

**A STUDY ON FAST FOURIER TRANSFORM (FFT) AND ITS
IMPLEMENTATION IN IMAGE PROCESSING**

NOR ASHIKIN BINTI MOHAMAD KAMAL

**A THESIS SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF
BACHELOR OF SCIENCE (HONS.) IN INFORMATION TECHNOLOGY**

**FACULTY OF INFORMATION TECHNOLOGY
AND QUANTITATIVE SCIENCES
UNIVERSITI TEKNOLOGI MARA
SHAH ALAM**

2002

ACKNOWLEDGEMENT

In the name of ALLAH, Most Gracious, Most Merciful. Praise to ALLAH, the ONE and ONLY, for giving me strength to complete this thesis.

The contribution of many people was indispensable to complete my thesis. My sincere gratitude goes to Dr. Arsmah Hj. Ibrahim, my supervisor, for her support and encouragement, guidance and assistance. My special thank to En.Azlan bin Ismail who has helped me with the knowledge and skill in java programming.

I would like to extend my sincere thanks and gratitude to Pn. Noor Elaiza bt Abdul Khalid who had given me the encouragement to pursue this project in the area of image processing.

This thesis would never have appeared without the valuable help of my colleagues especially Rani Aris @ Azis. Thanks to all of you.

Finally, my heartfelt thanks go to my parents and my brother for everything. Their love and understanding always accompanied me during my study.

ABSTRACT

Image processing is not a new phenomenon. Computer-based image processing systems have become increasingly widespread over the past decades. Computers are used not only to collect information in a form of a digital image but also to improve the visual appearance of images to prepare images for the next processes. Techniques for the manipulation and enhancement of digital images have been practiced for over thirty years. Now, image processing has insinuated itself into many areas of human endeavor such as medical and astronomy.

This project is to study about Fast Fourier Transform method used in image processing. At the end of the research, an understanding of how this method is applied in image processing will be achieved. The report is based on secondary sources from the Internet, books, articles and magazines.

TABLE OF CONTENTS

	Page
DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	vi
CHAPTER I INTRODUCTION	
1.1 Background	1
1.2 Transformation	1
1.3 Problem Description	2
1.4 Project Description	2
1.5 Project Objectives	4
1.6 Project Scope	4
CHAPTER II LITERATURE REVIEW	
2.1 Introduction	5
2.2 A Historical Evolution	6
2.3 Applications of Image Processing	7
2.4 Background of Fast Fourier Transform (FFT)	9
2.5 FFT Applications in Image Processing	11
2.5.1 Image Signature Generation using FFT	11

2.5.2	Fourier Fingerprint Technique	12
-------	-------------------------------	----

CHAPTER III FAST FOURIER TRANSFORM

3.1	Preliminaries on Complex Numbers	13
3.2	Introduction to One-Dimensional Fourier Transform	14
3.3	Introduction to Two-Dimensional Fourier Transform	18
3.4	Discrete Fourier Transform (DFT)	19
3.4.1	One-Dimensional DFT	19
3.4.2	Two-Dimensional DFT	23
3.5	Fast Fourier Transform	37
3.5.1	Derivation of FFT	38
3.5.2	Successive Doubling	42
3.5.3	Reordering the FFT	44
3.6	Fourier Spectrum	48

CHAPTER IV RESULTS AND DISCUSSION

4.1	Introduction	63
4.2	Result	64

CHAPTER V CONCLUSION

5.1	Introduction	72
5.2	Limitation and Benefits	72
5.3	Recommendations for future works	74