UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOP A DENTED DEFECT DETECTION ON CYLINDRICAL TYPE BATTERY VIA VISION

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering Technology (Industrial Automation and Robotics) With Honours

by

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SESI PENGAJIAN: **2016/17 Semester 1**

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I hereby, declared this report entitled "DEVELOP A DENTED DEFECT DETECTION ON CYLINDRICAL TYPE BATTERY VIA VISION" is the results of my own research except as cited in references.

Signature **:……**

Name **:** VERYSON KOHIYA

Date **:** 5 JANUARY 2017

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Robotic And Industrial Automation) With Honours. The member of the supervisory is as follow:

…….

(ARMAN HADI BIN AZAHAR)

ABSTRACT

The main goal of this final year's project is to develop a dented defect detection based on vision system for a cylindrical battery types. This project focus is to design a system that can detect the defect that occur on the surface of the battery and study the shadow effect that produce in the images while capturing images with a suitable lighting. The project use Halcon Camera and ring light to take the sample image from good and bad product sample. The ring light attached to the camera to help the camera see the product being capture. Using human eyes, we can determine either the battery are defected or not, in this project we need to teach the system to see and determine the condition of the product either it's Pass or Reject while inspection. To complete this task we need to develop the codes and mathematical algorithm to teach the vision system, to do this we used MATLAB as our software to produce the codes and Graphical User Interface (GUI) to monitor the system.

ABSTRAK

Tujuan utama tugas akhir ini adalah untuk membina system yang boleh mengesan kecacatan yang berlaku pada bateri jenis silinder berdasarkan system penglihatan. Fokus projek ini adalah untuk membina sebuah sistem yang dapat mengesan kecacat yang terjadi pada permukaan baterai dan mempelajari efek bayangan yang menghasilkan dalam gambar saat menangkap gambar dengan pencahayaan yang sesuai. Projek ini menggunakan kamera Halcon dan cahaya cincin untuk mengambil imej sampel dari sampel produk yang baik dan buruk. Lampu cincin dipasang pada kamera untuk membantu kamera melihat produk yang ditangkap. Menggunakan mata manusia, kita boleh menentukan sama ada bateri ini mempunyai kecacatan atau tidak, dalam projek ini, kita perlu mengajar sistem untuk melihat dan menentukan keadaan produk sama ada ia lulus atau Tolak manakala pemeriksaan. Untuk menyelesaikan tugas ini kita perlu membangunkan kod dan algoritma matematik untuk mengajar sistem penglihatan, untuk melakukan ini kita menggunakan MATLAB perisian kami untuk menghasilkan kod dan antara muka pengguna grafik (GUI) untuk memantau sistem.

DEDICATIONS

Special dedicated to

My beloved parents, my friend and siblings, who have encourage, guided and supported me throughout my study.

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CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter discuss about the introduction of this project which include the general information of this project, background of the project, the problem statement, objective of the project and project work scope.

1.1 Background

Machine vision is the use of a device for optical non-contact sensing to automatically receive and interpret an image of a real scene in order to obtain information and control machine or processes. There are number of methods which can be applied in machine vision system. The first thing need to be consider before developing a machine vision is the purpose of the machine vision, each and every field do have different function and reason(Singh & Gautam 2015). There are four main classifications of machine vision operation measurement, identify, location and inspect. Each machine vision can perform one operation or more than one operation depends on it purpose. The basic five basic components needed to develop a machine vision which is camera, lens, light, processor and program.

The basic operation perform by a machine vision can be understand in simple way which is at the first stage of the operation with the aid of lighting source and lens the camera will capture the image of the object and the image will be send to the processor. The processor with aid of suitable programmed will do the inspection and the process will repeat continuously.

The beginning of machine vision were developed in late 1940s and early 1950s, Roots of machine vision traced back to early image analysis military applications of artificial intelligence Studies in artificial intelligence began in the post war period driven by increases in computer technology human thought more efficiently emulated through the use of modern digital computers. This concept become industrialized in 1960s/1970s, at this point, Massachusetts Institute of Technology developed an image analysis system that could control a robotic arm for applied industrial uses. In the 1980s, machine vision took off and saw great expansion on the industrial level. At this point, gray scale machine vision algorithms, single board image processors, and cameras for industrial applications became commercially available. Machine vision became a production line staple in many industries(Kirsch 2009).

In 1980s, Image Processing and Machine Vision was a field of study in their own right Stanford Research Institute (SRI) and MIT promoting adoption of machine vision with robot control, licensing technology to commercial companies Gray scale machine vision algorithms developed (8 bit) and single board image processors available Windows 1.0 released in 1985 Vision industry setback with the collapse of Machine Vision International in 1988 Cameras begin to be manufactured specifically for industrial applications and the machine vision market Mass adoption of machine vision by semiconductor manufacturers. The 1990s brought a boom of growth to the machine vision industry.

The advancement of computer technology was the main driver behind this expansion. Processing chips made it possible to create smart cameras, which can not only collect the image data, but it can also extract information from these images without using a computer or other external processing unit(Kirsch 2009). In 2000s, Development of ergonomic system solutions for factory integration machine vision industry adopts FireWire (IEEE1394) digital camera technology market continues to expand rapidly with smart cameras and sensors GigE camera technology joins Fire wire as accepted standard within machine vision industry Smart and intelligent cameras readily available Increased use of data matrix code readers within industry. 3D algorithms are starting to be developed Windows 7 64 Bit with .NET technology will form the basis for future PC based machine vision solutions start in 2010s and until now.

1.2 Problem Statement

The usage of rechargeable battery is used in most all types of electronic component now days. A battery is a container that consisting of one or more cell, this battery converts chemical energy to an electrical energy that used as a source of power. A dented battery can cause connection issue and short that will affect the safety of the user. As we can see the demand of the rechargeable battery is increasing but the product that has been release into the market by the developer some of the products are already dented and this can harm the costumer that using the battery. There are some problem that occur and make the vision system required, there are:

I. Dented that occur at the surface of the battery either at the bottom or at the top of the battery most occur on the manufacturing.
II. Dented battery are not safe to used, the dented can cause connection issue and short circuit that will affect the safety of the user.

1.3 Objective

We propose for developed dented defect detection on cylindrical type battery via vision. These projects have two objective needed to be achieved in order to make this project successful:

I. To create shadow effect for a dented battery surface for image capturing and inspection of dented battery surface.
II. To design a vision system based on offline method.
III. To use vision to make the inspection for a defect dented battery from shadow image that been capture by camera.

1.4 Scope

To make this project successful, there are few thing that been focus as the scope of the project or the limitation of the project, there are:

I. Ring light system used as light source for a vision system to create shadow for a dented inspection
II. Used offline method to do inspection that occurs on the bottom surface of cylindrical battery types.
III. detect the dented that occur on the bottom of the cylindrical types battery at static position

CHAPTER 2

LITERATURE REVIEW

2.0 Introducton

This chapter discus about the inforamtion that been taken from previous research and the information about vision. In oder to complete this project an infromation or knowladge about vision are needed. In oder to peform a vision task there are three main component need to be study(SICK IVP 2006):

I. Camera.
II. Lighting source.
III. Processor.

The purpose of camera in a vision task is to capture or record the object or target that being inspect, in the other terms camera act as the eye of the system. The lighting source of the camera is the light source to aid the camera so that the camera can see the object or target that being inspect. The processor are the brain of the system, the processor will make the decision based on the programing that been set in the camera. A vision can perform one task or more than one task in each vision and it is part of machine vision. There are four categories or classification of machine vision which is measure, inspect, locate and identity. This chapter was complete using the k-chart as a reference and the flow to acquire the data are show in the k-chart below.

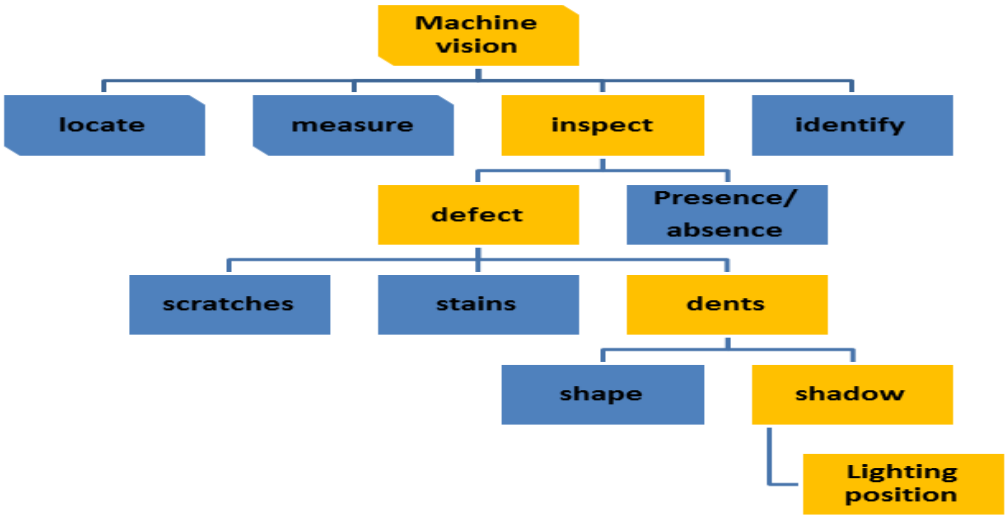

Figure 2.0 K-charts for machine vision

2.1 Machine Vision Flow Process

Machine vision can be categorize in 4 types, measure, locate, inspect and identify. All types of machine vision have same concept but can be applied in different application(SICK IVP 2006). The concept of machine vision system show in figure below:

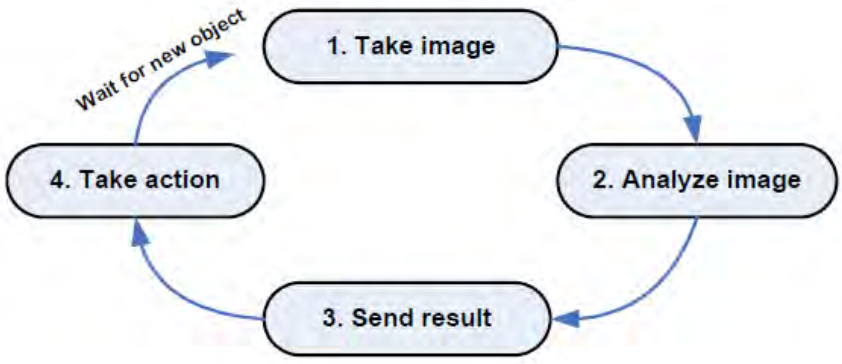

Figure 2.1: Basic concept of machine vision

As show in figure above, the basic concept or basic operation of machine vision there are 4 step(take image, analyse image, send result and take action) need to complete and this operation will repeat continuously until we stop the operation. In this project for a vision task to detect the dented that occur on the bottom surface of the battery the take image and analyse image are used.

2.1.1 Take Image.

In a machine vision, the imaging is the stage where the images of the target object were created. To get the high quality of image that been capture are the goal of this stage(SICK IVP 2006). to get the best quality image of target/object there are few thing need to be consider:

I. Field of view (FOV).
II. Working distance and resolution.
III. Depth of field (DOF).

The field of view (FOV) is the area or the part in which the camera can see the object or target, it's depends in the lens and the working distance between the camera and the target(Rosenfeld 1985). The working distance refer to the distance between the camera and the object being inspect and the resolution are the minimum feature size of the object under inspection(Rosenfeld 1985). The depth of field (DOF) is the sharpness of the image taken at certain distance depends on the camera ability, different camera will have different DOF(SICK IVP 2006).

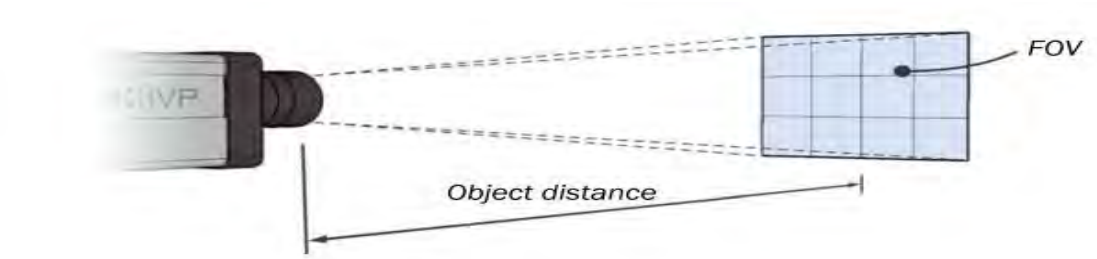

Figure 2.2: Field of distance

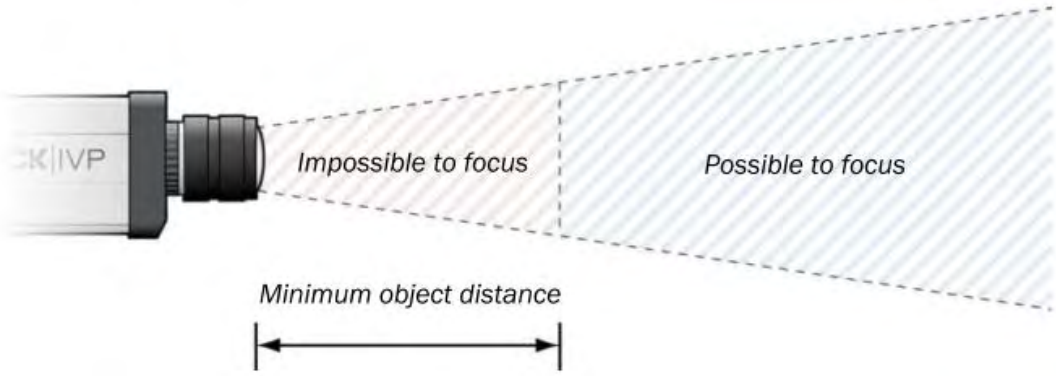

Figure 2.3: Depth of field.

2.1.2 Image Processing

Image processing can be divided into two types analog and digital(Rao 2006). Antilog image can be define as the alteration of image through electrical(Rao 2006) and the digital image is the processing of two-dimensional picture and the image of digital image is an array of real numbers represented by finites numbers by bits(Adelson & Anderson 1984) and it's is the most used in vision application. Image processing is the study of the algorithm that take the image as an input and the output also image that have been improve the visual quality of synthesized(Processing & January 2012). To perform image processing software is required to the task, there are plenty of software that can be used to perform this task for example MATLAB, LABVIWE and etc. In this project the software that will be used is MATLAB and other techniques that include in image processing are based on MATLAB software. Image processing

used 2D image or 3D image to as an input to perform image processing stage which will produce an images as an output(Processing & January 2012).

In a computer graphic, there are two types of computer graphic which is raster and vector. Raster is a rectangular small grid of pixel and each pixel is assigned its position(Gonzalez & Woods 2009) and colour in the image and the more the pixel the image will be more accurate(Inglot & Technology 2012). Vector graphical are not in form of pixel like raster but the image files size are smaller than the raster(Inglot & Technology 2012).

In image processing, to analyse the input or the image a method is required to do so. There are many types of method to analyse image and in this chapter, there are few of the method were cover there are:

I. Image processing.
II. Image segmentation.
III. Image analysis.

2.1.2.1 Image Enhancement

The aim of image processing is to enhance the visual appearance of the image and to improve the manipulation of dataset(Luboz & Dr F Bello (Dept. of Biosurgery) 2012). The image that produce directly using camera may have some issue within the pictures taken(Processing n.d.), to provide more suitable image for future analysis. This process also includes the magnification, scaling, reduction and noise removal(Rao 2006).

2.1.2.2 Image Segmentation

Image segmentation is where the unwanted area of the image such as background of the image are ignored in other terms image segmentation is where only the importance area of the image were taken for future analysis(Gao n.d.). The goal of image segmentation is to identifies separation

object within an images and find the boundaries between region within the images(Luboz & Dr F Bello (Dept. of Biosurgery) 2012). Thresholding technique are use in image segmentation(Rao 2006).

Threshold technique creates binary images from grey level one by truing all pixel below some threshold to zero and all pixel about the threshold to zero(Segmentation & The n.d.). In thresholding there are 2 types of algorithm used in thresholding the first one is local, local algorithm is a threshold surface that is function on the image domain(Kind n.d.). The other types of algorithm is global threshold, this algorithm is a single threshold for all the image pixel is used.(Unknown 2008)

Figure 2.4: Image with threshold technique.