Smart Campus-Based Study on Optimization Model for the Computer Information Processing Technology in Universities and Colleges

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Abstract

The university is where students develop. And against the backdrop of informationization, smart campus construction has become an important part of educational informationization. However, as the computer information processing technology nowadays is still inadequate in China for building smart campus, there exist the problems of information security as well as difficulty in obtaining information, and the smart campus is still at a certain distance from being really “smart”. Therefore, combined with architectural model of the smart campus, this study makes possible information visualization and high-efficiency resource allocation by optimizing the computer information processing technology in universities and colleges, thus perfecting the smart campus and facilitating the informationization of education.

Keywords: Smart campus, Universities and colleges, Computer, Information processing, Optimization model.

1. INTRODUCTION

1.1 Literature Review

The smart campus is different from the digital campus. And scholars conducts various interpretation of its connotation from different perspectives at the level of theoretic research. But whatever its concept is, it requires to strengthen computer information processing so as to make the smart campus go beyond just an ideal and be able to solve teaching problems by optimizing the teaching process (Huang et al., 2012). Meanwhile, a uniform platform need be constructed by combining the information processing technology as well as such connotative features as smart campus network, intelligence, data and service, etc. with the aim of providing one-stop service for both students and teachers, thus optimizing effectively the management as well as decision-making process and detecting problems within the university (Wang, 2014). In building the smart campus operation maintenance platform, computer information processing technology is also needed to dig and sort campus information so as to design targeted services for teachers and students, thus modifying maintenance during service, simplifying the procedure, and improving working efficiency of the smart campus (Yu, 2015). But with the development of informationization, computer processing technology can’t meet current social demand, so it requires combining features of the information processing technology to design new data service website targeted at promoting the transition of the computer technology toward cloud computing technology, hence ensuring the information security during its transmission (Wu and Wang, 2015). However, as the smart campus is still in its starting period when the university computer information processing technology hasn’t been optimized effectively, the optimization strategy still needs further study.

1.2 Research Objective

With the continuous development of the information technology, construction of smart campus has become one of the focal problems which the education workers pay much attention to. But still at the primary stage, it has not been effectively perfected all around (Zhao, 2012). Meanwhile, as its operation and maintenance are closely related to the computer information processing technology, construction model based on it is of important significance to the optimization of this technology. This study aims at laying foundation for construction of the smart campus through perfecting the design framework of the information processing technology in terms of smart campus data, improving the visual processing technology, optimizing the information processing ecosystem as well as resource allocation, and constructing the optimization model.

2. INTRODUCTION TO THE SMART CAMPUS
2.1 Connotative Features of the Smart Campus

Being closely linked to the Internet of Thing, the smart campus is a form of smart region in the campus (Tang, 2014). It is actually a new concept at the primary stage, so different scholars post different interpretations toward it. It has become the “upgrade version” of the digital campus, combining the information technology with the campus by a great margin and integrating informationization application deeply, thus constructing a smart campus with sensing terminal. The smart campus has three characteristics. Firstly, it can provide a comprehensive intelligent sensing service platform which is able to provide specialized service for teachers and students. Secondly, it can bring computer information processing service into application in the university, thus realizing synergy of resources. Thirdly, the intelligent sensing platform can provide an interface of communication and sensing for the university.

2.2 Theoretic Basis for the Smart Campus

The smart campus is established based upon context detection and sensing technology, which is the premise of individualized learning resources and learning activity (Lv, 2013) as well as one of the theoretic basis for the smart campus. In addition, construction of the smart campus requires the campus mobile internet technology. The emerging of wired and wireless network makes the construction possible. What’s more, application of the social network technology has provided basis for the information searching and campus construction. Finally, the digital resource and its sharing technology is also the theoretic basis for the smart campus, providing the teachers and students with intelligent resources push and retrieval capability.

3. ARCHITECTURAL MODEL FOR SMART CAMPUS CONSTRUCTION

In constructing the smart campus, the three-tier structure of the IOT need be taken in, i.e. the perception layer, the network layer, and the application layer (Yang, 2015). In this three-layer system, the information is detected and collected through the sensor network, then transmitted, thus realizing the organic fusion of the campus network and the Internet. And unified management is realized through integration of information resources so as to achieve the optimized development of the storage computing. Moreover, through application of the IOT, the smart campus is successfully implemented to automatically detect and manage the vehicles, personnels, security, libraries, information assets as well as files, etc. The construction of the smart campus and its technical principle is dominated by the above mentioned three-tier structure, of which the perception layer is the core of the smart campus as well as the major part in sensor network construction, such as the sensor, two-dimensional code, etc. (Wan, 2015). The network layer, or the access layer, is the middle layer in smart campus construction principle and requires corresponding interfaces developed so as to perceive the interconnection between various network information. The last is the application layer. As the application core of the smart campus service solution, it targets at controlling the information at the network layer with the aim of realizing high-efficiency intelligence module, thus turning the smart application into reality.

4. OPTIMIZATION MODEL FOR THE COMPUTER INFORMATION PROCESSING TECHNOLOGY IN UNIVERSITIES AND COLLEGES

4.1 Design Framework of the Information Processing Technology in terms of Smart Campus Data

Information processing technology, based on information data, records the data 24h a day in an all-around way with support from the IOT and the big data technology, then shows the campus information clearly by integrating and displaying the most valuable data in the campus, thus enabling both teachers and students understand intuitively the visual multi-dimensional data before making management decisions more efficiently (Ji and Xi, 2017). It includes mainly four modules of storage, collection, processing and security management in terms of smart campus data. Against the backdrop of the big data era, the distributed storage technology, most commonly used with high efficiency, can be used for information storage in the smart campus. In addition, as the traditional information security management has been unable to meet the social demand already, it is necessary to strengthen detection of information management so as to maintain information security by using the informative character of the big data.

4.2 Design Framework of the Visual Information Processing Technology

Design framework of the visual information processing technology can be divided into two modules, the
information data and the campus interaction. The framework design targeted at the information data is conducted through collection by electronic terminal equipment and the human (Zhuang, 2011). It consists of three levels, data collection, data processing decision-making and data display. In the campus, the visual technology is mainly to display the data, enabling it to present a ring structure. The framework design of the campus interaction, mainly displayed on the web page or the mobile client-side, need contain design of visual structure, graphical element and task-driven interactive operation. The visual structure design is mainly targeted at the transformation of graphical system, space, and property.

### 4.3 Optimization Model Construction for the Ecocycle of Computer Information Processing in Universities and Colleges

Optimization model for the ecocycle of computer information processing in universities and colleges features the IOT ecosystem that enables the information to be stored, transform and flow in various forms of energy in the system (Zhang, 2010). It constructs the energy flow into information network through various transformation strategies, then optimizes it for analysis by using the theories about energy as well as analytical methods, thus displaying the information flow relationship in the whole system and revealing the interrelationship between internal information systems within the system. Meanwhile, it need be constructed targeted at the energy value model of the information. After being proposed, the energy value analysis method has guaranteed construction and optimization of the information processing ecocycle to a certain extent (Zhou, 2013). Therefore, by combining the energy value analysis method, the author has constructed the model targeted at the optimization of the computer information processing ecocycle. Y refers to the output energy value of the information subjects, and Y_i is the output energy value of the ith information subject. W_i stands for the redundant information and g means the input energy value for processing W_i. R refers to the input energy value of the renewable information while F_i means the non-renewable system. After constructing the energy value model, the author has also conducted the optimized circumstances analysis of the information ecocycle, and sorts the optimization of the information ecocycle by analyzing the information input type, thus providing basis for the computer information processing technology.

F_i refers to the total input energy value of the system optimization information and F_{bef} is the sum of input energy value after optimization while G is the total increased energy value after optimization. The relation between F_{bef} and G can be traced in below equations:

\[ F_{bef} = F_{bef\,-\text{energy}} + F_{bef\,-\text{material}} \]
\[ F_{aft} = F_{aft\,-\text{energy}} + F_{aft\,-\text{material}} \]
\[ G = G_{\text{energy}} + G_{\text{material}} \]

At this time, assuming that the input demand of the information decreases after system optimization, i.e. F_{bef} decreases gradually, the optimization model has a good effect, as shown below:

\[ \Delta F = F_{bef} - F_{aft} \geq 0 \]
\[ \Delta F = F_{bef\,-\text{energy}} - F_{aft\,-\text{energy}} \]
\[ \Delta F_{\text{material}} = F_{bef\,-\text{material}} - F_{aft\,-\text{material}} \]
\[ \Delta F = \Delta F_{\text{energy}} + \Delta F_{\text{material}} \]

### 4.4. Optimization Model for Allocation of Computer Information Processing Resources in Universities and Colleges

If the change of a certain information influences that of another information, we can say the two pieces of information are marked with the structure of influence arrow (Jiang et al., 2016). Applied in information resources and personnel management in universities and colleges, the optimization model for allocation of the computer information processing resources in universities and colleges can effectively guarantee construction of the smart campus. But only when information resources allocation is conducted effectively concerned with the stock and increased amount can this model reach its most optimized status and achieve the high-efficiency
working target. Table 1 shows the detailed optimal allocation elements of the information resources in universities and colleges.

**Table 1 Elements of optimal allocation for information resources in colleges and universities**

<table>
<thead>
<tr>
<th>class indexes</th>
<th>secondary indexes</th>
<th>third-level indicator</th>
</tr>
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<tbody>
<tr>
<td>The elements of optimal allocation of information resources in Colleges and Universities</td>
<td>the abilities of information retrieval</td>
<td>Point number (number)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of computers</td>
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<td>Information disclosure level</td>
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<td></td>
<td></td>
<td>open database</td>
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<td>Online service ability</td>
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<td></td>
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<td>Domain Name</td>
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<td>Information resource transmission structure</td>
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<td>Technology ownership index</td>
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<td>Network coverage network environment</td>
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<td></td>
<td></td>
<td>Total amount coordination of channel</td>
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<tr>
<td>basic resources</td>
<td>Rate of information in Colleges and Universities</td>
<td></td>
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<td></td>
<td>Human resource index</td>
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<tr>
<td></td>
<td>The importance of information technology in Colleges and Universities</td>
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</tbody>
</table>

In constructing the optimization model for allocation of the information processing resources, optimization matrix can be made use of to display the optimization results. \((X, R)\) refers to the system, and when \(X\) is finite set, elements of \(X\) can be taken as rows and columns, thus forming the matrix \(A\) with formula as below:

\[
A = \begin{pmatrix}
S_1 & a_{11} & a_{12} & \cdots & a_{1n} \\
S_2 & a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
S_n & a_{n1} & a_{n2} & \cdots & a_{nn}
\end{pmatrix}
\]

(3)

Where \(a_{ij} = \begin{cases} 
1, & \text{si exerts influence on sj} \\
0, & \text{si exerts no influence on sj}
\end{cases}\)

(4)

Then can form below matrix:

\[
A = \begin{pmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
\]

(5)

5. EVALUATION INDEX SYSTEM FOR THE MODEL OF COMPUTER INFORMATION PROCESSING TECHNOLOGY IN UNIVERSITIES AND COLLEGES CONCERNED WITH THE SMART CAMPUS
Concerned with the smart campus, the computer information processing in universities and colleges goes through four stages, the starting period, the integration period, the infusion stage and the innovation period (Jiang et al., 2017). After continuous optimization, the maturity of information processing technology will increase constantly. During the starting period, the maturity of the processing technology is relatively low, the information processing in universities and colleges is being constructed and various links are in an isolated state. During the integration period, the information processing technology in universities and colleges is already applied in a certain scale, various links are interconnected with each other and the information is already integrated. During the infusion period, the information processing technology is already promoted all around in universities and colleges, and the smart campus is already applied deeply in various fields. With the continuous infusion of information and education, the information processing technology has become the mainstream technology in informationization of the smart campus. And during the innovative period, the information processing technology is already optimized to play its enhancement function.

Therefore, in order to evaluate effectively the maturity of the information processing technology, an evaluation index system need be established for the information processing technological model with the indexes being classified by level, thus setting up the viewpoint for effective evaluation. The information processing technology can be divided into information collection, integration, infusion and broadcast in terms of the degree, and each degree can be divided into five grades for quantitative analysis. The corresponding score for the five grades is respectively 0, 1-2, 3-4, 6-8 and 9-10. The four degrees can be scored independently with index weight being set up before the final summary and induction. When the average score falls between 6-8 or 9-10, it means optimization of the information processing technology has obtained good effect.

6. CONCLUSIONS

Based on the computer information processing technology, the smart campus makes management and teaching in the campus more intelligent. However, as construction of the smart campus is still in its primary stage, the current computer information processing technology need be optimized by constructing optimization evaluation index. Meanwhile, optimization model for information resources management, visual optimization model, information ecocian optimization model need be constructed with the aim of promoting the computer information processing technology to meet development demand of universities and colleges, thus enabling the smart campus fully play its intelligent function and providing convenience for teachers and students in both learning and life.

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