Internet Based Material Selection for Quality Function Deployment

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ABSTRACT

The Internet, incorporating computers and multimedia, has provided tremendous potential for remote integration and collaboration in business and manufacturing applications. The Internet is making the manufacturing world truly global, connecting buyers and sellers from around the world in all aspects of their business.
Material selection is one of the important activities for engineers in design and manufacturing processes. A selected material at the beginning of design stage affects functionality of the designed part as well as manufacturability and cost of the final product. Unfortunately there are not many accessible material databases that can be properly used for design.
 A customer focused or customer selected materials for manufacturing a product using Quality Function Deployment (QFD) is never far from realization.
This paper deals with the recent World Wide Web (WWW) or internet technologies that could energize all activities of material selection and manufacturing using QFD. Various web services and technologies when coupled with artificial intelligence based software can provide a strong platform for harnessing the power of the Internet to enable collaborative manufacturing in such a setup where the key components such as the human resource personnel and the manufacturing equipment are geographically separated.

Keywords: **Material Selection, Material Database, Web material selection model, QFD material selection Supplier based material selection.**

1. INTRODUCTION

The rapid emergence of increasingly Internet-based services is greatly shaping manufacturing industries. Internet developments offer sophisticated communication and information transfer services supporting market exploration, electronic commerce transactions, collaborative manufacturing among geographically dispersed organizations. More importantly, Internet communication technologies break through barriers between customers and manufacturing companies, providing an effective mechanism to support development of customized products [1].

Material selection is a process of key importance starting from the stage of product conceptualization to final product release [2]. Gone are the days when few materials are available for manufacturing a component which restricts the designer from giving out his best design. Also the availability of materials and the demands of existing supplier may increase the cost associated with the product. A QFD frame work based on Internet is proposed which can be used for finding out that material that is perfect in engineering perspective, cost effective, easily available and competitive.

2. WEB TECHNOLOGIES

Compared with the traditional distributed computing methods developed using the client–server architecture, both the client programs and the server programs in a Web-based system are preserved in the server side, and the client programs are automatically downloaded to a Web-browser at the client side.

Many new computer and Web/Internet technologies, including computer languages such as Java, CPP and C#, script languages such as Perl and VBScript, Web mark-up language such as Hypertext Markup Language (HTML), Dynamic HTML (DHTML) and Extensible Markup Language (XML), Web-based client–server programming tools such as Active Server Pages (ASP) and Java Servlet, distributed object modelling methods such as Distributed Component Object Model (DCOM), Remote Method Invocation (RMI), Common Object Request Broker Architecture (CORBA) and .NET, etc., have been employed for developing Web-based manufacturing systems [2]. Many commercial software packages have also incorporated some Web/Internet technologies into their systems.
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3. WEB BASED MATERIAL SELECTION FRAMEWORK

Basic three-tier architecture for a web based material selection system is shown in figure 1. This framework can be extended to create a multi-tier system where

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each and every phase of product design, development and manufacturing can be incorporated.

This architecture starts with various web pages that contain material data, properties and cost associated with it. These are dynamic pages that are created using the above web design and development software discussed in the above paragraph. These pages can be accessed by the web enabled Integrated Development Environment.

This IDE can also access the company's existing material database which will aid in comparing the new material with the existing material used or possessed by the company. The clients depict various prospective suppliers that can quote their supply data with respect to the material selected.

Fig. 1 Web Enabled Material Selection Framework

The QFD web material selector is the heart of this system which communicates with the different servers and data bases which are associated with framework.

Updating of new alloys or materials can be done efficiently since www is a space which has no boundary limits.

This framework also allows a company to locate a supplier which can supply the chosen material. It can also give the engineers of the company an idea about where the material is available in the lowest rate thereby avoiding fake charges or cost by local suppliers.

3.1 WEB MATERIAL SELECTOR

This interface will be complicated in its design and development. This interface should have high communication capabilities. This interface not only communicates to web sites but also to other servers or network to which it has access. This interface or program has to use distributed computing because it has to retrieve data from other servers. This retrieval should be highly secure and should only access the material database. This can be achieved by using packages like DCOM, COM, RMI, CORBA, .NET etc.

4. ISSUES IN THE FRAMEWORK

In the development of various types of Web-based manufacturing systems, a number of key issues were addressed to improve the functions of the conventional computer-based systems and network-based systems using advanced Web technologies. We classify these key issues into the following four categories: (1) collaboration among product development partners, (2) data modelling, (3) system architecture design and (4) security management. Details of these key issues are discussed in the following subsections.

4. 1COLLABORATION AMONG PARTNERS

Collaboration among different partners/components through the forms of communication, co-ordination, negotiation, etc. plays an important role in distributed systems such as multi-agent systems [6]. In the Web-based systems, in additional to the conventional collaboration methods, many Web technologies have also been used for improving the capabilities of collaboration.

4.2 DATA MODELLING

With the advances of computer and network techniques, many database systems have been developed for modelling products, manufacturing resources including materials, machines and personnel, etc. in implementing advanced manufacturing systems. In the Web-based manufacturing systems, many Web technologies have also been employed to improve the capabilities of modelling the databases.

4.3 SYSTEM ARCHITECTURE DESIGN

Architectures of most Web-based systems were designed based upon the client–server communication method. In these systems, the modules and databases are distributed at both the server sites and the client sites [5]. Contrary to the traditional client–server applications, the client programs are usually downloaded automatically from the server sites to the
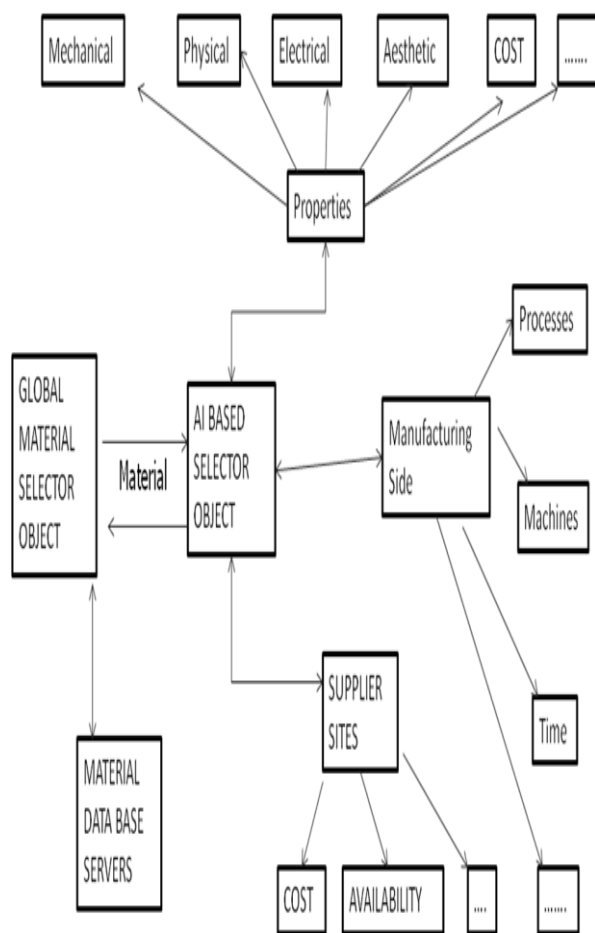
local computers through Web-browsers in the Web-based applications. Depending on the sizes of the programs and databases at the client and the server sites, the Web-based applications are classified into two categories: fat-client and thin-server applications when the major computation is conducted at the client side and thin-client and fat-server applications when the computation is primarily carried out at the server side.

4.4 SECURITY MANAGEMENT

Since Web-based systems allow the clients to download client application programs from the server side, access the client programs using local Web-browsers, and execute programs at the remote server side, security management mechanisms are required to specify different levels of accessibility permissions for different users for preventing the local machines from being damaged by poor programs and viruses from the remote server sides and preventing the server machines from being visited by the unauthorized clients.

5. CONCLUSION

This paper introduces a basic framework on developing Web-based or web enabled material selection and manufacturing systems. The key issues in developing Web-based systems are discussed. The framework developed is not just for selecting materials and processes but it also have the ability to locate a supplier and do cost analysis. The key issues in developing Web-based systems are discussed which can be addressed by a separate study taking aid from experts in that field.

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