Development and Application of the Single-Camera Vision Measuring System

Kuei-Shu Hsu, Ko-Chun Chen, Tsung-Han Li and Min-Chieh Chiu

Abstract: The main purpose of this research is to construct a highly efficient low cost image-calculation system. In this system the distance between the user and the targeted object can be calculated by a light signal (Super LED) received from a image input device (CCD). We are trying to accomplish two things: an image measurement in conjunction with an image depth and a fast measurement of the image’s distance. Of course, it is difficult to measure the distance between an object and an image using a simple eye lens (CCD). The hardware platform of a system is composed of a light source, a Web cam and a convex lens constitute. According to the principle of parallel optical axis, the distance can be obtained by conveying the image to the system via USB communication interface, applying a characteristic (a straight line between the light source and the object), utilizing the dimension data and using a variety of light from the light source. Consequently, the experimental results reveal that the distance between the object and the image lens can be acquired by utilizing a system where the image calculation in conjunction with a vision algorithm is used.

Key words: Explore, luminance, image measurement, distance measurement, web cam

INTRODUCTION

A computer’s visual system can be divided into two categories: plane vision and stereoscopic vision. The difference is based on the ability to estimate the depth of an object in an image-depth perception. In Barnard and Thomson (1980) proposed the idea that a computer stereoscopic vision system should include image acquisition, camera modeling, feature detection, image matching, depth determination and interpolation. At the end of 1970, researchers had already developed several computer stereoscopic vision algorithms. The stereoscopic visual system needs at least two cameras to synchronously capture a stereo image. An accurate parameter acquired from the camera is required so that the object’s stereoscopic depth can be calculated by using the corresponding point of the object’s stereo image. The stereoscopic depth of the object (Hemtock and David, 1966; Olson and Huttenlocher, 1997; Starck et al., 2003) can be obtained by using the asymmetric geometry under the given parameters of the camera. The accuracy of stereoscopic depth is related to the parameters of the camera. Many researchers have proposed several calibration methods for correcting the cameras stereoscopic vision so as to decrease the calculation error in the object’s depth (Mallon et al., 2002).

This research will establish a quick, efficient and low cost image-calculation system in which a distance calculation can be achieved by using the web cam (CCD), a cheap input device and a USB interface—this is done without auxiliary equipment. The image-calculation system is used to evaluate the target’s distance (from the system’s platform) and the variety of the object. In addition, the distance between the system’s platform and target can be evaluated using the diaphragm size of the light source derived from the CCD (Barnard and Thomson, 1980; Tsai, 1987; Bertozzi and Broggi, 1988; Olyae et al., 1998; Yau and Wang, 1999).

A traditional image, using one eye, cannot detect the distance between an object and a web camera (Tirumalai et al., 1992; Stafford et al., 2007). In this research, a new judgment rule is adopted to find the distance between the light source and the camera. The camera will pick up the image continuously (Olyae et al., 1998). The variety of light from the light source is therefore acquired through image processing. Moreover,