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## CAD Graphic Preview and Interaction of the Mould Collaborative Design

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### Abstract

CAD graphic preview and interaction is a key problem in the mould collaborative design system. It can realize with Java Applet program, but it is necessary to development Java Applet program, that will restrict many terminal users of the mould collaborative design system. In order to realize the problem that terminal users can preview CAD graphic, correct and transfer the CAD graphic to other terminal users easily and quickly, this paper put forward a way that terminal users can use previewing the original data file of AutoCAD graphic, correcting and transferring the CAD graphic to other terminal users, the way is using the Voloview control program which developed by Autodesk company, and put forward the concrete methods and steps to achieve. Test shows that, the way can meet the terminal users requirements and implementation in mold collaborative design system.

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*Key words:* mould collaborative design; CAD graphic preview; graphic interaction; the Voloview control

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### 1. Introduction

To realize the business cooperation of the whole mold industry, the key is the collaborative design of the mould. During the concurrent design of the mould in different places, the interaction of the simple text information is not enough for the designers, and it also needs to preview the graphics directly on the platform to check the design problems and control the design process. Because of the heterogeneity of the softwares used by the designers, the data formats of the graphics are usually different. The drawings designed by one designer can not always be opened normally through the CAD software used by another designer. So, a uniform platform is necessary to freely preview the graphics by the browser for the designers of different regions without opening their own CAD software system. It is the key issue in the off-site concurrent and collaborative design of the mold.

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CAD models include two-dimensional engineering drawing and three-dimensional entity model. To display three-dimensional model in a browser, a VRML (Virtual Reality Modeling Language) is needed to be used for the rebuilding of the model, and a special browser is also required. Because of the limit of the company scale, 2D CAD softwares such as AutoCAD are widely used in the small and middle company of mould manufacturing at present. Therefore, the interactive display of 2D CAD graphics in the client is mainly discussed in this paper.

## 2. The data formats of 2D CAD graphics

The file formats of 2D graphics include BMP, IPEG, GIF, PCX, TIFF, DWG, DXF, DWF and so on. In these formats, DWG, DWF etc. belong to the binary files based on vector format, and BMP, GIF, JPEG etc. belong to raster graphics files. The former are composed of the line segments, arcs and curves, and the latter are composed of the pixels. Thus, the data formats used by these two types of the file are quite different.

Raster image is also called bitmap image, and it is generally used by Photoshop and other drawing softwares. Bitmap image is composed of the pixels, and a specific location and color value are assigned to each pixel. When a bitmap image is dealt with, the pixels are edited rather than the objects or shapes, that is, every single point is edited. Because the bitmap images can show the micro layers of the shadow and color, they are commonly used as the electronic media of continuous tone images such as photographs or digital drawings. Bitmap image is related to the resolution, that is, a fixed number of pixels are contained in a certain area of the image. Therefore, if the image is magnified with a larger multiple in the screen, or printed with a lower resolution, the details would be lost in the bitmap image, and jagged edges appear.

Vector graphic is composed of straight lines and curves defined by the vectors. Adobe Illustrator, CorelDraw, CAD and other softwares create the drawings based on vector graphics. Vector graphic is described according to the geometrical properties of the contour. After drawing the contour of the graphic, it is placed in a specific location and filled with the color. Moving, scaling or changing the color will not reduce the quality of the graphic. Vector graphic is independent of the resolution. It can be scaled to any size and printed with any resolution on the output devices without losing the details or affecting the definition.

In order to allow the users to browse the CAD graphics similar with CAD environment, the way which directly views the vector graphics in the browser is used in this paper.

General browsers such as IE and Netscape support the graphic formats of JPEG and GIF. For the raster graphic formats of JPEG and GIF, the browser can directly view the graphic without any external program. However, For the graphic files based on vector format in the CAD system, the preview of CAD vector graphic must be realized by the CAD software, using Java Applet or ActiveX technique .

As mentioned above, because of the heterogeneity of the CAD softwares used by the designers in different regions, design drawings can not be opened by other designers sometimes. Therefore, the approach of opening the corresponding CAD application software to display the graphics is infeasible.

After compiling Java Applet, \*.class file can be generated, embedded in HTML document and interpretative executed by the Web browser. When the user browses the HTML pages with Java Applet, the Applet would be downloaded to the client and run. This program is independent of the platform. As long as the browser is compatible with the Java, the program can be carried out through the Java virtual machine (JVM) on different platforms. Java Applet is interoperable, and don't need the client to setup. But, to use the Applet to display the CAD graphics, the user needs to develop their own Applet programs. So, it is feasible to use the Java Applet to preview CAD graphics, and there exist some problems concurrently.

A simple and practical method is to use ActiveX control for the preview of the CAD graphics. ActiveX control can be regarded as an access code module for the browser. With the help of the control, Web browser can understand and translate the file which the browser is unable to deal with, and interact with the vector graphics directly without an external application program. The advantage of this method is

temporary access if desired and immediate disengagement to release the system resources after finishing the work.

### 3. The interaction of 2D CAD graphics by using ActiveX control

#### 3.1 Whip! Control

Whip! Control released by Autodesk Company early is a free tool of browsing AutoCAD engineering drawings in the Internet environment. The control uses a special file format of vector graphic DWF (Design Web Format). DWF is a kind of special CAD graphic data format. It is based on the vector, and transmitted on the Internet with a special compressed form. It has the characteristics of small document size, high accuracy, and fast transmission rate. With the help of the Whip! Control, CAD files can be released through the Internet and the CAD data can be viewed by the browser.

However, to release the CAD graphics by using Whip! Control, the CAD graphic data format must be DWF. Moreover, the save of DWF as DWG file in the browser by right key is equivalent to search the homonymous file of DWG to save in the directory of DWF file. In order to download the files successfully, two documents of \*.dwg and \*.dwt must be uploaded with a same name, and stored in the same directory.

#### 3.2 Voloview Control

Because of the limit of Whip! Control, the Voloview Control is used to browse the AutoCAD original data files directly in this paper.

Voloview is a powerful graphical browsing tool released by Autodesk Company recently. Besides browsing DWF documents, it can view DWG files directly. The realization process is as follows [1-2]:

(1) Get Voloview control. The server and client can download the Voloview from the Web site of the company freely, and obtain the control by installing the application software manually. In order to get the control by all kinds of users quickly, Avviewx.dll file can be packaged and compressed as ActiveX control by Cabinet SDK tool, and then saved on the server for the users to download.

(2) Upload AutoCAD graphics (DWG or DWF files) to the server. The graphic files are stored on a directory in the server, while the relevant information (the file name, upload person, upload time, additional remark) is stored in SQL Server 2000.

(3) Query the database. All the file information uploaded to the server is displayed on the web page.

(4) Edit the web page displaying AutoCAD graphics. When the page program is edited on the Frontpage or Dreamweaver, the ActiveX control (Voloview) is inserted, and its properties such as the location of the file stored on the server, the path and name of DWG file, the display area in the page and other information are set and modified. It should be noted that the control parameter, that is the name of the DWG file, is transmitted to the page by the Application object.

(5) Browse AutoCAD Graphics (DWG files). When the user requests the web page including AutoCAD images shown by Voloview Control, the client checks whether this control exists in the local system according to the key value of the control (CLSID) firstly. If the control exists, it doesn't need to be downloaded. Otherwise, the system will automatically download and register the control packed and compressed by the author from the server. Then, the web page designed in the step (2) can be browsed in the client. When the DWG documents are browsed in the internet, the shortcut menu can be popped-up by clicking the right key. By using this menu, the graphics can be translated and scaled easily just like inside the AutoCAD software. The CAD graphics also can be printed separately, or printed with the Web page.

(6) Download the graphic. The User can save it to the local by the option of "Save Target As" on the shortcut menu of the right key.

#### 4. The General operation process of the graphic system

The hierarchical model of the whole graphic system is B/S three-layer structure, and it can be showed by the general operation process of CAD graphic interaction (Figure 1).

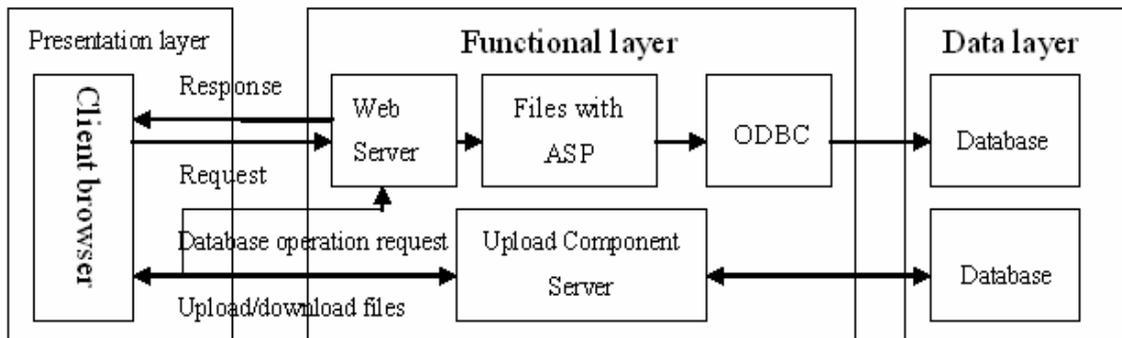


Figure 1 The general operation process of CAD graphic interaction

Where, the presentation layer (Browser) needs to download the Voloview control, accomplish the function of the data interface, and achieve the display logic of the CAD files. The function layer transmits, processes the data, and achieves various customer application functions by using the server. The upload module of the file is the key in this layer. It can achieve the upload of the file and save it to a directory of the server. The data layer is used to preserve some information of the uploaded files, such as the author information, uploading time and the saving path.

After uploading the CAD file to the server by the upload component, the CAD file is stored under a directory on the server, and the relevant information about the uploaded file is saved in the database. By using the access component ADO of the ASP database, the file uploaded to the server can be viewed through the ODBC way.

By the Voloview control, the presentation layer can browse the CAD graphic.

#### 5. Conclusion

CAD Graphic interaction is a key problem of the mould collaborative design. According to the data format of 2D CAD graphic, the direct preview of CAD vector graphic and graphic interaction can be realized by the ActiveX control conveniently.

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