A Study on Conference System with 3DCG Using Digital Pen and Dot Screen

Takuya Ishibashi, Seiji Ishihara,
Makoto Hasegawa
Tokyo Denki University
Tokyo, Japan
t.ishibashi@m.ieice.org,
ishihara_s@mail.dendai.ac.jp,
hasegawa@mail.dendai.ac.jp

Eizaburo Iwata
Universal Robot Co., Ltd.
Tokyo, Japan
eiza@urobot.co.jp

Kazuo Suzuki
Dai Nippon Printing Co., Ltd.
Tokyo, Japan
suzuki-k3@mail.dnp.co.jp

Abstract—A conference system with three-dimensional computer graphics using a digital pen and a dot screen is proposed. Our digital pen reads extremely tiny dots printed on a whiteboard and it is possible to input our handwriting into computers. Three-dimensional computer graphics is projected on the screen with a projector, and handwriting in the graphics model can be perform in our system. We also discuss how to fill in texts to the models by annotation; multimedia information addition; measurement of distance and area. For example, our system is useful for medical conference with some doctors.

Keywords— Digital pen; Anoto dot screen; Handwriting; 3DCG; Conference system

I. INTRODUCTION

A conference system with three-dimensional object drawing using a digital pen, a projector, and a screen is proposed. In the case of recent medical scene, doctors can discuss about medical treatments using some plastic models of the patient's organ scanned by a medical equipment MRI and generated using a three-dimensional printer **[1]**. It is effective to refer to patient's organ models directly for the doctor collaboration. However, the doctors only take the plastic objects and observe them. In our resent works, we discuss a drawing system on three-dimensional paper craft models using a digital pen **[2]**. Writing on three-dimensional objects is very useful for the medical fields.

Our digital pen called "Anoto pen" has a camera in the pen tip as Fig. 1; the camera scans extremely tiny dots called "Anoto dots" printed on papers as Fig. 2. Our digital pen can compute the position of the pen tip using the Anoto dots, and we can digitize our handwriting and execute various processes in computers. For example, in the field of education, student's handwriting is scanned and transformed into its texts by the character recognition **[3, 4]**; teachers can provide a quick feedback to the students. In the plant field, the Anoto pen improves its safety by digitized maintenance check sheets **[5]** and in sales field, digitizing questionnaire. Also, at the time of disaster, it is possible to use the Anoto pen for an information system **[6]** and a triage system. Drawing on the two dimensional plane of the paper is a general usages for our digital pen. Therefore, when we try to extend to three-dimensional contents, the paper craft is easy to adapt in our previous method; however we have a technical issue about low resolution to create the paper crafts.

Fig. 1 Anoto pen.

In this paper, we propose a novel conference system with three-dimensional object drawing using a white board with the Anoto dots called "dot screen." Drawing can be performed on the dot screen, and our handwriting also can be digitized and execute various processes in computers. Three-dimensional objects are described using a computer graphics software, and we display it to the dot screen with a projector as Fig. 3. Our handwriting on the dot screen can be put and drawn to the three-dimensional computer models easily. Drawing process with the digital pen is very simple, moreover the operations on the three-dimensional computer graphics can be perform using the one digital pen. We reduce the complicated functions on the three-dimensional computer graphics software and construct the simple user interface. Users who cannot master the three-dimensional computer graphics software also can draw to the three-dimensional object surface, so that all person can join to

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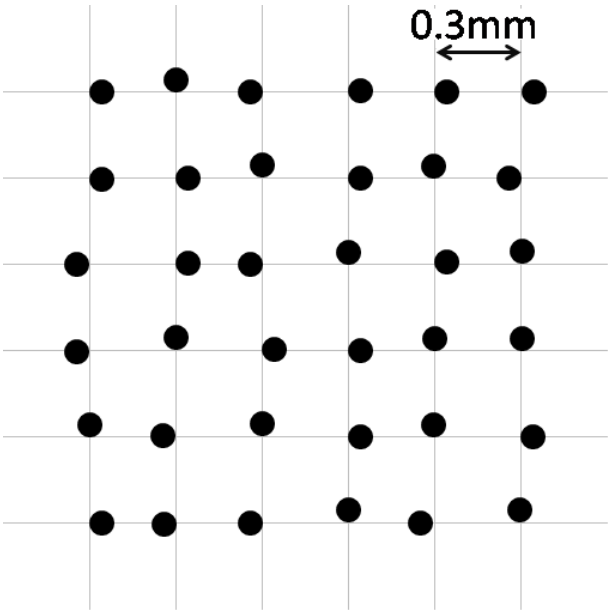


Fig. 2 Anoto dots.

the conference with our system. Since the dot screen is flat plane, we can draw more easily than our previous method using the paper crafts.

The Anoto pen, the Anoto dots, and the dot screen are introduced in our next section. Our conference system is proposed in Sec. III. Finally, we conclude and talk about our future works.

II. ANOTO PEN, ANOTO DOTS, AND DOT SCREEN

The Anoto pen has a small built-in pin-hole camera as Fig. 1 and scans the Anoto dots under the pen tip when we draw our handwriting. The Anoto dots are extremely tiny dots shown in Fig.2, and these dots are located according to special rules - up, down, left or right on the virtual orthogonal grid. The built-in pin-hole camera in the Anoto pen scans 6 dots × 6 dots, total 36 dots in the moment, and this 36 dots pattern provides different enormous variation as many as 36th power of 4. The position of the pen tip is computed using the pattern of 36 dots, and a stroke of handwriting are recorded in the Anoto pen temporarily and transferred into computers.

In our system, we use the dot screen with a projector. The dot screen is a white board with the Anoto dots. Drawing can be performed on computer software with the dot screen, and our handwriting also can be digitized and execute various processes in computers. When we use the Anoto pen on the dot screen, an ink cartridge is not installed on the pen, the strokes of the handwriting based on the computer graphics are displayed using the projector. The Anoto pen and the dot screen contribute to not only drawing, but also a click operation for input device as a computer mouse or a tablet pen.

III. OUR CONFERENCE SYSTEM

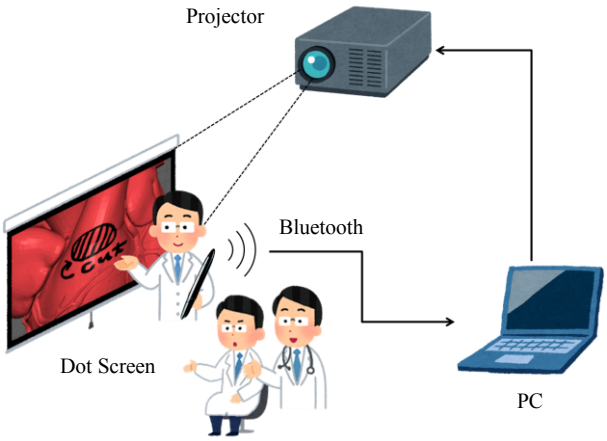


Fig. 3 Our conference system.

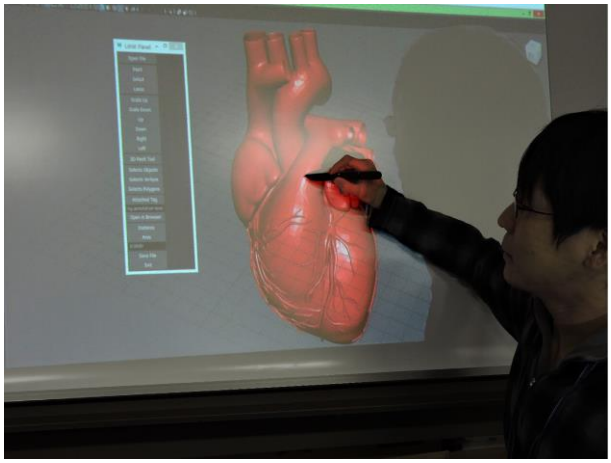


Fig. 4 Drawing on our dot Screen.

Three-dimensional objects are captured using a three-dimensional scanning device as “RGB-D camera” or “light field camera”; in the medical fields, we can use “CT” or “MRI”, and three-dimensional models of the objects are generated. We can also create a three-dimensional model by handwriting using a computer graphics software. We display them to the dot screen with a computer graphics software and a projector as Fig. 3. We draw some figures or character strings on the dot screen using the Anoto pen as Fig. 4. Changing our viewpoint on the computer graphics software – tumble, track, and dolly –, model selection, click operation, and text input are possible using only the Anoto pen without a keyboard and a mouse. Complex computer operation is unnecessary for us.

Our important operations are “file open” of a three-dimensional model data, “viewpoint change”, “drawing”, “save” the model data, and “exit”; however the three-dimensional computer graphics software provides more rich functions. These functions are too complicated and difficult to operate for beginner on the three-dimensional computer graphics software. Therefore, unnecessary functions are

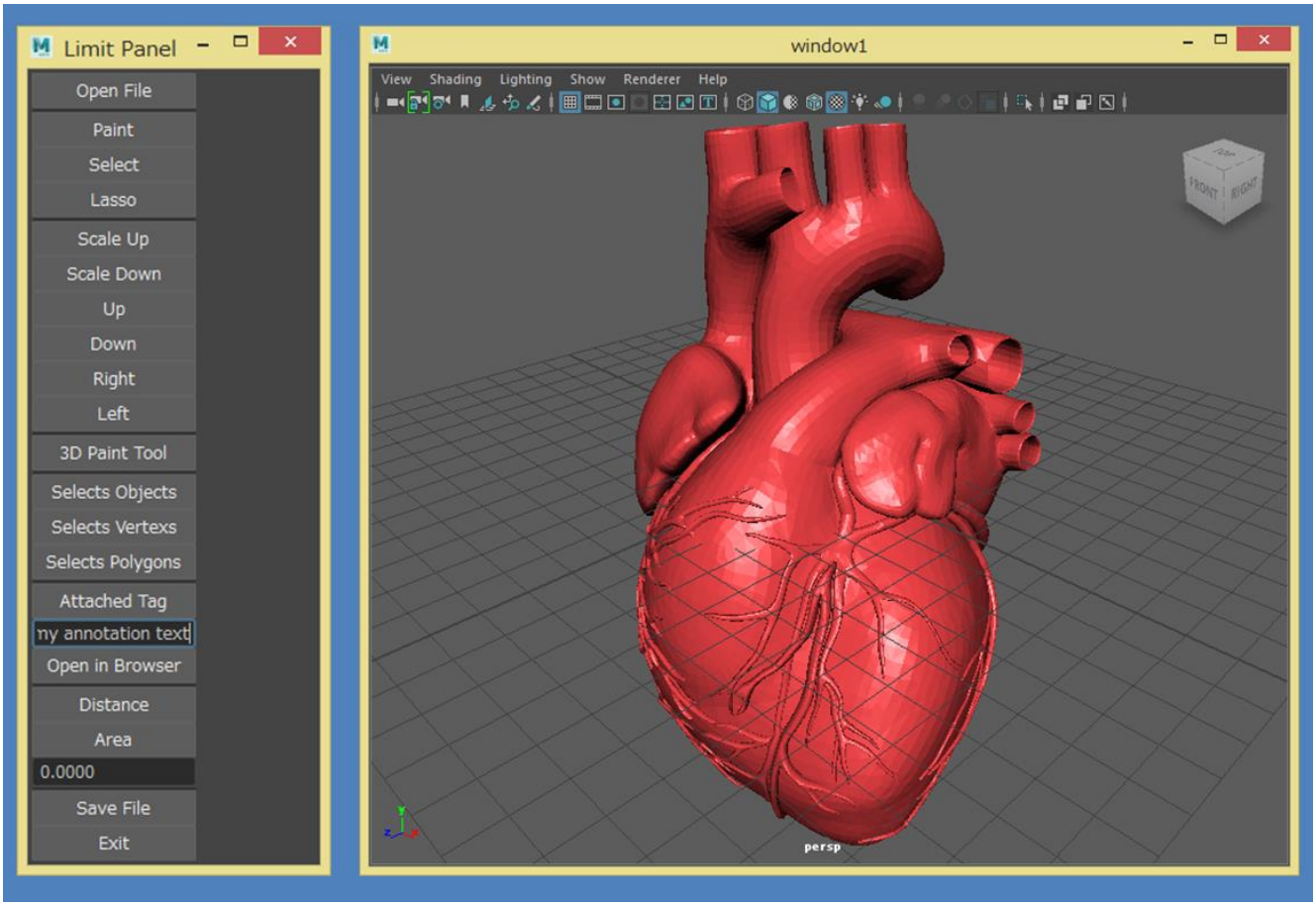


Fig. 5 User interface.

removed in our system, and we develop our simple interface as Fig. 5. The model tumble is realized with the dice called "view cube" on the upper right of the main window. We rotate the view cube using the Anoto pen, and the models are tumbled. The morel track is realized with the buttons "Up", "Down", "Right", "Left." Moreover, the model dolly is realized with the buttons " Scale Up" and "Scale Down." We draw some figures or character strings on the dot screen, however those strokes are not painted. The strokes of the handwriting are generated on the computer graphics and are displayed using the projector as Fig. 4.

We also provide useful functions in our system. Text annotation is available as Fig. 7. Moreover, we can attach some URL links of web page. When we click the URL annotation, a web browser is popup, and those web sites are shown. As a result, various multimedia information can attach in the three-dimensional graphics models. Distance and aria measurements are available in our system as Fig. 8. These are very useful for the medical field.

Our system is developped using the Anotopen and the dot screen called "DNP digital pen set (IWB-ADP-601)" provided by Dai Nippon Printing Co., Ltd. and three-dimensional computer graphics software called "MAYA". Our user interface is developed using the Maya Embedded Language (MEL).

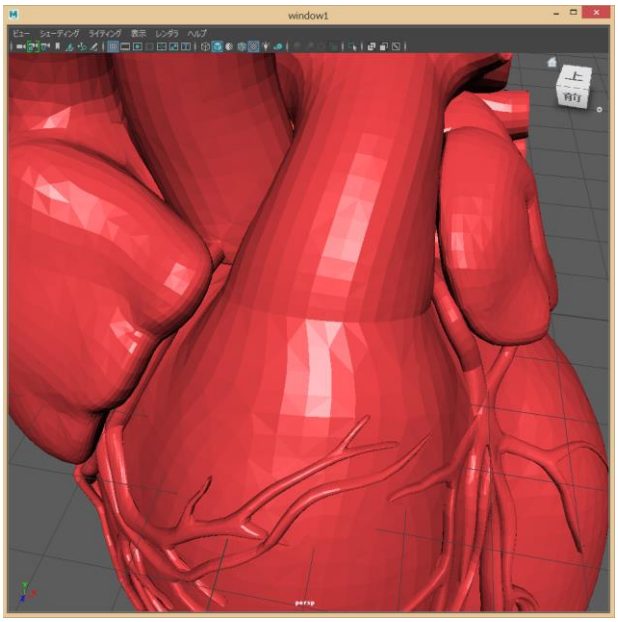
In the case of our previous method, it is useful to actually pick up the paper craft model, however we have technical issues about the polygon resolution. Furthermore, breakage of the strokes also occur in the boundary between the rough polygons. In our novel system, it is possible to realize high polygon resolution, and our system can be a practical product. Since the dot screen is flat plane, it is easier to draw than our previous method using the paper crafts.

IV. CONCLUSION

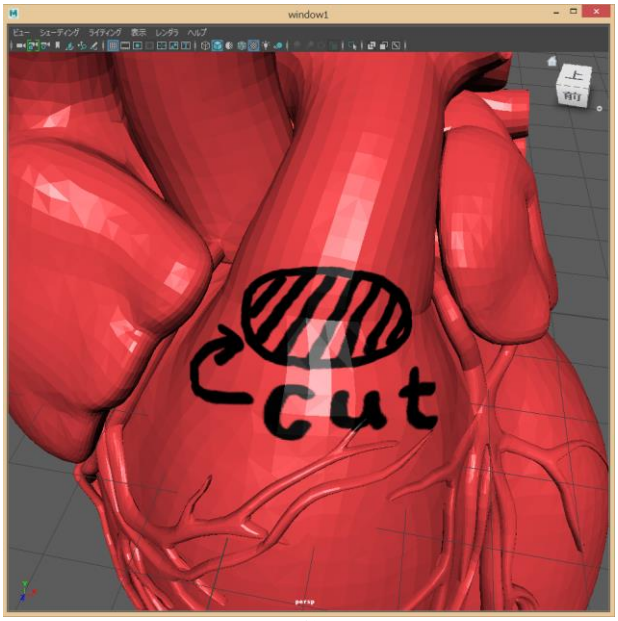
We propose a novel conference system with three-dimensional object drawing using the Anoto pen and the dot screen. Drawing some figures or character strings on the tree-dimensional graphics models is available using our system. We also provide useful text annotation, multimedia annotation, and distance and aria measurements.

In our future works, we try to use our system in medical fields, product design, education, disaster countermeasure using three-dimensional map, and estimate our performance.

ACKNOWLEDGMENT



(a)



(b)

Fig. 6 (a) Before drawing; (b) the results of drawing.

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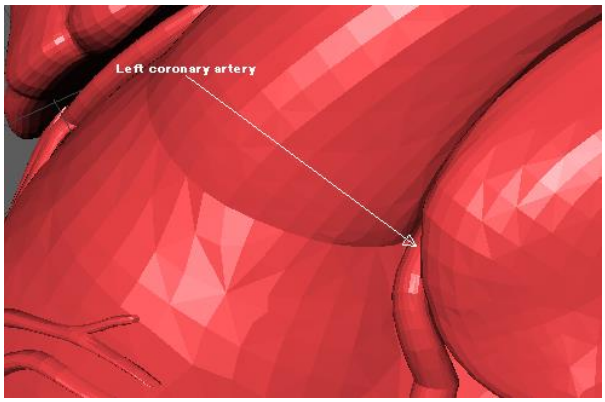

Fig. 7 Annotation.

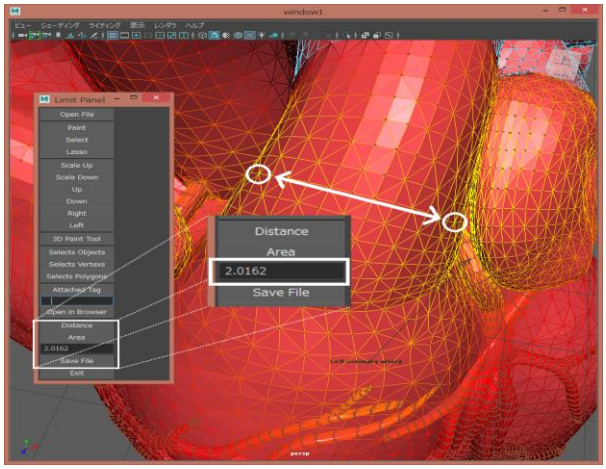

Fig. 8 Distance measurement.

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