

FINGER VEIN VERIFICATION

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Bachelor of Engineering with Honours
(Electronics and Computer Engineering)
2009

UNIVERSITI MALAYSIA SARAWAK

BORANG PENGESAHAN STATUS TESIS

R13a

Judul: FINGER VEIN VERIFICATION

SESI PENGAJIAN: 2008/2009

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FINGER VEIN VERIFICATION

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Thesis is submitted to
Faculty of Engineering, Universiti Malaysia Sarawak
in partial fulfillment of the requirements
for the degree of Bachelor of Engineering
with Honours (Electronic and Computer Engineering) 2009

Dedicated to my beloved parent

ACKNOWLEDGEMENT

Initially, the author would like to express her sincere appreciation and gratitude to her project supervisor, Mr. Tengku Mohd Afendi Zulcaffle for his guidance and support in accomplishing the project.

Likewise, the author would be very pleased to extend her appreciation to Dr. Bakhtiar Affendi Rosdi from University of Science Malaysia, Penang for giving such previous database that enable the project to be conducted successfully.

The author would also like to express her earnest appreciation to her parent and siblings for their unwavering love and support. At the same time, the author would like to dedicate a special thanks to all her friends for their constant encouragements.

Last but not least, the author would like to acknowledge the assistance and help of her seniors, Kak Siti and brother Lai in completing the project.

ABSTRAK

Pada masa kini, sistem biometrik digemari ramai kerana peringkat keselamatannya yang tinggi dapat mengurangkan penipuan, pencerobohan dan peniruan. Sistem biometrik menggunakan ciri-ciri fisiologi dan karakteristik kelakuan seseorang seperti muka, cap jari, iris, tulisan, suara, tandatangan dan sebagainya. Dewasa ini, antara ciri biologi yang digunakan sebagai sistem biometrik adalah urat jari. Urat jari memiliki kekuatan, kestabilan dan yang paling pentingnya ia amat unik bagi setiap individu. Oleh yang demikian, fungsi ini menawarkan tahap keselamatan yang tinggi kerana sebarang penipuan tidak dapat dilakukan dengan mudah. Projek mengesahkan urat jari ini dapat mengesahkan urat jari identiti seseorang berdasarkan corak urat seseorang. Secara umumnya, imej-imej urat jari tersebut akan diproses terdahulu dan satu rangkaian neural akan dikembangkan untuk mengesahkan imej urat jari. Prestasi pengesahan urat jari ini akan dinilai. Secara keseluruhannya, projek ini telah mencapai kejituan sebanyak 82.86%.

ABSTRACT

At present, biometric system is well-liked as its high security level manage to reduce frauds, intrudes and forgeries. A biometric system utilizes physiological features and behavior characteristics of an individual such as face, finger mark, iris, handwriting, voice, signature and others. One of the recent biology feature used as biometric system is the finger vein. The vein features are robust, stable and most importantly unique for every individual. This trait offers a higher security because forgery is extremely difficult. The finger vein verification project verifies a person's identity based on the vein patterns. Generally, the finger vein images are pre-processed and a neural network algorithm is developed to verify the finger vein images. Last but not least, the performance of the finger vein verification is evaluated. The project achieved an overall accuracy of 82.86%.

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LIST OF ABBREVIATIONS

| | | |
|--------|---|----------------------|
| CSV | - | Comma Separate Value |
| MATLAB | - | Matrix Laboratory |
| RGB | - | Red Green Blue |
| ROI | - | Region of Interest |

CHAPTER 1

INTRODUCTION

1.1 Background

According to [21], rapid developments of science and information technology lead to a major security problem that needs an immediate solution. Basically, there are two types of traditional identity recognition. The first technique is based on the contents, such as code, password and others. There are possibilities for the codes and passwords to be forgotten. While, the second technique is based on items, such as certificate, key, smart card and many more. The certificate, key and smart card are more prone to be forged, stolen or lost. Furthermore, both of these methods can be abused and easily intruded.

Hence, it gives rises to the identity recognition based on biology features. It utilizes inherent physiological features and behavior characteristics of an individual. Examples of physiological features are face, finger mark, iris, vein and so on. Some examples of behavior characteristics are like handwriting, voice, signature and others.

Vein pattern is defined as the vast network of blood vessels underneath the skin of a particular part of a human body. Veins features are robust, stable and largely hidden patterns. Vein biometric systems work on the fact that everyone has distinct vein patterns. In addition, vein patterns are not easily observed, damaged, or changed. Finger vein verification is a biometric approach to verify an individual's identity by recognizing the pattern of blood veins in the finger. The applications of finger vein authentication and future developments are shown in Figure 1.1.

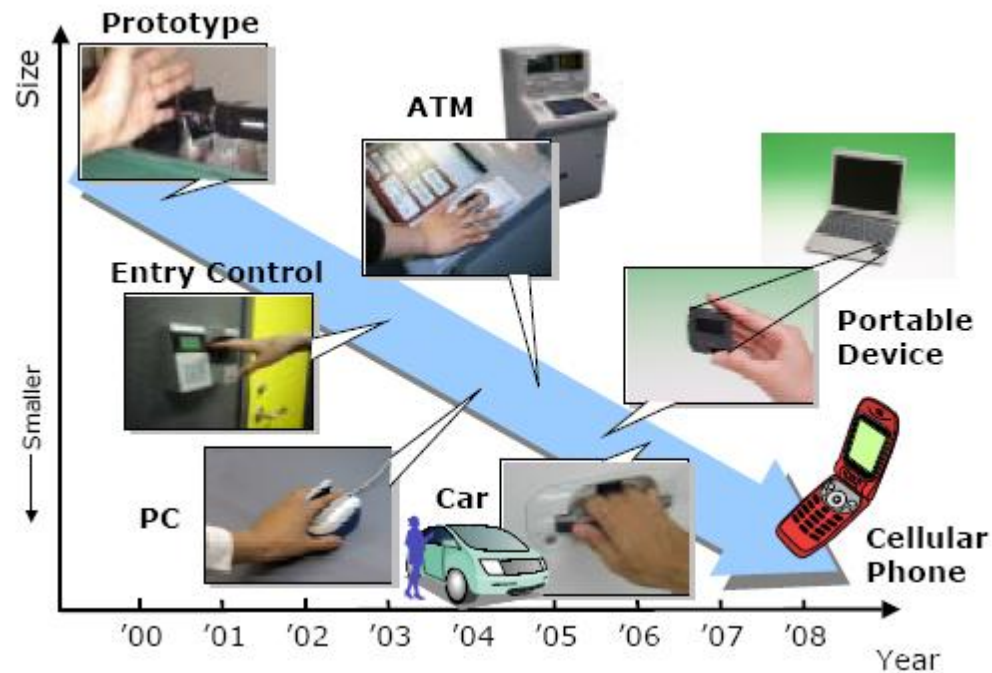


Figure 1.1 Applications of finger vein authentication and future developments. [7]

1.2 Problem Statement

Generally, security has become a popular issue as the growth of computer and network technology increases. This is due to the great security demand for person goods, in-house network, building passage, internet and electronic commerce. Thus, the requirement for a better and more reliable method for identity authentication becomes more significant. Biometrics can provide a better solution to reduce these security problems. [20]

As stated in [20], there are more possibilities for the identity cards to be lost or the passwords can be forgotten. These problems can be overcome by using an individual's biology features such as face, finger mark, palm print and veins. In comparison, the finger mark recognition, face recognition, iris recognition, palm shape recognition and gait recognition have lower assurance coefficients. A relatively mature, reliable, non-disturbing and more convenient biometric technique by using the finger mark. But, this finger mark methods have some drawbacks:

- There are less finger mark features for some people or some colony can't meet the demands of building record.
- The crime finger mark databank in the automatic finger mark identifying system is so widely used by the global judicial practice that people have wariness with it.
- By using finger mark, the user's finger mark pattern is left in the finger mark collector, and these patterns can be used to copy finger mark.

The finger vein identifying system is more efficient and can solve many difficulties faced by traditional biometrics method. Compared to finger mark, the finger vein has more advantages which are emphasized in [20] such as:

- Universality and uniqueness. The vein images are different for all human. Plus, the vein images are not influenced by the increase of ages.
- The vein lies inside human body. Thus, the finger vein recognition has no effects on body health.
- It is difficult to forge or change the vein feature of an individual.
- The epidermis status does not have any effects on the finger vein.

1.3 Motivation

The characteristics of the finger vein which makes the user authentication more secure are the uniqueness, stability and its tolerance to forgery. The number of veins, their position and the points at which they cross are not the same for everyone. Even identical twins have different vein patterns. Finger veins are never influenced by aging, skin discoloration or time which means the vein pattern remains as it was. Furthermore, the finger veins are invisible and internal to the body, so it is difficult for intruders to forge them. Thereby, the finger veins are proved to be more reliable and enabling a very high level of security. This finger vein biometrics will gain public's attention due to its high accuracy, response timing, contact-less and non-intrusive technology.

1.4 Project Overview

Finger vein is a very unique and stable biology characteristic that has a huge potential to be used in user identifications as compared to other biology characteristics like finger print, iris, palm print, face and so forth. Finger vein verification is a process of verifying an individual's finger vein by matching the person's finger vein with the templates stored in database.

This project involves the application of digital image processing to pre-process the finger vein images. The software used for the project is Matrix Laboratory (MATLAB[®]). An algorithm is created for finger vein verification using neural network. Specifically, the supervised backpropagation neural network is implied in this project. The project is divided into two main phases, training the images and finger vein verification.

1.5 Project Objectives

The objectives of the project are:

- i. To apply digital image processing methods to pre-process the finger vein images.
- ii. Develop an algorithm to match and verify the finger vein images with the stored images using neural network.

1.6 Project Outlines

Chapter 1 is generally an introduction to the project. In the background section, a general explanation on biometric systems is presented. Problem statement is section where the drawbacks of current biometric systems are discussed. Meanwhile, the motivation section suggested a better biometric solution using finger vein. Also, this chapter contains project overview, project objectives and project outlines. In the project overview, it briefly describes about the finger vein verification project. The project objectives are the aims of doing this project and they are successfully achieved at the end of the project. Furthermore, the project outline provides information which is delivered via the separate chapters.

Chapter 2 gathers all the information needed to accomplish the project. This chapter emphasizes on past researches and studies done by other researchers or engineers which is related to the project. The chapter begins with some details regarding vascular biometrics and biometrics verification. Next, the digital image processing methods that are used for image pre-processing are discussed. Lastly, a brief introduction about artificial neural network and its descriptions are given.

Chapter 3 begins with a brief explanation of image database for the project. This is followed by detailed flow charts for the developed project. The next sub-topic discussed on the methods used to process, pre-filter as well as to extract features of the finger vein images. Finally, the patterns matching procedures are elaborated. Some related neural networks information is explained in order to understand the developed algorithm. The overall methods of finger vein verification process are discussed in very detail in this chapter.

In chapter 4, all the important results obtained are shown and explained in well manner. Related data, plots and graphs are inserted into this chapter to justify the obtained results. The results are translated into an inclusive conclusion. The analysis section emphasizes on analyzing the images, factors that affects the image matching and verification process. All the problems faced in the project that resists from getting the expected results are also discussed in this chapter. The overall results and performance are indicated.

The chapter 5 concludes the overall objectives and targets that are achieved. The finger vein verification's project limitations are elaborated. Furthermore, some useful recommendations are given for future works.

1.7 Summary

Biometric system is very useful as it employs biology features of an individual. Finger vein features are one of the good biological characteristic that is stable and distinct for everybody. Thus, it can ensure a higher security of the developed system. Compare to other biological traits such as finger mark, finger vein provides more advantages in terms of their uniqueness. Therefore, it strictly disallows frauds and intrudes into its system. Finger vein verification verifies an individual's finger vein by comparing and matching the person's finger vein with the stored templates. The objectives of the project are to apply digital image processing methods to pre-process the finger vein images and to develop an algorithm to match and verify the finger vein images with the stored images using neural network. Last but not least, an outline of the structures of the following chapters is provided.