A Study on Representation of Finger Language Animation using a Micro Computer

Mitsuru SHIONO*, Masahiro KAYAHARA**,
Tomoaki GOHDA*** and Hideyuki TOMITA****

* *Department of Electronic Science, Okayama University of Science, Ridaicho 1-1, Okayama 700, Japan*
** *Takamatsu Denshi Keisan Center Corporation*
*** *Hitachi Seibu Software Corporation*
**** *Hitachi Nishi-shohin Engineering Corporation*

(Received September 26, 1985)

ABSTRACT

Recently the computer graphic technology has been making great advances. It is applied to every field of society. The computer animation is one of the most typical applications of computer graphic technology. In this paper, the method for representing the finger language using computer animation is proposed and a fundamental experiment is shown.

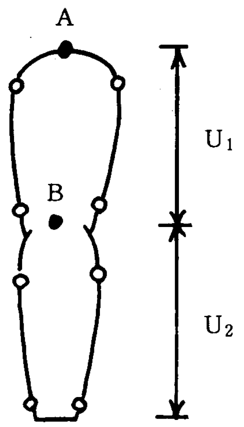
1. INTRODUCTION

Finger language (SHUWA in Japanese) is very important means of communication for deaf persons. But it is not so easy to learn it that all persons can not use the finger language. This study has two purposes. The first purpose is to use this system as the CAI (Computer Aided Instruction) system for teaching the finger language to both deaf and not deaf persons. The second purpose is to use this system as the communication device for deaf persons, namely the input to this system is the regular language, and the output is the finger language representing by computer animation on a CRT display.

2. ROTATION PROCESSING OF ARMS

The both left and right arms of the animation are controlled using two dimensional rotation processing. Data points of the movement of an arm is located as shown in Fig. 1. Rotation angle is given to the point A and B for the arm control.

The rotation processing oi the part U_1 is executed using Eq. (1).

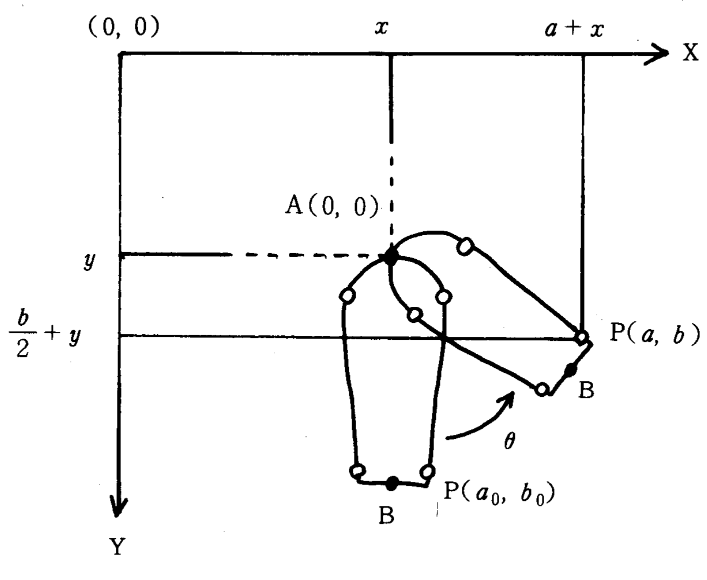


● A : Rotation center of the part U_1.
● B : Rotation center of the part U_2.
○ Data points.

Fig. 1 Rotation centers of an arm.

$$\left.\begin{aligned} a &= a_0\cos\theta - b_0\sin\theta \\ b &= a_0\sin\theta + b_0\cos\theta \end{aligned}\right\} \quad (1)$$

Point A is defined as (0, 0) on the absolute coordinates and (x, y) on the display as shown in Fig. 2. Since the dimension ratio of the x-axis and y-axis is 2 : 1,



———— : Display coordinates.
………… : Absolute coordinates.
θ : °0∼360° (Anti clockwise).

Fig. 2 Rotation of an arm in the coordinates.

dimension ratio arrangement is required. In this case, the value of the y-axis on the display is a half of the value of the y-axis on the absolute coordinates, so that the point (a, b) after computation becomes point (x, y) on the display as folows.

$$\left.\begin{aligned} X &= a + x \\ Y &= b/2 + y \end{aligned}\right\} \quad (2)$$

Same processing is executed tor part U_2 of the arm. After this processing, each data points are drawn using Spline function.

3. COMPLEMENTARY DRAWING AND PRESERVATION OF THE ORIGINAL PICTURE OF FINGER LANGUAGE

In this chapter, two processings, complementary drawing and preservation of original picture, are described. Complementary drawing is to draw detail parts by human hands. They cannot be brawn only with Spline function and rotation processing.

3-1 Complementary drawing

3-1-1 Decision of coordinates.

SET and RESET commands of BASIC are used for moving the points on the CRT display.

Assignment of ten-key for moving direction is shown in Fig. 3. The position of the point (x, y) on the display is stored in the memory. Movement computation is done when one of the keys (" 1", " 2", " 3", " 4", " 6", " 7", " 8,", " 9") is pressed. Movement of the indicating point on the display is done by this computation.

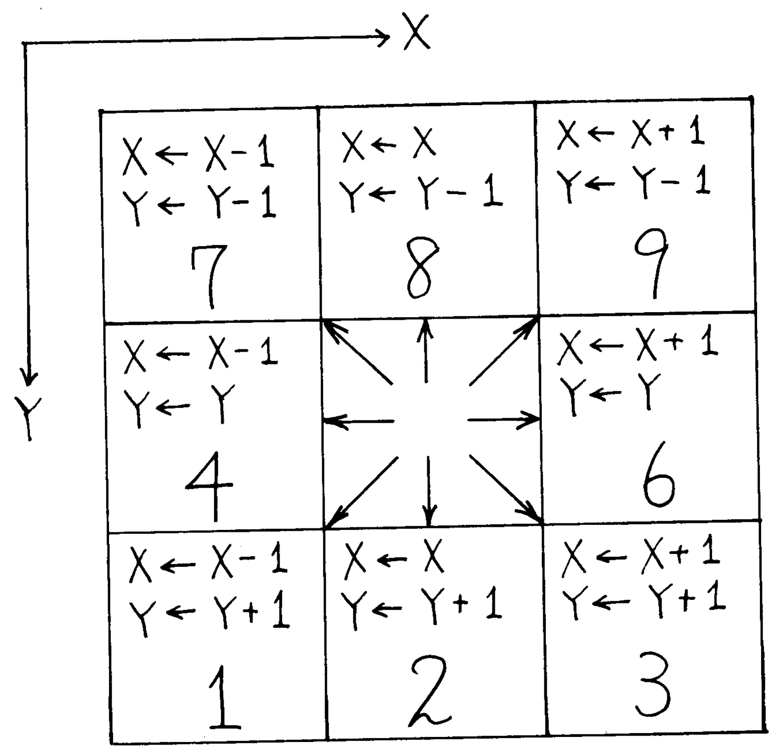


Fig. 3 Functions of ten-key.

3-1-2 Represention, deletion and movement of the point.

Three processings, representation, deletion and movement, can be selected by the parameter M. When M=0, the system investigates whether a dot has been setted on the current point. If a dot has been setted, RESET and SET command are done in this order and current position in the coordintes can be confirmed by human eye.

In like manner, if a dot has not been setted, SET and RESET command are done in this order. When M=1, RESET, SET, RESET commands are done for the dot in this order, and the picture is deleted. When M=2, SET, RESET, SET command are done in this order and new picture is drawn.

3-2 Storing and loading.

3-2-1 Storing in the array.

The positions of two points, minimum (x_1, y_1) and maximam (x_2, y_2), of the partial picture can be obtained. The horizontal dot number and vertical dot number can be obtained with x_1, y_1, x_2, y_2 using Eq. (3), (4) and the size of a required array is determined.

<REQUIRED BYTES> = ((<HORIZONTAL DOT NUMBER>
+7) ¥8) *<VERTICAL DOT NUMBER> *MODE+4 (3)

where ¥ is a integer dividing operator and,

MODE=1: monochrome mode

MODE=3: color mode

<ARRAY SIZE> = <REQUIRED BYTES> ¥2+1 (4)

After this calculation, the paritial picture within the region is stored in the array. This array is used when the same picture of the arm or fingers is required again.

3-2-2 Loading from the array.

When the stored picture is required, it can be loaded by PUT command of BASIC.

4. DECISION OF THE NUMBER OF FINGER LANGUAGE ACTION AND REPRESENTATION OF ANIMATION ON THE CRT DISPLAY

In this chapter, the method to decide the number of finger language actions and the method to represent the animation on the CRT display are described.

4-1 DECISION OF THE NUMBER OF FINGER LANGUAGE ACTIONS

Usually a statement consists of some words and its length is not constant.

Therefore if the number of words of a statement is not equal to the number of finger language actions, the meanings of the statement may not be correctly represented. So that the number of the words and actions must be same. But the number of words of a statement must be less than or equal to 16 because the memory of the micro computer (PC-9801F) is not so large. If the number of the words exceeds 16, the statement will be represented by two times or more.

When the number of words of the statement which is inputted from the keyboard is x ($x \leqq 16$), set the initial value of y (the number of action) to zero. Every time one data is read from the disk,

$$y \leftarrow y+1$$

is done. When y becomes equal to x, reading the data from the disk will be stopped and the processing for representation the animation will be started. When $x>16$, the statement is represented on the CRT display by two times of data reading and representation processings.

4-2 REPRESENTATION OF ANIMAION ON THE CRT DISPLAY

Since N_{88}-DISK BASIC of PC-9801F is an interpreter type, its processing speed is not so fast. For high speed processing, usually two means are used. One is to use a compiler type BASIC language, and other is to use assembler language. In this experiment, assembler language is used for animation representation routine.

Fig. 4 shows the number of original picture data which can be stored in one segment adress (64KB). This data contains two finger language actions. Eight segments can be stored in the original picture data preservation area of the memory. One segment data becomes one animation and represented on the CRT display by assembler program, because this assembler program can process only 64KB data. Therefore every time the segment of the original picture data changed, the data segment of the program must be changed. On the CRT display, left half is the animation representation area, and right half is the notation area. Animation is represented by 24 pictures per second. But the data preservation area can store only 64 original pictures, so that long animation cannot be represented. Since in this experiment, one action consists of 4 original pictures, the meaning cannot be understanded if the execusion speed is too high. To solve this prodlem, assembler program is called from BASIC program which has time delaying routine for speed adjustment.

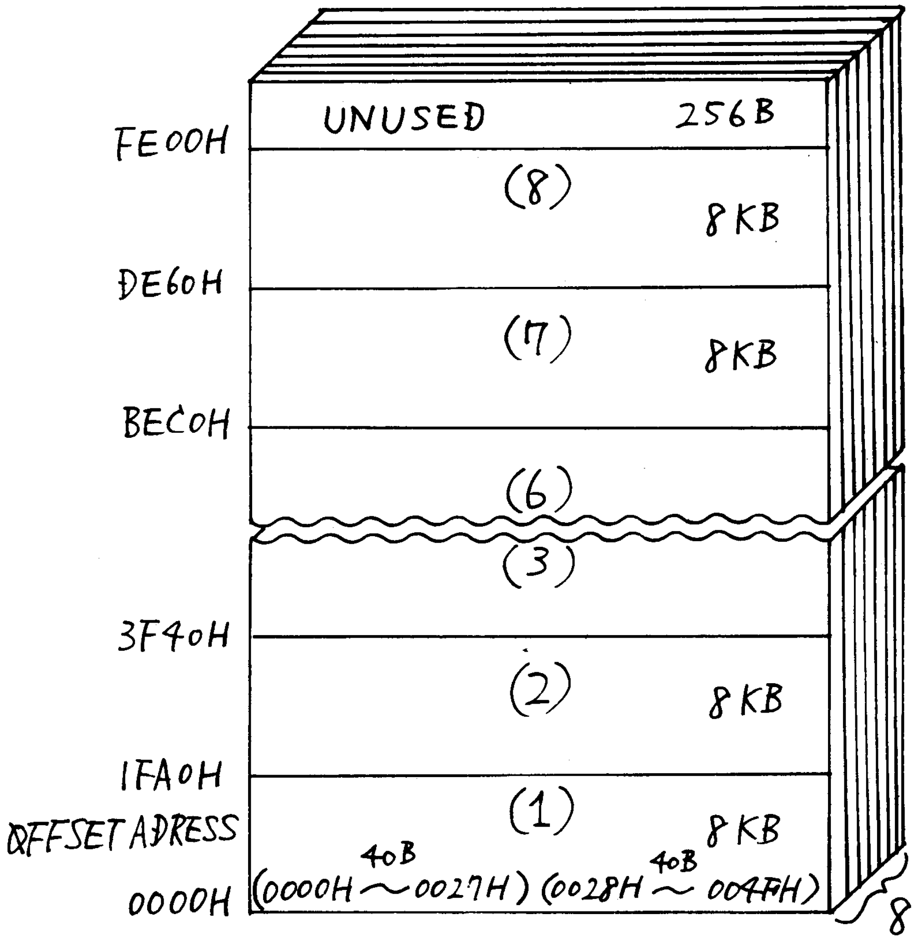


Fig. 4 Storing of the original picture data in the memory.

5. CONCLUSION

A method to represent finger language animation using a micro computer was proposed and fundamental experiments were executed.

An example of representation on the CRT display is shown in Fig. 5 (a)~(d). Action speed of the girl on the CRT display is almost equal to real human action. If larger memory can be used in the micro computer, more practical system can be made.

References

(1) Paul Swanson, Ryutaro Ohbuchl: MICRO COMPUTER DISK TECHIQUES, Kindai-kagakusha.

(2) Takayoshi Oshino; 8086 16bit CPU assembler nyuumon, Nikkan Kogyo Shimbunsha.

(3) Akira Sakurai, et. al: Spline kansuu nyuumon, Tokyo Denki Daigaku Shuppankyoku.

(4) Takeshi Agui, et. al: Computer animation, Sangyo Shuppan.

(5) Ryuji Tagami: Hajimeteno shuwa, Nippon Housou Shuppan Kyoukai.

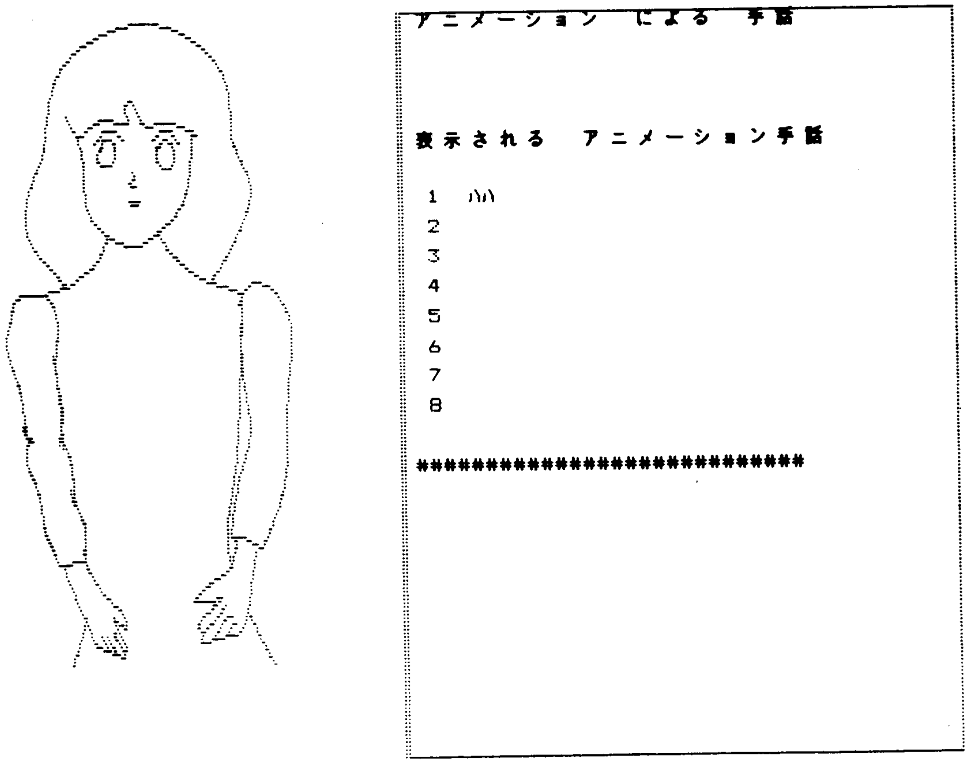


Fig. 5 (a) An example of animation represention on the CRT display.

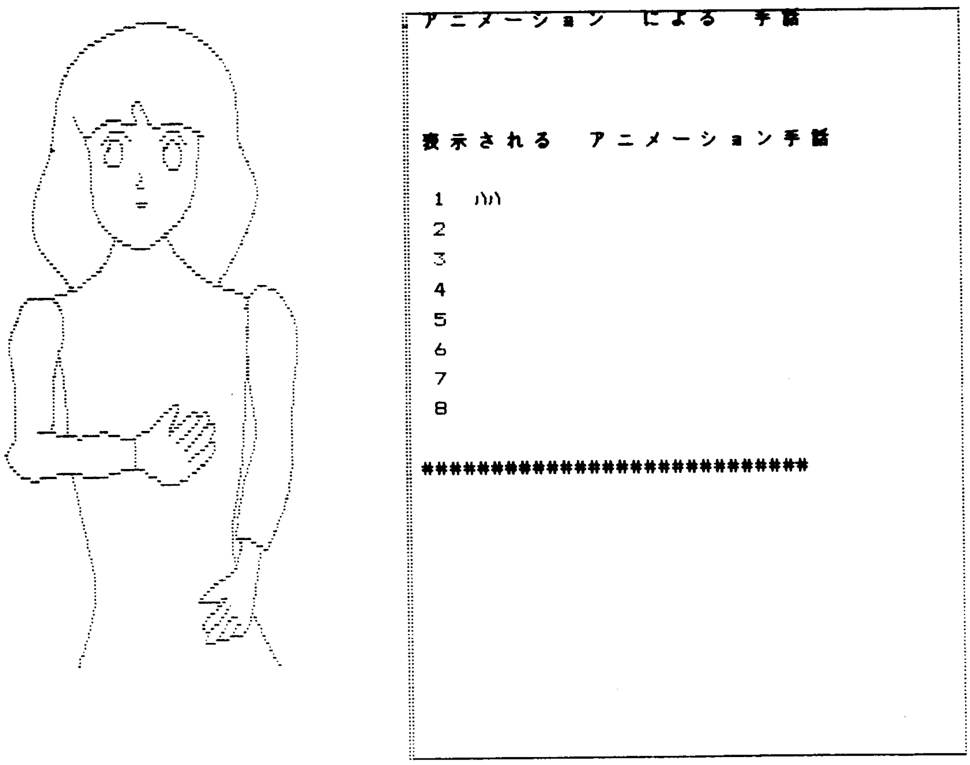


Fig. 5 (b) continued.

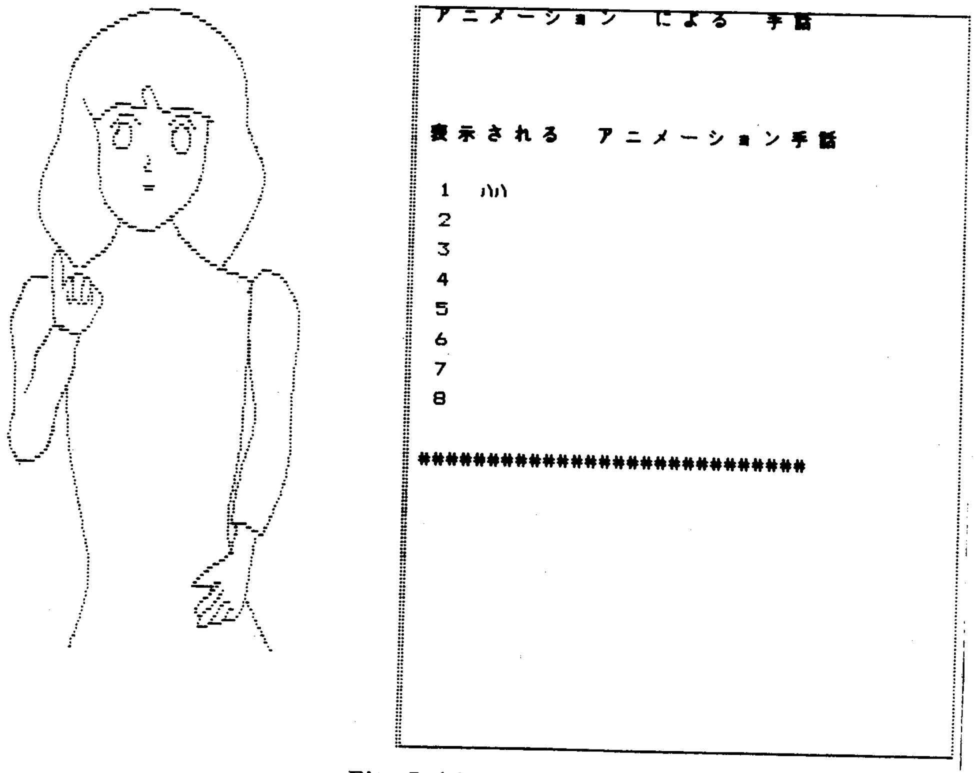


Fig. 5 (c) continued.

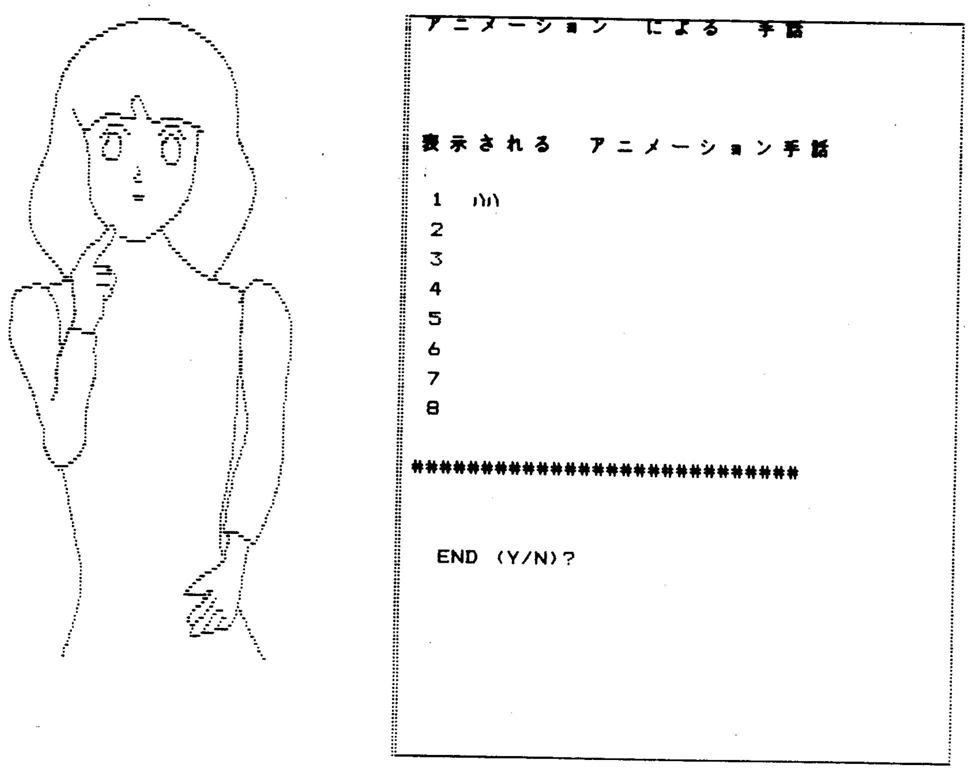


Fig. 5 (d) continued.