"I/We admit that I have read this thesis and in my/our opinion this thesis is adequate from the scope and quality for awarding the Bachelor Degree Of Electronic Engineering (Industrial Electronic)"

Signature : .....

Name MISS FAUZIYAH BT SALLEHUDDIN

Date : 31/03/05

salinan fakulti

THE ELECTRONIC LOCK USING SIGNATURE RECOGNITION BY NEURAL NETWORK

ROSIELAWATI BT ZAWAWI

This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor Degree Of Electronic Engineering (Industrial Electronic)

Faculty Of Electronic And Computer Engineering
Kolej Universiti Teknikal Kebangsaan Malaysia

MARCH 2005

DECLARATION

"I, hereby declare that this thesis entitled, The Electronic Lock using Signature Recognition by Neural Network is a result of my own research idea except for works that have been cited clearly in the references."

Signature : .....

Name : ROSIELAWATI BT ZAWAWI

Date : 31 MARCH 2005

Special dedication to my loving mom Puan Hajjah Zawiah Mohd Makkhtar, my late father allahyarham Haji Zawawi Bin Ismail, all my siblings, my kind hearted supervisor Miss Fauziyah Bt Sallehuddin, and my dearest friends.

Special dedication to my loving mom Puan Hajjah Zawiah Mohd Makkhtar, my late father allahyarham Haji Zawawi Bin Ismail, all my siblings, my kind hearted supervisor Miss Fauziyah Bt Sallehuddin, and my dearest friends.

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to my supervisor, Miss Fauziyah bt Sallehuddin, for her assistance and guidance towards the progress of this thesis project. Throughout the year, Miss Fauziyah has been patiently monitoring my progress and guided me in the right direction and offering encouragement. Obviously the progress I had now will be uncertain without her assistance. Special thanks must also go to Mr Redzuan Abdul Manap, lecturer of Faculty of Electronic Engineering and Computer Engineering for his advice and help on the software development.

My special appreciation and thanks to my best friend Norhaslina, Mohd Fauzy, Hazli Rafis, Intan Bazliah and Norlizah for their invaluable assistances towards this thesis project. Most of all, I am very grateful to my family especially my dearest mom, Puan Hajjah Zawiah bt Mohd Makhtar and all of my siblings for their unfailing encouragement and financial support they have given me over the years. Not forgetten my late father, Allahyarham Haji Zawawi bin Ismail, may Allah bless him always.

ABSTRACT

The Electronic Lock using Signature Recognition by Neural Network is a process of verifying the writer's identity by using signature recognition as a key to the electronic lock. This project highlights the development of signature recognition system using MATLAB to recognize the input signature from the stored samples in bit-map file. The signature data will record by using the digitizing tablet and will be sent to a recognizer that will check the similarity of the writer's signature. The signature then will go through the pre-processing process and comparison process to differentiate the data signatures. In this system, the back propagation neural network algorithm in MATLAB Toolbox is used which is able to identify all the signatures stored in bit-map file. The neural network is trained to learn and identify whether the signature is genuine or forgery.

ABSTRAK

Projek *Electronic Lock using Signature Recognition by Neural Network* adalah satu proses mengenalpasti tandatangan sebagai kunci kepada kekunci elektronik. Projek ini mengetengahkan pembangunan sistem pengenalan tandatangan menggunakan MATLAB 5.3 untuk mengenalpasti tandatangan masukan daripada contoh-contoh tandatangan yang disimpan di dalam fail *bit map*. Data tandatangan akan direkodkan dengan menggunakan *digitizing tablet* (proses *data capture*) dan akan dihantar ke *recognizer* yang akan memeriksa persamaan tandatangan penulis. Tandatangan akan melalui proses *pre-processing* dan *comparison process* untuk membezakan tandatangan. Dalam sistem ini, algoritma *backpropagation neural network* di dalam *Toolbox MATLAB* digunakan untuk mengenalpasti semua tandatangan yang disimpan di dalam fail *bit-map*. *Neural Network* ini akan dilatih untuk memahami dan mengenalpasti tandatangan sama ada tandatangan tersebut adalah yang asal atau yang palsu.

CONTENT

LIST OF TABLE

LIST OF FIGURE

CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

Nowadays, there are many types of human biometrics features that are being explored and developed today. There are including fingerprint recognition, iris recognition, retinal recognition, hand geometry, *signature recognition*, voice authentication, keystroke dynamic identification, facial feature identification, body odor identification, and ear identification. Biometrics consists of measurable physiological and/or behavioral characteristics that can verify the identity of an individual. This biometrics is used for identification and security purpose. Biometrics offers greater security and convenience than traditional methods of personal recognition. In some applications, biometrics can replace or supplement the existing technology.

The Electronic Lock Using Signature Recognition By Neural Network is a process of verifying the writer's identity by using signature recognition as a key to the electronic lock. In this project the biometric used is the signature recognition which requires the use of Digitizing Tablet contains stylus (pen) and tablet plate.

1.2 OBJECTIVE

The objectives are:

i. To develop software to recognize signature for personnel identification by using MATLAB.
ii. To gain knowledge about the MATLAB software.
iii. Study the comparison method by using neural network toolbox in MATLAB.
iv. Study the process of the electronic lock using signature recognition by neural network.

1.3 SCOPE OF THE PROJECT

The scope of this project is to developed software to recognize signature for personnel identification by using MATLAB. The signature is used as the key to the electronic lock. The signature data recorded with an electronic tablet or digitizer will be sent to a recognizer that will check the similarity of the customer's signature. This system is using a simple multi layer neural network trained with the back propagation for comparing the signature. Processing of the image that appears on the screen will carry out by adopting histogram data. The histogram data is needed as an input to neural network toolbox in the case of signature recognition. The neural network trained to learn and identify whether the signature is either forgery or genuine.

1.4 PROBLEM STATEMENT

Nowadays, many of the applications for identification authentication use a smart card, look like a credit card and contain circuitry that encodes personal information and handles password protection. When inserted into a specially equipped computer, the smart card can identify the user identity. However, the main problem with smart card is that, as with the private encryption keys, subject to thefts. The electronic lock using signature recognition by neural network is chosen to overcome this problem. Biometrics electronic recognition of personal characteristics as signature recognition provides another approach to authentication. User can forget or lose password, encryption key or smart card, but no one can steal the signature.

Dynamic signature recognition is one biometric strategy. The technique is far sophisticated than a simple analysis of a finished signature. As a person signs on a pressure-sensitive tablet, the software records the character shape, writing speed, stroke holder, off-tablet motion, pen pressure and timing. These characteristics uniquely identify a person and cannot be mimicked or stolen.

In this project, the user will sign on the tablets by using pen (also called stylus). The signature is then processed by the neural network in the MATLAB software to recognize the user signature whether it is genuine or forgery. Once the signature is recognized as the genuine one, the electronic lock will open. If it is forgery, the electronic lock will never be open. Additionally, this electronic lock using signature recognition by neural network system can be used for identification purpose involving security access systems in management information service departments, government agencies, ATMs or banks and others.

1.5 THESIS OUTLINE

This thesis represent by five chapters. The following is the outline of the electronic lock using signature recognition project in chapter by chapter.

Chapter I : This chapter discuss about the brief overview about the project such as introduction, objectives, problem statement and scope of the project.

Chapter II : This chapter describes about the research and information about the project.

Every facts and information which found through journals or other references will be compared and the better methods have been chosen for the project. The literature review and the software development of the project which is used a backpropagation neural network MATLAB 5.3 with the aid of Paint Tool also available in this chapter.

Chapter III : This chapter discuss about the project methodology used in this project such as data capture, pre-processing and comparison process. All these methodology should be followed for a better performance.

Chapter IV : This chapter describes about the project findings such as result and analysis

of the electronic lock using signature recognition. The result is presented by tables, graphs and figures.

Chapter V : Discussion and conclusion achieved in this project.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

For thousands of years, human used body characteristics such as face, voice, gait, and so on to recognize each other. In the mid 19th century, Alphonse Bertillon, chief of the criminal identification division of police department in Paris developed and practiced the idea of using various body measurement (for example, height, length of arms, feet and fingers) to identify criminal [1]. Today, however, many civilian and private-sector applications are increasingly using biometrics to establish personal recognition.

For the time being, there are many types of human biometrics features that are being explored and developed today. There are including fingerprint recognition, iris recognition, retinal recognition, hand geometry, *signature recognition*, voice authentication, keystroke dynamic identification, facial feature identification, body odor identification, and ear identification. Biometrics consists of measurable

physiological and/or behavioral characteristics that can verify the identity of an individual. This biometrics is used for identification and security purpose.

Among many possible biometrics schemes, such as fingerprint iris and palm print, signature can be easily obtained and the device is relatively cheaper. Signatures are one of the most popular and reliable biometrics features for verifying a person's identification. With the natural time, speed, pen pressure and inclination features which are never forgot and difficult to be stolen, signature recognition has therefore obvious advantages in the network personal identification. The signature recognition is the process of verifying the writer's identity by checking the signature against samples kept in a database. The result of this process is usually a number between 0 and 1 which represents a fit ratio (1 for match and 0 for mismatch).

Its prevalent usage demands that security be provided to prevent forgery. Signatures form a special class of handwriting in which legible letters or words may not be exhibited [3]. So many efforts have been made to develop computational system that able to recognize and to verify signatures. In signature verification, the system aims to authenticate a user signature that is, to determine if a user is who it claims to be. It is simpler problem than recognize signatures, in which the system analyses the entire database searching users who have similar signature to the one given as input, and offers a list of likely users in descending order of similarity.

Signature classification systems can be divided in two groups: on-line and off-line. In the first one, signatures are obtained though an electronic device in which the user signs. Under these conditions, dynamic information likes speed of writing and pressure can be extracted. In off-line system, the signatures are captured from documents using a scanner or a video camera.

For many past years, many scientists have tried to solve the problem and several signature recognition systems, both on-line and off-line have been proposed.

N. Papamarkos proposed off-line signature recognition system, which is based on multiple neural network structure in combinations with tree powerfully, features set [6]. They used three different sets of features, each describing a different aspect of the signature: global features, grid information features and texture features.

Meanwhile, Jean Pierre Drouhard, Robert Sabourin and Mario Godbout introduced an Evaluation of a Training Method and of Various Rejection Criteria for Neural Network Classifier used for Off-line signature verification [8]. This paper addresses the problem related to the design of a neural network classifier used in the first stage of an Automatic Handwritten Signature Verification System (AHSVS). This project used the directional Probability Density Function (PDF) as a global shape vector, and its discriminating power was enhanced by a pretreatment.

Bin Li, Kuan-Quan Wang, and David Zhang proposed a low cost on-line signature verification method based on matching of curves about x-axis and y-axis attaching some dynamic features [4]. Just as human being's behavior, different local weight and unfixed threshold are introduced to improve the performances of the signature verification systems. This journal also presents some applications of on-line signature verification in ATM, on site credit card verification and Internet E-Commerce.

Signature verification is a pattern recognition problem. More specifically it is a two-pattern classification or a hypothesis testing problem. To overcome this problem, Lee Luan Lee addressed neural network on-line verification using a function feature: Bayers Multilayer Perceptrons (BMP), Time Delay Neural Network (TDNN), and Input-Oriented Neural Network (IONN) [11]. A signature is input as a sequence of instantaneous absolute velocity | v(t) | extracted from pair of spatial coordinate time functions(x(t),y(t)). The BMP provides the lowest misclassification error rate among three types of networks.

Yingyong Qi used Multiresolution approach to the signature verification problem [19]. The top-level representation of signature obtained by using wavelet transformation was the global geometric features. The disadvantage of global method is degraded rapidly when significant distortion and style variations are presented. Obviously, the on-line system works well than off lines systems. It is because the classifier of the on line systems has an additional dimension, being able to capture signature characteristics that are inaccessible, or only partially accessible, to off line systems. By the other hand, the on-line systems is not able to recognize a made signature (its needs the signer) and the electronic equipment needed is more expensive that of off line systems (just a scanner). In order to use the cheaper off-line system and alleviate their drawbacks, Jose L. Camino proposed a new parameterization method of scanned signatures [19] [9].

Besides, Mihai Costin Manalescu refers to a signature recognition algorithm based on a new feature extraction method [12]. This low complexity algorithm can be run effectively on low-end hardware (8 bit microprocessors) and requires under 400 bytes for each signature representation. The recognition algorithm is based on a neural networks with about 350 nodes and which can be trained with 4-10 signature samples. Experimental results indicate a score above 0.9 for genuine signatures and below 0.7 for forgeries.

The paper by Iwata [7] proposed a method using Learning Vector Quantization (LVQ) network with self organizing learning algorithm for roughly classifying input data. Even this method does not clarify which features of characters are important for the recognition. Meanwhile, Shiregeru Watanabe, Takeshi Furuhashi, Kenzo Obata and Yoshiki Uchikawa proposed a fuzzy net which can extract personal characteristics from the connection weights of trained network [16] [17].

As for W.L. Chan's paper analyses the fundamental differences between patterns of power harmonics generated by various common loads [18]. A method to