Procedure Based Help Desk System

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ABSTRACT

In this paper, we describe an outline of "Procedure based help desk system".

Preparing enough amounts of contents for help desk system is important for constructing an efficient help desk system. However, the preparation of contents is a hard job for contents-creators (usually, who is an expert of the work.).

To support making help desk contents, we developed "Procedure based help desk system". Primary functions of this system are to easily generate help desk contents about software usage (They will be called as "procedure data".). Then the system classifies procedure data and constructs procedure database. Also the system provides useful functions to refer accumulated procedure data.

Keywords
Help desk, case based reasoning, guidance.

1. INTRODUCTION
"Help desk systems" have been used for customer support (a call center) works or trouble shooting works, and several development tools for help desk systems have become available [1]. When a help desk system is developed by using a "case based reasoning" technology, normally, each case is described by a pair of "question" and "answer", or a pair of "trouble's status" and "how to fix it", then users search such cases by using a full-text search technology.

However, we think that help desk services are also effective not only for trouble shootings but also for "guiding a sequence of working procedure". In this sense, purposes of help desk services are 1) education of beginners, 2) sharing and inheritance of expert's knowledge.

For these purposes, we need to provide some functions, such as, 1) supporting users to generate procedure data, 2) classifying procedure data by the system, and 3) supporting users to retrieve procedure data. We developed "Procedure based help desk system" that guides a sequence of software operations. This system is constructed as a WWW application software.

Procedure based help desk system automatically records a sequence of user's software operations, then generates "procedure data" from user's software operations. To refer procedure data, the system records user's operations, then uses the recorded sequence as a search key. The search results are procedure data that each sequence is similar to user's operations. Therefore, users can refer the procedure, which may include expert's knowledge.

This paper describes an outline and various functions of Procedure based help desk system.

2. OUTLINE OF PROCEDURE BASED HELP DESK SYSTEM

2.1 Problems and Our Approach

2.1.1 Supporting to create procedure data
It is needless to say, that quality and amount of contents are definitely important for a help desk system. However, the preparation of contents is not an easy job. Normally, some experts must be responsible for preparing enough amounts of contents. Thus, it is desirable to provide a mechanism to create procedure data as easily as possible.

In this system, user's each operation on software (menus, commands) and its result (usually it is shown in a window) are automatically recorded in order. For this function, this system uses the message (or event) hook facility that is provided by an operating system. Then, all recorded operations and window images of results are gathered in procedure data documents. By this entire process, the system provides a facility to generate procedure data as easy as possible.

2.1.2 Referring procedure data
As for data searching functions of help desk systems, the following two methods are well known. By using either method, users can retrieve and refer appropriate help desk contents.

1) Using full-text search technique on help desk contents. Users describe a purpose or a problem on their work and use them as search keys.

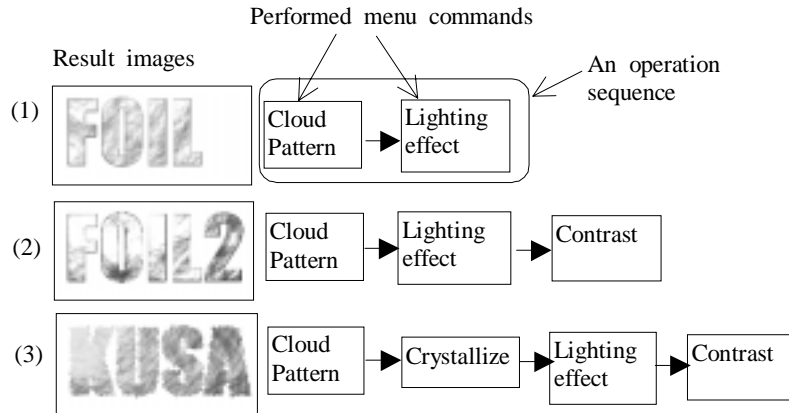Especially, on works that are done by using software, also menus and commands can be used as search keys.

Figure 1. Samples of software operations (on "Adobe Photoshop™" software)

2) Users specify characteristics that will be contained in a result (i.e. colors, brightness, contrast, etc.), and then a system uses those characteristics as search keys. This way is common when results are multimedia data, i.e. pictures, movies, etc.

One primary purpose of this system is to realize the ability that beginners can refer to procedures of experts. In other words, one primary purpose of this system is to provide the ability that beginners (who know only basic ways on their work) can refer higher or complicated techniques and can learn them. In this case, it is desirable that a help desk system recognizes user's operations and shows them other ways that include higher techniques, interactively. For example, Figure 1 shows some procedures to make logos. When a user has performed operations that are shown in Figure 1. (1), then the system shows some other ways (Figures 1. (2) and/or (3)) which may be applicable for similar purpose and may include higher techniques.

For explanation, we use the menu commands of Adobe Photoshop™ software for showing examples.

To show appropriate procedure data, the system should provide searching functions that are based on a sequence of user's operations; i.e. an order of performed menus of software. Normally, full-text searching functions do not consider an order of search keys. Procedure based help desk system provides not only a normal full-text searching function but also an original order-dependent searching function.

2.2 Supposed Usage of Procedure Based Help Desk System

We classified types of the users of Procedure based help desk system into the following two types.

1) Beginners: Mainly refer procedure data that are stored in the help desk server.

2) Experts: Mainly generate procedure data from their performed operations and store them into the help desk server.

Figure 2 shows the usage of Procedure based help desk system for each type of users.

The system automatically records operations of experts by the procedure recording function. So an expert should just only start the procedure recording function, perform software operations as usual. Then the procedure recording function records performed

menu commands and each result image of each performed menu command. After all operations have been done, all recorded menus and images are sent to the help desk server. Then the help desk server generates a procedure document (to be shown to other workers), classifies and registers it to the procedure database.

To refer procedure data that are registered in the procedure database, a beginner starts the procedure recording function and performs his/her job. Recorded menu commands are used as search keys. Then a beginner executes the searching function. The searching function retrieves procedure data that are similar to the beginner's operations, sorts retrieved procedure data, and shows to beginners the list of similar procedure data.

Through this whole process, beginners can refer the procedure data created by experts, and can learn high techniques about software usage.

3. FUNCTIONS OF PROCEDURE BASED HELP DESK SYSTEM

This section describes primary functions of Procedure based help desk system.

3.1 Recording User's Operations

The recording function is implemented by using "a message-hook function" prepared by the operating system (We developed the recording functions on Microsoft Windows95™, so we use the message-hook functions that are provided by Microsoft Windows95).

Entire recording process is as follows.

First, the recording function observes message-passing between the operating system and a software, finds the timing that a menu command is performed, and then retrieves the string of the performed menu command. Second, when a user performs any kind of interactive operations, such as a mouse click or a keyboard input, then the result of the performed menu command is displayed. Then the recording function captures the displayed image as a result of the performed menu command. By iterating the above process, the recording function records a sequence of software operations. Figure 3 shows information types that the recording function captures.
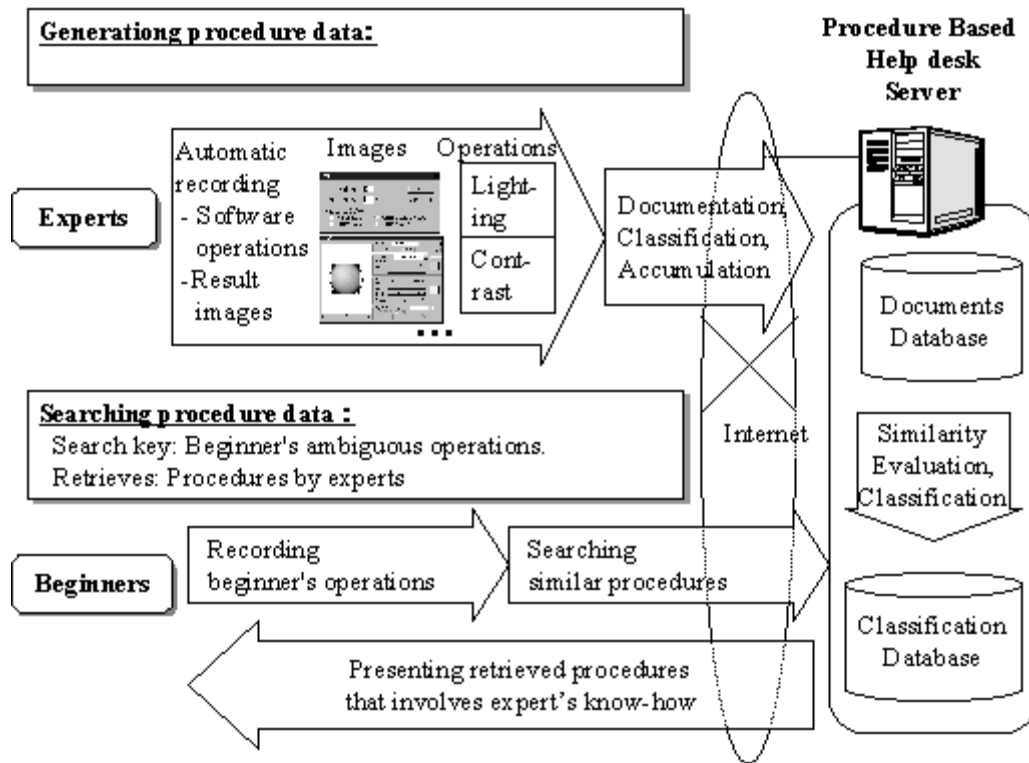
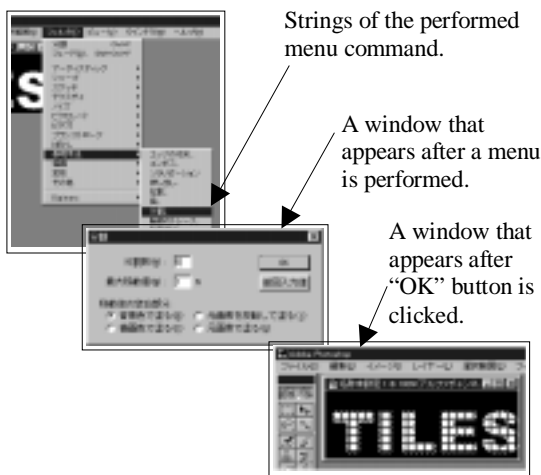**Figure 2. Usage of Procedure based help desk system**

2) a sequence of performed menu commands;

3) each result image of performed menu command;

4) others (notes and comments).

(2) and (3) are automatically recorded by the recording function. Unlike this, (1) and (4) are supplied by users. It is supposed that (1) and (4) are described after (2) and (3) are recorded. The system has an edit function for this purpose. Figure 4 shows the window image of the recording function (we call it "Operation recorder"). In Figure 4, the No.2 row of the "Performed Menu" column means that the menu command "Separate…" is performed, and No.3 row of the "Window Image" column shows the result window image of "Separate…" menu command.

(2) is used for classifying and searching procedure data. By using software menu commands for classifying and searching, each user can generate/retrieve procedure data in common expression.

Because each software determines software menu commands, this system's procedure data are free from blurring of expression by users.

Figure 3. Information types those are to be recorded

3.2 Constructing Procedure Data

3.2.1 Data structure of procedure data
Each "procedure data" is comprised of the following four elements:

1) name of procedure data;

3.3 Classifying Procedure Data
"Procedure data" has order information. Also, even if the purpose of procedures is the same, there are many methods of procedure data, such as "a basic procedure", "a procedure that depends on a certain situation", and "a procedure that includes a high technique". Therefore, to construct procedure database, it is necessary to consider a similarity of procedure data.
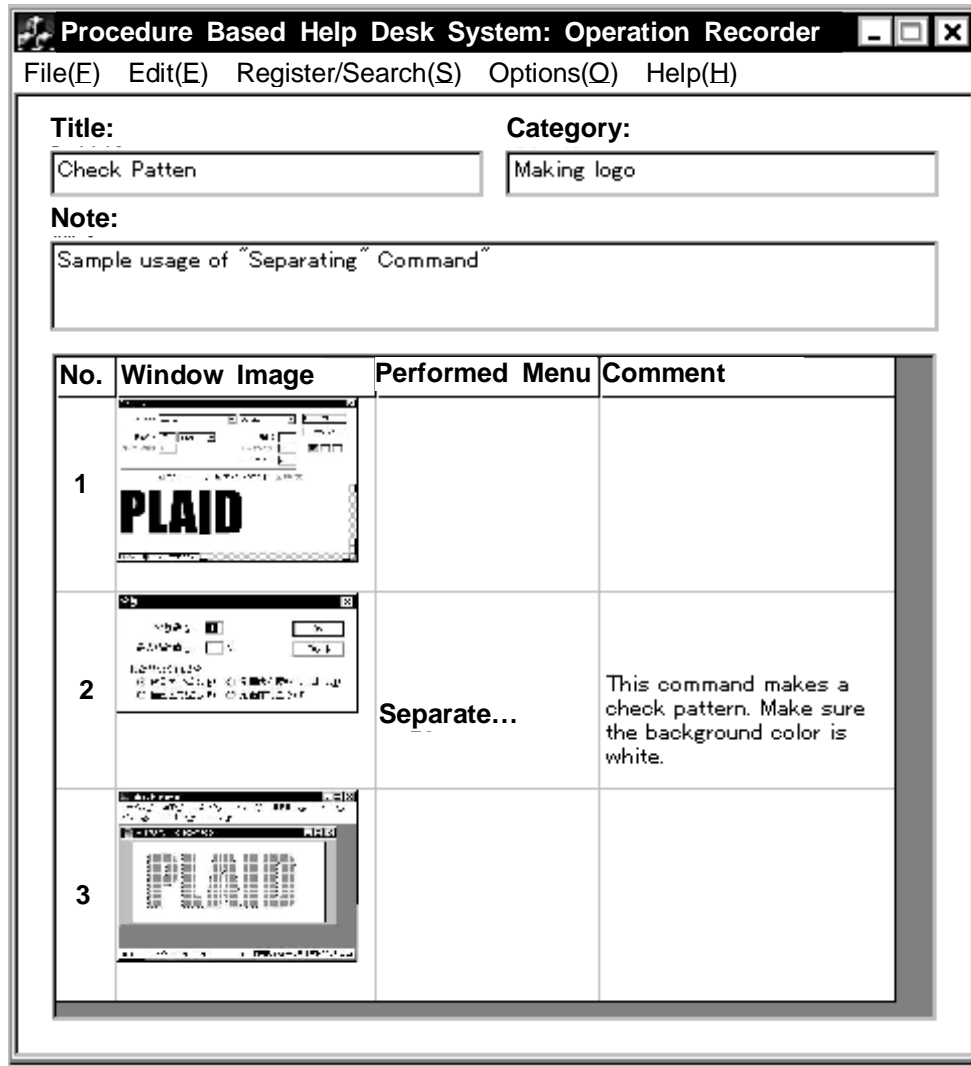
Figure 4. Window image of the operation recorder

The system provides the following functions for manipulating procedure data.

1) Classifying procedure data that is based on the similarity of operation sequences and storing them into a procedure database.

2) Searching procedure data from procedure database that is based on the similarity of operation sequences.

This subsection defines the similarity of operation sequences in the system, and the methods of classification and searching.

3.3.1 Definition of the similarity of procedures

We defined the degree of similarity of two procedures as follows.

$$A \text{ Similarity degree} = 2X / Y.$$

X: the number of menu commands which appear in both procedures in the same order; the largest number when there are multiple combinations.

Y: the sum of menu command numbers of two procedure data.

For example, compare the two procedures that are shown in Figure 5, where the menu commands B, D and C appear in both procedures 1 and 2 in the same order, and this is the largest combination of menu commands. The sum of menu command numbers is eleven. So the similarity is 2*3/11 = 55%.
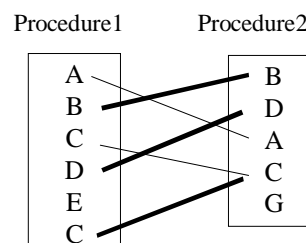

The sequence of menus B, D and C is the largest combination whose order is the same to both procedures.

Figure 5. Definition of the similarity of procedures

By using this definition, the system searches similar procedure data from the procedure database.

3.3.2 Classification

This subsection describes a classification method of the system. First, the system checks the similarity of two procedures. If all menus within a shorter procedure appear in a longer procedure in the same order, then the system judges that the two procedures are related. On this occasion, a shorter procedure is considered as "a basic procedure" and a longer procedure is considered as "a variation of the shorter procedure", which includes some kind of higher techniques. By attempting the above method for all of registered procedure data, the system classifies procedure data and makes a procedure classification tree. Figure 6 shows an example of such tree.
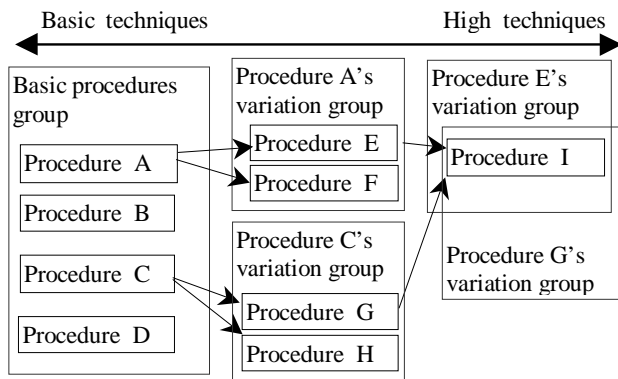
Figure 6. A sample of procedure classification tree

In Figure 6, when the procedure A is shorter than procedures E and F, and all menu commands in procedure A appear in procedures E and F in the same order, then procedures E and F are grouped into "the procedure A's variation group". When the procedure E is shorter than procedure I, and all menus in procedure E appear in procedure I in the same order, then procedure I is classified into "the procedure E's variation group". Also, if a procedure includes more than one procedure's menu commands, then the procedure is classified into each variation group (ex. procedure I in Figure 6).

If the menu commands of a certain procedure data are not included in any other procedures, then such a procedure data is classified into "the basic procedures group". The basic procedures group is placed at the top of the procedure classification tree.

3.4 Searching Procedure Data

When a user searches procedure data, the system uses a method for evaluating procedure's similarity degree and a procedure classification tree (both of them are described in the subsection of "Classifying Procedure Data".). Then the system shows some procedures that are similar to user's operations.

The detailed process of searching is as follows. User's operations are recorded and treated as search keys. The system searches procedure data that operation sequence are similar to user's operations by comparing each procedure data in procedure database (which is classified like Figure 6). All procedure data (that are evaluated as similar to user's operations) are sorted by the order of similarity degree, and are displayed in a window

(Figure 7). In Figure 7, each title is linked with its procedure data document, and each variation button shows the list of its variation procedures. Displayed items are: the name of the procedure, a result image, and a similarity degree to user's operations. Searching is performed on http, so searching results are shown by using a WWW browser.

The order of procedures that is listed in a search result corresponds to the sequence of search keys. In Figure 7, the search key is a sequence of the "Add noise" menu command and the "Crystallize" menu command. In Figure 7 the procedure data that have both menus in this order appear higher, and procedure data that have only either one or have both but in reverse order appear lower.

Figure 8 is a sample of procedure data document. Each procedure data document is comprised of procedure's title, procedure's category, note, procedure's result image, and sequence of performed menus and each menu's result images.

By the above process, users can refer other procedure data that are similar to their operations. In addition, users can refer the variation of displayed procedures so they can refer procedures which have higher techniques.

4. IMPLEMENTATION

Figure 9 shows a construction of Procedure based help desk system.

Procedure based help desk system is comprised of mainly two software modules.

First one is the "operation recorder" that is placed in each user's machine.

The operation recorder records user's each operation and has some menus to invoke registering function, searching function, and editing function. The operation recorder is permanently stationed at a user's machine, so it can record user's operation sequences. Also the operation recorder sends each searching or registering request to the help desk server via http. The operation recorder uses a general WWW browser for presenting procedure data. Each procedure data is shown in a general WWW browser.

Second one is the "help desk server" that is placed in a server machine. It manages registered procedure data and responds to user's requests (i.e. registering and searching procedure data). The help desk server is comprised of the following four elements.

1) Procedure document database: it stores all of procedure data documents. This is implemented by using a document database software on the market.

2) Procedure classification database: it stores classification data of stored procedure data. This is implemented by using a relational database software on the market.

3) Procedure searching and registering module: it accepts user's requests and responds to them.

4) Http server: it is an interface for operation recorder and procedure searching and registering module. This is implemented by using a http server software on the market.

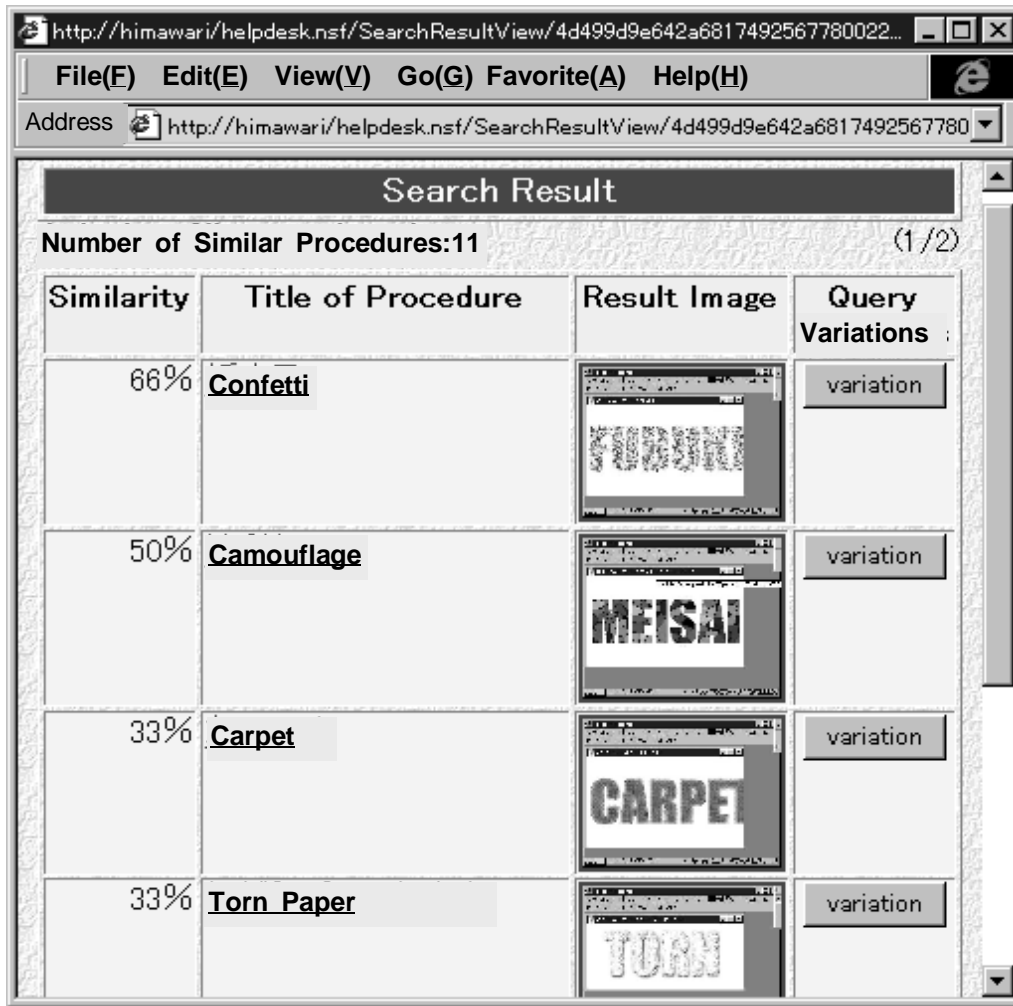In addition, we call a set of (1) and (2) as the "procedure database".

Figure 7. A sample of search results window

5. DISCUSSIONS

5.1 Future Works

We implemented all functions of Procedure based help desk system described in this paper. Now we are evaluating the system. For evaluation, we apply Procedure based help desk system for multimedia contents creation business.

One of our future works is to utilize a long term working procedure. Now we are considering about how to accumulate and to utilize long term working procedures. The current method can correspond to using a sequence of software operations, but if the work takes much longer term (say it takes one day or longer), it will affect the readability of procedure data, the performance on classification, and the performance on searching.

To solve the above problems, we are considering to "separate" each procedure data with a certain criteria, or to remove "useless" part of each procedure data. We need further research on feasibility and needs.

5.2 Related Works

Our work is related to "Programming by Demonstrations"[3]. The purpose of "Programming by Demonstrations" is to generate a program from user's software operations. In addition, researches of "Programming by Demonstrations" intend to the generated program is being suitable for user's intention.

These researches can be regarded as extensions of "macro recording technologies". Macros are good for iterating exactly same operations, however, if you wished to apply a recorded macro to some different tasks, you have to revise the macro. It means that you have to write a new program. Researches of "Programming by Demonstrations" try to solve this problem by finding user's intentions, and adds variables, branches, iterations onto generated programs.

For instance, SmallStar[3] shows alternatives to users for determining user's intentions. Eager and Metamouse[3] find branches by comparing multiple examples. Turvy[3] gets related information from users. Peridot[3] shows its interpretations to users, then users can verify them.
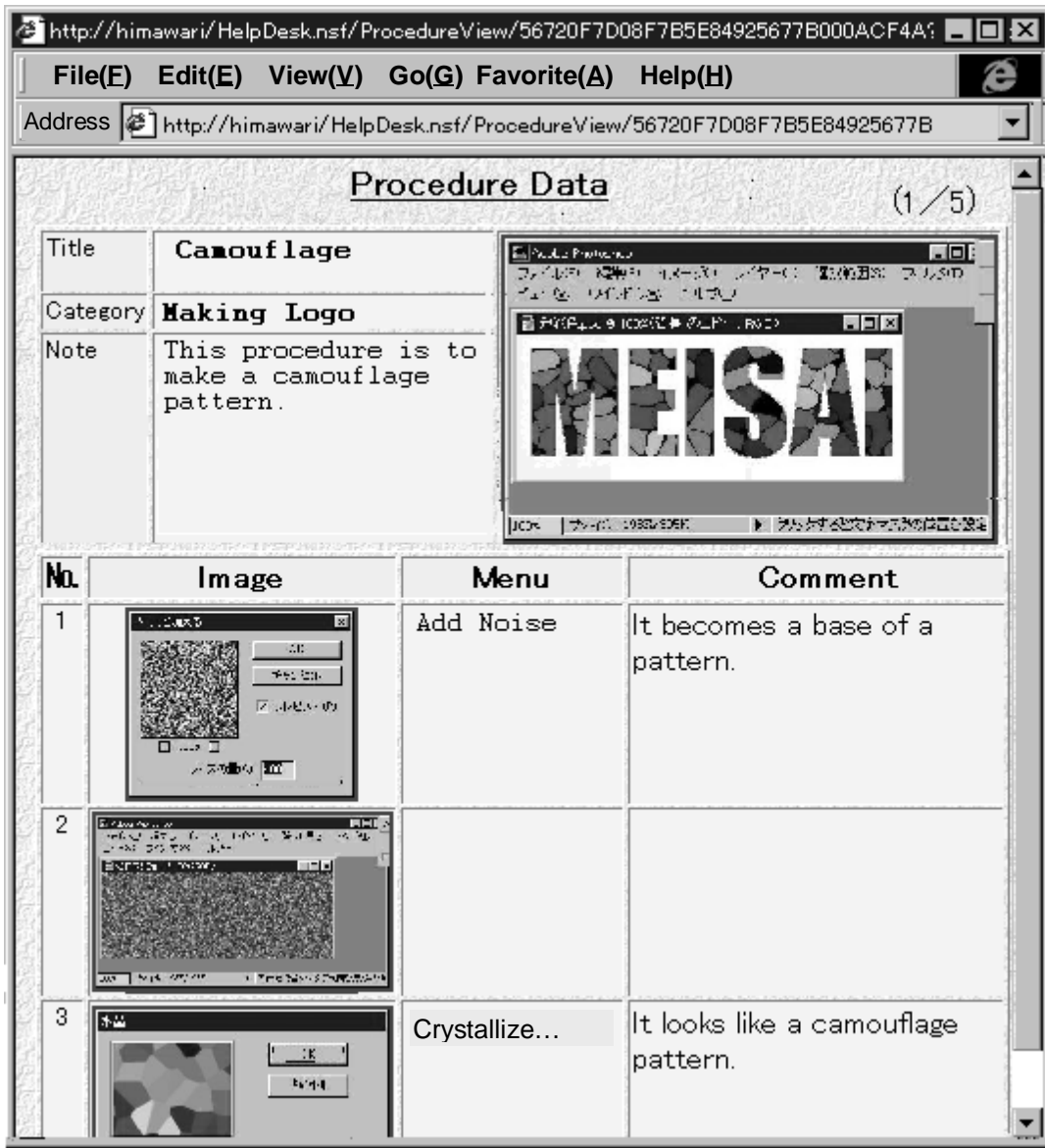
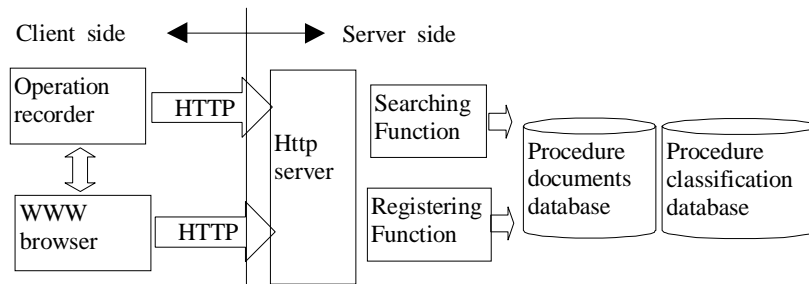**Figure 8. A sample of procedure data document**

Figure 9. The architecture of the system

Our primary purposes is to generate procedure data documents from user's operations. So far, we have not focused to generate programs, and to understand user's intentions. Therefore, currently, users have to write their intentions as comments. However, it is desirable to involve user's intentions to generated documents. So PBD's activities will help our future works. On the other hands, we hope that our activities will contribute to PBD's activities for generating documents.

In addition, recognizing "paragraphs" and structuring a document from paragraphs are also future problems for our system. (For PBD, "generating a document from paragraphs" corresponds to generate a "structured" programs.)

By recognizing paragraphs, users can refer especially related part of the procedure document rather than the whole procedure document.

6. CONCLUSION

We have developed Procedure based help desk system for guiding software operations. The purpose is to share operation knowledge (especially knowledge of experts) between contents-creators, and to provide the ability to easily generate procedure data documents and easily retrieve them. Now we are evaluating our system on multimedia contents creation businesses and considering enhancing the system on points discussed in the previous section.

7. ACKNOWLEDGMENTS

8. REFERENCES

[1] List of various help desk software. Available at http://www.helpdesk.com/software.html .

[2] Simsic,G. *Photoshop Type Magic 2*, Hayden Books, 1996.

[3] Cypher, A. *Watch What I do: Programming by Demonstration,* The MIT Press, 1993. The full text of every chapter is available at http://www.acypher.com/wwid/ .