

Three-Dimensional Display Of Directory Structure To Support Users Tidying Up Files

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1 Problems of Performing Disk Space Reclamation

Disk space reclamation is a task often performed to save disk space by deleting unnecessary files and to arrange them in a easy-to-find way. Indeed, however, it tends to be a boring work. To investigate the reason for that, we observed 4 subjects performing reclamation of their disk spaces each for approximately 30 minutes. As a result, we found that existing tools used for disk space reclamation had following problems.

One of the problems is on how to present the directory structure and move around directory hierarchies. With the tree view which has been used in many existing tools such as Explorer of Windows, it is not possible to display the entire hierarchical structure since each directory is presented in a one-dimensional row. Another restriction is that one screen can present files in at most one directory. Furthermore, moving to a directory in the depth of the hierarchy requires a user to track a directory one by one, and it forces him/her to open a tree view again and again. Even if the entire directory structure is displayed, it will not fit into one screen and thus a user has to find a target directory by scrolling the screen. The lack of ability to present the entire directory structure, as presented here, becomes a large problem in the disk space reclamation which involves referring to various directories and performing file operations many times.

Another problem is that of presenting information necessary for disk space reclamation. When a user performs the task, he/she usually refers to name, size, content and the last used date/time of files. In case of the existing tools, it is not possible to present several of them simultaneously and he/she has to perform a series of operations to change the information to be presented. Together with the lack of ability to present the entire structure, this makes it difficult to choose a specific file from many files.

On the other hand, to avoid this kind of boring work, there exist several tools specially designed

for disk space reclamation to avoid a boring work like this. However, many of these are the tool for deleting unnecessary files automatically and it is hard to say that they provide a solution to problems discussed in previous paragraphs.

In this study, we developed a tool that focuses not only on deleting unnecessary files but also on replacing files, considering the issues of the existing tools mentioned above. Furthermore, we also realized a new method of visualizing a file structure using three-dimensional graphics, taking aspects such as novelty and uniqueness in addition to practicability into consideration.

2 Existing Researches on Visualizing a File Structure

Regarding the display of visual hierarchical structure, there have been a couple of researches such as Cone Trees[2] and Information Cube[3], but these are not necessarily focused on presenting directory structure. 3D File System Navigator[4] aims at displaying directory structure. This represents files and directories like a building, but it is not designed for file operations.

3 Features of This Tool

3.1 Display of Directory as a 'Tree'

The most notable feature of this tool is the three-dimensional visualization of a file structure utilizing the metaphor of a 'tree'. A leaf corresponding its file and a branch to its directory, a specified directory is represented as a 'tree' (Fig1). The size of a leaf is proportional to the logarithm of its file size and the color of a leaf varies based on the last modified time of the file. This three-dimensional visualization of a file structure enables a user to see the distribution of files and makes it easier to comprehend the structure of the directory, thus it gives a solution to the problem of moving and presenting a directory mentioned in the beginning. Furthermore, it enables to show a part of the in-

formation necessary for disk space reclamation, while maintaining the ability to present the entire structure. In addition to that, it is also expected that using a metaphor of a 'tree' helps a user familiarize with the tool and thus reduces the user's subjective fatigue.

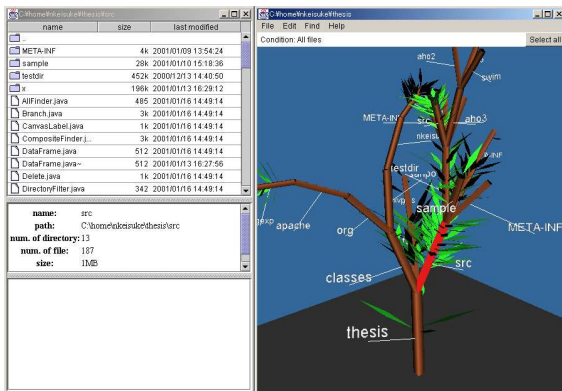


Figure 1: Display of directory structure as a 'tree'

The actual file operations derive from the existing interface. Once files or directories are selected by clicking them, a user can move them to an arbitrary directory by drag and drop or delete them. While a user is dragging files or directories, only directories which can be the destination need to be displayed and thus leaves are turned semitransparent, making the directory structure easier to understand. The tree view can be rotated, scaled or moved by dragging the screen.

3.2 File Pick-out Feature

When we think about disk space reclamation from the perspective of replacing files, a task of bringing files which have something in common such as an extension, a file name etc., together into a specific directory would dominate it. For that, it is necessary to comprehend how such files are distributed. On the other hand, when we think about disk space reclamation as a task of deleting files, it is notable that unnecessary files are characterized by containing a specific character such as ~ in their file name, or not having been used for a long time, etc. Therefore, to facilitate these tasks, this tool has a feature to pick out files with specific conditions.

3.3 Other Features

To present detailed information on the files in a specific directory, this tool provides a table view.

It also enables to preview the head of a file. Other than them, it allows unlimited undo.

4 Issues on Implementation

This tool is implemented using Java 3D. As it requires large amount of computer resource, if a directory containing more than 1000 files is shown on the computer currently used for development (Pentium III 750MHz, 128MB RAM), the speed of rotation/moving and selection is degraded so that it can hardly be used for a practical purpose.

5 About Evaluation

We ask subjects to freely tidy up a part of their directory using this tool and fill out a questionnaire on feeling aspects such as interest factor and functional aspects such as operability in comparison with the existing tools, before and after the task, and evaluate it based on the questionnaire.

As of writing we are in process of evaluation, however from the result so far it is expected that feeling aspects would be improved. Regarding functional aspects, out of seven tasks[1]* of visualization method by Schneiderman, it is expected that the performances of Overview and History would be improved compared to the existing tools while that of Zoom would be degraded, and those of Filter and Details-on-demand would not differ from the existing tools. Note that Relate and History tasks are not implemented and they would be a point of improvement in future.

References

- [1] Schneiderman, B: Designing the User Interface: Strategies for Effective Human-Computer Interaction, 3rd Ed., Addison-Wesley, 1998.
- [2] George G. Robertson, Jack D. Mackinlay, and Stuart K. Card: Cone Trees: Animated 3D Visualizations of Hierarchical Information. In *ACM CHI'91*, pp.189-194, 1991.
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- [4] Silicon Graphics, Inc.: 3D File System Navigator http://www.sgi.com/fun/freeware/3d_navigator.html

*Overview, Zoom, Filter, Details-on-demand, Relate, History, Extract