A STUDY ON ULTRASONIC WAVE TO ESTIMATE MANGO MATURITY STAGE

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To my late father,

To my beloved mother,

To my beloved brother,

All my friends, colleagues and relatives.

Thank you for their support and always standing behind me.

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ABSTRACT

This project present a study of non-destructive testing implementation in the agricultural industry to ease the farmers or other related bodies in estimating the mature stages of fruits before it harvested and ship out for market. The growth of technology needed in agricultural industry to simplify works, make it efficient and fast. This matter to avoid any time consuming, lake of harvesting knowledge and wrong stage of harvest than lead to fast rotten. The increase in the demand of fruits throughout the world makes a tense situation of fruits providers not just mango provider but also other type of fruits. Since demand increase an efficient way to harvest is important to avoid early mature fruit which by the time it reach consumer it rotten out. Ultrasonic technology is the efficient way to be implemented on fruits since it will not destroy the fruits wholly. Ultrasonic technique can be used to correlate different characteristic physiologically and chemically of fruits and it is not strictly to fruits but also can be tested on vegetables. The main parameter of ultrasonic that needs to be focus on was the attenuation coefficient which the absorption or scattering effect feels by the wave when it propagate through a medium. Therefore a study on ultrasonic is needed to help the growth of agricultural industry

ABSTRAK

Projek ini membentangkan kajian pelaksanaan ujian Tanpa Musnah dalam industri pertanian untuk memudahkan para petani atau badan-badan lain yang berkaitan dalam menganggarkan peringkat kematangan buah-buahan sebelum ia dituai dan eksport keluar untuk dipasarkan.Pertumbuhan teknologi yang diperlukan dalam industri pertanian untuk memudahkan kerja-kerja penuaian, menjadikan ia lebih cekap dan pantas. Hal ini untuk mengelakkan penggunaan masa yang terlalu lama, kurang pengetahuan musim atau keadaan yang salah peringkat tuaian boleh menyebabkan buah-buahan cepat busuk atau rosak.Peningkatan dalam permintaan buah-buahan di seluruh dunia membuat keadaan tegang dimana bukan sahaja pembekal pembekal Mangga tetapi juga pembekal buah-buahan.lain Cara yang berkesan adalah penting untuk mengelakkan buah-buahan matang awal sebelum ia sampai pada pengguna. Teknologi ultrasonik adalah cara yang berkesan untuk dilaksanakan pada buah-buahan kerana ia tidak akan memusnahkan buah-buahan. Teknik ultrasonik digunakan untuk mengaitkan ciri-ciri yang berbeza fisiologi dan kimia buah-buahan dan boleh diuji ke atas sayur-sayuran.Parameter utama ultrasonik yang perlu memberi tumpuan kepada adalah pekali pengecilan yang kesan penyerapan atau penyerakan rasa oleh gelombang apabila ia menyebarkan melalui media. Oleh itu satu kajian mengenai ultrasonik diperlukan untuk membantu pertumbuhan industri pertanian.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

A_0	-	Amplitude of the received signals
A	-	Amplitude of the transmitted signals
D	-	Distance between transmitter and receiver
DW	-	Dry weight
α	-	Attenuation coefficient
V	-	Voltage
Hz	-	Hertz
k	-	kilo
cm	-	centimeter
μ	-	micro
s	-	second
R_f	-	Feedback resistor
A_v	-	Voltage Gain
R	-	Correlations

CHAPTER 1

INTRODUCTION

1.1 An overview of ultrasonic measurement

In the agriculture industry there are many method have been develop to monitor and determine agriculture products quality. This industry is still on development mode in determining the best and reliable testing method for distinguishing product quality.

Fruits are part of agriculture products and are highly in demand by fresh market and food industry. Since it is a demanding industry a method is needed to monitor and determine the quality of supply fruits. People base their quality evaluation of fruit on combined sensory inputs from several of their senses and since human judgments are, in general, subjective, these evaluations are liable to be inconsistent and can lead to erroneous quality determination of the fruit. Thus there is an increased need for better quality monitoring.

For this project, mango was selected as product specimen since it is Malaysia local fruit. Easy to find mango since there are a lot of mango orchard. Highly demand by Malaysian, fresh market and industry. Mango is a tropical fruits and increasingly demands by global market therefore a massive supply of good quality mangoes are needed.

Maturity determinations of the fruits before picking and subsequent quality evaluation are important issues that affect the agriculture industry. The demand of high quality calls for reliable, rapid, non-destructive, and non-invasive technique for measuring some of the physical properties of the fruit, which develop as it matures and which are indicative of its quality (Mizrach, 2000). Maturity indicators in mango are softening of the flesh, decreased acidity, increased contents of sugars, soluble solids and total solids, and increased pigments (Mizrach, 2000).

Non destructive testing technique is not harmful to the mango, it provide real-time measurement, low in costing, and not time consuming.

1.2 Problem Statement

The old fashion harvesting was time consuming and involves lot of human labor. In accurate timing when determine maturity. When increasing in demand it is not a proper solution to overcome the demand, therefore a research and development in agriculture industry especially focusing on fruit quality growing.

Destructive testing method is not suitable to be implemented because it will ruin the fruits texture and skin. To overcome this problem a non-destructive testing method were introduce. Ultrasonic was chosen since only small amount of wave propagate through the small area that need to be tested. It is fast and cheap.

Most of the laboratory in Malaysia provide penetration test to determine the chemical properties of fruits. This laboratory request customer to sent tissue sample from specimen then will go through about 5 working days to get the results. Other than that each of the chemical testing are charge differently. So it is quite expensive just to know two or three chemical property in fruit tissues.

Most of the ultrasonic equipment is suitable for industrial usage not suitable for agriculture. Medical-imaging equipment can be use but still costly and the construction is big not suitable for agriculture usage.

1.3 Project Objective

The objectives of this project are:

1) A study on ultrasonic testing method suitability for agriculture sector
2) Distinguish category of mango based sweetness and acidity level during maturity process.
3) Investigate the effect of attenuation effect on mango.
4) Determine the relationship between acidity and sweetness with attenuation.
5) Setting up a reliable yet simple experiment to determine the mango maturity base on ultrasonic measurement.

1.4 Scope of Work

The scopes of this project are:

1) To study an ultrasonic testing method on mango fruits as one of the non – destructive testing method.
2) To study the relationship of ultrasonic property and mango fruits physiology composition.
3) Analysis focus on the effect of ultrasonic attenuation with various level of sugar and acidity content in mango fruits.
4) Destructive testing is used to collect data of sugar and acidity content of mango. This data will be used as reference.

1.5 Methodology

The approach that was applied in order to complete this project can be divided into several stages which are shown on the flow chart below.

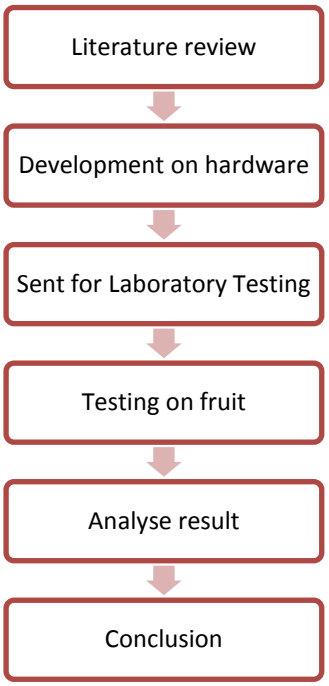

Figure 1.1: The flow chart of method to complete this project

1.6 Thesis Outline

Chapter 1 provides an explanation on the introduction of the project background. The explanation covers problem statement, objectives, scope of work, methodology and thesis outline

Chapter 2 describes the background study in general and explanations are base on the finding from journals, books and other sources which is used as references and guidelines.

Chapter 3 provides explanation about ultrasonic wave characteristic and property. Describe types of ultrasonic sensing mode and measurement method.

Chapter 4 describe the method were used in order to complete this project.

Chapter 5 provides Description of the hardware constructions and the circuits involve producing wanted ultrasonic wave.

Chapter 6 provides explanations by comparing the result from laboratory with the result from the developed hardware. Discussion on correlation between laboratory result and obtained result.

Chapter 7 provides explanations on conclusion of the finding obtain from the developed project and suggest or recommend other approach for future development system.

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