Internet-based Information Communication and Management
--the Application of Project Information Portal

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Abstract

Due to the long construction period, numerous involved participants and geographical disperse, construction projects are generally faced with a lot of barriers during information communication. The ineffectiveness of information communication not only directly causes a lot of unnecessary waste, but also affects schedule and quality of construction projects indirectly. Project success relies heavily on effective communication among different participants. The paper puts forward the concept of Project Information Portal (PIP) to create an effective and efficient environment for all the involved participants. PIP, an Internet-based project communication solution, provides the single entry for involved participants per friendly and convenient interface. The paper, analyzes the concept of PIP and presents the architecture and functions of PIP system. Based on business process reengineering (BPR) theory, the construction process of PIP environments is analyzed and redesigned.

Keywords

Information Communication, Internet, Project Information Portal , Virtual Organization

1. Introduction

Along with the economy globalization and technology development, construction projects are becoming more and more large and complex. Due to the long construction period, numerous involved parties and geographical disperse, construction projects are generally faced with many information communication difficulties. Lots of claims and disputation are due to the incorrect or outdated information. As shown in Bricsnet.com Company's statistic data, 3-5% of project cost is caused by avoidable mistakes in which using incorrect or outdated drawing contributes 30%. The fee spent on FedEx is about 500 million US dollar (dollars) each year in order to transfer construction files or drawings. 1-2% of project cost is simply spent on daily printing, copying and faxing etc. Any participant only could own less than 65% of the whole project valuable record at project completion.

With the rapid development of the Internet technology, more and more researchers are now making research into using the Internet as the platform of information communication and collaboration. Using corresponding software and hardware platform, the user could retrieve, edit and track any information in anywhere and in anytime. At the same time, the communication cost could be decreased sharply. Hence, how to establish an Internet-based information communication and collaboration environment for construction projects has been becoming more and more important and urgent.

2. Malpractice Of Traditional Information Communication

Traditional information communication in construction projects usually causes a lot of malpractice such as:

(1) The amount of information is extremely vast and diversified during the implementation of construction project. If there are no effective information communication methods, the involved parties will face up countless and disorderly information. A great deal of unnecessary information is overloading; on the other hand, a lot of valuable information is omitted.

(2) Lots of documents and drawings will be transferred among different participants, which cause a lot of waste.

(3) The success of construction project needs a lot of external resources, participated units located in different cities, even in different nations. Traditional information communication usually adopts written forms. Information delay is often caused, and the related units or personals could not make right decision in time. On the other hand, the telecommunication and office costs such as telephone, fax and express mail, is very amazing. The traveling fee of organizing face-to-face meeting, which acts as one of the most important traditional information exchange and coordination measures, is very expensive, and sometimes this kind of meeting is not feasible.

Up till now, the linear pyramid-shaped organization structure is adopted by construction projects. Due to the characteristics such as lack of the transverse relations, the longitudinal communication manners are resulted. The efficiency of information communication in the specific construction project is exemplified by the processing of design change. The process of information communication is shown in figure 1. Under the organization structure in figure 1, the client needs a design change caused by his demands (supposing the design change occurs in designer 2).

3. Internet-based Project Information Portal

Internet-based Project Information Portal (PIP) is to create an information communication and collaboration environment for all the involved participants using information technology and communication technology and its application platform is Internet and corresponding virtual organization environment. Through standard Web interface of PIP, different project participants and the public could retrieve, inquire and share related information stored in central database within their authority. In addition, PIP integrates functions such as workflow management, issuing of project information, Video conference, BBS, online Video, virtual reality, application software sharing, etc.. The basic philosophy of PIP is presented in figure 2.

More detailed analysis of Internet-based PIP is as follows:

(1) The cardinal target of Internet-based PIP is to improve poor information communication situation. The users include related project participants, government officials and the public.

(2) It is necessary to create a virtual organization environment in the application of Internet-based PIP. The virtual organization is a dynamic alliance between organizations. Virtual organization is characterized with geographical dispersion, fully utilizing information communication technology, boundary crossing, complementary core competencies/the pooling of resources, changing participants and participant equality. It is obviously that above mentioned characters could reflect in the virtual organization environment of construction project.

- - - - Information flow of requesting design change from owner to sub-designer 2

―――― Information flow of sending design change (not having approved) from sub-designer 2 to owner

═════ Information flow of sending design change (having approved) from owner to all related participants

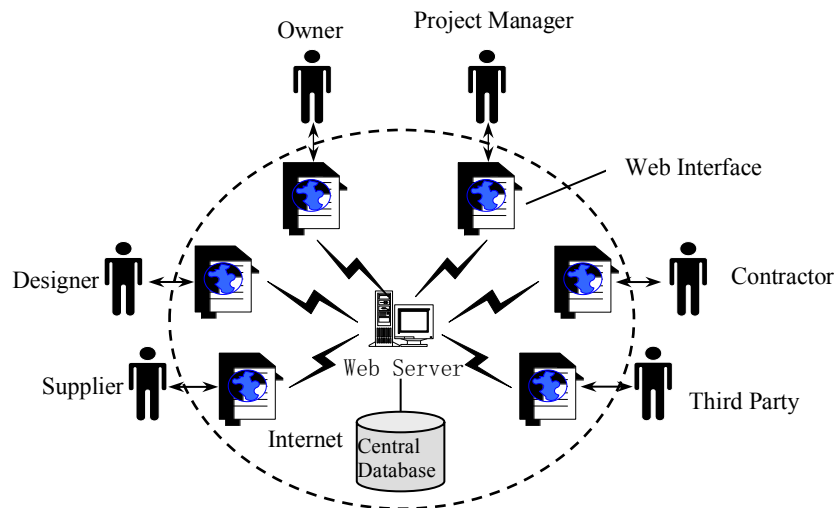**Figure 1: Traditional Information Processing Flow of Design Change**

Figure 2: Internet-based Project Information Portal （PIP）

(3) PIP will serve as the primary interface for formal project communications. The data generated and maintained in the PIP must be accessible to all project participants at all times. The PIP will be a fully Web enabled system. Full access to the PIP will be made available to all participants through commonly available HTML browsers. All project documents must be accessible through the Web Browser Interface. The PIP will follow the tracks of all related documentation and information, and send automatically the documentation to corresponding participant in time. In addition, PIP integrates or realizes functions such as issuing of project information, Video conference, BBS, online Video, virtual reality and, application software sharing, etc.. Function modules of PIP are shown in Figure 3 below.

(4) The core of PIP is central database. Any project participant could retrieve project information stored in central database through the web interface. Central database consists of not only structured information (i.e. data), but also unstructured information (i.e. document) mostly. It is necessary to point out that any document information must be classified and coded before stored into the central database. Information code can comprise basic information and read-write authority of the document actually. In addition, because of the varieties of document type (such as cost information, schedule information, quality information, etc.) and document format (such as word file, CAD file, video file, etc.), the most feasible way is to store any document information into central database as its binary format and user could retrieve a document information via its information code. As to review and modification of documents, user could open any kind of project document directly on the Internet browser by dint of installing Plug-in or downloading Java Applets with no need to install the relevant application software on his computer. While Internet is open to each project participant and the public, it's very important to insure the security of project information by using firewall techniques, encryption techniques and authentication techniques.

Figure 3: Function Modules of Project Information Portal (PIP)

4. Virtual Organization Environment of Internet-based PIP

Comparing to the traditional vertical information communication, the information communication in the virtual organization environment is the so-called "Lateral Communication" or "Parallel Communication" which is determined by its characteristics, such as "Complementation of Core Competencies / Share of Resource", "Equality of Partners" and so on.

In the virtual organization environment, the corresponding information processing flow of design change is shown as Fig 4: ① owner brings forward a design change order and uploads the document information to PIP，PIP sends it to project manager automatically; ② project manager checks the change order and PIP sends it to principal designer automatically; ③ principal designer checks the change order and PIP sends it to designer 2 automatically; ④ designer 2 discusses the change order (if approves), changes its design (downloads the drawing or online modification) and PIP sends it to principal designer

automatically; ⑤principal designer confirms the changed design and PIP sends it to project manager automatically; ⑥ project manager confirms the changed design and PIP sends it to owner automatically; ⑦ owner approves the changed design and PIP sends it to all the project participants automatically. In the information flow above, digital ideograph or relevant authentication technique is used to confirm or approve document information.

Figure 4: Information Processing Flow of Design Change in Virtual Organization Environment

As discussed above, PIP has Document Share function and Workflow Management function. The former means that all kinds of document information are stored in the central database after classification and coding, any project participant can upload, query, review, download and online modify project documents within his authority through standard web interface. The latter means the automation of workflow (mainly information flow). This is to say, PIP can forward the relevant document information to the relevant project participant automatically. Document Share function and Workflow Management function of PIP realize the Lateral Communication of information. The communication channels of project participants are greatly shortened, therefore communication problems such as distortion, delay, high cost, etc. can be settled effectively.

5. Conclusion

Along with the advent of the information age, traditional construction industry has been impacted by the information/communication technology inevitably. This impact can be generalized as follows: on the one hand, information technology provides new thinking and new organization of construction industry with powerful technical support; on the other hand, information technology brings on new technique of construction industry directly. In recent years, many research projects have focused on different application problems of information technology in different areas of construction industry. The paper proposes the concept of Internet-based PIP with intention of creating an effective communication and collaboration environment using Internet technology.

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