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Research and Application of Wisdom Campus decision support system based on Big Data

Yuao Chen, Lu Zhang *, Leilin Huang, Zhuyao Liu

[1]School of Electrical and Information Engineering, Quzhou University, China, 324000

*Corresponding Author:Zhanglu90573@163.com

Abstract: The traditional campus mainly relies on man-made management, oral communication, paper storage, which make a lot of inconvenience and duplication of work, so work efficiency is very low. In the mature development period of the traditional digital campus in the past few years, coupled with the increasing use of the Internet of Things, the data warehouse of the digital campus is getting larger and larger, but it is not fully utilized, so how to dig the hidden information behind these data, improve data utilization and provide decision support for relevant participants have became an urgent need for smart campus construction and decision support systems. In terms of platform utilization, the system mainly uses oracle database to manage the data, and uses Java language as the basic programming development language to design and experiment a platform for experimental data processing and mining and visualization. The experimental content mainly includes: data collection and preprocessing, design development and implementation of data visualization platform, data mining and analysis, experimental results support.

Keywords: Wisdom Campus; Decision Support System; Data Mining; Visualization.

1. Introduction

The traditional campus is built on human management, verbal delivery, paper storage, which leads to a lot of inconvenience and repetitive work and low efficiency. With the rise of campus informatization, the construction of digital campus has become a revolution of the traditional campus. Its characteristics of digitalization, networking, multimedia and intelligence also make the daily study and work of teachers, students and managers more convenient. And the development of Internet technology and the emergence of smart campus will usher in another revolution of campus informatization. In the ubiquitous, cloud-based, iot, integrated and intelligent campus, more innovation and application will better serve learning and scientific research. The smart campus

has spawned a new model of campus development, which not only serves teachers and students, but also helps decision makers.

2. Wisdom Campus

With the wide application of new information technologies such as cloud computing, Internet of things, mobile Internet, big data, knowledge management and social network, it provides the foundation for smart campus. The construction of smart campus is a long-term and progressive process. At the current stage of growing maturity of digital campus, smart campus should follow the principle of unified planning, step by step implementation and gradual improvement. Based on the Internet of things and the application of existing platforms, it should be improved in accordance with the overall development strategy of the school.

2.1 Intelligent Management

Smart management is a very important branch of smart campus construction and an important part of highlighting the "wisdom" of smart campus. The decision support based on education information serves the intelligent management. As shown in figure 1, it is the overall framework of the intelligent management. The intelligent management uses the platform application service implemented by the perception layer, storage layer, support layer, data layer and interface extension layer of the intelligent campus.

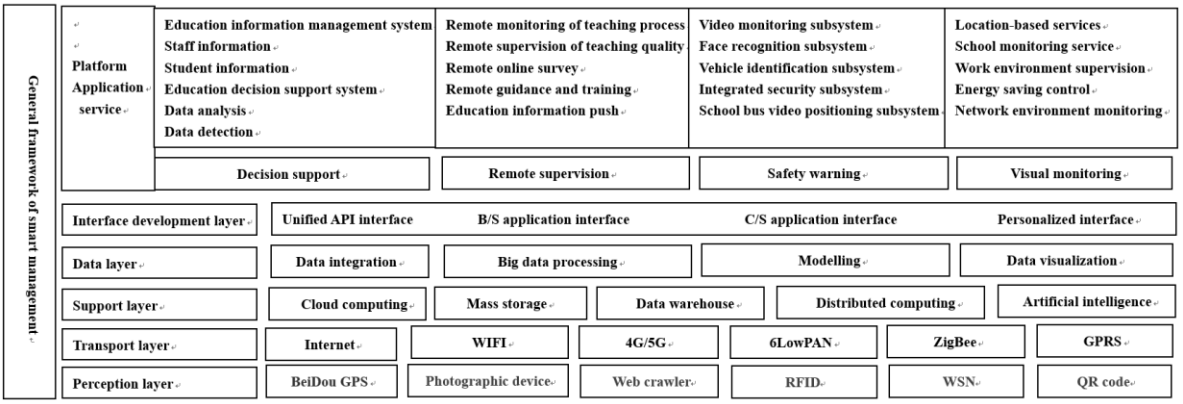

Figure 1 General framework of smart management

With the support of Internet technologies such as big data, it uses data and models to analyze and mine, extract useful information, and form knowledge expression to help managers of education better understand education process, discover potential problems and predict possible problems.

2.2 Decision support system

The main functions of decision support system include: collecting, managing and providing information at any time; being able to provide relevant mathematical models

and other methods; having good data communication and can process data with model; having certain data visualization function.

The decision-making process of decision support system is generally divided into four steps:

(1) determine the requirements of decision-making problems, including establishing the decision-making model and making plans.

(2) describe the possibility of various outcomes generated by each scheme quantitatively with probability.

(3) the decision-makers make quantitative evaluation of various outcomes, which is generally expressed with the utility value. Utility value is a quantitative estimate of the value of various outcomes made by decision makers according to their personal ability, experience, style and environmental conditions.

(4) analyze the information of all aspects comprehensively, determine the plan, and study the impact when the original data changes.The decision-making process is often impossible to complete only once, but is an iterative process. Decision-making can be accomplished with the help of a computer decision support system, which is used to assist in the determination of goals, formulation of plans, analysis and evaluation and simulation verification. In this process, the parameters of different schemes can be provided and selected by decision makers through man-machine interaction.

The development of decision support system in some large enterprises and some commercial fields has entered a deeper stage. The decision support based on big data and cloud computing has provided strong support for the management and decision-making of many enterprises at home and abroad, realizing the accuracy and efficiency of management and decision-making.

2.3 Data Warehouse

Data warehouse is established to assist decision making. There is a large amount of historical data in the data warehouse, which provides comprehensive information for decision makers and reflects the macro situation of users. The decision support of on-line analysis processing is mainly to analyze the data from multi-dimensional data from multiple different perspectives, while data mining is to obtain the regularity of the data and predict the future situation by using the data mining algorithms such as classification, clustering and correlation analysis. Decision support system based on data warehouse is based on data warehouse, the use of big data, new technologies, such as cloud computing resources, make full use of the data in multidimensional data analysis for on-line analytical processing and data mining, on the basis of the information and use visualization will result in a more intuitive way, provide quick and effective auxiliary decision-making information and knowledge.

The emergence of data warehouse technology is the continuous progress in the research and application of traditional database technology, which processes the data in daily operation of enterprises and helps them to do a good job in the future strategic development direction. Figure 2 shows the decision support system structure based on data warehouse.

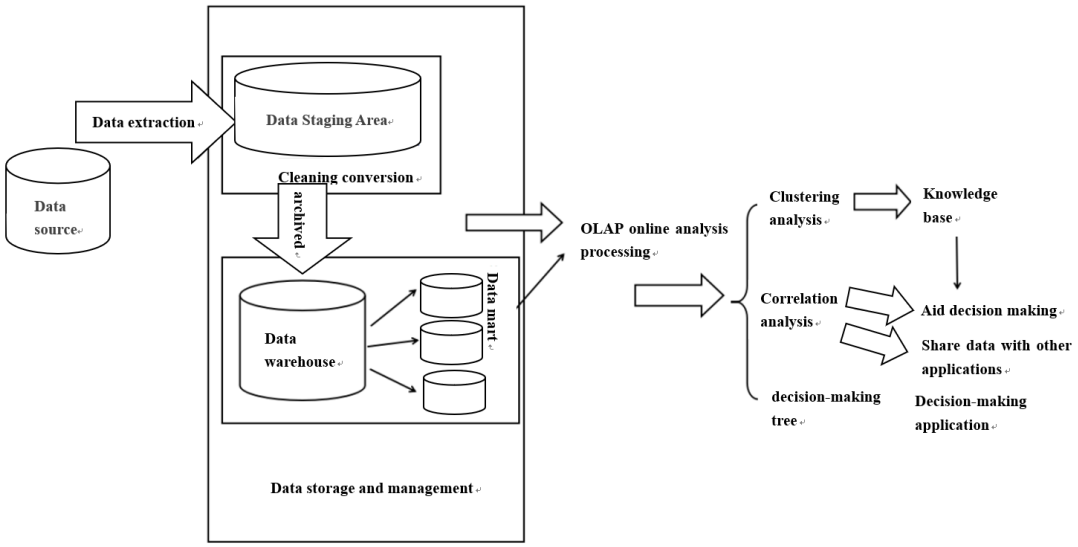

Figure 2 Overall framework of decision support system based on data warehouse

2.4 OLAP（Online analytical processing）

OLAP is an online data access and analysis for a specific complex problem. OLAP is the main application of data warehouse system, which is specialized in dealing with complex analysis operations. According to the requirements of the decision-maker, a large number of complex data is processed quickly, and the access is fast, stable, consistent and interactive from multiple perspectives and dimensions. In addition, the results are used to help decision-makers understand the data information, so as to understand the data subject information. OLAP helps decision users to analyze the data in the data warehouse from different perspectives, so that users can get the feature information of the data in a real and intuitive way. The different angles here are the dimensions in OLAP.

Data processing can generally be divided into two categories: online transaction processing OLTP, and online analytical processing OLAP. OLTP is a traditional relational database application, mainly involves basic, daily transaction processing. OLAP is the main application of data warehouse technology, which focuses on decision support, supports complex analysis and processing, and provides intuitive and understandable query results. There are many differences between OLTP and OLAP, as shown in table 1.

Table 1. OLTP versus OLAP

	OLTP	OLAP
User	Database operators, bottom management	Decision makers, senior administrators
Function	Daily operation, transaction processing	Analysis and decision
Database design principles	Business oriented, application oriented	Subject-oriented
Database design size	100MB-GB	100GB-TB
Data	The latest, newest, two-dimensional discrete for applications	Historical, aggregated, multi-dimensional integrated and unified
Access	Read and write a small amount of data at once	Read millions of data at once
Work units	Simple transactions	Complex query
Time requirements	Real-time	Not strict with time
The main application	The database	The data warehouse

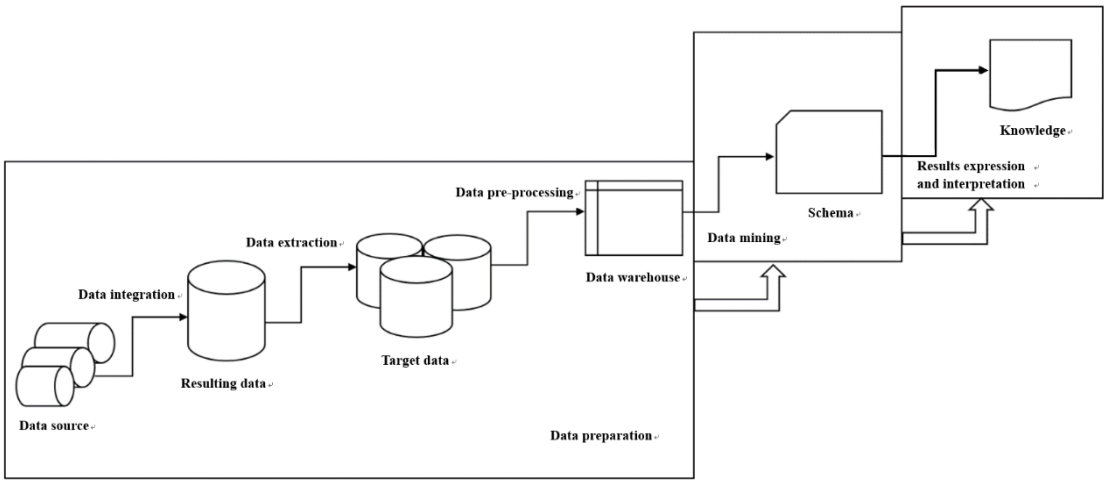

Figure 3 KDD flow chart

2.5 Data mining technology

Data mining is to extract useful and interesting knowledge and information from massive, noisy and incomplete data. The data used for data mining must be real, effective and abundant. The goal of data mining is to acquire useful knowledge, which can be understood and applied.

Data mining technology mainly includes: summarization, classification, clustering, association rules, evaluation, prediction and other technologies. In this system, the mining technology mainly adopts clustering and classification methods. The whole project of data mining mainly includes data cleaning, data integration, data

transformation, data mining and knowledge representation. Data cleaning is mainly to eliminate data noise and other irrelevant data, such as some data because of system error or incomplete; Data integration mainly combines related data from multiple data sources, such as smart card consumption record and personal information for correlation integration;Data transformation is mainly to replace the format of source data in the database and transform it into data that is easy to analyze and mine.

Data mining from the strict sense, is Knowledge Discovery in Databases in the process of using the algorithm from the preparation of the data extracted form Knowledge, is the important step in the process of KDD, but with the progress of the research, data mining and Knowledge Discovery has become increasingly blurred the boundaries between the already, the following figure 3 is based on Fayyad institute of KDD process of drawing graph:

As shown in figure 3, although data mining is only a step of KDD, other parts are also indispensable for data mining. The process of completing data mining or the process of KDD includes three stages: data preparation, data mining, result expression and interpretation.

(1) data preparation: data preparation is the primary task of the entire data mining process, which requires us to determine the requirements, consider problems and make targets according to the research objects, and select data to process according to the targets, mainly including data collection and data preprocessing.

(2) data collection: determine the data object according to the data mining target, select the target data and select it from the data source. Since the data in the data source is often complex and large, and also contains a lot of data that is not related to the research object, useful data should be left in the selection process and interference items should be removed to reduce the complexity of data preprocessing.

(3) data preprocessing: this process mainly includes data cleaning, data integration, data specification, data transformation, etc.

①Data cleaning: because of the data itself or the reasons in the collection process, the data source often contains some wrong data, which will affect the data mining results, so it is necessary to delete the noise data and inconsistent data

②Data integration: according to data mining objectives, data related to data are selected and combined together, and these data are often different. However, data integration can improve the accuracy and efficiency of the mining process.

③ Data specification: data sets can be normalized by data to simplify the transformation of data. Data volume can be reduced and the format can be easily processed. The main methods of data specification are dimension, quantity and data compression.

④Data conversion: the processed data can be converted into data types and data

formats, which can be converted into data in line with mining. The strategies for data transformation include smoothing, constructing attributes, normalization, aggregation, discretization, and generating concept layering from nominal data.

(4) data mining: the most critical step in the whole process is to select the appropriate algorithm to process the data, and adjust the algorithm at any time during this process, so as to obtain more satisfactory results.

(5) result expression and interpretation: relevant interpretation is made for the results of data mining, and the results are displayed intuitively with the help of visual tools, so that users can understand them more clearly.

At present, the research field of data mining in China is mainly related data mining theory, data mining algorithm and practical application of technology, and there have been relatively successful data mining applications in some large enterprises to improve the production efficiency and benefits of enterprises. Many scientific research institutions have also carried out practical application research in this regard. For example, Beijing Institute of Systems Engineering has studied the practical application of fuzzy methods in knowledge discovery, while Fudan University and Huazhong University of Science and Technology have optimized and improved the association rule algorithm.

2.6 Smart card technology

The smart card can also be understood as an integrated circuit card, and can be packaged into different. The campus smart card is mainly a general card style, which applies integrated circuit technology, information security technology and computer technology in the process of making, and students can complete daily life through smart card.

The campus card has been developing for 20 or 30 years on campus. At present, it can realize the functions of book borrowing, public transportation and medical treatment. At the same time, the technology of contactless IC card has been very mature, and the construction of information system platform has also changed from the original information platform based on database to the platform system of information synchronization and information exchange, whose convenient and practical features have provided good services for teachers and students on campus. With the development of card technology and platform technology, traditional one-card is moving to the intelligent stage. Smart cards are now part of the digital campus. In the future, NFC technology, mobile payment, fingerprint identification, face recognition technology may be the new smart card technology, smart card from the form of intangible.

3. Conclusion

A decision support system is formed by combining data warehouse, online analysis and processing, data mining, model base, database and knowledge base. The integrated decision support system gives play to the advantages of traditional decision support system and new decision support system to realize more effective decision support. Integrated decision support system is the future development direction.

In this system, the decision support system starts to combine with the expert system to form an intelligent decision support system. The intelligent decision support system fully achieves the organic combination of qualitative analysis and quantitative analysis, which makes the ability and scope of problem solving develop greatly. With the development of new technology of data warehouse, on-line analytical processing and data mining, the concept of new decision support system is gradually formed. The characteristics of the new decision support system is to obtain the auxiliary decision information and knowledge from the data, which is totally different from the traditional decision support system. The integrated decision support system gives play to the advantages of traditional decision support system and new decision support system to realize more effective decision support. For school administrators, a timely and comprehensive understanding of the overall campus operation and timely adjustment of decisions can improve the overall campus operation efficiency. In daily life, teachers and students can learn about the flow of personnel in the whole school in time through the platform. The catering department can timely learn about students' eating habits and hobbies through the system analysis platform, so that the window can be dynamically adjusted to meet the needs of teachers and students. By using the overall data of the school, the model of poor students was established, and the students who applied for poor students were compared with the low-consumption group, reflecting their actual consumption in the school, and providing decision-making support for the distribution of scholarships and grants.

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