

# 3D Precise Inspection of Electronic Devices by Single Stereo Vision

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## Abstract

*It is very important to guarantee the quality of the industrial products by means of visual inspection. In order to reduce the soldering defect with terminal deformation and terminal burr in the manufacturing process, this paper proposes a 3D visual inspection system based on a stereo vision with single camera.*

*It is technically noted that the base line of this single camera stereo was precisely calibrated by the image processing procedure. Also to extract the measuring point coordinates for computing disparity; the error is reduced with original algorithm. Comparing its performance with that of human inspection using industrial microscope, the proposed 3D inspection could be an alternative in precision and in processing cost. Since the practical specification in 3D precision is less than 0.02 mm and the experimental performance was around the same, it was demonstrated by the proposed system that the soldering defect with terminal deformation and terminal burr in inspection, especially in 3D inspection, was decreased.*

*In order to realize the inline inspection, this paper will suggest how the human inspection of the products could be modeled and be implemented by the computer system especially in manufacturing process.*

## 1. Introduction

It is indispensable to prepare for the spreading variations in product design and for the shortage in product life cycle, under the changing circumstances of portable phone, PC, and several electronic devices. Accordingly the inspection of the electronic devices must be shorten in development period, must be enforced in precision and also be refined in size.[1],[2],[3] Therefore image processing is becoming one of the important key technologies in this field.

This paper proposes a flexible image processing system for the inspections of electronic device's terminal lead such as small size connectors implemented on general purpose PC. [4],[5],[6]

In the real production line, inspection of electronic devices is categorized into two basic categories: visual inspection and size measurement. The former is a task for replacing human visual inspection and the latter is one for replacing human works using special measurement equipment. In order to introduce 3D measurement for the 3D form of the electronic devices of which form is complicated, and to introduce high precision measurement, an optical probe system or the optical cutting

method are normally used for these 3D measurements.[7] However, the laser apparatus for lighting is needed and it will become an expensive and complicated system.

To do this in our research, we propose an inspection environment for realizing not expensive and highly precise 3D measurement scheme and its algorithm.

## 2. The necessity for 3D measurement

Figure 1 show the soldering state of a terminal lead, which consists of copper alloy. Since the size of the device and the number of terminals are not always fixed, inspection system must cope with the variations both in size and in number, and must cover 3D measurement supplemental to 2D measurement.

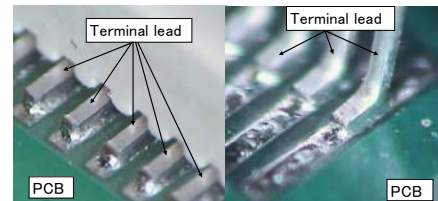


Figure 1. Soldering state of a terminal lead

Since the 2D measurement of the terminal lead with the deformation or terminal cutting burr that is difficult to extract only from the appearance information, it is necessary to measure the distance between the camera and a terminal's measurement point by stereo system. In order to detect simultaneously the deformation, bend, garbage adhesion and terminal burr as shown in Figure 2, 3D measurement is essential. The appearance of the defect of the terminal lead cannot be recognized from the direction shown as "B" in Figure 2. It is necessary to measure the 3D shape using the image information seen from the observable direction "A". Therefore, the system which performs 3D measurement and measures the distance is required.

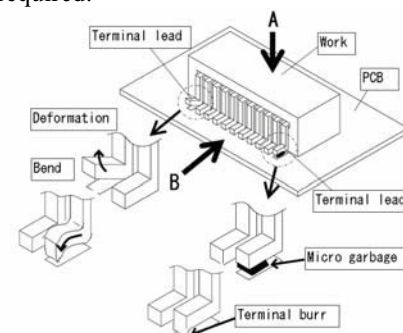


Figure 2. Terminal lead with some problems





