Laser Tracking using Computer Vision for Optical Wireless Power Transmission

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1. Introduction

Optical wireless power transmission system can charge the mobile electronic devices through laser power beam using a photovoltaic cell [1], [2]. A method of reflecting a laser beam on a corner cube attached to an object and controlling the position change in real time using a quadrant optical sensor on the exit side[3].

In this research, we propose a method of tracking an object using CCD camera, Python's program, and OpenCV to control the goniometer stages. This stages mounted on a 1 mW laser power to drive the laser beam on the moving object.

2. Experiment and Results

This system used a CCD camera as a sensor to capture and recognize the position of an object in horizontal movement. The pixel change (Δx), viewing angle (θ_{mx}), number of pixel (N_x), and angle change ($\Delta\theta_x$) has a correlation using the equation below.

$$\Delta\theta_x = \tan^{-1}\left(\frac{2\Delta x}{N_x}\tan\frac{\theta_{mx}}{2}\right)$$

In the program, the size of a frame is 640 x 480 pixel. An object recognized with a rectangle line and the cental point. The program is design by

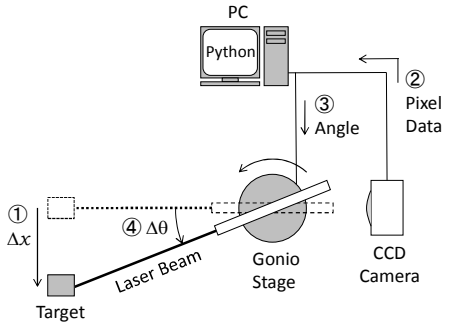

Fig. 1. Experiment Setup

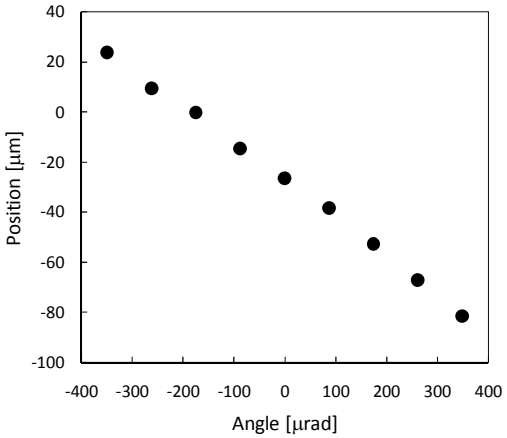

Fig. 2. Micro angle and beam position

20 fps to record the data position of an object. This data is used to rotate the goniometer stages. The experiment setup can be seen in Fig 1.

The goniometer stage has the ability to drive the position in micro radian angle. However, the tracking speed limited with the geared servo motor is 3 degrees/secs. The correlation between micro angle and beam position can be seen in Fig. 2.

3. Summary

The high accuration beam steering system is obtained using the CCD camera and computer vision. This result can be expected to realize the optical wireless transmission system.

Refferences

[1] P. Anand T.P. et al., International Journal of Mechanical Engineering and Research, **5** (2015) 137.

[2] A. Sahai et al., International Conference on Space Optical Systems and Applications (ICSOS) (2011) 164.

[3] K. Takeda et al., Space Technology, **7** (2008) 27.