Ortho Projection and Drawing for Archeological Artifacts of complicated form

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Commission V, Working Group 4

Keywords: Digital, Archeology, Ortho-image, Real-time, Laser-beam, Jomon-pottery

ABSTRACT

In the compilation of archival records for archeological artifacts, true orthographic drawings of these artifacts have to be drawn by the archaeologists themselves or part-timers, expending a great deal of time, labor and skills.

This paper describes the real time orthographic drawing system for archeological artifacts with complicated form using CCD camera. Finally, it demonstrates real time orthographic drawing results for Jomon pottery by using this system instead of the manual method which requires 3-4 hours.

1. INTRODUCTION

Many sites are excavated yearly in Japan. For example, over 8,000 archeological sites were excavated in 1994, and an abundance of archeological artifacts such as Jomon or Yayoi pottery are uncovered from these sites. In this context, the large format still camera is expected to become a useful tool in taking orthophotos.

There are, however, still some issues which need to be solved for real time orthographic drawing, such as, developing, enlargement and tracing. From the view point of tracing, it is possible to utilize a scanner, nevertheless developing and enlargement are still subjects.

By using the orthographic drawing system with a CCD camera as proposed in this paper, an orthoimage for archeological artifacts can be acquired in real time even there are uneven parts and high quality image can be taken by using line laser beam instead of slit fluorescent light.

Furthermore the orthographic drawing can be obtained in real time via image processing procedures wherein the orthoimage is recorded as part of a rebirthable data image.

2. ORTHOGRAPHIC DRAWING SYSTEM

An orthophoto can easily be taken from the continuous photo which is taken with the shutter opened while the artifact is slowly moved in the dark space and slit lights are applied from both sides (Yokoyama, et al., 1995).

In a general way, the Still camera is used for this purpose (Miyatsuka, 1994), nevertheless it has the weak points described above. If a CCD Camera can be utilized instead of Still camera(Fig 1), an orthoimage can be acquired in real time.

Furthermore, tracing can be done in real time by using image processing procedures since the orthoimage is digital data.

With this mind, the authors developed the orthographic drawing system using a CCD camera.

Table 1 shows the components of the orthographic drawing system and Figure 2 shows the configuration of this system.

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
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<tbody>
<tr>
<td>CCD camera</td>
<td>XC-75 (SONY)</td>
</tr>
<tr>
<td>Lens</td>
<td>VCL-16Y-M (SONY)</td>
</tr>
<tr>
<td>A/D converter</td>
<td>FRM2-512 (PHOTORON)</td>
</tr>
<tr>
<td>TV monitor</td>
<td>PVM-1454Q (SONY)</td>
</tr>
<tr>
<td>PC</td>
<td>PC9801BX (NEC)</td>
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Fig 1 Ortho projection using CCD camera
this system improve the weak point for two slit lights system.
On the other hand, Figure 7 show an orthoimage which was taken by using two line laser beams instead of fluorescent slit lights under view point to getting fine image quality.

3. EDGED IMAGE

The Laplacian-Gaussian filter was used in this paper to acquire the edged image for the archeological artifact since it is advantageous for both Laplacian and Gaussian filter (Marr, 1982). Figure 8 show the edged images produced by this filter.

4. CONCLUSION

This paper describes the orthographic drawing system using a CCD camera. Table 2 shows the differences between the Still camera and CCD camera system.

Table 2 Characteristic points between Still camera and CCD camera system

<table>
<thead>
<tr>
<th></th>
<th>Still camera method</th>
<th>CCD camera method</th>
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<tbody>
<tr>
<td>Time for taking photo</td>
<td>2–3 minutes</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Developing and</td>
<td>Need</td>
<td>Not need</td>
</tr>
<tr>
<td>Enlarging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time for tracing</td>
<td>3–4 hours</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Data format</td>
<td>Analog</td>
<td>Digital</td>
</tr>
<tr>
<td>Image processing</td>
<td>Need to change</td>
<td>Easy</td>
</tr>
<tr>
<td></td>
<td>into digital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Photo</td>
<td></td>
</tr>
<tr>
<td>Data saving</td>
<td></td>
<td>Disk</td>
</tr>
</tbody>
</table>

Consequently, the real time orthographic drawing system using a CCD camera is expected to become a useful tool in the archeological field. The orthoimage and orthodrawing can be acquired in real time and thus recorded as part of the image data. There are, however, still some issues which need to be solved before this system can become operational, for example, image quality and the synthesizing speed of the orthoimage.

REFERENCES


David, Marr, 1982. VISION, W.H. Freeman and Company
Fig. 4 Synthesis process of ortho image
Fig. 5 Three slit lights with cut system

Fig. 6(b) Image of light up from only upside

Fig. 6(a) Image of two slit lights system

Fig. 6(c) Image of three slit lights system
Fig. 6(d) Image of three slit lights with cut system

Fig. 7 Image of laser beam system
Fig. 8(a) Edged result of three slit lights with cut system

Fig. 8(b) Edged result of line laser-beams system