THE DESIGN OF INTELLIGENT RESIDENCE PROPERTY MANAGEMENT INFORMATION SYSTEM (IPMIS) BASED-ON E-BUSINESS

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Abstract: The information and intelligent requirement of modern residence is improving with the development of computer and property management. It is becoming the key problem for property companies how to implement the intelligent property information management. In this paper, we present a framework of property management information system based-on E-business, which can integrate the information of intelligent residences, property information and user information. We apply GIS technology into the spatial property information management, then different of property data can be displayed and evaluated by using E-map. The network hardware integration of property system is based-on LonWorks technique which can make multi-networks to use the same route. The property services model is based-on e-business and thus property user can inquire and pay property fees by the internet. It is a versatile and flexible framework for functions and processes required by subscribers for different property business needs, with reusable application modules throughout the system.

Keywords: Intelligent Building, MIS; Property Management; web service; E-business

1 Introduction

With the reformation and development of residence housing, the size of resident community is increasing in China. And the level of intelligent, information and automation in building and residence housing is rapidly improving. It will be very difficult to manage the great deal of housing property by hand, if you do not use the information technology and MIS. The personal computer and the Internet technology have been widely used in company management and manufactory. However, it is lack of in the field of real estate market and housing information management [Han 2001]. The case study [Han 2001] confirms that property management company's computer applications are lagging behind the advancement of computer hardware and software. Three reasons may explain the paradox. First, property management companies are dealing with a small portion of properties by using the computer and internet. Second, property management involves many personal touches in which computers are not helpful. Third, software packages can not meet the requirement of special property management tasks, which are developed in other parts of management information system (MIS).

Information technique will play an important role in intelligent building property management. The intelligent residence property management has been gradually becoming a research focus for professional property manager [Yang 2001]. For property companies, it is becoming the key problem how to realize the intelligent property information management.

The future intelligent resident community [Cheng 2006] mainly includes three facets of property management, web-based information services and the integration of housing hardware and software. The modern property management system requires advanced management method and better property services, especial in the aspect of web-based information search. Moreover, it can be integrated with others of information systems which are related to real estate [Lin 2004]. At present, the property management technique [Lin 2004] is out of late. It can't keep up with the information technique development and don't meet the requirement of property users.

In this paper, we present a framework of intelligent property management information system (IPMIS) based-on E-business, which can integrate the information of intelligent residences , property information and user information service. The system of IPMIS is composed of four subsystems which are property company inner management, property operation management subsystem, property information service subsystem and network communication and support system. Property operation management subsystem has the main

functions such as auto-record of personal water, power and gas. The design of property space information management is base-on GIS, then different of property data can be displayed by using e-map. The network hardware integration of property system is based-on LonWorks technique which can make multi-networks to use the same route. The property services model is based-on e-business. The user can pay property fees by the internet. It is a versatile and flexible framework for functions and processes required by subscribers for different property business needs, with reusable application modules throughout the system.

2 The principles of intelligence property management information system (IPMIS) design

In order to make the system to have a good performance and usability, the system design should follow the rules which are described as follows.
- Advanced software design technology

  Firstly, the property management system should be based on the WEB. The three-layer WEB structure (B/S/S) should be considered in the system design. All kinds of property data is distributed to different professional database servers. The advanced distribution DBMS are used to deal with the property data. Thus, the property data can be captured and processed separately. The development platform and Toolskit should have the character of compatibility with other information systems such as OA system. The software design method of module and COM is applied into the software development so as to it can be easily modified and updated according to the user requirement.
- Usability

  The system can be easily operated and has a good interface. The property users can use the system, even though they don't have much more background knowledge on property management system.
- Security

  All the information with related to the property is processed by the MIS system. Much private property data and user information is stored in the DBMS. Any property user can access the MIS at any time by using the Internet. It is very important to make the web to be security.
- Expansibility

  Property management is rapidly developing in China only in recent ten years. Property management ideas and methods aren't very perfect. They are changing with the requirement of property user. Thus the system must have a good expansibility. It can be updated with the development of IT technology and provide more services.
- E-business

  Different web services and home automation need to be integrated in the intelligence residence community. Property user can log in the property management information system and search property information. They can inquire the property fees and e-pay it by using the internet. Thus the system must have the function of E-business and it is very necessary to ensure the security of e-payment.

3 The framework design of IPMIS

The entire IPMIS system is composed of four subsystems which are property company inner management subsystem, property operation management subsystem, property information service subsystem and network communication and maintenance system, as seen in figure 1. We will discuss the composition and function of every subsystem in this section.

3.1 Property company inner management subsystem

The subsystem mainly deals with the inner transaction of property company. It provides these services of property policy, property news, OA, property markets, property planning, staff management, finance analysis and decision-making for property company management. The OA software can share the property data with the system of IPMIS, so that different information systems can be integrated. The interface of finance can

input the property fees data from the property recharge module. And it can also output the property fee data into the finance analysis software developed by another software company. In addition, it has the function of analyzing property data and can provide decision-making support for property management.
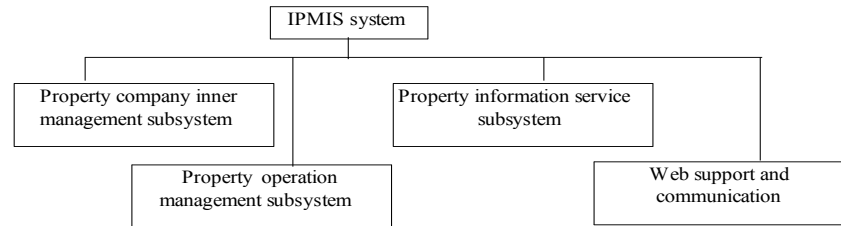

Figure 1 the structure of IPMIS

3.2   Property operation management subsystem

Property operation management subsystem is composed of two subsystems of homeowner property information management and public property information management (see figure 2). The module of homeowner property management mainly realizes these functions of homeowner management, property fees management, property rental and sale, home security and surveillance, and so on. Moreover, it can automatically capture property user dada and process it by using the LonWorks network and home automation technology.
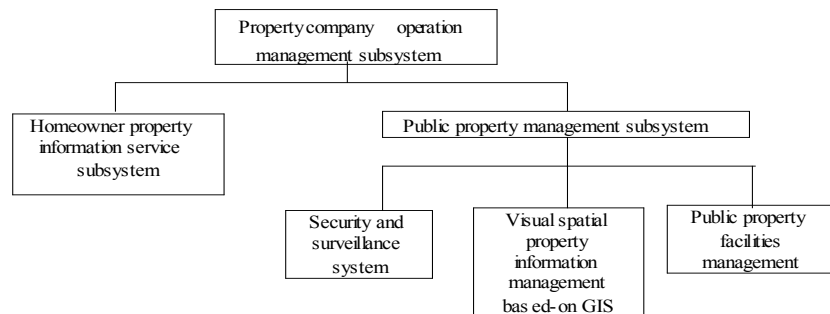

Figure 2 property company operation management subsystem

Public property information management subsystem is made up of three modules which are security monitor system, public property facility management and space information management. Monitor system can monitor the entire community to ensure the residence security and processing the emergence. We will discuss the space property information management in detail in the following section. Property management is developing toward the direction of visualization and intelligent management [Ma2004]. In order to realize the visual property management, we introduce GIS into the spatial property information management.

3.2.1   Visual spatial property information management based-on GIS

The system manages the public underground pipes and lines, home pipes and lines, spatial property planning and vehicle management. Space property information management is one of the most important contents in the design of IPMIS, because much property information is related to location. However, space information is usually descried as 2D data in most MIS systems that are developed before, which can not meet the requirement of information visualization [Zhou2000]. We applied the GIS technology into the design of space property information management system. Thus it can describe the property information by using 3D graphic.

Property user can search and inquire property information based-on the multimedia content. GIS technique will play an important role in the following property data management.

- underground pipe and wire management
- home pipes and wire
- visual property planning
- property evaluation and decision-making
- visual housing management
- car management, e-monitor, security alarm.

GIS are now able to address some of the problems inherent in property information value maps by producing them efficiently and as part of a wider suite of data analysis techniques. Howes (1980) acknowledged the imitation of a value map with regard to its information content but the functionality of GIS means that a value map need not be a static display, but can form part of a more comprehensive analytical process. Advances in IT mean that computer-based maps allow frequent updating, quicker production time and greater analytical potential. A GIS is quicker, cheaper, more versatile and adds value to data collected for other uses. Problems in the past related to lack of information resources, the production of expensive paper maps and the complex calculations involved. A GIS can manage the data input, calculations and presentation of the results in a graphical format. Dixon (2002) highlighted the value GIS might be value to property management by giving a spatial dimension to their information.

3.2.2   Visual property evaluation based-on GIS

GIS can provide a visual valuation method of spatial property information system. The comparison method of valuation is the most widely adopted in practice and involves the assessment of property value by comparing it with evidence of transactions for similar properties. Every method of valuation has recourse to sales comparison to a certain degree. Using the comparison method of valuation, physical, legal and market factors can be compared directly but every property is spatially unique, so spatial factors require an alternative method of adjustment. Fraser (1991) says "of dominant importance in understanding the demand for any urban property management is its property user and IT information technology development". There is an adage, common within the property companies, that says there are three crucial factors which determine the success of a property; location, property management and good services.

Using the GIS, the interesting property properties are displayed on an E-map and shaded according to their location; it provides a visual representation of the spatial distribution of comparable properties and the magnitude of their location values. The geographical display of the selected property properties also aids spatial analysis. Depending on the location of the subject property it is possible to assess its value and also determine which properties provide the best comparable evidence, not only in terms of physical value factors but also in terms of location. The research highlighted the issues that must be addressed when recording and analyzing property value factors, for example, the best method of spatially representing property interests that exist on different floors of the same building; a feature common to commercial property.

3.3   Public information service subsystem

It can provide some services on the property company policy, property management guide and residence community service. And it can construct a communication bridge between property users and property manager which they can describe their opinions in the property forum. Moreover, information search and property enquire are realized in this module.

4   The hardware integration of IPMIS

The network communication and hardware integration in intelligent residence community is implemented by using LonWorks technology. LonWorks technology [Feng2002] can control and link public property facilities, home security and surveillance systems, vehicle controls, home property automation and distributed systems

for optimum efficiency and flexibility. LonWorks protocol conforms to the standard Open System Interconnect (OSI) model, and can realize the multi-operation between different management information subsystems. LonWorks provides a home automation module. It specializes in the specific automation requirements of private homes and in the application of automation techniques for the comfort and security of its residents.
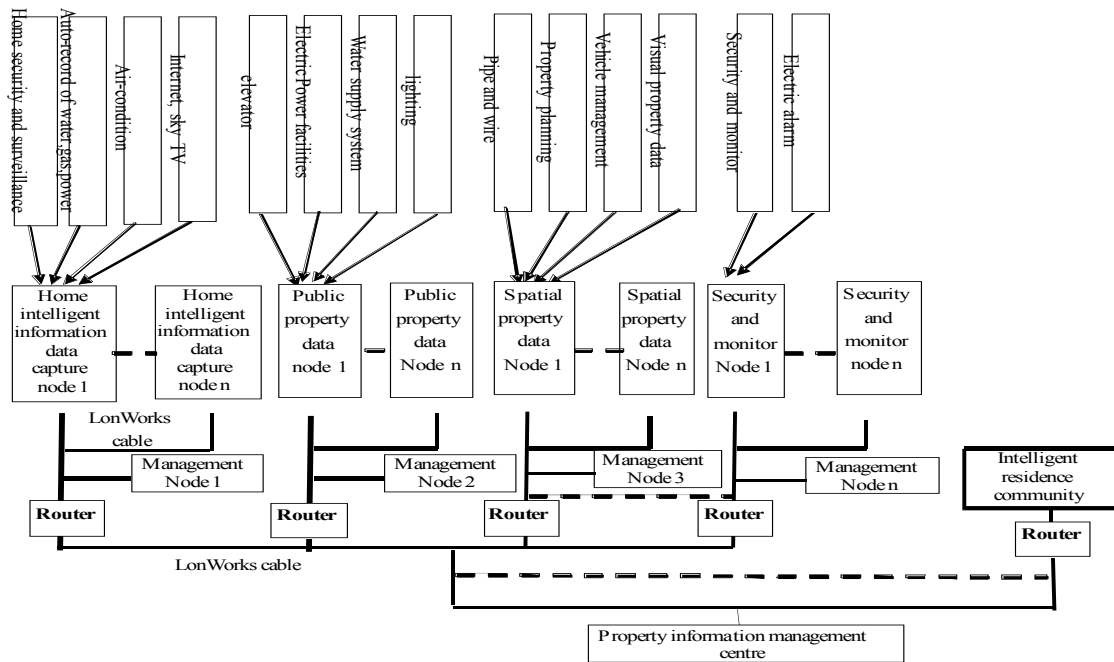

Figure 3 the hardware integration of IPMIS

Because there are many property data captured nodes in intelligent home and they are distributed at different locations, we can easily integrate all the property services and relative property facilities by using LonWorks communication platform. Now it is possible to create affordable networks of intelligent devices that sense, process, communicate, and control a multitude of applications ranging from handheld instruments to large process control systems.

Figure 3 describes the entire hardware integration of intelligence residence buildings. Different intelligent home communities can be linked to the centre of property management by LonWorks cable, which belong to the same property company. There are different property management nodes which sample all kinds of property data. These nodes include home automation property node, public property information node, spatial property information node, security and surveillance node. Home automation property node can realize the auto-record of home water, power and gas by using the LonWorks home automation module. Then, the property data is sent into the distributed special property management node to process. At last, different property management nodes sent the data processed to property information centre.

The intelligent Web management node product (SVT-GLJD2000) of LonWorks is used in the system integration. It has the advantage of web management and data storage. The Web management can optimize the performance of web communication and automatically monitor the node work condition.

5 The service integration of IPMIS based-on E-business

E-business's impact on property management and real estate is just as significant and multifaceted as in other areas. Its momentum springs from two factors: an increasing population of online property customers and increased involvement and investment from the real estate industry [Muhanna 2002].One study in 2000

projected that up to 50 percent of prospective US homebuyers would use the Internet to search for new homes within two years, encompassing more than 9 percent of households online, or about six million visitors, to various real estate sites [Greenberg 2000]. Therefore, the design of modern property management information system must been based on WEB and has the character of E-commerce function for property users. We will discuss the design framework of IPMIS that aims to implement the E-commerce in this section.

5.1 Property management framework based-on Web

Property information can be shared by property managers, property customers and property users after transacting IPMIS system. The property information services use the distributed databases structure, and different property data processes in different databases servers. The property data input from the LonWorks web nodes. The web design framework (see figure 4) is three-layer structure of B/S/S (Browser/Servers/ Application Servers). The web servers provide a public visiting interface for property managers and users. Any user can login the property management web by surfing the Internet to search property fees and inquire the property services.
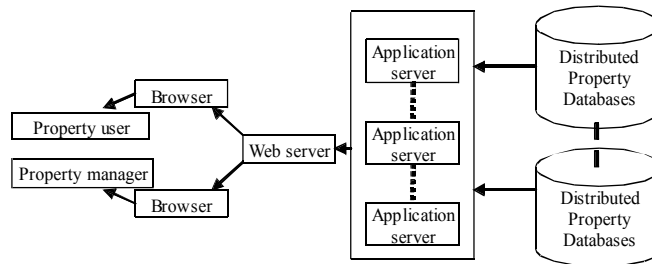

Figure 4 property management Web framework

5.2 Property services model based-on E-business

IMW(http://www.inetworks.com) specializes in Web-based application implementation, database integration, and Web development and hosting for businesses of all types. IMW's services for real estate businesses include lead generation, and management for real estate transactions, realtor membership, property listings, property management, and auctions [Lin 2004].

Focusing on Web-based information services, IMW applied an approach driven by its e-business model to design CommRex. CommRex is a Web-based property and real estate information system. We apply the e-business model into the property services. These services fall into the four-level structure (see Figure 5). The first level is a common Web site structure with HTML and XML scripting, Web graphing (a service that generates graphs for publication on a Web site), page styling, and so forth.
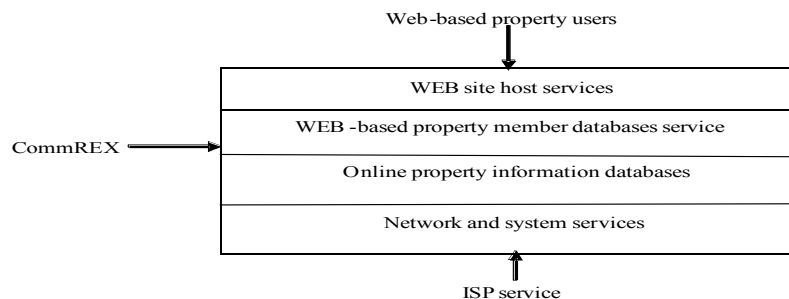

Figure 5 property service model based-on E-business

The second level is the development and maintenance of Web-based property membership databases, which

hold contact information for subscribers. Membership databases let IMW applications control subscriber access to some features. This level is an extension of the first level of service. Membership databases also provide an important service for property manager and property companies by letting them advertise themselves, and their products and services. Clearly, a searchable database of property information that is accessible from property company's Web site can significantly increase the service's value to the company.

The third level is the development and maintenance of databases for online property data listings. This level further extends the services of the first two levels. The prerequisite for this service is a membership database; each of the client company's members owns an account through which they can access the property-listing features. With this level of service, members can post, modify, and delete property listings from their password-protected account; and the public can search for property listings on the Web. This is the main channel through which realtors can advertise and conduct e-business. Therefore, the property-listing database has a high business value and has become an important service.

The fourth level of service is the networking and system operation service, which lets client companies have personalized Web domains and services set up at other locations that they specify; IMW then provides technical support. The first three levels of services are available in a standardized core package with several advanced options that make up additional customized services.

5.3   Logic structure of E-business model

Property companies that are successful in e-business commonly share the characteristic [Karris 2001]. They offer applications that solve data-integration issues— systems that can connect islands of data and information from different sources or sites. We use the high performance CommRex in the implementation of E-business service.

A high priority in CommRex's design was the distribution of data resources for business operation, system performance, and user management. This allocation of data resources considers the primary data distribution as well as how to adjust that distribution to improve response time and availability.

CommRex provides six subsystems to construct the E-business DBMS, as seen in Figure 6. They are:
- property Web-hosting services
- membership database services
- property service system
- public property information services
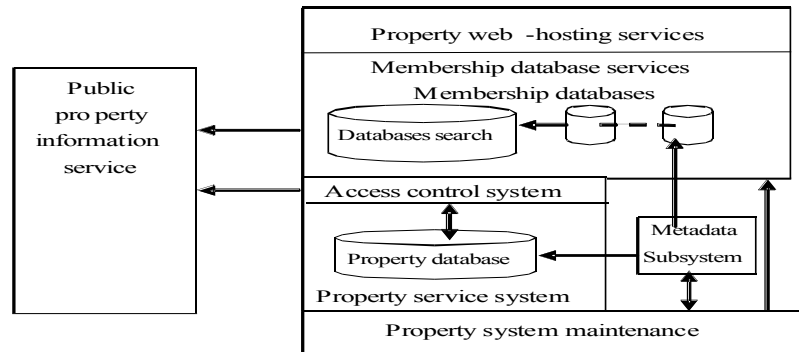- metadata system, and
- property system maintenance.

Figure 6 the logic structure of CommREX

Figure 6 gives a diagram of these subsystems. Property Web-hosting service is a set of basic Web development and hosting services. It is particularly suitable to novice members who have limited knowledge of Internet technologies. Advanced members can request service expansions from property Web-hosting services to membership database services then to property service system, which are top-down includable; that is, each more advanced subsystem depends on the lower-level subsystem. In this case, each membership database is associated with a specific Web site in property Web-hosting services that is customizable for the functions and

features in the contract between IMW and the subscriber. IMW intends this structure to meet the requirements of different business operations and systems management.

It is a versatile and flexible framework for functions and processes required by subscribers for different business needs, with reusable application modules throughout the system. In addition, this structure's flexibility permits easy additions or deletions when subscribers leave the CommRex system.

6 Conclusions and future

The framework design of IPMIS system is based on LonWorks technology which has many advantages in home automation and intelligent building property management. It can easily implement the integration of different networks applications such as home intelligent control net, Internet services and sky TV net based on the single physical LonWorks cable. Thus it can simplify the web construction of the intelligent housing and save construction fee.

The web-based property services aims to E-business and are implemented by using the advanced CommRex E-commerce software. CommRex's performance in terms of four characteristics—scalability, portability, operation ability, and availability—is satisfactory, owing to its distribution data allocation scheme. CommRex is scalable, according to a property subscriber's customization needs. Both property membership and property database services provide optional functional modules for customization, which include a data model extension, optional advanced functions, and other business services. IMW can more easily implement these modules because of the core data model and the use of metadata management. CommRex's design is also portable to different network operating systems and platforms.

The logic structure of IPMIS is three-layer web services (B/S/S), so as to the system can be integrated with other internet applications.

In addition, we use the GIS technology in the description of spatial property information. GIS can provide a visual property valuation method on interest property information.

The development of current property information management is toward to the direction of visualization, integration and E-business. The research of modern property management is focusing on how to use the GIS and other visual methods into the property information management and how to integrate the intelligent property MIS with other information systems. It is also becoming a challenge issue for property companies how to realize the function of business by suing the management web. Property management based-on E-business will be the mainstream of property system development and design.

Acknowledgements

References

Cheng, D, Z, Fang, W, and Chen H (2006). *The research of intelligent building future development*, Intelligent Building, 2006, 6.
Dixon, T. (2002), *IT applications in property*, Mapping Awareness and GIS in Europe, 16(2), 49-51.
Feng, P, and Chen, Z, C(2002). *LonWorks Technology Application in intelligence Residential Community*. Technology Report.
Fraser, W. (1991), *Principles of Property Investment and Pricing*, Macmillan, London.
Greenberg P.A(2000).*Consumers Edge Toward Web-Based Real Estate*, E-Commerce Times, 10 April 2000; http://www.ecommercetimes.com/perl/story/2932.
Han,S,S,and Lim L,Y,(2001). *Computers in property management companies*. Journal of Property Management , 19(5),433-440.
Howes, C. (1980), *Value Maps: Aspects of Land and Property Values*, Geo Books, Norwich.
Karris N. and Pike P(2001). *Entering the E-Commerce Age*. Mortgage Banking, July, 2001, 40-46
Lin, G, X, and Xuan H,Y. (2004). *Design of Information System Based-on MS.NET and Application in Property Management.*，The Journal of Computer Application Research, in Chinese, 21(4). 207-208
Lin ,Z.X, Anderson, G. D, and Anderson T.J. (2004). *Web-based services for real estate: model and implementation.* IT Pro . 2004, 52-57. (http://www.computer.org/publications/dlib).

Ma, X , M, Chen, L, Q, Zhang, Z, J. Chen, L, G,(2004). *Development of Property Management Information System in Residential Community Based-on GIS.* The Journal of Computer Technology. In Chinese , 2004 (4).80-84

Muhanna W.A. and Wolf J.R.(2002). *The Impact of Ecommerce on the Real Estate* Industry:Baen and Guttery Revisited, J. Real Estate Portfolio Management, 8(2),141-174.

Roderick A. R. (2000). *A construction management information system to assist to constructor prequalification.* Dissertation, Michigan State University, 2000

Wang, H, S, and Xie, W,Y. (2003). *The Development of Property Management Information System Based on Rational Unified Process.* The Journal of Computer Application Research, in Chinese, 20(1). 150-152

Yang, J. H(2001). *Property Management System Research on the Intelligence Residential Community.* Electric and Intelligent Building, 2001(10), 75-77.

Zhou, W, S, (2000). *Design of Visual Property Management Information System in Residential Community.* The Journal of Computer Application Research, in Chinese ,17(2). 148-150