Data base with World Wide Web for Open Production System

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Abstract: Open production system is a key technology for constructing world wide cooperate and highly advanced production system. For establishing high level open production system, it is essential to use the common parameters affecting on process such as material, process control and specification.

In this report, we construct the system utilizing WWW on Internet to extract the information about parameter that is controlling and relating with printing system. This WWW homepage can collect and distribute the information about technical knowledge from experts of printing field in the world.

1. Introduction

The integrated production system is gradually introduced in the print industry and the elements for automation of the print are developed by printing machine manufactures one after another.

A lot of assists of skilled operator based on experience are, however, required during initialization, fine adjusting and trouble shooting process in press machine operation. By getting rid of these assists, the advantage of on-demand printing, high-speed setting up, and highly automatic printing will be progressed notably.

The disagreement of the provided control code of each machine elements from different manufacture also makes a trouble in connecting the elements and the integrating printing production system.

To achieving both requirement of elimination of operator assist and anonymous control code among elements of press system, all information on the print including skilled operator's know-how and the experience is necessary

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to accumulated systematically into unified database written by standardized code.

We previously proposed the method for describing the parameter and the knowledge into an architecture model having layer structure [1].

To obtain complete set of parameter and standardization of this data base under world wide consensus, the usage of www will be good tool for widely spread technician and researcher to join in discussion through homepage. This report shows the detail of the homepage arranged for discussion about the architecture model of printing system and control parameters for process, material and specification.

The advantage of WWW in the internet is in getting same communication environment in a different platform and in ability of exchanging the data with visually, rapidly and the world wide scale.

The discussions on WWW will construct the excellent printing system architecture model through which we can exchange all parameters without any misunderstanding among different manufactures, printer and designer even in different countries after getting consistent architecture. The model can also be used as the data base which contains expert's knowledge on the printing process operation.

2. Layer structure model

Figure 1 shows the structure of data base proposed in the previous report [1]. The each parameter in printing process is classified through four steps corresponding to each layer from rough classification to detail and concrete expression of parameter. The parameter naming is given in fourth layer. Then we can access the necessary parameter by tracing four layers successively from the first layer.

The terms appeared in first layer shows the rough concept constituting the printing process such as "Design", "Printing material", and "Printing machine".

The second layer shows more detail classified terms of the concept which was shown in the first layer.

The terms in the third layer are group names of material properties, functional names of machine element or objects for specification.

The terms in fourth layer are real parameter defined with clear physical dimension or concept which is expressed with functional relation of other clear parameters.

A group of the related parameters followed by the term in fourth layer will appear in the fifth layer. These parameters in fifth layer are the variable of the function which is used for calculating the actual value of parameter in the fourth layer. In this database, a parameter is defined by the set of 4 concepts and a group of the related parameter shown above. The combination of the concepts and related parameter describing a parameter attribute is called 'FAMILY' hereafter. The 'family name' is equal to the parameter name appeared in fourth layer. In the consistent system, the parameters appearing in fifth layer should be defined as another parameters in another family. In other word, we can check the consistency of the database system by using above condition.

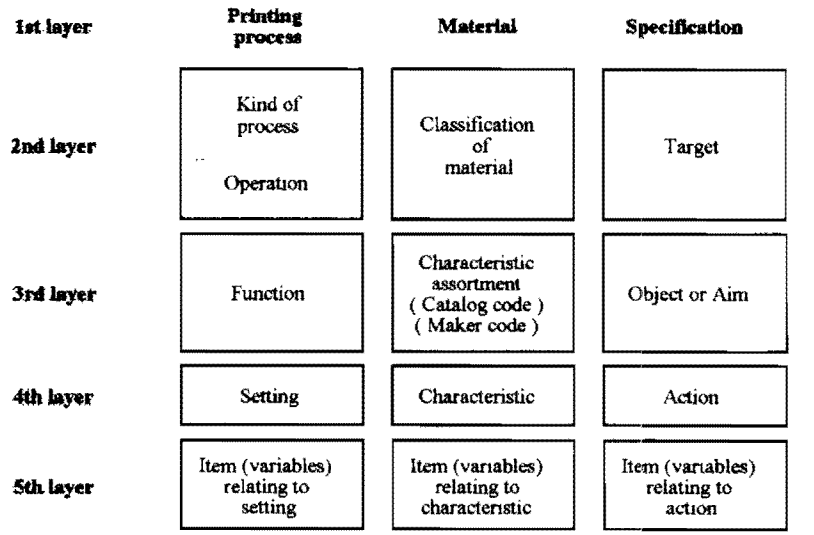

Figure 1. Layer structure model for printing process parameters

Figure 2 shows the conceptual classification of printing process which contains the terms in first and second layer. Each concept in each layer have each code number. The concept in second layer is called combined code with first and second layer code. For example, Film belong to Material with 20 code number in first layer and is given 02 code number (hexadecimal) in second layer, then Film has the code number '2002'. As the result, we can use the code separately for searching the conceptual group in both rough or detail concept by using first 2 hexadecimal digit or first 4 decimal.

The wide conceptual acceptance become narrower as going down next layer. Figure 3 shows an example third and fourth layer of the coded system. The number of the conceptual term in third layer become bigger than that of second layer. This is the same in the relation between first and second layer and also third and fourth layer. In figure 2, 15 categories can be seen in first layer and 62 categorized in second layer.

Figure 3 show a layer structure up to the fourth layer (parameter layer) about the branch of 'strength' in Paper followed by Material. The parameter of the tensile strength takes the code '20040402' as shown before. The first 2 hexadecimal represents Material and next 2 means Paper and next 2 Strength and so on. In this explanation of parameter, we can search easy in any selection of wide or narrow concept or parameter. The flexibility of selection of searching mentioned above has a great potential for application utility programs of database which are used for constructing the integrated intelligent control system for printing and intelligent manufacturing system.

There are many kind of the printing machine. Four types of printing machine of "Sheet-fed offset press", "Web-fed offset press", "Gravure print press", and "Screen print press" are registered in this stage. Other type of machine can be added and put code since the few code numbers are vacant now seen in Figure 2.

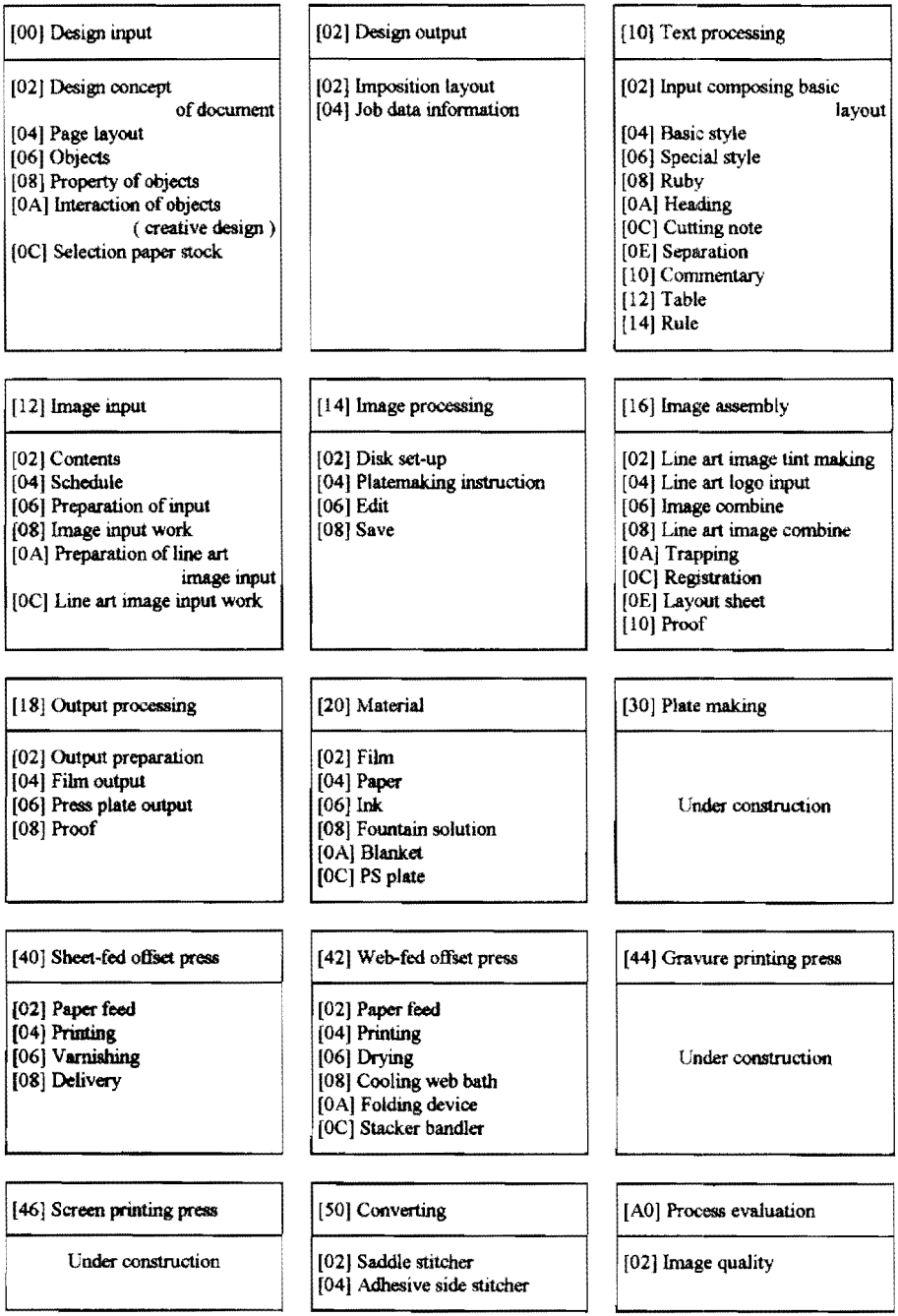

Figure 2. Conceptual classification of printing process (First and Second layer)

2nd layer	3rd layer	4th layer
[20] Material	[2004] Paper	[200404] Strength
[02] Film [04] Paper >> [06] Ink [08] Fountain solution [0A] Blanket [0C] PS plate	[02] Geometric [04] Strength >> [06] Surface [08] Bending [0A] Smoothness [0C] Frictional [0E] Air resistance [10] Absorption [12] Optical [14] General [16] Electrical [18] Chemical [1A] Structure [1C] Stability [1E] Pulp contents [20] Filler and pigment [22] Paper machine [24] Paper handring	[02] Tensile strength [04] Stretch at break [06] Young's modulus [08] Tensile energy absorption [0A] Tearing strength [0C] Bursting strength [0E] Folding endurance [10] Internal bond strength [12] Compressive strength [14] Compressibility

Figure 3. Layer structure of Material (case of paper)

3. Graphic system model on WWW

The construction of dispersed open database used commonly is essential for getting successful result of open production system. The first step for realizing it is the making framework of the database which is accepted by every engineers relating to printing field. It is not so easy to make up because of wide spread field such as physics, chemistry, electronics, art design, mechanical engineering and so on.

Recently, the progress of communication using WWW can make easy to collecting information from wide spread people in different fields and distribute back to them again for obtain their consent.

In this research, we constructed the graphic system model on WWW basing the concept of the layer structure previously shown. This system model on WWW has the merit as following:

1. The icons are used to represent the terms in first, second and third layer beside their item name. They are designed to be easy to understand contents of item name and an item code was added.

2. The icon patterns provided by ISO and JIS are used if exist. This will make easy to standardize this model in future.
3. Same information can be shared without any trouble for conversion of the format in a different platform because the data base is on WWW.
4. English is used for the item name for convenience of mutual communication in world wide scale.
5. By using return path, any people can send comments to the administrator. The administrator can replace or add information on the WWW immediately according to the comment. The contents of each layer are written in HTML (Hyper Text Mark-up Language) document and those each page link to other mutually.

At present, the HTML data file has 361 files and the icon images put into 375 files. The number of registered terms include parameters are 1165 until March, 1996. Table 1 shows list of detail of each layer.

CODE	HTML	GIF	1st	2nd	3rd	4th
00	44	44	1	6	37	132
02	4	9	1	2	1	8
10	56	56	1	10	45	106
12	43	43	1	6	36	58
14	34	34	1	4	29	86
16	36	36	1	8	27	95
18	16	16	1	4	11	14
20	49	50	1	6	42	214
30	0	1	1	1	0	0
40	5	5	1	4	0	0
42	55	60	1	6	48	60
44	0	1	1	1	0	0
46	0	1	1	1	0	0
50	14	14	1	2	11	85
A0	5	5	1	1	3	42
Total	361	375	15	62	290	900

Table 1. Number of registered data file and number of registered data

3.1. First layer

Figure 4 is the displayed update first layer contents of this system model. The whole printing process is classified roughly from image design to final output. Fifteen kinds of items are registered at present, but it will be added some more such as image evaluation according to consideration and the comment. The code number of two hexadecimal from 00 to A0 is put for each conceptual item.

The order of the code in display does not means the order of the process, since the conceptual classification is not always obeyed to process. The displayed data as the icon is very comfortable in perception and the item can be selected only to click it with the mouse on the screen instead of key in the item name.

Moreover, this system model can collect the information from the engineers and technicians joining WWW. When they want to correct or an additional item to this data base, the user can selects "Please send comments.....[Yes]" on the page. The window for sending mail is opened to send the comment. The comment can be sent from any page of any layer, since this selection button for return path is appended to the page of all layers.

((1st layer))

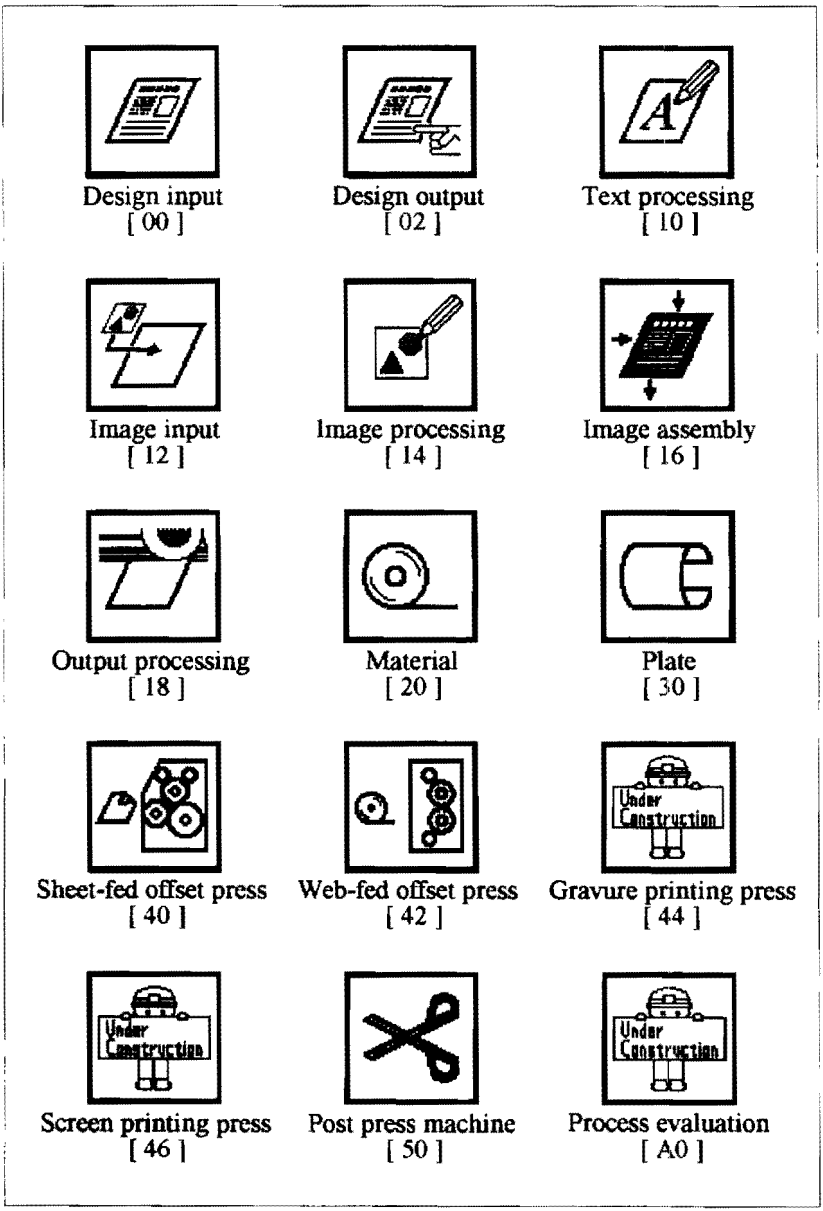

Figure 4. Top page (First layer)

3.2 Second layer

The second layer is consist of the item by which the detail of concept shown more than that of the first layer. Since there are some differences among the graphical expressions of each page for Print machines and others, both cases are shown separately.

3.2.1. Case of "Material"

There are six categories in second layer followed by "Material" at present, which are "Film", "Paper", "Ink", "Fountain solution", "Blanket", "PS plate" as shown in Figure 5. The category in first layer leading this page is shown upper part of the page. Each icon leads to next layer followed by it.

((1st layer)) Material [20]

((2nd layer))

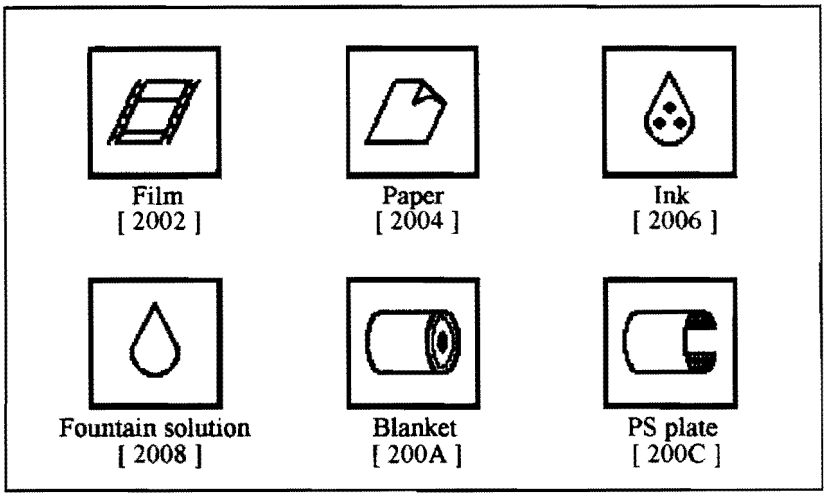

Figure 5. Second layer (case of material)

3.2.2. Case of "Printing machine"

In "Printing machine", the outline of each printing machine is shown as the second layer unlike "Design" and "Print material". Figure 6 shows the case of "Web-fed offset press" in which six items of "Paper feed", "Printing",

"Drying", "Cooling web bath", "Folding device" and "Stacker handler" are registered as a composition unit of it.

Each component can be selected by click on each composition unit or the item name with mouse. Forward layer belonging this layer is presented upper part of the page.

((1st layer)) Web-fed offset press [42]

((2nd layer))

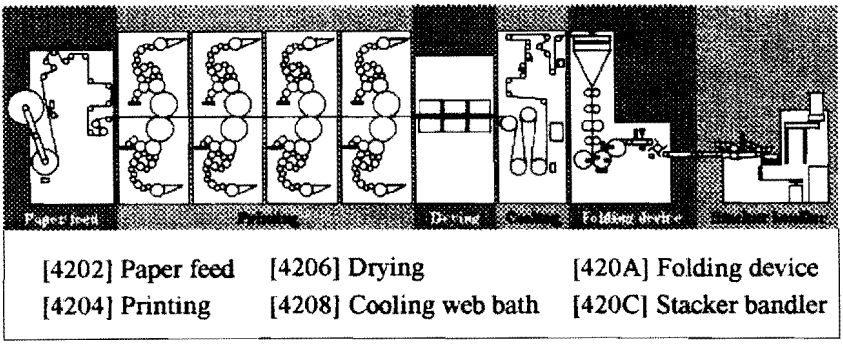

Figure 6. Second layer (case of web-fed offset press)

3.3. Third layer

The systematic group of characteristics in material, processing in design and element in machine are classified in third layer. The displayed patterns in the page for "Printing machine" are quite different from that of "Design" and "Material" as in second layer.

3.3.1. Case of "Material"

Figure 7 shows the displayed image when we select "Ink" in second layer. This indicates that six kinds of the properties groups are considered in this architecture model as the affecting parameter set. Upper inclusive terms are shown upper left corner of displayed image as second and first layer. The hexadecimal code numbers are also shown just below the pattern.

The visitor can also move into fourth layer which contains real parameters by putting cursor on the desired pattern and click the mouse Moreover, it is possible to return to a upper layer by selecting the item name on the top left corner of page.

3.3.2. Case of "Printing machine"

Figure 8 shows the case that the "Printing" is selected in second layer of Web-fed offset press (Figure 6). We describes as an example of the case where "Printing" unit of "Print machine" is selected. In this layer, it is shown that web-fed offset press can be considered as dividing six components of ink fountain, inductor, ink form roller, ink fountain roller, ink disting roller and plate cylinder. These elements have serious affection to the image quality and are required the suitable adjustment.

((1st layer)) Material [20]

((2nd layer)) Ink [2006]

((3rd layer))

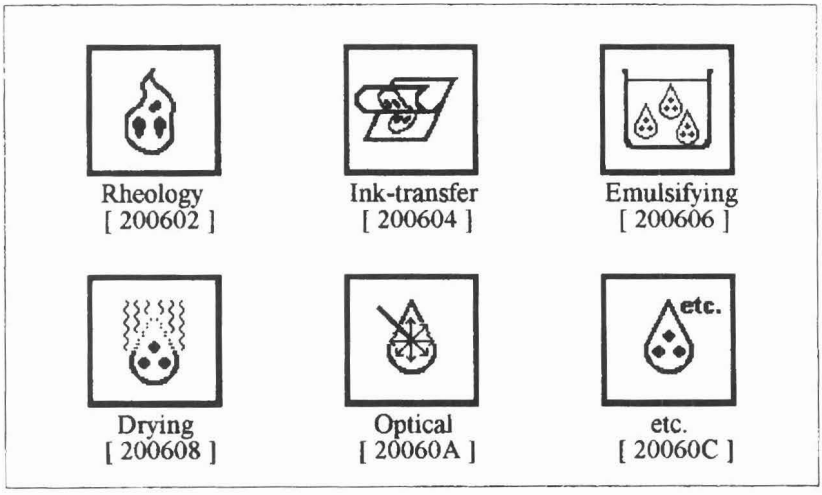

Figure 7. Third layer (case of ink)

((1st layer)) Web-fed offset press [42]

((2nd layer)) Printing [4206]

((3rd layer))

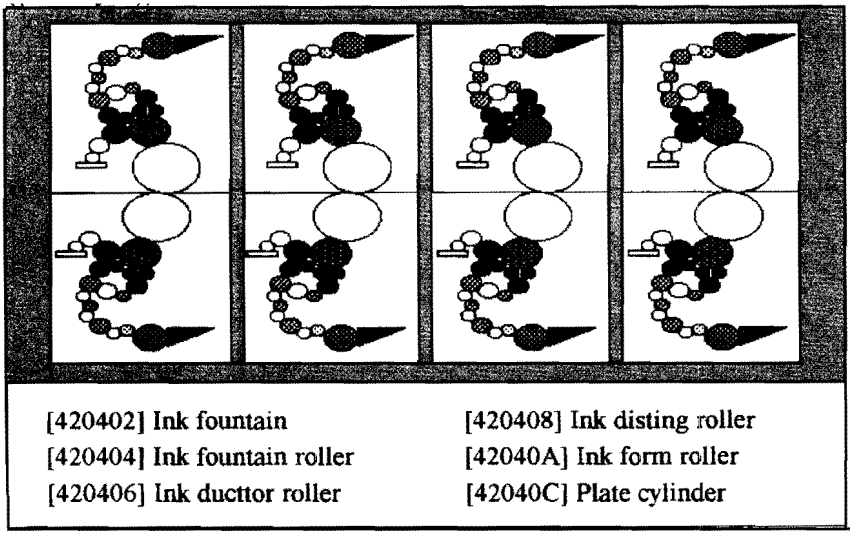

Figure 8. Third layer (case of printing)

3.4. Fourth layer

The fourth layer is composed the set of adjusting points (adjusting parameters) for machine or the characteristics of the material shown by the third layer. In this layer, a set of parameter names and each hexadecimal codes without icon are shown on the displayed image.

Figure9 (a) and (b) show the case of selected "Rheology" and "Ink-transfer" on the third layer. Figure10 (a) and (b) shows the case of selected "Ink fountain" and "Ink fountain roller" on the third layer. The icon image of the function characteristic or the part element in third layer is presented at the right of the page and the parameters and codes is shown left.

These parameters affect the decision of adjusting condition for design of image and for operating the press. The real adjusting value or action is driven from the combination of other parameter under functional relation.

These relations and the sets of related parameters for deciding the value of parameter will give lower layer named fifth and sixth layer after finishing the first step of collection of parameter in fourth layer.

((1st layer)) Material [20]

((2nd layer)) Ink [2006]

((3rd layer)) Rheology [200602]

((4th layer)) Parameters

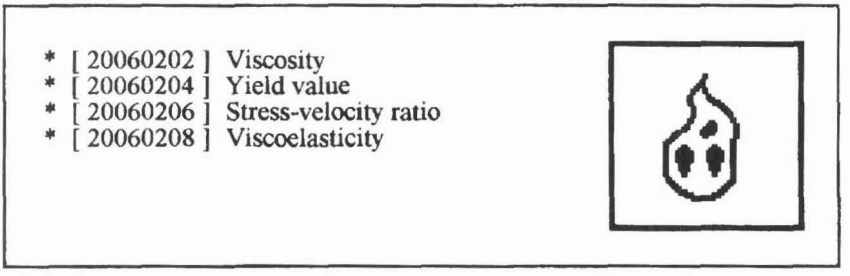

Figure 9(a). Fourth layer (case of Rheology)

((1st layer)) Material [20]

((2nd layer)) Ink [2006]

((3rd layer)) Rheology [200602]

((4th layer)) Parameters

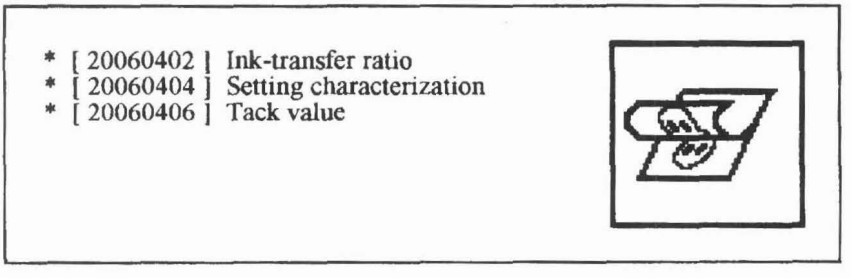

Figure 9(b). Fourth layer (case of ink-transfer)

((1st layer)) Web-fed offset press [42]

((2nd layer)) Printing [4206]

((3rd layer)) Ink fountain [420402]

((4th layer)) Parameters

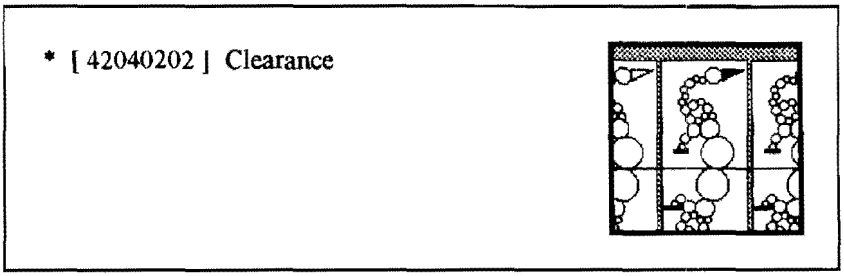

Figure 10(a). Fourth layer (case of ink fountain)

((1st layer)) Web-fed offset press [42]

((2nd layer)) Printing [4206]

((3rd layer)) Ink fountain roller [420404]

((4th layer)) Parameters

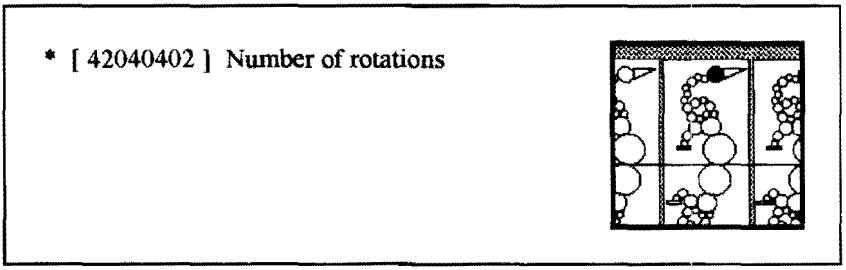

Figure 10(b). Fourth layer (case of Ink fountain roller)

4. Conclusion

Although the architecture model of graphic system model have stored a large amount of terms and parameters relating printing system as coded data, the data are not enough to control the printing system all-around.

This data base has a reserved code and give still a survey, since the complete set of information over all of the printing system has not been

accomplished. The framework of database proposed here will be beneficial for controlling the printing machine, integrating knowledge about operator skill and communicate each other among different venders, because this model includes all of parameters relating to such a printing process as design, image processing, image evaluation, material, printing and converting. The usefulness grow up rapidly more and more, as the grade of integration of data progresses more. The homepage on WWW shown here is powerful tool for integrating the data and making more complete set of data under world wide cooperation.

The visitors to the homepage on WWW are strongly requested cooperation for correcting and adding the data according to their knowledge intensively. A sample set of utility program for database handling and application program of this database for printing factory will be come across in near future. The visitor will also create own database, the utility and application program by themselves under the same rule (use same code number as same parameter), since this architecture model can act dispersing atmosphere.

5. Acknowledgment

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Reterences

[1] H.Mishina and T.Yuasa: pp. 483 - pp. 497 TAGA Proc. 1994

Home page: http://bear.mech.muroran-it.ac.jp/mech/gsm/grapacs.html