Green Construction Evaluation System Based on BIM Distributed Cloud Service

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Abstract. Based on the BIM cloud service, in the green construction evaluation system, this paper introduces the sub-module and the overall architecture. In the sub-module, it includes auxiliary evaluation system, load balancing architecture, and data service. It is an effective method to store data. Through the conversion and integration of data storage methods of various computer protocols, the traditional green construction evaluation methods can be efficiently and accurately evaluated by cloud computing servers. At the same time, the database can hold a large amount of data and continue to expand.

1. Introduction
After the emergence of sustainable construction concept, based on green construction, some countries have promulgated relevant standards and norms, and in green construction, as a guide. For green construction, it is a more important work, which needs to integrate all kinds of information, and then carry out data interoperability. These data come from two aspects, one is the building information model, the other is the green construction standard.

2. Overall framework design
The improvement of data storage can reduce the probability of error, reduce the construction cost, ensure the construction quality, deliver the project as soon as possible, and help to improve the operation of the project. In the information age, the effective integration of the following two technologies is the development trend of the construction industry, one is BIM technology, the other is cloud computing technology. Based on the BIM cloud service, for the system infrastructure, the load balancing architecture includes two piecewise machines, one host and one replica set machine, which can provide cloud data services and can be managed in two aspects, one is data index, the other is network system. Based on the IFC entity, the index database is used to construct the index, and the
spatial information is saved by the graph database, which is connected with the knowledge base. In the ontology knowledge base, it not only contains the rule base, but also includes the fact base. Finally, the view is checked by the generator, and the result is output, which matches the knowledge base based on the reasoning engine, thus outputting the report.

3. Submodule Design
Green construction will involve a large amount of data, whether retrieval or information storage, has been difficult to meet the needs of development. For the past compliance inspection work, it is basically manual to check. The accuracy of inspection is not high and the efficiency is low. An effective and convenient method is needed to evaluate green construction. For sub-module design, this paper mainly from the distributed load balancing system, database data service system, green construction evaluation system and other aspects for reference.

3.1. Distributed Load Balancing System
For ES, it belongs to an open source search engine with high performance and expansibility. It can provide two aspects of data, one is real-time analysis, the other is full-text retrieval. For real-time analysis, it includes both unstructured and structured. Based on the construction of cluster server, the backup of data can be realized through distributed cluster. The data originates from replica set and is segmented to achieve the purpose of segmenting data, relying on different nodes. To save and backup distributed data, while strengthening retrieval ability, but also to ensure data security. Based on the construction of load balancing architecture, according to the IFC data storage, and combined with the retrieval process. In the system, the module implementation process is described below. The IFC file is uploaded to the system; the module is parsed by the IFC file and the information is parsed to the data set. The set comes from the IFC, object data containing two kinds of information, one is spatial relationship information, the other is attribute information table 1 shows the cluster environment.

| IP          | CPU            | OS        | MEM |
|-------------|----------------|-----------|-----|
| 192.168.1.110 | Intel Xeon E5 1620 3.6 GHz | CentOS7.3 | 32G |
| 192.168.1.111 | Intel Xeon E5 1620 3.6 GHz | CentOS7.3 | 32G |
| 192.168.1.112 | Intel Xeon E5 1620 3.6 GHz | CentOS7.3 | 32G |

3.2. Database data service system
The data is mainly based on the database, and combined with the IFC model to achieve a series of operations, such as uploading, modifying, for API, belong to a Web service, mainly through the use of HTTP, and combined with the principle of REST.

—Reasonable application API. In many requests, can promote various servers to handle different requests, and promote server performance. For the data layer, IFC files can be treated as data sources. For the data model, it is necessary to process the data and convert it into a graph data model to store it. In the database, the purpose of index can be achieved, then embedded storage is used, and index interface is used.

3.3. Green Construction Evaluation System
This paper proposes a new method based on green construction knowledge, which can be stored, managed, and reused, and applied to green construction evaluation. To the green construction standard, because of its certain particularity, plus the problems of inspection methods, this paper integrates a variety of technologies to standardize the green construction evaluation, such as BIM technology, ontology, etc. in the implementation, based on the XML rules, report the identified problems through its associated BCF documents. For BCF, it is an open standard, which helps to realize information interaction among various applications. Compared with the previous reports, there are some
differences. Through this method, the information model can be connected to the building model, and then the BIM software is used to display the model. Among many suppliers, BCF format is favored. The complex calculation can not be solved by XML. This kind of calculation originates from the information rule. Based on the green construction, the ontology is constructed to deal with the semantic information problem. In fact, in the initial stage, the whole information can not be defined. So in the XML, we should expand some new information and ensure that it is not defined. Different methods have both advantages and disadvantages. To the XML data, it can be transformed into two formats, one is RDF, the other is that the semantic technology and XML, can be integrated, and then the compliance inspection can be carried out together. Specifically, it can be divided into the following modules.

—Data source section. In the data source standard, green construction is one of the ingredients, can be expressed in combination with rules, combined with terms, which translates into two formats, the first is XML, the Second is OWL format. On MVD and IFC, for the model information they share, Essentially a data source, can be represented in the Excel, after preprocessing the data, and using the converter, can form XML format. Without green construction information, construction information can be added to the XML by using IfcDoc.

—Knowledge base section. For the knowledge base, It can be divided into two categories, one is the rule base, second, the database of facts. For the fact bank, from three ontologies. In green construction, these three ontologies come from language descriptions, construction conditions work items, and conceptual models. Based on XML data, convert it into OWL format, or into RDF format, and language description. In this way, the rule base of ontology can be formed. Meanwhile, drawing on XML rules, model problems can be examined, and output BCF reports, and then in the revit, BCF plugin, read out the problem.

—Jess reasoning engine. Through the Jess inference machine, only the format file can be parsed, so for the RDF and ontology, the corresponding knowledge should be transformed in order to generate the coding format, and then the knowledge base can be matched by the inference machine. Finally, the reasoning result is obtained. Green construction evaluation. The results obtained by inference machine can be represented by coding format. In order to meet the requirements of query function, the reasoning results should be transformed to form a readable format. After the data conversion is completed, the data can be represented in the form of triples, which are defined by values, resources and attributes, and can also represent the relationship of the subject. The final two queries, one is SWRL, the other is SQWRL, in a HTML format, the results are output.

4. Conclusions
Through the above analysis, we know that reasonable application of API, in many requests can promote various servers to deal with different requests and improve server performance. For BCF, it is an open standard, which helps to realize information interaction among various applications. In XML, some new information should be expanded and ensure that this information is not defined. The MVD and IFC are essentially data sources for the common model information, which can be represented in the Excel. After preprocessing the data and using the converter, the XML format can be formed.

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