. Application of Measurement Robot in Topographic Measurement and Mapping Automation. Nanorobotics is envisioned as the application of biological principles to discover new phenomena and develop programmable molecular robots at the nanoscale. Synthetic biology has redesigned cell signaling and gene regulatory networks, resulting in another way of nanorobotics. For practical topographic survey work, nanorobots can be used. On the actual topographic survey work, GPS, software and hardware measuring instruments and equipment cannot be executed uniformly because of environmental elements, mainly because of the harsh environment such as mountainous areas causing GPS data signals to be blocked out and GPS receivers not working properly in. At this stage, the application of measurement robots can solve this problem. A new measurement system software will automatically collect

Model	DJI M600
Wheelbase	1133 mm
Size	1668*1518*759 (mm)
Weight	9.6 Kg
Takeoff weight	15.1 Kg
Endurance	No load: 40 min Load: 5.5 Kg; 18 min
Operating time	4.4 Kg Load: 18 min
Maximum speed	18 m/s (No wind)

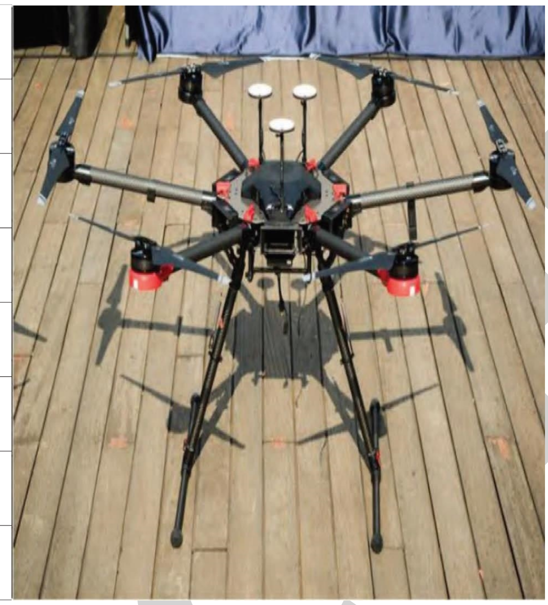

FIGURE 4: Basic technical parameters of the mapping UAV.

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the information of measurement points in the record [8]. When the comprehensive measurement cell phone software collects data about the depth of the landscape, the measurement robot will also automatically obtain the coordinate system matching this, and reasonably combine these two data to get accurate and complete three-dimensional coordinate data, so as to efficiently carry out the topographic measurement, thus improving the efficiency and quality of the construction of road surfaces and other related construction.

2.2.3. Specific Steps and Considerations for the Application of Nano-Type Measuring Measurement Robots. Nano-type measuring robot application specific steps: (1) Make complete advance preparation before measuring, introduce the datum into the measuring area, pick the best installation worker position, assemble the reflection prism on the measuring instrument equipment so that the reflection prism is located at the top of the measuring machine; it may block the prism and the measurement data collection terminal occurs. (2) Carry out the actual measurement practical operation in accordance with the basic principles of integration, connect the detector, GPS system, electronic computer, open the measurement cell phone software, set the main parameters of the measurement instruments and equipment, and ensure the normal operation of all measurement instruments and equipment. (3) Set RTK, open the relevant measurement cell phone software, pick new requirements in the menu bar, set the relevant measurement station, overall target and reflection prism pointing, turn on the locking power switch, enter the geomorphology menu bar, set the starting point and detection time spacing [9].

In addition, in the geomorphology measurement and fully automatic mapping engineering session, the communication base station worker has to pay high attention to the detector so that the measurement cell phone software score is consistent with the measurement robot score. In this process, may suffer from the influence of external factors, and then please record down the number. When the interference is too strong, it is necessary to finish the measurement first and wait for the influence to clear before carrying out the geomorphological measurement.

2.3. According to the Accident Modern Logic Site Safety Management Problem Characteristics Identification. In order to be able to scientific research control and effective prevention of building construction accidents, from the accident detection system, to the construction of aerial falls, object strikes, lifting injuries, collapse, and other typical accidents as an example, from the essence of the accident generator unsafe and behavior objects unsafe situation, the key factors of its text subtext, semantic network, and other text retrieval manipulation accidents can effectively prevent the vast majority of accidents. Tables 1–4 show the characteristics of the four unsafe scenarios. On the premise of the above scientific research, this section clarifies the main theme of the whole text, identifies the characteristics under typical unsafe scenarios on the spot, and completes the database of accident prevention.

On this basis the unsafe features of the four scenarios are summarized, and the unsafe features of the scenario cause only a part of the unsafe elements of the accident.

2.4. Generalized Scene Image Recognition Technique for Building Construction Based on Convolutional Neural Networks

2.4.1. Structural Characteristics of Convolutional Neural Networks. In general, convolutional kernels have different sizes, and the subspace of convolutional kernels is slightly smaller [10]. According to the multidimensional

Table 1: Features of unsafe scene of fall.

Category	Failure factors	Core key factors	Scenario problem characteristics
People	A1 work in violation of regulations A2 no protective measures A3 safety education in form A4 defective site management A5 weak safety awareness A6 construction without license A7 inadequate supervision A8 blind command, organization construction	AB1 work in violation of regulations AB2 no protective measures AB3 management is not in place AB4 not hanging safety belt AB5 safety awareness is weak	F1 no safety belt F2 no protective measures F3 no edge protection F4 material damage F5 violation of regulations F6 management is not in place F7 weak safety consciousness
Object	B1 not hanging safety belt B2 wire rope breakage B3 destabilization B4 no protection near the edge B5 no horizontal protection net B6 unqualified scaffolding material B7 no shelter at the hole B8 overload of unloading platform		

convolutional kernel, the features are acquired by certain step level or vertical smooth movement. Small filters of different sizes prevent simplistic acquisition of features, and then bias terms can be imported to extract cognitive content from partial features. In addition, discrete system features are introduced into the convolutional network according to the activation function, and finally a two-dimensional feature map is derived. The pattern of fold stacking is shown in formulas (1) and (2).

$$Cj^1 = \sum_{i\in M_{ij}} Xi^1 * Kij^1 + bj^1, \quad (1)$$

$$Xj^{i+1} = Yj^i = f\left(Cj^1\right), \quad (2)$$

Cj^1 indicates the result obtained from the computation of the convolution layer, l is the number of superimposed layers, and j is the feature plane indicating the first Ith feature of the first layer. It indicates that the feature plane of the fully connected layer of the Ith feature plane and the jth feature plane connected by the first layer is the bias term. The convolution and output are measured, and the $l+1$th layer keying features are obtained based on the activation function solution plane, i.e., the feature plane. In order to be able to excite the words this function, the discrete system function is introduced into the neural network that measure the output neuron's entry data, transform the output conclusion, restrict the categorization category, and provoke the common neurons [11]. There are Sigmoid functions, hyperbolic tangent functions, calibrated linear enterprises, etc. The activation function used in this chapter is ReLU, which is calculated as shown in formula (3) below:

$$\mathrm{f}(x) = \max(0, x). \quad (3)$$

The domain of definition is $(-\infty, +\infty)$ and the domain of value is R. The image of the function is shown in Figure 5.

The following convolution operation is illustrated in Figure 6, where an image matrix of dimension $5 * 5$ is used with a $3 * 3$ convolution kernel, and the step size is set to 1 [12].

The size of the output feature map after the convolution calculation is shown in formula (4).

$$\mathrm{w}' = \frac{w + 2p - k}{\mathrm{stride}} + 1. \quad (4)$$

where w represents the size of the input image matrix, k is the convolutional kernel size, stride is the convolutional kernel sliding step, and p is the number of complementary zero layers, which serves to complement the presence of image matrix filters that cannot be fully extracted.

2.4.2. Fully Connected Layer. The principle of fully connected layer is to obtain all the information from the previous layer and process it together, usually at the end of the network. In the fully connected layer, all two-dimensional features are stitched together into one-dimensional features for better classification by the classifier, which is called "fully connected." Figure 7 shows the schematic diagram of the fully connected layer. Formulas (5) for the fully connected layer shows

$$X^l = f\left(w^l x^{l-1} + b^l\right). \quad (5)$$

2.4.3. Convolutional and Neural System Network Boosting. Dropout techniques are applied to convolutional neural networks. In the forward phase of network training, the activation value of a certain neuron is restricted to participate in the training with a certain probability p, which reduces the dependence of the model on certain local features and enhances the generalization ability of the model [13]. The main principle of this method is to prevent the nodes in the hidden layer of the network from participating

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Table 2: Object striking unsafe scene characteristics.

Category	Failure factors	Core key factors	Scenario problem characteristics
People	C1 blind operation, improper standing C2 violation of work rules C3 not wearing helmet F1: not wearing helmet C4 entering the dangerous area of the city C5 poor safety awareness C6 confusion in site management C7 blind command and organization of construction	CD1 working in violation of rules and regulations CD2 poor safety awareness CD3 falling from height CD4 equipment overturning CD5 dangerous area CD6 safety helmet	F1 not wearing helmet F2 improper standing F3 equipment overturning F4 falling objects from height F5 legal operation F6 poor safety awareness
Object	D1 falling from height D2 equipment overturning D3: equipment failure		

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Table 3: Lifting injury unsafe scenario features.

Category	Failure factors	Core key factors	Scenario problem characteristics
People	E1 illegal operation E2 failure to maintain a safe distance E3 no license to work E4 chaotic site management	EF1 illegal operation EF2 crane	F1 improper standing F2 soft foundation F3 rope missing strands F4 illegal operation
Object	F1 crane F2 hook F3 loose foundation F4 wire rope missing strands	EF3 inappropriate standing position EF4 hook EF5 soft foundation	F5 falling hook

Table 4: Unsafe scenario characteristics of collapse accidents.

Category	Failure factors	Core key factors	Scenario problem characteristics
People	G1 illegal operation G2 management G3 blind command G4 unqualified construction	GH1 illegal operation GH2 no support, support	F1 no support F2 blind slope release F3 uneven soil quality F4 wall lost support
Object	H1 blind slope release H2 no pit support H3 uneven soil quality H4 loss of wall support	GH3 uneven soil quality GH4 pit	F5 illegal operation

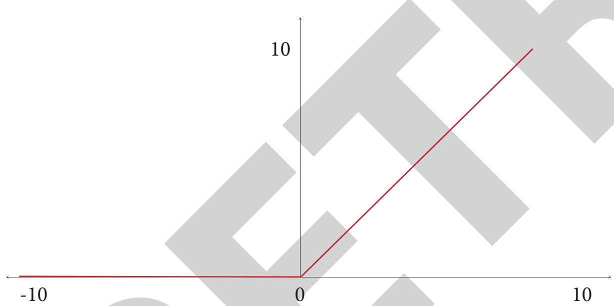

Figure 5: ReLU function graph line.

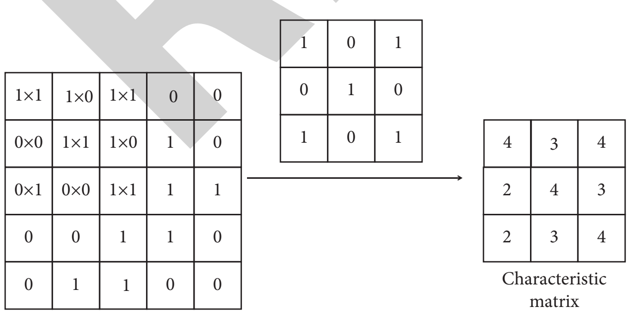

Figure 6: Convolutional operation diagram.

in the computation by randomly limiting their weights during the network training. The variation of the network formula with Dropout is as follows:

The network operation without Dropout is shown in formulas (6) and (7). Network operations with Dropout are shown in formulas (8)–(11).

Network computing without Dropout

$$z_i^{l+1} = w_i^{l+1} yl + b_i^{l+1}, \tag{6}$$

$$y_i^{l+1} = f\left(z_i^{l+1}\right). \tag{7}$$

Network computing with Dropout

$$r_j^{l} \sim \text{Bernoulli}\,(p), \tag{8}$$

$$\tilde{y} = r^{(l)} * y^{(l)}, \tag{9}$$

$$z_i^{(l+1)} = w_i^{(l+1)} yl + b_i^{l+1}, \tag{10}$$

$$\mathrm{y}_i^{(l+1)} = f\left(z_i^{(l+1)}\right). \tag{11}$$

The Bernoulli function generates a random limit of 0 and engages the work if it is 1.

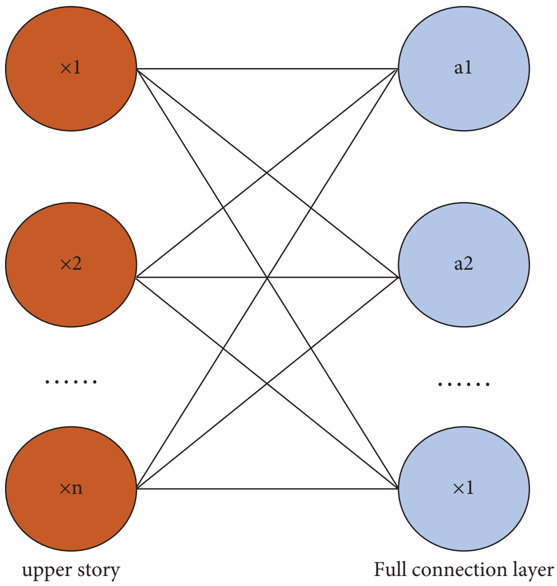

Figure 7: Schematic diagram of the fully connected layer.

3. Specific Description of the Use of Surveying and Mapping Technology in the Application of Bridge Engineering Project Measurement Measures

3.1. Active Marketing to Promote the Application of New Technologies. At this stage, numerous new surveying and mapping technologies can be employed in the bridge engineering project measurement industry. However, it is essential to actively and proactively market these innovations to encourage their widespread adoption. For example, automation technology is used to implement the actual operation of measurement. The service supports the appearance and performance assessment and is used to conduct performance tests of bridge structures through a series of mechanical tests. Control systems such as surveillance cameras and laser sensors are used to take pictures of the bottom edge and surface, obtain image data, create a physical model of the bridge, and obtain bridge configuration information based on measurements to support bridge operation and management [14]. In addition, the application of intelligent robotic tilt photography technology was explored on some measurement work in the predesign of bridge construction projects, and assisted in organizing the relevant measurement and mapping work in the same time combined with 3S technology for efficient measurement and mapping.

The idea of nanorobotics is to apply biological principles on the nanoscale to discover new phenomena and develop programmable molecular robots. Synthetic biology redesigned cell signaling and gene regulation networks to develop “in vivo” or “wet” biocomputers or cellular robots, resulting in an alternative approach to nanorobotics, which is now used in measurement In the future, nanorobots will be used for measurement. Thus, it is necessary to attach great importance to professional and technical personnel, grasp the measurement technology used as well as the technicality of surveying and mapping, and carry out bridge engineering project measurement control development design and implementation. Bridge measurement work should be strictly enforced in the preparation of professional and technical personnel standards and standardized organization of the external environment in the work, to collect the necessary data information for the next step in the work and implementation of professional data information to ensure the quality of bridge projects and operational safety.

3.2. Carry Out Data Information Quality Testing. Although the various surveying and mapping technologies commonly used in bridge surveying work are in a state of continuous improvement, there are still difficulties in the practical application because of the limitations of various conditions. Therefore, in order to ensure the available use value of mapping effectiveness, we must pay attention to the quality inspection of data information, ensure the quality of the acquired data, provide data information for bridge construction engineering design, engineering construction management, and operation manipulation, achieve a variety of business needs, and complete the bridge project measurement its value function. Bridge infrastructure construction is large and complex, the project construction period is easy to produce unfavorable conditions, measurement precision is reduced, and even deviations can occur. Thus, it is necessary to do a good job of measuring and monitoring operations in the construction of the project, and strictly control the quality of operation and bridge safety [15]. The operator is supposed to standardize the use of surveying and mapping data information and implement various control measures.

3.3. Bridge Operation and Management Link in the Mapping Work

3.3.1. Measurement and Inspection of Bridge Structure. In the bridge construction process, in order to further strengthen supervision and management, we need to ensure the overall quality of the construction of the bridge project. At first, it is advisable to carry out a reasonable test analysis of the road bridge structure, including the coordinate points of the bridge structure, bridge pile deviation, bracket deviation, centerline deviation, etc. The corresponding regulatory work should be carried out according to the test results [16, 17]. However, in the specific measurement and testing of bridges, most of the supervisors choose the traditional measurement method, and the relevant measuring machines and equipment, such as RTK, commonly used in the traditional type of measurement method are easily restricted by various natural environmental conditions around. As a result, the information obtained with it has certain deviations, which will further jeopardize the final measurement and inspection results. The fusion of the BIM virtual environment and nanoscale robotic mapping system software can also set fixed, immobile measurement points during the bridge construction process. That way, bridge

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construction and measurement within a certain range are done on this basis, reasonably ensuring the accuracy and precision of bridge measurement. At the same time, using the mobile measurement station to collect and sample the information of the overall structure of the bridge, the information collected is transmitted and processed in real time, which enhances the measurement efficiency of the bridge.

3.3.2. Deformation Measurement and Monitoring of Bridges. Through the long-term use and damage of bridges, certain deformation may occur, which seriously endangers the safety and stability of bridges. Thus, it is of important practical significance to improve its deformation measurement and detection [18]. According to the efficient measurement and inspection technology means, the deficiencies are found early and then solved scientifically and reasonably to ensure the bridge safety and reliability reasonably. In the bridge deformation monitoring link, the close combination of BIM virtual environment and robot mapping system software can effectively improve the bridge deformation monitoring efficiency and precision. At the same time, the work efficiency efficiently shortens the time of bridge deformation measurement and enhances the bridge safety and reliability.

3.4. Construction Site Identification and Safety Hazard Detection System Software Design. In recent years, with the implementation of construction projects, as an integral part of bridges, the demand for bridge span, relative height of bridge piles, and bridge bearing capacity has continued, and there are more regulations on the construction precision and erection efficiency of bridge projects. So we want to reasonably carry out all aspects of the bridge project under new standards and the new mandatory requirements to further strengthen the bridge project mapping work, enhance the bridge mapping work on a variety of resource integration, and actively explore and improve the various aspects of professional technology, which can effectively give full play to mapping in bridge construction to promote the role of the bridge project and enhance the overall quality of the bridge project [19].

In this paper, BIM technicality is combined with robotics to collect needed data and use data enhancement technicality to expand the data sample set. Finally, the test set of network model exercise is created and the system software for safe construction problem discovery is given. The first step of the system software design principle is to identify the overall target scenario, and the second step is to distinguish whether the overall target scenario is a safety hazard problem, so that site safety managers can make a more comprehensive analysis and manage the method site safety protection situation [20].

3.4.1. Overall Target Scenario Collection Link. Nanoscale intelligent robots periodically take pictures of construction sites, repair, and slice the collected images, and select images that have discriminatory value and safety status discrimination significance as a basis for leaders to carry out safety work judgments.

3.4.2. System Software Product Testing. Show that the overall target scenario test set with reference to the overall target scenario identification sample version; implementation of the identification entity model; export; target identification entity model export data to be identified as a sample version of the security hazard detection model test sample version of the scenario to be identified; export the results of the implementation of the security hazard detection model.

3.4.3. Early Warning Information and Decision-Making Stage. The system software generates detection results, providing early warning information about the on-site situation to management staff. This enables them to determine whether it is necessary to implement security risk improvement measures at the site.

In Figure 8, for the operation process of the safety construction problem discovery system software, the system software, according to the visited target scenario, identifies the target scenario according to the general engineering project scenario identification entity model enabled in the previous section of the exercise and filters the identified images. For security hazards found in the entity model of unidentified data samples, we can directly complete the entity model identification. According to the inspection of an image, the fusion of building construction safety problem discovery involves an entity model, the identification of 4 categories of classification incident site, so that the system software could distinguish the effect of the scene as “safe” or “unsafe;” the conclusion was “unsafe.”

3.5. Establish and Improve the Integrated Bridge Survey Management System. The use of bridge surveying and mapping technology in China can be divided into three stages: early design and planning, middle and late construction, and late operation and management. This method can effectively ensure the overall quality and precision of the bridge project, but because of a variety of conditions restricting bridge mapping cannot be reasonably carried out. Therefore, in the road and bridge construction, it is necessary to actively introduce the world’s leading-edge surveying and mapping technology and equipment, integration of the construction of the bridge specific conditions, reasonable surveying and mapping work, and the basic construction of high quality and high level of bridge engineering.

Along with the rapid development of China’s science and technology, more and more high-tech technology is widely used in our own daily work lives. Accordingly, bridge engineering, according to the application of high-tech technology, including the establishment of a complete bridge accurate measurement design program integration management system, can effectively promote the structural stability and safety coefficient of bridge engineering [21]. The first use of intelligent robotic aerial photogrammetry

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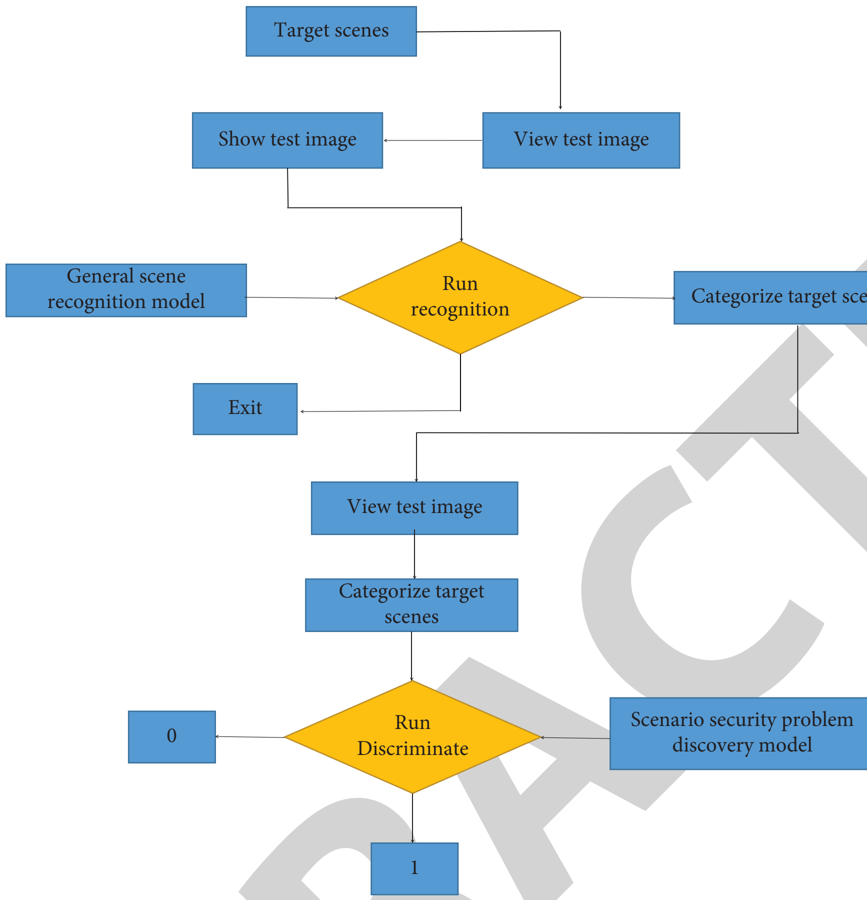

Figure 8: Construction site safety problem discovery system process.

technology was to take pictures around the bridge and upload the captured data images to computer software for backup purposes. In the following, the positioning information of the nanoscale intelligent robot application was recorded using GPS positioning technology. A complete map of the bridge project was produced by fusing the data images obtained from the earlier photographs and using digital photographic nanoscale measurement technology. In addition, when measuring along the road and bridge, we were able to use remote sensing technology technique to collect the geological structure and water engineering around the bridge in all directions, further reducing the cost and high efficiency of accurate measurement. Then, all the collected data will be keyed into the computer software after a reasonable statistical analysis for road and bridge engineering design planning, engineering construction management, and development management decisions to give the necessary information and data. The establishment and perfection of an integrated bridge engineering survey management system can grasp bridge engineering design planning in general and reasonably ensure the quality of bridge engineering.

4. Conclusion

In a word, the BIM virtual environment and nanoscale robotic mapping technology play an important role in surveying and mapping construction. The application of intelligent nanoscale robotic remote sensing technology has created a new era for mapping engineering projects and has endless potential for future development in the construction engineering measurement industry. BIM being closely based on three-dimensional digital technology, the BIM design model not only contains the new project entity line but also includes the functional characteristics data. In addition to the content of three-dimensional graphic information, the entity model also contains a lot of data information content, such as the type of material on the building and the entity model, the relevant data of the building materials, and their spatial relationship with the docking fasteners. This kind of data is suitable for simulating the behavior of individuals in this world of reality. It completes the efficient collection of mapping data and high efficiency of mapping, reduces the cost of mapping fees, and ensures the precision of mapping. In practice, applications can lead to early detection of difficult problems, survey area problems, further improve the security of mapping, reduce the need for precise measurement when conditions are not good, the environment is poor resulting in accidents and risks, and allow the middle and later phases of construction projects to use accurate data.

Along with the current state of Chinese society, the level of economic and technological strength of the rapid development and the surveying and mapping technology of bridges have also become more advanced. A variety of new surveying and mapping technologies in road and bridge engineering construction and the extensive use of accurate measurement methods and construction technology in China's bridges have contributed to this subversive change. In addition, along with the rapid development of surveying and mapping technology, the scope of surveying and mapping is not only limited to bridge design and engineering construction but also includes the initial design of the bridge, the middle and later engineering construction, and later management aspects. The application of new surveying and mapping technology can effectively enhance the precision and efficiency of bridge surveying and mapping, which can better ensure the overall quality of the bridge project. Therefore, as the relevant personnel of road and bridge surveying and mapping, they should be deeply aware of the need for efficient use of surveying and mapping technology in bridge engineering. Integrate the specific natural environment of bridge engineering, select the most ideal precise measurement and mapping technology, accurately and systematically reflect the real situation of bridge engineering, and further promote the rapid development of the capital construction level of bridge engineering in China.

Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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