

BIOMETRIC SYSTEM

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Tajuk Projek: BIOMETRIC SYSTEM

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To Mom and Dad

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ABSTRACT

This project is to develop a biometric system featuring iris as the main character in this system. Iris is chosen because of the uniqueness and its stability as a biometric trait. It might not be as popular as fingerprint trait, but it provides better accuracy and high security system. This project focuses on developing algorithm and uses MATLAB software as its main software to develop the system. MATLAB is a powerful software that provides image processing toolbox, and also high level programming methodology, suitable in developing this system. The iris recognition system started with image acquisition, followed by initializing process that includes iris segmentation and iris normalization. After initializing, recognition process took over with feature encoding process. The process returns iris template as the output. The final stage of this project is classification and training, which involves Local Binary Pattern (LBP) technique to classify the iris templates. Neural Network method will be used to train the images afterwards. The final output obtained will determine whether the iris image is authentic or vice versa.

ABSTRAK

Projek ini adalah untuk membangunkan satu sistem biometrik iris menampilkan iris sebagai ciri utama dalam sistem ini. Iris dipilih kerana keunikan dan kestabilannya sebagai sifat biometrik. Ia mungkin tidak popular seperti sistem biometric cap jari, namun iris mampu memberikan ketepatan yang lebih baik dan sistem keselamatan yang tinggi. Projek ini memberi tumpuan kepada membangunkan algoritma dan menggunakan perisian MATLAB sebagai perisian utama untuk membangunkan sistem. MATLAB adalah satu perisian berkuasa yang menyediakan pemprosesan imej toolbox , dan metodologi pengaturcaraan aras tinggi , sesuai dalam membangunkan sistem ini. Sistem pengiktirafan iris bermula dengan perolehan imej , diikuti dengan proses yang termasuk iris segmentasi dan iris normalisasi memulakan. Selepas Memulakan , proses pengiktirafan mengambil alih dengan proses pengekodan ciri. Proses ini menghasilkan templet iris sebagai output. Peringkat akhir projek ini adalah klasifikasi dan latihan, yang melibatkan teknik Corak Perduaan Tempatan (LBP) untuk mengklasifikasikan templet iris. Kaedah Rangkaian Neural akan digunakan untuk melatih imej selepas itu. Output akhir yang diperolehi akan menentukan sama ada imej iris tulen atau sebaliknya.

TABLE OF CONTENTS

PROJECT TITLE	i
ACKNOWLEDGEMENT	vi
ABSTRACT	vii
ABSTRAK	viii
TABLE OF CONTENTS	ix
LIST OF TABLES	xi
LIST OF FIGURES	xii
ABBREVIATION	xiv
APPENDICES	xv
CHAPTER I	1
INTRODUCTION	1
1.1 Project Background	1
1.2 Problem Statements	2
1.3 Objectives	3
1.4 Scope	4
1.5 Sustainable Development	4
1.6 Potential Commercialization	5
1.7 Project Outline	5

CHAPTER II	7
LITERATURE REVIEW	7
2.1 Biometrics Technology	7
2.2 Unimodal Biometric System	9
2.3 Iris Recognition System	11
CHAPTER III	13
METHODOLOGY	13
3.1 Project Flow	13
3.2 Biometric System Modules	15
3.3 Iris Recognition System	17
Chapter IV	18
RESULTS AND DISCUSSION	18
4.1 Image Acquisition	18
4.2 Image Pre-Processing	19
4.3 Feature Extraction and Encoding	25
4.4 Classification and Training	26
4.5 Analysis of data	31
4.6 Graphical User Interface (GUI)	36
CHAPTER V	39
CONCLUSION AND RECOMMENDATIONS	39
5.1 Recommendations for future work	39
5.2 Conclusion	42
REFERENCES	41
APPENDIX A	

LIST OF TABLES

Table 3.1	Gantt Chart for This Project	14
Table 4.1	The Results of Neural Network Training	32

LIST OF FIGURES

Figure 1.1	Airports and Corporate Building using Iris Recognition System	5
Figure 2.1	The Technology Illustrated From Biometric System	8
Figure 2.2	Multimodal Biometric System	10
Figure 2.3	Iris and pupil localization and the top left picture is the result of 2D Wavelet Demolution after encoding the phase sequence of iris pattern	11
Figure 3.1	The Flow Chart of The Biometric System Project	12
Figure 3.2	The Biometric System with MATLAB Toolbox	16
Figure 3.3	The Flow of Iris Recognition Algorithm	17
Figure 4.1	The examples of segmented eye image	20
Figure 4.2	Daugman's Rubber Sheet Model	21
Figure 4.3	The Examples of Whole Normalized Iris Image	22
Figure 4.4	Examples of noise images of iris from MMU database	23
Figure 4.5	The Normalized Region of An Iris	24

Figure 4.6	The Noise of The Normalized Region	24
Figure 4.7	The Iris Template After Feature Extraction	25
Figure 4.8	LBP Histogram For The Iris Image	27
Figure 4.9	Layer of Neural Network	28
Figure 4.10	Neural Network Training Tool GUI when the program is executed	29
Figure 4.11	Network Pattern Recognition Tool from Neural Network Toolbox	30
Figure 4.12	Examples of Eye Images from MMU Database	31
Figure 4.13	Specificity and Sensitivity Table	32
Figure 4.14	Test Outcome Positive for Output	35
Figure 4.15	The first part of the GUI	36
Figure 4.16	The second part of the GUI	37
Figure 4.17	The whole part of the GUI built in MATLAB	38
Figure 5.1	Various ways of Multimodal Biometric System	41
Figure 5.2	The general flow chart process of Multimodal Biometric System	42

ABBREVIATION

CASIA – Chinese Academy of Sciences – Institute of Automation

GUI – Graphical User Interface

LEI – Lions Eye Institute

LBP – Local Binary Pattern

MATLAB – Matrix Laboratory

SVM – Support Vector Machine

APPENDICES

A	Examples of Output from Neural Network Training	43
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CHAPTER I

INTRODUCTION

This chapter will explain generally about the project, which includes the background, problem statements, objectives and scope. Moreover, sustainable development and potential commercialization of this project also will be explained briefly to complete this chapter.

1.1 Project Background

Biometric system is a system that is designed to analyze and identify a physiological or behavioral characteristic and also measurable characteristics of a person. Measurable characteristics of a human are the things that can be counted or numbered such as weight. Physiological characteristics include eye color, fingerprint or DNA. While for behavioral characteristics examples are the way a person moves, walks or talks. The whole system includes not only virtual software program, but also external hardware devices.

A biometric system is classified into two types, which are Unimodal and Multimodal biometric system. Unimodal system depends solely on one trait or characteristic. On the other hand, Multimodal biometric system uses more than one trait in the system, which increases the accuracy of the system by providing higher percentage of accuracy.

Iris is one of the examples of reliable biometric traits. This trait, like any other traits are very unique and easily obtained. In addition to that, this trait is stable, which the data is obtained from one source only. The project is conducted by developing algorithm with MATLAB software as the platform. A reliable Biometric System is expected to be developed.

1.2 Problem Statements

There are 3 aspects covered in the report to state the problems regarding this project. Firstly, the problem statement is about the biometric technology. Secondly, there is a brief explanation about multimodal biometric system and lastly, the traits of iris.

1.2.1 Biometric

The original biometric system started from a thousand years ago when human tried recognizing faces for identity authentication. Only a few decades ago the automated biometric system is built up due to the advance in computer processing field. The reason why biometric is very useful in identity verification is because it used a very unique and exclusive for each identity. It is very useful these days especially in security business as an alternative method, compared with the traditional ones. For an example, in the Automated Teller Machine (ATM) system, cards are used as an excess device, which commonly are stolen or lost. However, when applying biometric system on the ATM, the problem can be overcome. This is because it is a system for personal and distinctive authentication, which depends only physiological traits of a person as an excess.

1.2.2 Unimodal

The biometric system is basically divided into two modes, which are Unimodal biometric system and Multimodal biometric system. In case of Unimodal biometric system the individual trait is used for recognition or identification. The system performs better under certain assumptions but fails when the biometric data available is noisy which makes the obtained image is harder to be processed. The system also fails in case of unavailability of biometric template. Thus in such a condition, multimodal biometric systems are used where more than one traits are measured and detected.

1.2.3 Traits of Iris

Among the available biometric traits some of the traits outperform others, nevertheless, every traits has their own advantages, which others does not have. The reliability of several biometrics traits is measured with the help of experimental results. Iris trait is very hard to be replicated, in addition to the uniqueness of the traits and its specific details of image; compared with face recognition – which might cause two person to have similar data i.e twins and, thus confusing the system. When combining both traits, the biometric system produced might becoming more reliable than ever.

1.3 Objectives

- To develop algorithm of iris detection
- To integrate developed algorithm with Graphical User Interface

1.4 Scope

The design of this Biometric System will cover iris detection using the toolbox of the MATLAB software in order to develop the algorithm. There are several steps in developing algorithm, which consists of two major processes, initializing process and recognizing process. The processes will be finalized with combination of them after the respective algorithm is tested successfully.

1.5 Sustainable Development

The idea of attaining projects or systems within limits of earth's natural resources based on aspects such as social, environmental, and economic is called sustainable development. In order to ensure the project is successful, from the beginning until the end of it, how it affects on environment and mother earth should not be neglected.

Biometric system of iris would promote sustainable development regarding increasing efficiency, improving service and accountability, also allowing third world countries especially, to build sophisticated identification systems in a relatively short period of time. Biometrics can also facilitate inclusion for certain groups, an exclusive and upgraded identifier that can replace the need for extensive documentation, which the poor often lack, in many cases [15]. For several examples,

- In Nigeria, introducing biometrics into the federal pension system eliminated nearly 40% of the beneficiary roll. This is not only increases efficiency and accountability, but has the potential to improve services (assuming the funds saved are redirected to other services).
- Bolivia was able to expand its voter roll to large section of the population previously absent from the political process.
- South Africa has been using biometric identification and electronic transfers and ATMs to distribute pensions and social grants for over 20 years.

- In Pakistan, an efficient national identification agency (NADRA) ensured transparent management of disaster relief funds by ensuring that only those affected by the 2010 floods received reconstruction payments through Visa cards.

1.6 Potential Commercialization

This project is considered successful when it can run smoothly and applied in the real world and provide better service than the previous situation as shown in Figure 1.1. This system proposed can be applied at maximum-security and 24/7 surveillance place such as:

- Airports
- Corporate Building
- ATM (Automated Teller Machine)



Figure 1.1: Airports and Corporate Building using Iris Recognition System

1.7 Project Outline

Starting with Chapter 1, the project is introduced to describe what the project is all about. Chapter 2 follows after to explain about the literature review from various sources. Sources are wide ranging from research journals, invited paper, books to the

internet website. Next is Chapter 3, which discusses about methodology of the project. How the project is going to be conducted is explained in this chapter. Also, the algorithm process and modules are going to be stated in this chapter too. Chapter 4 is all about results and discussions. All the outputs are stated and analyzed in this chapter. Lastly, Chapter 5, which concludes the report together with recommendations for future work.

CHAPTER II

LITERATURE REVIEW

This chapter includes the review about research or experiment that has been conducted regarding this project. The review take 3 aspects to be covered which are on biometrics technology, multimodal biometric system and also iris and hand vein recognition. All the sources are stated in the references section.

2.1 Biometrics Technology

Biometrics field is a very wide and well known in biomedical world that brings both life science and engineering aspects together in a system. Revising through biometric history, this system started as early as 5th Century when back in the day, the Egyptians differentiate physical characteristics of workers for fairly food distribution. Another example is much later during 19th Century when Scotland Yard became the first police organization to use fingerprint technology to identify criminals [1]. Those scenarios happened in the day during the non-existed computer time, which from observation were getting improved every time. Every research and studies are being conducted in order to

improve the system from time to time and all of different techniques are introduced to enhance the existing system.

Today's technology allows this system to be encoded in the software alongside the embedded hardware. Biometric system generally implies the similar process. Starts with biometric enrollment, follows with biometric verification and finally biometric identification. Biometric enrollment is a process of acquiring images of biometric data and stores all of it in a database, for it to be compared later. Biometric verification includes process of comparing the verification template to the enrollment template previously. After both the processes are successfully conducted, biometric identification take place. Identification process determines the identity by matching the image with the one stored in database before [2]. As the time goes by, the technology is getting more and more updated in every aspect such as performance, accuracy and precision that can be seen in Figure 2.1 for an example.



Figure 2.1: The Technology Illustrated From Biometric System

2.2 Unimodal Biometric System

Unimodal biometric system means only one trait involved. All the existed traits like fingerprints, hand, face, vein and others can be used and applied in the biometric system. All of these traits are unique and it could not be forged or copied anywhere else, and the main reason for the acceptance of the biometrics as a tool for security is its universality, distinctiveness, permanence and collectability [14]. Main issues to be considered when implementing a biometric system is performance and acceptability. Unimodal biometric system can provides a great performance in execution time, since it only requires one trait to be processed.

However, narrow down the scope of the system as a verification tool, the limitation of one biometric is explained. Several issues are raised such as intra-class variations, distinctiveness ability and noise in sensed data. These limitations are said to carry to high false acceptance rate (FAR) and false rejection rate (FRR) [3]. False acceptance rate in simpler term means the probability of an impostor being accepted as a genuine individual while false rejection rate is a probability of a genuine individual being rejected as an impostor. Apparently, multimodal biometric system provides solutions to overcome this problem, apart from providing higher accuracy and higher protection from spoofing, it may however be a little more complicated.

Multimodal biometric system on the other hand requires more than one trait to be combined as shown in Figure 2.2. This kind of system applies more processes and more complicated algorithm since it may need a different kind of algorithm for each trait involved, and also in the combination process. The process of combination is known as fusion process. The traits can be fused at few different possible level of fusion which are at the sensor level, at the feature extraction level, at the matching score level and also at the decision level [3].