

3D MEASUREMENT BY USING CCD LINE SENSOR

Tsukasa Hosmura

Tokyo Denki University, Ishizaka, Hatoyama-machi, Hiki-gun, Saitama, 350-0394, Japan
hosomura@ia.dendai.ac.jp

Commission V, WG V/2

KEY WORDS: Photogrammetry, Urban, Modeling, CCD Line Sensor, Experimental

ABSTRACT:

By putting CCD Line Sensor on the mount, which rotates at the steady speed, and taking the images of 360 degrees. It would be able to easily realize the 3D measurement of the object. In this study, such system was produced experimentally, and measurement accuracy was examined.

1. INTRODUCTION

Generally, 3D measurement of most equipment uses the principle of the triangular measure. There are several methods for example stereo method using the binocular, spot projected method, pattern projected method and moire topography, etc. Stereo method is the passive method, other methods are active method, which projects the light. Stereo method using two cameras is called the binocular stereoscopic vision. This method can be got 3D information of all points in the scene. However, it is difficult to find out the corresponding point in both scenes. In 3D modeling of the landscape, distance measurement of plural point on the object is sufficient for modeling in most cases. It is possible to calculate the distance to the corresponding point, which has reflected on the scene obtained from many directions on the horizontal surface. But, it is difficult to get many directions from stile camera. It was considered to use of CCD line sensor for this situation. By putting the CCD line sensor on the mount, which rotates at the steady speed, and taking the images of 360 degrees. It would be able to easily realize the 3D measurement of the object. In this study, such system was used experimentally, and measurement accuracy was examined.

2. OUTLINE OF THE SYSTEM

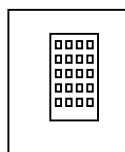
This system has been composed of 3 components. These are CCD line sensor (CORE CCD camera CV-L103), servomotor (FUJI ELECTRIC, GYC101DC1-S) and decelerate gear system. This gear system is used to rotate the camera in fixed minutes. Lower part is servomotor. Rotating time of the sensor can be changed several steps. Middle part is decelerate gear system. Rotating speed of servomotor is too fast for obtaining object images. Decelerate gear system can be slow down the rotating speed of servomotor. Top part is CCD line sensor. This CCD line sensor can get object images by 2048pixels x 80 line /minute.



Figure 1. CCD Line Sensor System used in this study

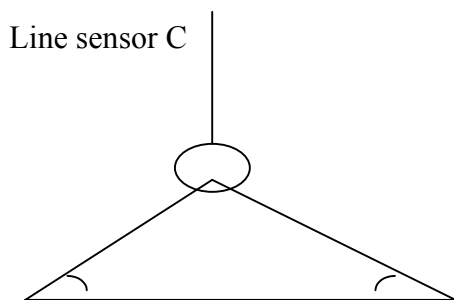
3. MEASURING METHOD OF THE DISTANCE

This equipment is set at plural positions (for example, line sensor A, line sensor B, line sensor C and so on) on the identical circumference, and scenes of 360 degree circumferences are obtained, and the images are incorporated in personal computer. By putting the CCD line sensor on the mount, which rotates at the steady speed, and taking the images of 360 degrees. It would be able to easily realize the 3D measurement of the object. By counting the scene number of one line sensor (for example line sensor A), the angle from the direction of other camera (for example line sensor B) to the target marker can be calculated. Angle from the direction of line sensor A to the same target marker can be calculated by using the other line sensor B. As the result, distance from line sensor A to the target marker can be found out. The distances from each line sensor to the markers are calculated by using the above method.



Line sensor A Line sensor B

Figure 2. Obtaining method of target image



Line sensor A Line sensor B
Figure 3. Measuring method of the angles

4. COMPARISON BETWEEN EXPERIMENTAL RESULT AND MEASURED DISTANCE

The measurement was carried out using this system at Kanazawa Institute of Technology in Japan. CCD line sensor was set at 3 points near library center in campus. Three kinds of rotating speed were selected. Highest rotating speed is 10 minutes per 360 degrees rotation. Middle and lowest speed is 15 and 20 minutes respectively. We took 14 target points around campus. Analysis of image sequence did not finished. We will show the experimental result at the workshop. Measurement accuracy will be also examined.



Figure 4. Experiment executed in Kanazawa Institute of Technology

5. SUMMARY

In this system, there are some merits compare with conventional surveying method. Only one stuff is sufficient for measurement. Images obtained from CCD line sensor can be memorized. The object can be freely chosen.

References

Hosomura, T., 2001. 3D Modeling of Earthenware by Using Video Camera. Proc. of International Workshop on Recreating the Past –Visualization and Animation of Cultural Heritage- Ayutthaya, Thailand, Vol. XXXIV, Part 5/W1, pp. 141-142.