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Face Authentication System Using Image With Algorithm Two Dimensional Discrete Cosine Transform

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Abstract

This study aims to build a facial recognition software image using Two Dimensional Discrete Cosine Transform algorithm and uses webcam technology instead of password in the login application. The phenomenon underlying this research is logged using a common password used to access a system / application often occurs a few things that lead to discomfort and insecurity system users , eg forgot password (probably too long), password not recognized when typing the appropriate records said password (may have changed cracker / hackers) and so on. This research is expected to generate a software, and with this software, the users of the application will be free of typing errors, forgetfulness and password theft, as slogan" your body is your password" that can not be forgotten, typing errors and theft of passwords for word sandimu attached on your body. In this study, facial recognition software which is built based desktop (offline) to access academic information system applications STMIK - STIE Musi Rawas South Sumatra web -based (online).

Keywords : *Authentication, Discrete Cosine Transform, Image Face, Webcam*

1 INTRODUCTION

The authentication process through the introduction of identity aims to improve the safety of a system. The introduction of self-identity to be able to access a computer -based system can be grouped into two: the traditional methods (conventional) and the method of biometrics (Darma, Putra: 2009).

Biometric method is self-recognition technology using human body parts or behaviors eg fingerprints, palms, face, signature, retina of the eye, iris, teeth, Deoxyribo Nucleic Acid (DNA), heat trace, ears and others. Traditional methods (conventional) are still widely used today in many fields of applications. Traditional methods are grouped into two based on what is known eg PIN (Personal Identification Number) and password, and which is based on something that belongs to such as business cards , microchips , and other keys . The use of PIN and Password have some drawbacks such as poor recall , and with a particular algorithm can

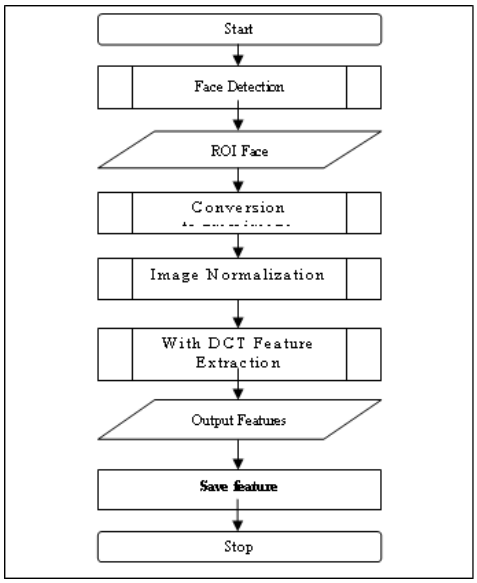

Figure 1: Phase of the storage process flow diagram of facial features

be easily guessed passwords, while the use of cards, microchips and key weaknesses are easily lost or left behind and easily duplicated. The use of traditional methods (conventional) will be increasingly less secure and less cumbersome to use, so alternative methods of biometrics is a better, more secure and more practical because it can not be duplicated and can not be lost and left behind corresponding slogan " your body is your password ".

Discrete Cosine Transform algorithm is an algorithm that is widely used for extracting facial features, ie certain parts of the face that is later extracted features are used to match the user's face authentication system in the process. Discrete Cosine Transform algorithm consists of two kinds of the One Dimensional Discrete Cosine Transform and Two Dimensional Discrete Cosine Transform. (Aman Chadha R. et al (2011:2)

By using the Discrete Cosine Transform algorithm and facesdk library developed by Luxand Corp., The programming process easier and more efficient, because the library has provided a variety of purposes for processing facial image. The purpose of this research is to design and engineer a software , which can take advantage of face images using the algorithm of Two Dimensional Discrete Cosine Transform in the authentication process, either directly (in real time) using a webcam to access locally-based academic web-based information systems.

The benefits of this research are as follows:

1. Improving the safety of the use of web-based information systems academic.

2. The ease and convenience of access to web-based information systems academic.

Understanding system according Jogianto (2005 :2) suggests that, the system is a collection of elements that interact to achieve a certain goal. Authentication is the process of proving the system, whether the user is going to access or use or the elements and procedures of the system is valid and the user is entitled to use the system by using the user's face image

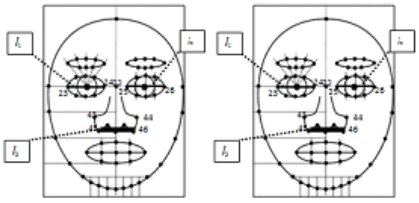

Figure 2: Features selected face

itself. Some of the facial image processing stages are: extraction, storage characteristics / facial features and matching process.

1.1 Extraction and storage of facial features

In this process, the image will be extracted facial features of its use Two Dimentional Discrete Cosine Transform so that it will produce a coefficient - coefficient to be used in the process of matching and registration process. Results of feature extraction characteristics are stored into a file with the suffix dat. Here is a flow diagram of extraction process and storage characteristics of facial features.

In this process, (Show in Figure 1) the user data that has been obtained through face detection process is then taken only on the face alone through the ROI (region of interrest). Gabor feature based experiments, the face ROI, and differential distribution point , to match and identify a label face , it would be better if the dots are used 23.24 points (corner of left eye) , 25.26 points (corner of right eye) 22, 24, 49 (nose straight line), and point 43,44,45,46 (Contour Edge nose). With eleven this point, some features can be designed with a very significant point parameters. Here's an example of the implementation of the above features with eleven points. For the first feature is tested, has a value differentiator for different labels are best (highest priority use) is f(k)1 (Figure 2, left).
l1=h(23.24)...(the distance between points 23 and 24)
l2=h(25.26)...(the distance between points 25 and 26)
l3=h(45.46)...(the distance between points 45 and 46)

So for the first feature formulated:f(k)1: (h (23,24)) + (h (25,26)) + (h (45,46))

The first feature is to use point 23,24,25,26,45, and 46. In other words, this first feature using the wide eyes and wide nose bottom.

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The second feature that has spread / best differentiator as f(k)1 is f(k)2. This feature uses the point of 22,24,25,43, and 44 (Figure 2. Right).

l4=h(22.24).. (the distance between points 22 and 24)l5=h(22.25).. (the distance between points 25 and 22)
l6=h(43.44)..(the distance between points 43 and 44)

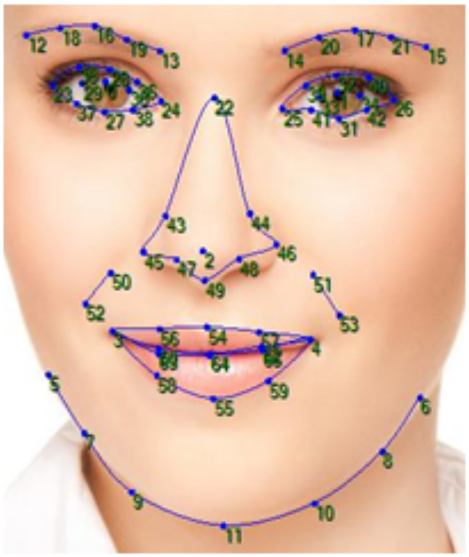

Figure 3: ROI (66 points) developed by Luxand.

So for this second feature is formulated: f (k) 2: (h (22,24)) + (h (25.22)) + (h (43.44))

The second feature is to use point 22,24,25,43, and 44. In other words, this feature takes into account the width of the middle of the nose, the eyes and the distance of the nearest point of the nose bridge. With the application of this ROI, using points that have high values of consistency, efficiency and optimal matching can be more precise.

After that, face to convert the gray image (grayscale image). Then do the normalization process smaller image size to 48 x 56 pixels. This is done in order to process the Discrete Cosine Transform computation (DCT) is not too long. The next process is the face image feature extraction algorithm using normalized Two Dimentional - DCT using the following equation: (Syed Ali Khayam: 2003)

$$C(u,v) = \frac{2}{MN}.\alpha(u)\alpha(v)\sum_{x=0}^{N-1}\sum_{y=0}^{M-1}\cos\left[\frac{(2x+1)u\pi}{2N}\right]\cos\left[\frac{(2y+1)u\pi}{2M}\right] \quad (1)$$

where

$$\alpha(n) = \begin{cases} \frac{1}{\sqrt{2}} & n = 0 \\ 1 & n \neq 0 \end{cases} \quad (2)$$

While according to Aman Chadha R. et al (2011:3) is:

$$F(u,v) = \sqrt{\frac{2}{N}}\sqrt{\frac{2}{M}}\sum_{i=0}^{N-1} A(i) * \cos\left(\frac{u(2i+1)\pi}{2N}\right) * \sum_{j=0}^{M-1} A(j) * \cos\left(\frac{u(2j+1)\pi}{2M}\right) * f(i,j) \quad (3)$$

where :

$$A(i) = \begin{cases} \frac{1}{\sqrt{2}} \; u = 0 \\ 1 \; u \neq 0 \end{cases} \quad A(i) = \begin{cases} \frac{1}{\sqrt{2}} \; v = 0 \\ 1 \; v \neq 0 \end{cases} \tag{4}$$

1.2 Matching

The process of matching coefficients obtained from feature extraction results on the test data will be compared with results using the weights of the extraction phase of the registration process is taken from the data file. Matching process flow diagram as follows (Show in Figure 4)

2 RESEARCH METHODOLOGY

Where the research was conducted was in STIE and Musi Rawas STMIK Lubuk Linggau, Jl. Yos Sudarso No. 141 Watervang Lubuk Linggau Musi Rawas South Sumatra . The study took place from July s.d. November 2013.

In conducting this study, the authors use several tools that support research activities, namely :

2.1 Hardware

The hardware used consists of : Two (2) pieces of each laptop with 2 GB RAM and 4 GB, 500 GB hard drive, processor Core 2 Duo and Core i5, 1.3 mega pixel webcam and 2 mega pixels, Twopieces of personal computers to each processor core 2 duo, 2 GB RAM, 500 GB hard drive, LAN network device that is 1 piece of switches , cables UTP and UTP connector, Printer Canon MP 237, One External Logitec 1.3 mega pixel Webcam.

2.2 Software

The software used is :Microsoft Windows 7, Microsoft's Window 8, Borland Delphi 7.0, Microsoft Windows Server 2008, Microsoft Office 2007, StarUML, Google Chrome Browser, Maxthon, Citrio, Opera, Xampp Package 1.7, Notepad++ 5.9, MySql Yog 8.55, Library Facesdk.dll of Luxand Inc.

The method used in this research is descriptive method , in accordance with the definition (Kenneth D. Bailey, 1978), this study describes the techniques used to apply technology to utilize webcam facial image instead of the login password to access academic information system (SIMAK), which aims to improve keamanman, simplify, and improve access to SIMAK practicality.

Application of webcam technology in face recognition systems require the user 's face image directly (real time) which consists of four user groups namely: Master Administrator, Administrator Ordinary (BAAK), Lecturers and Students. Data collection was performed on the pilot phase the user registration and STIE STMIK Mura.

The data required to build this application are data obtained from internal STIE and STMIK Musi Rawas. The methods used to collect such data is by means of interviews, question and answer and direct communication to the fourth group of users of the system. Systems analysis methods used in this research is the Object Oriented Analysis (OOA).

Model design and development of this software follow prototyping model of software development. Mock-up is something that is used as a design model for teaching, demonstration,

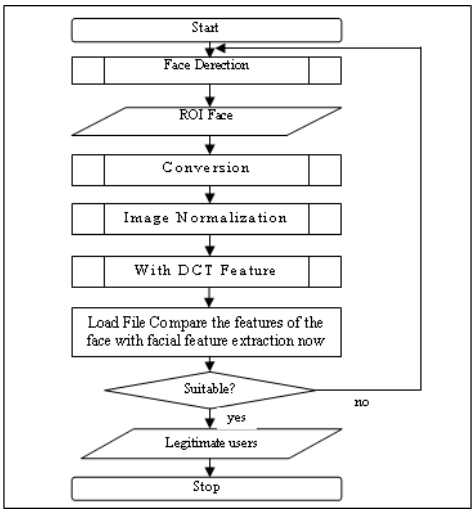

Figure 4: The matching process flow diagram

evaluation design, promotional, or other purposes. A mock-up is referred to as a prototype software if available or able to demonstrate a large part of software system functions and enables testing of software systems design. Corresponding stages (Rosa U.S. and Saladin, 2013)

3 RESULT AND DISCUSSION

System login to access academic information system applications in Musi Rawas STIE STMIK and is still using the conventional method using the password. The proposed system using facial biometrics, the technology faces a webcam to record the user login process to replace the password. Analysis of object-oriented or object-oriented analysis (OOA) is the stage for analyzing the specifications or the system needs to be developed using object-oriented concepts as defined by the U.S. Rosa and Salahuddin (2013:114). OOA using the Unified Modeling Languange (UML) in the use case diagrams, class diagrams and object diagrams. UML use visual diagrams to explain the elements of the system to be developed. (Shodiq, 2006:7)

User login trials conducted at five (5) each user in the span of the morning (07:00 to 09:00) , lunch (11:00 to 13:00), afternoon (15.00 to 17.00) and evening (18.00 tol 19.00), user registration is done once in that time span, the position of the face facing webcam camera and sixty-six point face area seen by the camera . Each registered user 's face image obtained four (4) and stored in a text file. Trials using fault tolerance (thresold) five percent (5%) , using a 2 mega pixel camera (C1) and a 1.3 mega pixel (C2) , which is performed in a state that is not normal weather and overcast or rainy, overcast and or considered approaching rainy dark (night) . Registration and user login at night using bright lights to the normal level that most people can read a book ($\leq 50cm$), and a recognizable facial image appeared on the screen and the camera application in a green frame for the process of recognition.

The following tables of test results for user registration using a 1.3 mega pixel camera which is done each morning, daylight, afternoon and night and the login is done each morning,

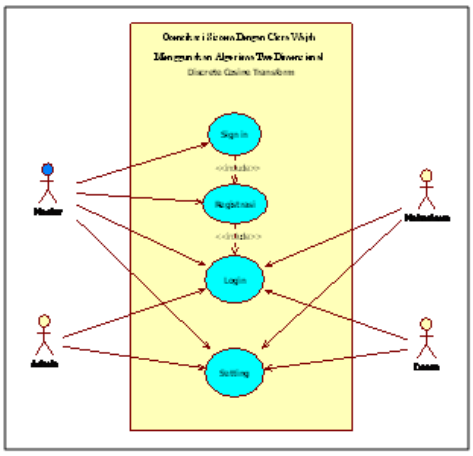

Figure 5: Use Case Diagram of The System

Table 1: The results of trial registration and user login in in the morning, daylight, afternoon and at night

Group	Older (Seconds)
Very quickly	≤ 30
Quick	> 30 s.d.≤ 60
Normal	> 60 s.d. ≤ 120
Slow	> 120 s.d. ≤ 180
Very slow	> 180

User	Morning		Daylight		Afternoon		Night	
	C1	C2	C1	C2	C1	C2	C1	C2
The trials were done for the user registration the mornings								
1	RVF	RVF	RN	RN	RN	RN	NR	NR
2	RVF	RVF	RN	RN	RN	RN	RVS	RVS
3	RVF	RVF	RN	RN	RN	RN	NR	NR
4	RVF	RVF	RN	RN	RN	RN	NR	NR
5	RVF	RVF	RF	RF	RN	RN	NR	NR
The trials were done for user registration during the day								
1	RF	RF	RVF	RVF	RN	RN	NR	NR
2	RF	RF	RVF	RVF	RN	RN	NR	NR
3	RF	RF	RVF	RVF	RN	RN	NR	NR
4	RVF	RVF	RVF	RVF	RN	RN	NR	NR
5	RN	RN	RVF	RVF	RF	RF	NR	NR
The trials were done for user registration the afternoon								
1	RN	RN	RF	RF	RVF	RVF	NR	NR
2	RN	RN	RF	RF	RVF	RVF	NR	NR
3	RN	RN	RF	RF	RVF	RVF	NR	NR
4	RN	RN	RF	RF	RVF	RVF	NR	NR
5	RF	RS	RF	RF	RVF	RVF	NR	NR
The trials were done for user registration night								
1	NR	NR	NR	NR	NR	NR	RVF	RVF
2	RVS	NR	NR	NR	NR	NR	RVF	RVF
3	NR	NR	NR	NR	NR	NR	RVF	RVF
4	RVS	RVS	NR	NR	NR	NR	RVF	RVF
5	NR	NR	NR	NR	NR	NR	RVF	RVF
Explanation:	RVF = Recognized Very Fast, RF = Recognized Fast, RVS = Recognized Very Slow RS = Recognized Slow, RN = Recognized Normal, NR = Not Recognized							

daylight, afternoon and night. In this study, consisting of grouped time is very fast, fast, normal, slow and very slow which is identical to the approximate length of time required for a successful login is calculated in units of seconds as follows:

From the research , recapitulation NilaiUsability are as follows 1.

Based on table 1. user registration trials conducted in the morning and user login is done each morning, midday, afternoon and evening, it appears that the login process is very fast (perfect) occurred on the morning of the appropriate time user registration process, while at noon, afternoon and evening decline rate which means that the login process login time becomes longer even can not recognize the user's face image at night, as well as in the tables 5.3, 5.4, and 5.5, this shows that the image matching user login process happens very quickly (perfect) when the user registration and login process occurs at the same time or nearly the same, this is because the level of luminance (brightness) significantly affect the matching process (recognition).

4 CONCLUSION

Based results of this research we can conclude: Software (application) that is generated in this study is a main file that is WPP.exe locally based , which can be used to log the user to access the Academic Information Systems (SIMAK) are web-based.The advantages of this software is easy to use, real-time process and high-speed access to the process of tracking and recognition, because the application is placed on the user's computer and only store data of each user in a text file. The weakness of this app is not able to adjust the lighting on resgistrasi and user login process, factors of light and brightness quite significantly the effect, though may be overcome by providing illumination at or near the same at the time of registration and user login or registration is done more than once during different brightness levels vary for example in the morning, afternoon, evening and night. Another drawback is the application can only run on Microsoft Windows (not multi- operating system).

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