DEVELOPING A FACE RECOGNITION SOFTWARE

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

April 2008

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek	:	**DEVELOPING A FACE RECOGNITION SOFTWARE**
Sesi Pengajian	:	**2007 / 2008**

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Special dedicated to my beloved parents, family and fellow friends, who had strongly encouraged, inspired and supported me in my entire journey of learning…

ACKNOWLEDGEMENT

First of all, I would like to thank Allah the Mighty, which with his bless, I manage to complete this thesis. I would like to thank all the people who helped to make this project a reality, especially my supervisor Miss Syafeeza Binti Ahmad Radzi who shares her times, attention and knowledge to make sure my project is done properly for PSM. Then I would like to express my appreciation to my parent, who gave full executive support to the whole project. I also would like to express my appreciation to my friends, who share their knowledge to this project. Thanks.

ABSTRACT

Nowadays, face recognition and authentication has become important in the homeland security. Face identification and recognition are classic problems of computer vision. By developing a PC-based face recognition system, the sufficient reliability is at lower cost. Face recognition is almost certainly one of the most non-intrusive and user-friendly biometric authentication methods currently available. This project describes an approach in developing a face recognition program using Vector Quantization Histogram technique with LabVIEW programming language and NI Vision Development Module. Face images from the well-known ORL Face Database, for both database training and real-time recognition will be used.

ABSTRAK

Dalam dunia yang serba maju kini, pengenalan identiti melalui bentuk muka telah menjadi begitu popular serta penting dalam sistem penggera bunyi rumah. Pengenalan identiti melalui bentuk muka adalah masalah klasik dalam penglihatan komputer. Dengan menggunakan sistem PC asas pengiktirafan muka, telah memadai kerana ia adalah salah satu perisian yang murah berbanding perisian lain. Pengiktirafan muka adalah salah satu kaedah yang selamat dan amat senang untuk dikendalikan berbanding kaedah-kaedah lain yang ada di pasaran. Projek ini membincangkan pangiktirafan bentuk muka melalui teknik 'vector quantization histogram' dengan menggunakan program LabVIEW dan NI Vision Development Module. Bentuk muka daripada pangkalan data ORL, akan digunakan.

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ABBREVIATION

PIN	-	Personal Identification Number
ATM	-	Automated Teller Machine
ID	-	Identification
PC	-	Personal Computer
KLT	-	Karhunen Loeve Transform
PCA	-	Principal Component Analysis
ORL	-	X
FLD	-	X
LDA	-	Linear Discriminant Analysis
SOM	-	Self-Organization Map
VQ	-	Vector Quantization
RGB	-	Red Green Blue
TSVQ	-	Tree Structured Vector Quantization
LBG	-	Linde-Buzo-Gray
NI	-	National Instruments
SQL	-	Structured Query Language
PLC	-	Programmable Logic Controller
IMAQ	-	Image Acquisition
BMP	-	Bitmap
TIFF	-	Tagged Image File Format
JPEG	-	Joint Photographic Experts Group
PNG	-	Portable Network Graphics
AVI	-	Audio Video Interleave

VI	-	Virtual Instrument
LED	-	Light Emitting Diode
LabVIEW	-	Laboratory Virtual Instrumentation Engineering Workbench

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CHAPTER I

INTRODUCTION

1.1 Project Overview

The strong demand for user-friendly systems which can secure our assets and protect our privacy without losing our identity in a sea of numbers is obvious. At present, one needs a PIN to get cash from an ATM, a password for a computer, a dozen others to access the Internet, an ID card to enter the building, and so on. However, when an injustice user of a system appears by the theft of an ID card, or the outflow of a password, the firmness of a system will be collapse. Since an injustice user is specified subsequently, even when equipping with a security camera, a user's face cannot necessarily be taken.

Face authentication and recognition has fascinating attribute that other biometrics do not have. Facial images can be captured from a distance, any special actions are not always required for authentication and a crime deterrent effect can be expected because the captured images can be recorded and we can see who the person is at a fleeting look. A fundamental requirement of an image-recognition system is the ability to automatically adjust to the changing environment or to be easily reusable for different tasks.

Face recognition problem can be described as given a still or video image of a scene identify or verify one or more person in the scene using a stored database of faces. The input to the system is an unknown face, and the system reports back the decided identity from a database of known individuals, whereas in verification problems, the system needs to confirm or reject the claimed identity of the input face. This system will use at buildings, rooms, offices, home, terminal, image-guided surgery, quality control, entertainment, autonomous navigation, and others.

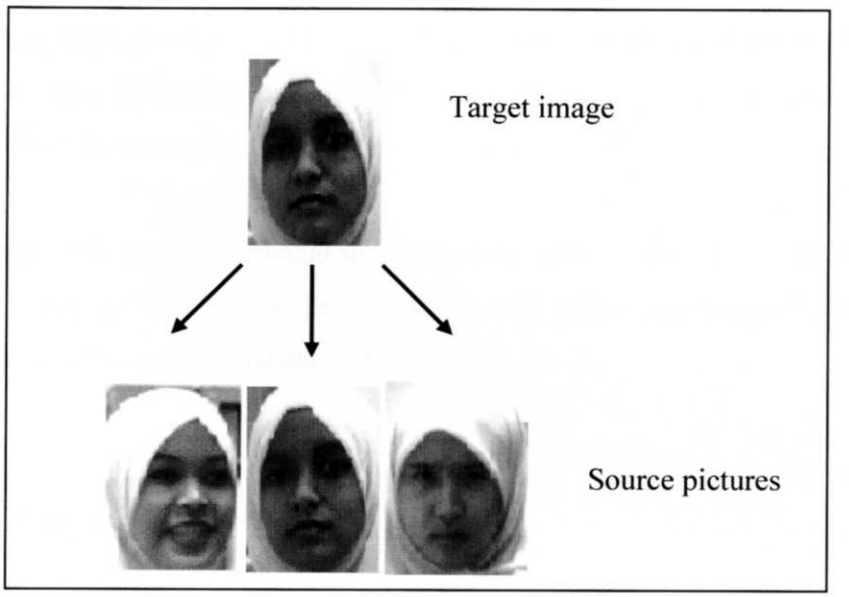

Figure 1.1: Face recognition system

1.2 Objectives Of The Project

This project has several objectives to be achieved. The objectives of this project are listed as below:

a) To develop a PC-based face recognition system with sufficient reliability at a much lower cost.

b) To design and develop a PC-based automated face recognition software utilizing LabVIEW and the Vision Development module.

c) To fully benefiting from its graphical programming environment to make the realization of complex face recognition algorithm development easy most crucially at a lower cost.
d) To recognize the type of eyes, nose, mouth and skin.

1.3 Problem Statement

Security system is very important for our safety. There are many method of security such as using ID card, password and others. However, these methods are not fully secure because for example ID card may be missing or stolen.

To overcome this problem, facial images had been used as the ID. These images not will be missing or stolen. The programming will select the images either it's matching or not with the stored database of faces.

1.4 Scope Of Work

The scopes of this project are divided to three parts. The first part is focusing on the research and literature review about the face recognition.

The second part is based on the software programming. The source code will be design by using LabVIEW programming software to implement face recognition system. The source code is used to recognize front face including eyes, mouth, nose, and eyebrow.

There are three main steps to recognition the faces. The input to the system is an unknown face image, while output is the recognition result, identifying the face image from a stored database.

1.5 Thesis Outline

There are 5 chapters for this topic, which have more explanation and easier to understand about this topic.

For the Chapter I, the focus of this chapter is on the brief of overview regarding project including introduction, objectives, problem statement and scope of the project.

Chapter II is about explanation of the research and literature review. All of the facts and information which were found from the journals or other references will be compared to choose the most accurate and satisfy methods. The literature review and the software development of the project which uses is LabVIEW software programming.

Chapter III defines and illustrates the steps involved in the face recognition. All these methodology should be followed for a greater performance.

Chapter IV is about describing the discussion and the result of the face recognition.

Lastly in Chapter V, this includes the conclusion of the project and the future recommendations.

CHAPTER II

LITERATURE REVIEW

2.1 History Of Facial Recognition Systems

In recent years face recognition has received substantial attention from researchers in biometrics, pattern recognition, and computer vision communities [1]. Humans have always had the innate ability to recognize and distinguish between faces, yet computers only recently have shown the same ability. In the mid 1960s, scientists began work on using the computer to recognize human faces. Since then, facial recognition software has come a long way.

The subject of face recognition is as old as computer vision, both because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because of its non-invasive nature and because it is people's primary method of person identification.

The most famous early example of a face recognition system is due to Kohonen, who demonstrated that a simple neural net could perform face recognition for aligned and normalized face images. The type of network he employed computed a face description by approximating the eigenvectors of the face image's autocorrelation matrix; these eigenvectors are now known as `eigenfaces.' Kohonen's system was not a practical success, however, because of the need for accurate alignment and normalization.

Face recognition scenarios can be classified into two types, which are face verification (or authentication) and face identification (or recognition) [2]. Face verification ("Am I who I say I am?") is a one to one match that compares a query face image against a template face image whose identity is being claimed. A good verification system should balance between the verification rate and false accept based on operational needs.

Then, for the Face identification ("Who am I?") is a one-to-many matching process that compares a query face image against all the template images in a face database to determine the identity of the query face (see Figure 2.1). The identification of the test image is done by locating the image in the database who has the highest similarity with the test image. The identification process is a 'closed' test, which means the sensor takes an observation of an individual that is known to be in the database.

The test subject's (normalized) features are compared to the other features in the system's database and a similarity score is found for each comparison. These similarity scores are then numerically ranked in a descending order. The percentage of times that the highest similarity score is the correct match for all individuals is referred to as the "top match score." If any of the top *r* similarity scores corresponds to the test subject, it is considered as a correct match in terms of the cumulative match. The percentage of times one of those *r* similarity scores is the correct match for all individuals is referred to

as the "Cumulative Match Score". The "Cumulative Match Score" curve is the rank *n* versus percentage of correct identification, where rank n is the number of top similarity scores reported.

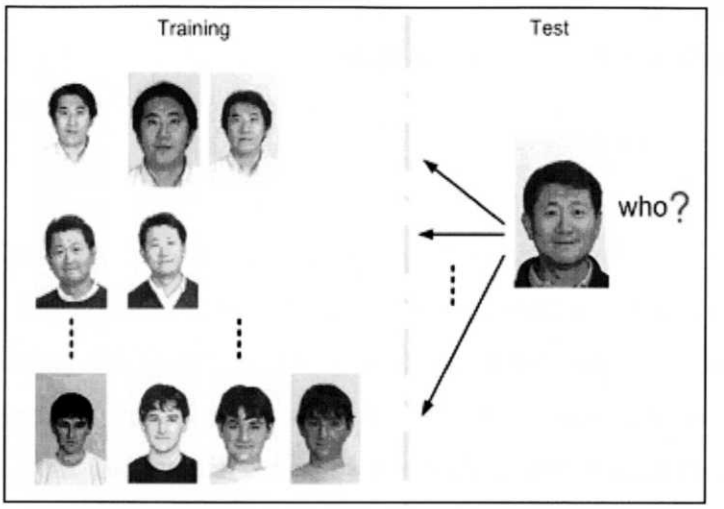

Figure 2.1: Face identification scenario

A face recognition system should be able to deal with various changes in face images. However, "the variations between the images of the same face due to illumination and viewing direction are almost always larger than image variations due to change in face identity" [3].

One of the most successful template matching methods is the eigenface method [4], which is based on the Karhunen Loeve transform (KLT) or the principal component analysis (PCA) for the face representation and recognition. Every face image in the database is represented as a vector of weights, which is the projection of the face image to the basis in the eigenface space. Usually the nearest distance criterion is used for face recognition.

In verification, an image is matched to only one image in the database (1:1). For example, an image taken of a subject may be matched to an image in the ORL database of faces to verify the subject is who he says he is. If identification is the goal, then the image is compared to all images in the database resulting in a score for each potential match (1: N). In this instance, we may take an image and compare it to a database of mug shots to identify who the subject is.

National Instrument, is an American, is one of many developers of facial recognition technology. Its software, LabVIEW(image processing), can pick someone's face out of a crowd, extract the face from the rest of the scene and compare it to a database of stored images. In order for this software to work, it has to know how to differentiate between a basic face and the rest of the background. Facial recognition software is based on the ability to recognize a face and then measure the various features of the face.

There are many types to recognize image of faces such as robust, eigenfaces, fisherface, and others. For this project, we are using Vector Quantization Histogram Technique.

2.1.1 Eigenfaces

Eigenfaces are a set of eigenvectors used in the computer vision problem. Kirby and Sirovich demonstrated that images of faces can be linearly encoded using a modest number of basis images. This demonstration is based on the Karhunen-Loeve transform. The idea is perhaps proposed first by Pearson in 1901 and then by Hotelling in 1933.