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Design and Implementation of an Automatic Design Edit System by Lisp Language

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ABSTRACT

Men's clothing has been recently giving higher market shares to the ready-made clothes rather than the custom-tailored clothes. With many active studies on the human body and design, the ready-made clothes win popularity due to their rapid repairing, various design, and cheap prices, though they are not perfect suitable for some people. Therefore the ready-made has a weak point unable to consider all of the individual physical characteristics. However the custom-tailored clothes are able to make clothing perfectly suitable for their customers, though they require longer time-taking and expensive costs. In this context, this paper is design and implementation an automatic design edit system to provide a rapid and cheap service for customers on the ground of the custom-tailored clothes. In other words, this paper intended to use computer systems for rapidly and precisely providing design dependent on the individual physical characteristics including a distorted bodies, types of the leg, and a height of the shoulder. To do so, the paper using not only studies on the human body and the custom-tailored clothes but also technical know-hows planned design for each individual body by LISP language and automatically process the design through CAD system. Consequently, the rapid and precise processing has reduced inventories and production costs, leading to supplying high quality clothes at lower prices.

Key words: Automation design edit system, LISP, CAD

1. INTRODUCTION

At the threshold of the 21st century, the modern society generally requires a new way to transmit information. Especially based on the Internet, the field of multimedia contents has jointed with all of the existing industries and changed into a new shape. As changing from the established Industry Society to Information Society, the manual industry joining GIS(Geographic Information System), CAD(Computer Aided Design), and CIM(Computer Integrated Manufacturing) has been taking a new shape of industry[1].

Accordingly the current industry society makes the pattern of consumption rapidly changed and makes industries that can't adapt to the trend lag behind the survival competition. That's why all of the industries have to actively respond to such changes for their lives.

In the current industrial structure, the market of men's custom-tailored clothes has been gradually giving advantages to the ready-made clothing market because of a lack of stored techniques. At last it will arrive at a standardized clothing age totally ignoring characteristics of each individual body[2].

Particularly, human is considered to be emotional and autonomically think a creative thing and idea[3]. In this context, the ready-made clothes are produced under the batch processing system to be unified and standardized. To solve the problem needs to wear a custom tailored cloth suitable for each person, resulting in maximizing creativity and autonomy of the individuals.

Therefore this paper proposed a way to automatically design and produce men's custom-

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tailored suits for each person by utilizing LISP language and AutoCAD. The way will create technical database about the individual body for the custom-tailored suits to reduce labor expenses and time-taking of manufacturing along with to satisfy various demands of customers. As a result, the new way suggested in the paper will contribute to the existing custom-tailored clothing industry.

2. STUDY BACKGROUND

A study on an automatic design edit system for men's custom-tailored clothing as a interdisciplinary study is related to many different studies. The automatic design edit system by LISP language consists of 1) studies on the human body, 2) studies on fashion design, 3) studies on the human body and fashion design, 4) studies on the ready-made and custom-tailored clothes, and 5) studies on the human body and computer interaction[4-9]. Each study developed its own classification system and defined its concept to materialize.

However the study on the automatic design edit system by LISP language didn't find out a comprehensive and easily understandable system classification in the existing literature. Therefore this paper will review the existing literature to propose the plan and practice of the automatic design edit system by LISP language.

The brief reviews of the existing literature mentioned above are as follows: First, studies on the human body precisely examine samples of height, girth, width, and thickness in the body with direct and indirect measurements in order to conveniently and functionally produce clothing suitable for the human body. Especially, physique is divided differently and complicatedly according to sex, age and differences of each individual body. To solve such problems, many studies on classifying physique have been conducted with dimension scales using values of interrelation among measurements of each body, statistics, and visual analyses[2,9].

Studies on fashion design analyze changes in men's clothing fashion and important factors to determine the fashion. Especially materials, figurative features, and dressing ways have been studied[7,8]. When it comes to studies on the ready-made and custom-tailored clothing, those on the ready-made clothing are more actively conducted because the ready-made recently occupies more market shares compared with the custom-tailored clothing. In addition, studies on classifying dimension suitable for many people are a prerequisite for the well-known clothing brand companies which manufacture ready-made clothes. But in comparison with various physique among people, dimension limitation of the ready-made clothing can't satisfy customers' needs so that demands of custom-tailored clothing and easy orders are on the increase.

Studies on the automatic design edit system by LISP language can find their roots from CASE (Computer Aided Software Engineering) Tool whose theoretical approach may be found in ISDOS(Information System Design and Optimization System) led by Professor D. Techerow of Michigan State University in 1968 that was developed from PSL/PSA(Problem Statement Language/Problem Statement Analyzer) projects started by the United States Air Force. These projects were studied with a focus on systematical and efficient management of software development. On the ground of such studies, along with development in the IT section, Multimedia Authoring Tool developed in the educational and design engineering aspects currently spreads into Multimedia Contents Industry, owing to development of CAI(Computer Aided Instruction) and CBT(Computer Based Training).

3. SYSTEM DESIGN

3.1. System structure

An automatic design edit system by LISP

language requires easy interface between different kinds of machines under Windows OS environment. To integrate many systems of the different machines and satisfy needs for information sharing, this paper used CORBA(Common Object Request Broker Architecture), a standard of Diffusion Object Technology, mainly emerging in the computer environment. And IDL(Interface Definition Language) based on OMG(Object Management Group) provided in CORBA was used to operate together with LISP and CAD among Client/Server Object language including C, C++, Java, CAD, LISP, Cobol, and etc. In LISP language, values defining algorithm for function statement will be automatically designed and practiced in CAD if the language has a structure like Fig 1.

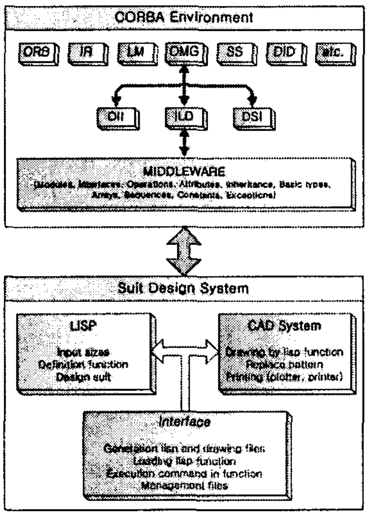

Fig. 1. Structure of CORBA and Edit System

3.2. Function statement of LISP

LISP short for LISt Processing is a language processing multiple data of LIST patterns. LISP language may be summarized in details as follows: LISP language uses a user-defined function to help graphic design. Especially the language directly handles instructions, variables, and drawing factors, which makes graphics easily available. It can make simple macro on computer, directly handle database, and change most of working conditions used in CAD such as automatic drawing by the existing data, input and output of required data into a suitable environment for itself. Its format is like the next.

3.2.1. Basic format of LISP

LISP consists of blanks in which functions enter. In the whole program, the number of opening and closing blanks should be the same. The function statement is as below:

```
(DEFUN C:EX ()
(SETVAR "CMDECHO" 0)
(SETQ P1 (GETPOINT "₩nFirst point:"))
......)
```

The above DEFUN function is C:EX created by instructions used in other CAD systems. And 'EX' means defining a function. LISP files are a language with interpretor methods used right after loading, unlike other languages creating execution files after compiling process.

To use the above function after loading into CAD needs to use Load function of LISP. If the above function is stored as "sang.lsp", the defined function can be executed in CAD after loading as below:

```
Command: (LOAD "sang")
C:EX
Command: EX
```

3.2.2. Usage rules

The number of left and right blanks should be the same, constants used should mean real numbers, and presentation of a fixed number should have 32 bits in size. As values of angles are used as values of radians, to present them by the degree unit needs to shift the radian values by using PI(3.141592). More than one blank is the same as one. The name of variables must start with the alphabet and then combine the alphabet, numbers, and some special characters. In addition, LISP doesn't distinguish between capital letters and small letters.

Data used in LISP is divided into largely Atom and List. Atom is the most basic data form referring to the simplest type of single data such as a fixed number, a real number, and a letter. List means single data binding several Atoms with blanks.

3.2.3. Inner function of LISP

The DEFUN function stating a function to use is used as follows:

(DEFUN Function-name(/ variable 1 ...)
Variable 2
Expression)

If the name of function was used as C: function-name, the function-name would be stated as instruction that can be used in CAD. And variables used in the function would be divided into local variables that were presented behind '/' in the blank after the function-name and the other global variables.

SETQ function putting data into variables is used as follows:

(SETQ Variable Expression)

Variables would are followed by data to be stored. Data to be put in the named variable would be constants, variables, or expressions. If nil is stored in variables, the variables will be deleted.

Command function, a function directly conducting CAD instructions in LISP, is used as follows:

(Command "CAD_Commands" instruction conditions " ")

Though instructions are surrounded by " ", instruction conditions depend on used instructions. CAD instructions presenting drawings include "LINE", "ARC", and "CIRCLE".

Besides, there are many LISP functions such as 4 arithmetic operations(ie. +, −, *, /), List functions(eg. list, nth, car, cadr, length, etc.), input functions(eg. initget, getint, getreal, getpoint, etc.), output functions(eg. princ, prinl, print, prompt), and others(eg. angle, inters, load, polar, distance, abs, sin, cos, etc.).

3.3. Edit module

To interface functions created in LISP language with CAD needs to make design into LISP files at first, define and activate objects for calling CAD, and then load LISP module. In the module, defined instructions will be executed and displayed. The module structure is like Fig 2.

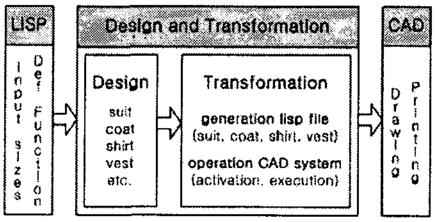

Fig. 2. Interface between LISP and CAD system

3.3.1. Decision of the base point of jacket and the baseline

A basic base point(basel) refers to a random point. With starting from this point, the other points in need can be obtained according to the two dimensional coordinate system. From the base point(basel) toward the bottom axial direction, other base points for the length of jacket, the waist line, and the hip line should be calculated. Distances between the base point(basel) and each other base point depend on the human body when applying the rate of the total sheets, the girth, and the shoulder height to the total sheets/2. Also it is important to make enough room for physique like a half length of the body and distorted bodies and custom's taste. On the basis of such points calculated, the horizontal lines become the base lines of each up and downside, the waist line, and the hip line. The bust line is determined by the neck height, the shoulder height, and the arm hall height. And again from the basel, base points in the horizontal lines should be calculated. These base points distinguish the back panel, the side panel, and the front panel respectively. Each distance is calculated by variables such as the width of the bust, the neck, and the waist.

The base lines from the basic base point are like Fig 3. From these base lines, required points for the back panel, the side panel, and the front panel should be calculated in order. These points should be connected by drawing a straight line or a curved line before printing the designed drawing.

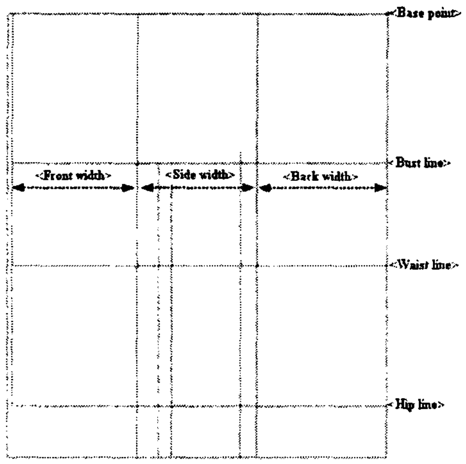

Fig. 3. Base line of jacket

3.3.2. Design of the back panel

Design of the jacket back panel, the beginning of the whole design for jacket, can be calculated by applying most of dimensions for jacket.

The important points of the back panel are calculated in order from (1) to (7) on the basis of the base point and then detailed points for the curved lines are calculated. In other words, the points presented in the round of Fig 4 refer to the important points from which the detailed points are calculated to present in the straight or curved lines.

3.3.3. Design of the side panel

In the side panel, the side width creates the base line. After all of the points for the back panel, the points for the side panel should be calculated.

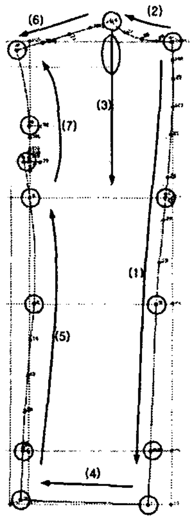

Fig. 4. Order of designing the back panel

The starting point of the side width is calculated in order from (1) to (4) on the basis of the point 30(waist line). Referring to the base point and the points obtained for the back panel, positions of coordinates are calculated. Especially in the process of (2) and (3), the last coordinate positions should be a smooth curve by referring to the points calculated in (2) and (3) processes. Finally, points for curved lines of (4) are calculated.

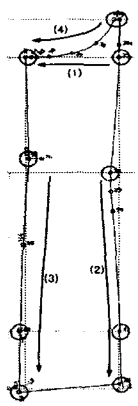

Fig. 5. Order of designing the side panel

3.3.4. Design of the front panel

Like the side panel, points for the front panel should be calculated after the points for the side panel. The starting point is the waist line from which each point of coordinates is calculated.

The calculation will proceed in order of (1) to (9). The base for the front panel depends on the points calculated for the front width. From the point 33, coordinate values of each point is calculated by information values of dimensions in the base lines.

The final process of (9) can see overlapping of the starting points of (4) and (5). However as the drawing designed in (9) will be separately tailored for a collar, the overlapping will be ignored in order to make design or confirmation easy.

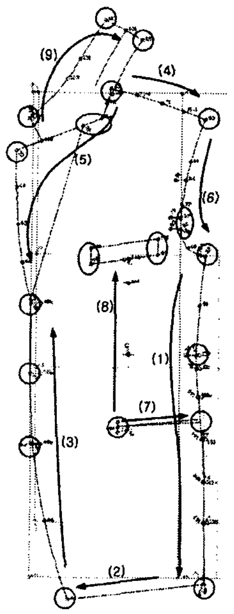

Fig. 6. Order of designing the front panel

3.3.5. Demonstration of linking and sewing lines

After finishing the (9) process of the front panel, finally the linking and sewing lines are additionally demonstrated.

Especially the front panel shows the linking lines between a lower pocket and a upper pocket and instructs the curved parts connecting the points calculated in the process of (1) and the sewing lines.

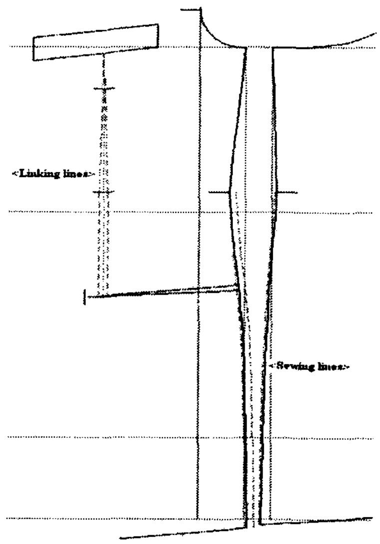

Fig 7. Linking and sewing lines

4. IMPLEMENTATION

4.1. Revision of jacket dimensions

According to the design process of jacket explained above, a drawing will be made and printed by shifting into LISP codes. Created LISP codes for jacket have an estimated 1,000 lines and the shifted codes are printed by using AutoCAD.

4.1.1. Establishment of initial variables

To present each point of the jacket drawing in LISP needs the following function considering input dimensions as variables.

```
(defun fun_init ()
(setq kr_length 1470.0) ; total sheets
(setq kr_breast 960.0) ; girth
(setq kr_waist 850.0) ; waist width
(setq kr_hip 980.0)  ; hip
..... )
```

Dimensions are stored in a total of 31 variables that are required values to demonstrate the jacket.

On the basis of such variables, the points for the back, side, and front panels of jacket are calculated according to physique of each person. To dispatch the points of the back, side, and front panels respectively, each appropriate function are used.

4.1.2. Drawing functions in CAD

To demonstrate each calculated point as straight and curved lines needs functions consisting of CAD instructions as follows:

```
(defun c:sa ()
(fun_init) (sang_base) (sang_back)
(sang_side) (sang_front)
(command "layer" "m" "baseline" "c" "3" ·
"line" basel redl redl1 red8 basel ""
...
"layer" "m" "sangeui_back" "c" "7" "" "s"
"sangeui_back" ""
"arc" blu11 blu10 blu12
...
"layer" "m" "sangeui_side" "c" "7" "" "s"
"sangeui_side" ""
...
"layer" "m" "sangeui_front" "c" "7" "" "s"
"sangeui_front" ""
...
"layer" "m" "ex1" "c" "2" "" "s" "ex1" ""
... )
```

The above function named "c:sa" can load LISP files concerned in AutoCAD and execute them by "sa" instructions. The function will be a defined function establishing variables at first and then call other functions to calculate points for the back, side, and front panels of jacket before displaying each calculated point as straight and curved lines in CAD.

The above codes indicate that a total of 5 functions are used to calculate points in need for designing jacket. The initial setting function of "fun_init" decides dimensions. The "sang_base" function decides the base point to calculate the base lines in need. The "sang_back" function calculates points in need for the jacket back panel. The "sang_side" function calculates points used for the side panel. The "sang_front" function consists of calculations of points for the jacket front panel.

Table 1. Jackets layers

layer name	contents	display color
baseline	baseline	green
sangeui_back	back	white
sangeui_side	side	
sangeui_front	front	
ex1	linking & sewing line	yellow

After executing functions in described order to calculate all of the points in need for jacket, "command" instructions uses "layer" to decide features including color and then straight-line and curved-line instructions are used for printing on screen.

Each layer is divided into 5 in all. For instance, "baseline" among them indicates the base line connecting the base points. Here the part in green is the very baseline. Layers of "sangeui_back", "sangeui_side", and "sangeui_front" are displayed all in white. The layer of "ex1" indicating other demonstration lines or sewing lines is displayed in yellow.

Jacket is divided into the body and sleeves. Besides design methods of pants, vests, coats, and Y-shirts were used to calculate points for printing in CAD.

4.2. Print of the CAD designed drawing

A drawing designed by inputting dimensions

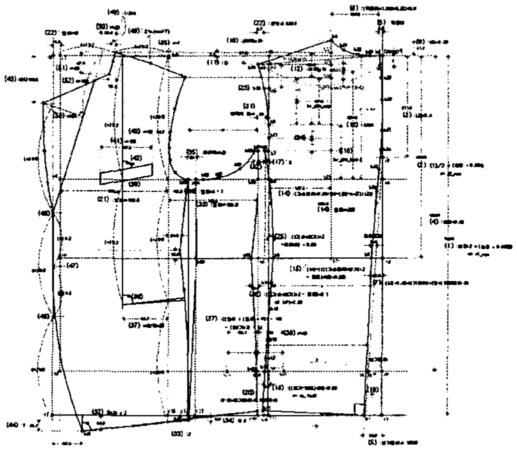

Fig. 8. Designed jacket

according to physique of customers will be printed by AutoCAD. In other words, the drawing made by LISP uses CAD to calculate points under the given instructions and display the results. Fig. 8 shows the result of printing the jacket drawing.

5. CONCLUSION

The Industry society of the 21st century is rapidly emerging into a single market of the global village based on the Internet. The existing custom-tailored clothing manufacturers relying on the traditional technology have faced with badly worse payability in a daily basis because of decreasing demands and increasing labor costs and materials.

To solve such problems, the LISP language-used automatic design edit system escapes from the traditional technology and focuses on storage of know-how based on the time honored experiences. The existing custom-tailored clothing takes about 1 week to take an order, cut, sew, and baste the cloth while the new developed system in the study takes just one day for all of the above processing.

The system created functions in LISP language to automatically design and implementation cutting, sewing, and basting like the ready-made clothing.

However this study doesn't support various fashion designs. In a case of jacket, the system suggested in the study can design only 2 button and 3 button clothes. To make various designs possible needs to create a new function for each feature and continuously upgrade the system in response to changing design. Also to reduce the volume of cloth in cutting after printing the resulting drawing, the process of patterns must be manual. As the system above described is an automatic design edit system appropriate for the custom-tailored clothing or Easy order, it has a manual-process of recognizing patterns in order to rapidly print the design of clothing suitable for each customer on the ground of cheap investment.

Further, the system resulting from this study can extend its service to other various industries. When some company produces goods fitting for individual physique, the company can use the above system to make a perfect design in a short time and satisfy custom's needs.

6. REFERENCES

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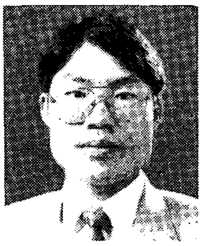

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