TOMATO INSPECTION AND GRADING SYSTEM

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To my beloved mother, father and husband, thank you for the support and encouragement

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ABSTRACT

This paper work explains a technique for automatically detecting tomatoes skin surfaces in digital color images. The system relies on a two step process which first detects regions which are likely to contain tomatoes skin in the color images and then extracts information from these regions which might indicate the location of a tomato in the image. An inspection and grading system for tomato has been loaded image and after that the image through the brightness process. After the image from webcam already loaded into the system then the system will process the both images (captured and input) by reading the color in each of pixel images. The processes of the images in this system it needed to display the percentages value of color in order to classify of the tomato grade. Matlab and its image processing toolbox have been used in images processing and analysis.

ABSTRAK

Kertas kerja ini menerangkan bagaimana teknik untuk mengesan permukaan kulit tomato secara automatik di dalam gambar berwarna. Sistem yang di bangunkan ni memerlukan dua kaedah untuk memproses permukaan gambar tomato, yang pertama sistem ini akan mengesan bahagian tomato yang terkandung di dalam gambar berwarna dan seterusnya mengambil segala maklumat tentang bahagian tomato bagi membolehkan lokasi tomato di dalam gambar di paparkan. Sistem pemeriksaan dan penggredan tomato beroperasi dengan memuatturun gambar didalam sistem terlebih dahulu. Kemudian gambar ini akan melalui proses kecerahan warna supaya gambar ini sesuai dengan gambar yang dimuat turunkan melalui web kamera ke dalam sistem. Setelah kedua-dua gambar tersebut mempunyai kecerahan warna yang sama kemudian sistem ini akan memproses kedua-dua gambar tersebut dengan membaca kandungan warna gambar di dalam setiap piksel. Proses ini bertujuan untuk memaparkan peratusan warna yang diperolehi dalam mengklasifikasikan kualiti tomato. Matlab dan *digital images processing* di perlukan dalam menjayakan sistem ini.

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LIST OF ABREVIATIONS

GUI	Graphical User Interface
HSV	Hue Saturation Value
RGB	Red Green Blue

CHAPTER I

PROJECT OVERVIEW

Nowadays the food quality is not under control and it is difficult to find the best food quality. This system was created to specify the quality of specific product. Quality is commonly related with product and it is very important to satisfy the customer's desire. This project is focus on quality of food which has impact on our health. For this system, a tomato is used as the product that to be tested for food quality.

1.0 Introduction

This project is to develop an inspection and grading system for tomatoes. To create this project is needed a lot of tomato images as an input to the system and save the images into the computer. Other function of this project, it will able to process the images and classify to a specific grade of tomatoes. Webcam is used to capture the tomatoes skin surface and send the image to the system by user interface. System will only operate when it received the captured images then it will make a comparison between the saved image and captured image to be classify into the respective tomato grades.

Hence, system will make a comparison by calculating the color percentage through tomatoes skin surface image. System will have three types of tomatoes grade and those are Grade A, Grade B and Grade C. Grade A is the best quality of tomatoes where it have the majority of red and striking orange color skin, Grade B is a good quality where it have the majority of orange color while Grade C is a bad quality where it have the combination color of orange and brown. After the system verified the tomatoes skin color for each grade, the system will display both result of tomatoes image and type of grade on the screen.

1.1 Problem Statement

i. Unable to define the best quality of tomatoes by using normal human sight. This is because normal human sight is very limited compared to digital camera lenses focusing.

ii. Difficult to put the suitable prices of product without referring to any grades. The grades for any product are very important, so this system is created to give the best price for every customer's expenditure.

iii. The traditional grading system takes time to classify the grades of product. Basically traditional grading system is quite slow because it uses human energy to classify the product according to the grades.

1.2 Project Objectives

In order for the project to success and to be implemented, the following objectives have to be achieved:

i. To develop an inspection and grading system for tomato
ii. To process the image of tomato and classify a specific grade
iii. To create automatic system inspection to replace manual system inspection
iv. To produce a great system for sauce manufacturing

1.3 Scope of Work

Generally this project is divided into two parts, hardware and software part. The hardware part refers to the webcam where it is used to capture the skin surface of tomatoes. The software part refers to the system which can load a lot of images into the system as an input and then makes comparison between two images (input and captured) of tomatoes. The comparison based on color skin of tomatoes red and orange that represented by the Graphical User Interface. To build this system, the Matlab version 7.0.4 is used.

1.4 Project Applications

i. For hypermarket in order to put the suitable prices for their vegetarians and fruits product
ii. For vegetarian farm, to replace the human energy in other to select the best product
iii. This project is developed for quality control of food products
iv. Other application, this project is user friendly because can be utilized for other product

1.5 Methodology

The methodology for carrying out the project is represented in the form of a flow chart below. The figure 1.1 shows the flow of the entire project.

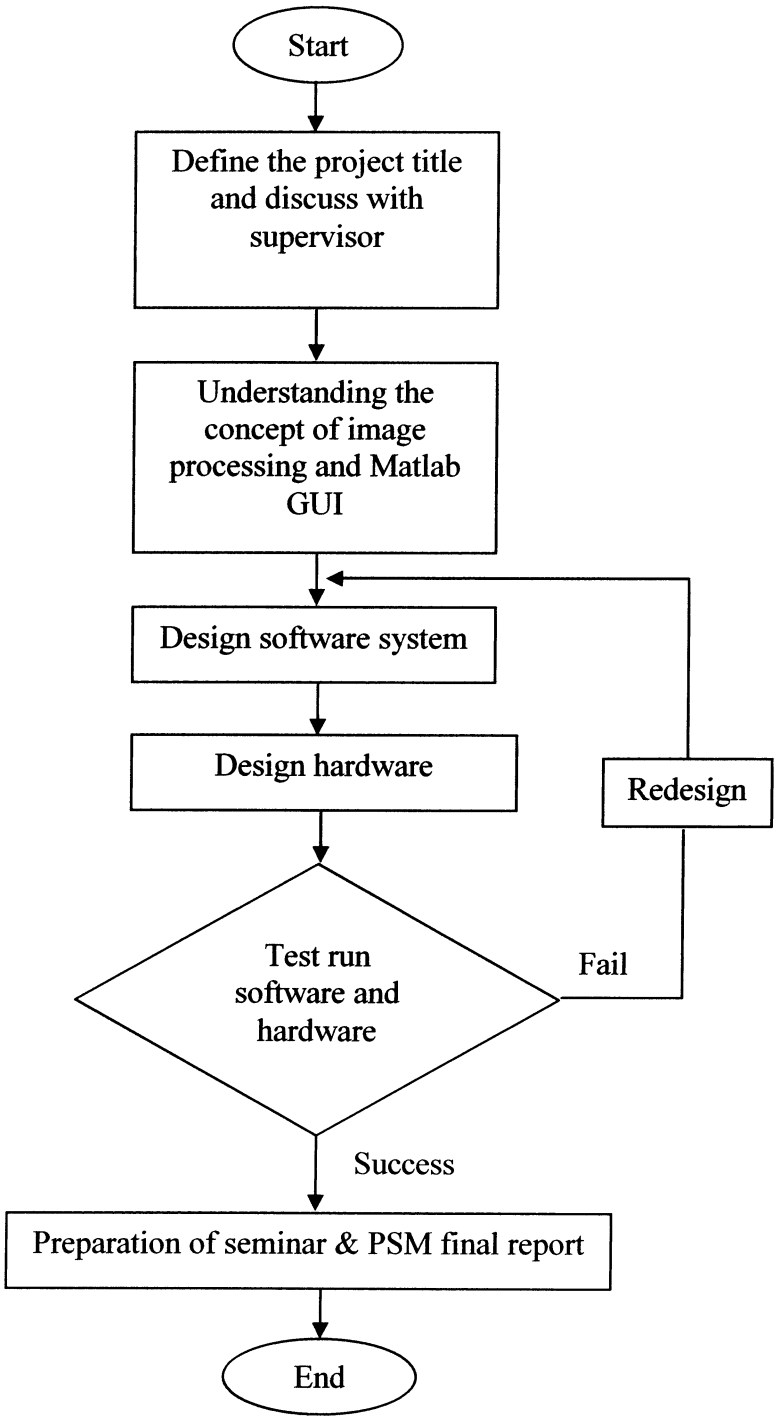

Figure 1.1 Flow chart of entire project

The explanation of the flow chart as below:

i. Define the project title and discuss with supervisor

After the project title was defined, the objective, problem statement, and work scope regarding the project are discussed with supervisor. During the discussion session, how the system will be operated and what software is need to be use are discussed.

ii. Understanding the concept image processing and Matlab GUI

To understanding the concept of image processing and Matlab GUI researches were carried out. The information was obtained from internet and books. Before design the software, the theoretical related with the project is understand first.

iii. Design software system

After all the information and material were obtained, the design of GUI for the system was developed and the program source code was written. The program source code in this system also consist calculation of percentage color of tomatoes skin.

iv. Design hardware system

In this system hardware refers to webcam, the webcam is used to capture the image of tomatoes.

v. Test run software and hardware

After the software ran successfully, the software and hardware will be integrated to test them whether running together or not.

vi. Redesign

If the system's running progress was failed, the program is debugging to repair the system. The program will be debugged starting from the GUI design until the end of flow chart process.

vii. Preparation of seminar and PSM final report

After the software and the hardware ran successfully, then the next step is to make preparation for seminar and final report Project Sarjana Muda (PSM) for submission.

1.6 Thesis Outline

This thesis is divided into 5 chapters to provide the understanding of the whole project.

The first chapter of this thesis will explain briefly about the project background, objectives to be achieved, problem statement and scope of work.

Chapter 2 describes about the literature review involved to gather information of the project in order to complete the whole project. This study is focused especially on all method used in this project.

Chapter 3 will explain about the project methodology approach taken and how the project is implemented to achieve the goal. The hardware and software technical details are also explained in this part.

Chapter 4 will display the output from the project which includes the simulation design and graphical user interface. This chapter will also discuss and analyze the overall project operation.

Chapter 5 will be the conclusion and suggestion to the project. The recommendation for the future project is explained in this chapter.

CHAPTER II

LITERATURE REVIEW

This chapter explains about theory and concept of the entire project. Literature review consists of explanation and review of the past projects that have been done. Besides that, this chapter is based on existing technologies and information that has been done in order to create a specific research about this project. It is mostly consists of the image processing tool which will be interfaced by Matlab Graphical User Interface (GUI).

2.1 First Review: Simulator for Digital Simulation Techniques

The purpose of this project is to design a simulator for digital modulation techniques. This simulator can display the outputs for ASK, FSK, PSK and MSK. The simulation built functioned as a platform for user to enter specific information (types of frequencies and types of modulations) that display the output automatically. This project can be an alternative program for user to run a digital simulation work effective and work efficient. This simulator was build with a Graphic User Interface (GUI) that helps users run the simulation easily. To make this project successful, another program must developed for purpose of data management because if users enter information into the program, the information will be read and the types of output will be display. When this project is complete, it can be use as a trainer for student such as Communication Principle and Digital Communication Principles.

2.2 Second Review: Face Detection in Color Images

This project presents a technique for automatically detecting human faces in digital color images. The system relies on two step processes which first detects regions which are likely to contain human skin in the color image and then extracts information from these regions which might indicate the location of a face in the image. The skin detection is performed using a skin filter which relies on color and texture information. The face detection is performed on a grayscale image containing only the detected skin areas. A combination of thresh holding and mathematical morphology are used to extract object features that would indicate the presence of a face.

In this project, a prototype algorithm for automating the detection of human faces in digital photographs was developed and can serve as an introduction for future work in detecting people in images. Several systems designed for the purpose of finding people or faces in images have already been proposed by numerous research groups. Some of these programs, such as the Rowley, Baluja, and Kanade system

developed at Carnegie Mellon, rely on training of a neural network and computing distance measures between training sets to detect a face.

Other software packages exist which can recognize facial features in pictures known to contain a human face somewhere in the image. This project focused on face detection in arbitrary color images and differs from the first type of system in that it relies on a combination of color and grayscale information. Additionally, it does not require the time consuming process of training a neural net or computing distance measures between every possible region in the image. The developed system also differs from those software packages that recognize facial features because, in this scenario, the task is to detect a facial region in an arbitrary image, and not to analyze images known to contain a face.

The process for detection of faces in this project was based on a two-step approach. First, the image is filtered so that only regions likely to contain human skin are marked. This filter was designed using basic mathematical and image processing functions in Matlab and was based on the skin filter designed for the Berkeley-Iowa Naked People Finder. Modifications to the filter algorithm were made to offer subjective improvement to the output. The second stage involves taking the marked skin regions and removing the darkest and brightest regions from the map. The removed regions have been shown through empirical tests to correspond to those regions in faces which are usually the eyes and eyebrows, nostrils, and mouth. By performing several basic image analysis techniques, the regions with "holes" created by the thresh holding can be considered likely to be faces. This second stage was a combination of Khoros visual programming and Matlab functions. The entire system was entirely automated and required no user intervention save for indicating the correct file names to be processed at each stage. While not implemented in this project, a more advanced program could implement a third step to discriminate between whole sizes and spatial relationships to make an even more robust detection system.