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Security Using Detachable Fingerprint Scanner

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Abstract: **-** Computers, tablets, smart phone mobiles etc serve as an important means of communication, socialization and various online transactions and hence have become indispensable in the day-to-day operations of various organizations. Security of data in these devices is a matter of concern for all organizations today, hence good practices are needed to be observed at all levels, from design to use, through the development of operating systems, software layers, and downloadable apps. Some of the security methods implemented include pin lock, pattern locks, biometric measures etc. Through this paper we highlight fingerprinting as a security measure to protect online data from various sites. We propose an inexpensive USB based finger print scanner which can be attached to these devices and can serve as solution to counter the threats like snooping. The main feature is to automate the process of fingerprint scanning to fetch the required site for various things. Fingerprinting data can be linked with mail and bank accounts for secure important data. Though fingerprinting is still a pre-mature technology, if properly implemented may serve as a primary measure of securing these devices in the future.

Index Terms: - Authentication, Fingerprinting, ridgeline algorithm, scanner, security, semiconductor fingerprint scanning device, snooping.

1. INTRODUCTION

A fingerprint in its narrow sense is an impression from the friction ridges of a human finger [4]. In a wider use of the term, fingerprints are the traces of an impression from the friction ridges of any part of a human or other primate hand [4]. Fingerprint records usually contain impressions from the pad on the last joint of fingers and thumbs and are commonly used for security purposes.

2. CLASSIFICATION OF FINGERPRINTS

A friction ridge is a raised portion of the epidermis on the human fingers and toes, the palm of the hand or the sole of the foot, consisting of one or more connected ridge units of friction ridge skin [8]. Finger prints are unique. The epidermis forms different patterns for each individual. Thus, Fingerprints can be broadly classified as:-**Loops, Whorls, and Arches.**

2.1 Loops

It constitutes 60-65% of the population of the world. It has one or more ridges entering from one side of the print, curving and exiting from the same side.

2.2 Whorls

Around the world, 30-35% of the population has whorls pattern on their fingers. All whorl patterns have type lines and two deltas. There are four major types: plain, central pocket, double loop.

2.2.1 Plain whorls

They have at least one ridge that makes a complete circuit, and an imaginary line from one delta to the other must touch a whorl ridge.

2.2.2 Central pocket whorls

They have at least one ridge that makes a complete circuit, and an imaginary line from one delta to the other cannot touch a whorl ridge.

2.2.3 Double loop

In this, two loops are combined to form a whorl.

2.3 Arches

This pattern is rarely seen. It constitutes 5 percent of the population. Arch ridges tend to enter from one side of the print and leave out the other side .Two distinct types—plain arches and tented arches

2.3.1 Plain arches

They have a wave like pattern

2.3.2 Tented arches

They show a sharp spike at the center of the arch.

Hence, there are various types of prints processed by an individual. Every individual has his own fingerprints that are unique in the world. Even the twins have their own different prints. On this classification and property, a new concept is put into the consideration. Let us see first how the fingerprint recognition system works.

3. FINGERPRINT RECOGNITION SYSTEM

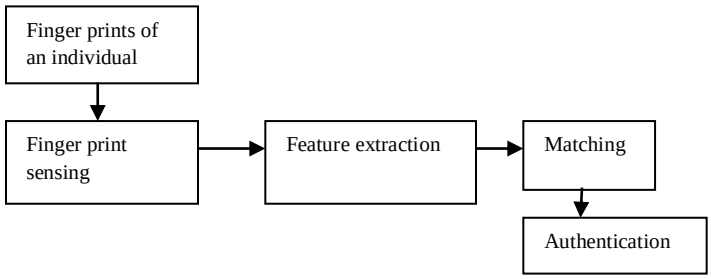


Fig. 1 Fingerprint recognition system

It consists of five major steps. These are the verification system used to authenticate the valid user. The main modules of a fingerprint verification system are:

a) Finger- print sensing-

The fingerprint of an individual is acquired by a fingerprint scanner to produce a raw digital representation

b) Pre-processing-

The input fingerprint is enhanced and adapted to simplify the task of feature extraction

c) Feature extraction-
The fingerprint is further processed to generate distinct properties, also called feature vectors

d) Matching-
The feature vector of the input fingerprint is compared against one or more existing fingerprint templates

e) Authentication-
When the fingerprint is matched and if the person authenticate itself as a valid user then the system unlock itself to provide the service.

4. FINGERPRINT DETECTION USING RIDGELINE FOLLOWING

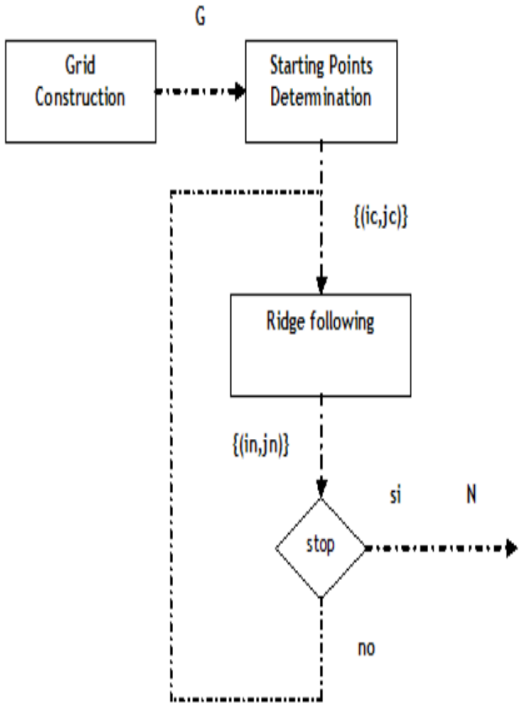
The basic idea behind ridge line following method is to track the ridge lines by traversing in the direction of the fingerprint image. Starting points are determined by superimposing a square-meshed grid on the gray level image of the fingerprint.

We start from the fingerprint area of interest W (i,j) previously calculated, the first step is the definition of a regular square-meshed grid G(is,js), with a granularity of v pixels, superimposed on the window W.This step discovers all the minutiae within W.

The basic idea behind ridge line following method is to track the ridge lines by traversing in the direction of the fingerprint image. Starting points are determined by superimposing a square-meshed grid on the gray level image of the fingerprint

The adopted implementation is shown in this algorithm:

Algorithm 1: [8]
Starting point determination
C = Ø
for each (is,js) ∈ G do
Compute the tangent direction ϕ s in (is,js)
Compute the section Ω centered in (is,js) along the direction ϕ s + π 2 and with
Length 2σ 1 + 1
Determine the "ridge line edges" calculating the local discontinuities between the gray values of (i,j) in Ω
Select the local maxima L= {(im,jm)} of I(i,j) along the section Ω, such that
(im,jm) belongs to a ridge line contained in Ω



[8] *Fig.2 Ridgeline algorithm flowchart*

Chose the local maximum (ic,jc) ∈ L nearest to (is,js) in according to the
euclidean distance
C = C ∪ {(ic,jc)}
Return C

The region of intrest W(i,j) is determined. A square meshed grid square-meshed grid G (is,js)⊆ W, having a granularity of pixels ν, superimposed on the window W. Next for each (is,js) ∈ G we calculate the corresponding (ic,jc) ∈ C, called "starting point", belonging to a ridge line and at the minimum distance from (is,js).

The next step is to track the fingerprint ridge lines starting from the set C by "sailing", according to the fingerprint directional image.

Algorithm 2: [8]
Ridge Line following
N = Ø
for each (ic,jc) ∈ C do
while ¬stop do
Compute the tangent direction ϕ c in (ic,jc)
(it,jt) = (ic,jc) ± μ pixel along the direction ϕ c
Compute the section Ω centered in (it,jt) along the direction ϕ c +length 2σ 2 + 1 and related to the current ridge line
Select the absolute maximum (in,jn) ∈ Ω
N = N ∪ {(in,jn)}
Stop =check-criteria()
Return in the correspondence of the analyzed ridge N

This step tracks the fingerprint ridge lines starting from the set C, by "sailing", according to the fingerprint directional image. The algorithm returns a set of points N = {(in,jn)} that approximates the ridge lines until some stop criteria are verified

Algorithm 3: [8]

Termination Criteria

Compute the mean gray level value of a square window centered in (in,jn)

Compute the discontinuity S between the mean gray level value of the current squarewindow and the mean of the previous regions

if (S ≥ thr d ∧ gray(in,jn) ≥ thr k then stop.

For termination the algorithm computes the mean gray level value of a square window whose size is half the average ridge line width. If the nth window loses the continuity of the mean gray level value compared with the windows of formerly estimated mean gray level values and gray(in,jn) ≥ thrk[1], the centre pixel of the (n-1)th window is extracted as the ending feature.

Algorithm 4: [8]

M = ∅

For each (is,js) ∈ G do

Determine the related starting point (ic,jc) ∈ C using the algorithm 1

if ((ic,jc) ∈ T) then stop

if (¬stop) then

Compute the set of points N = {(in,jn)} related to the current point (ic,jc) ∈

C using the algorithm 2

Store the possible minutiae M=M∪ {bif,rend}, if the termination or intersection criteria are verified

Store the ridge polygonal trace in T

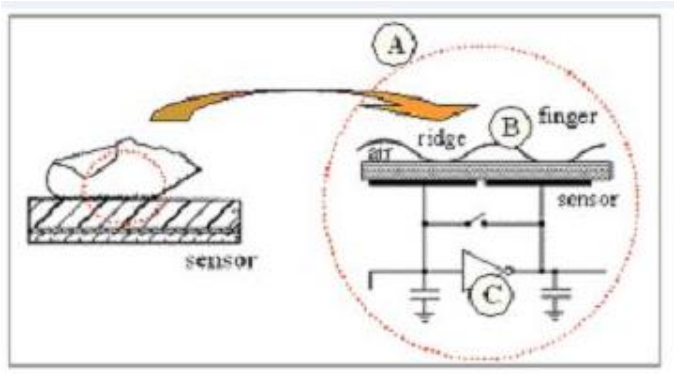
Return the set M

Minutia are searched by following the ridge line nearest to the starting point (ic,jc) in both directions ±μ. The possible false minutiae are detected on the base of their related distances.

5. STRUCTURE OF FINGERPRINT SCAN DEVICE

Semi-Conductor Input

This concept is considered advanced as it allows fingerprint sensors to be small and simple, and so its application area becomes wider. Also, the mass production of semiconductors reduces its manufacturing cost, thus making it more affordable. Semiconductor fingerprint sensor's structure is quite simple.



[5] Structure of semiconductor fingerprint input

Fig 3: Semi Conductor Based Fingerprint Reader

It gains fingerprint image as it touches the surface of sensor.

6. FUNCTIONALITY OF PROPOSED DEVICE

6.1) Quick Launch:

Website addresses are assigned to each finger. Swiping the finger launches the website automatically without the need to type the address manually.

6.2) Launch Applications:

Applications are being launched by simply swiping the finger.

6.3) Authentication:

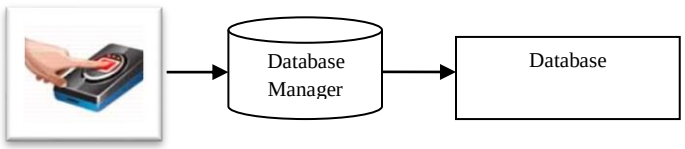
It authenticates the users for accessing their online accounts as well as for unlocking the device so as to provide security to the system.

7. IMPLEMENTATION PLAN

Step I:

Registration:

The finger needs to be swiped thrice on the device to register the fingerprint in the database. The fingerprint is scanned using the proposed algorithm method and file manager is set up where user fills in his details so that whenever he uses the device next time the finger print can be uniquely associated with the user.



[6]

Fig. 4 Registration plan

Step II:

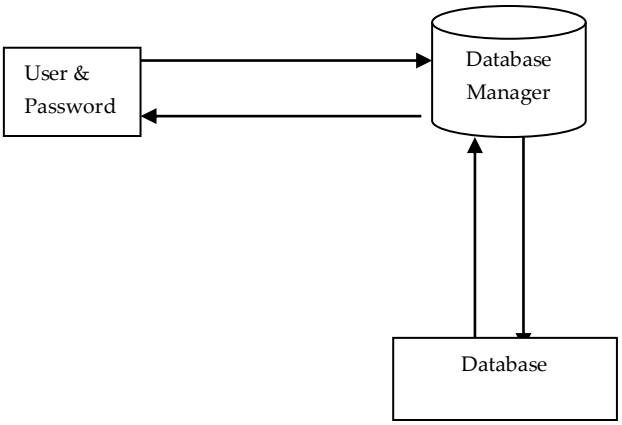


Fig.5 Authentication system

Authentication and Website Lock:

This module used to verify the identity of the owner. It can be used for locking applications and authenticating accounts using fingerprints.

Procedure:

1. Select a application or website to lock
2. Select a fingerprint for the website or application
3. Swipe the fingerprint against the reader to unlock the application or website

Authentication:

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Procedure:

1. Select a application or website to lock
2. Select a fingerprint for the website or application
3. Swipe the fingerprint against the reader to unlock the application or website.

Step III:

Launch Apps:

App Launch-

It is used to launch applications by swiping the finger on the device.

Procedure:

1. Select an application installed on the phone
2. Select a fingerprint for the application
3. Swipe the fingerprint against the reader to launch the application

Web Launch-It is used to launch websites by swiping the finger on the device.

Procedure:

1. Select a website to open
2. Select a fingerprint for the website
3. Swipe the fingerprint against the reader to launch the website directly into the default browser

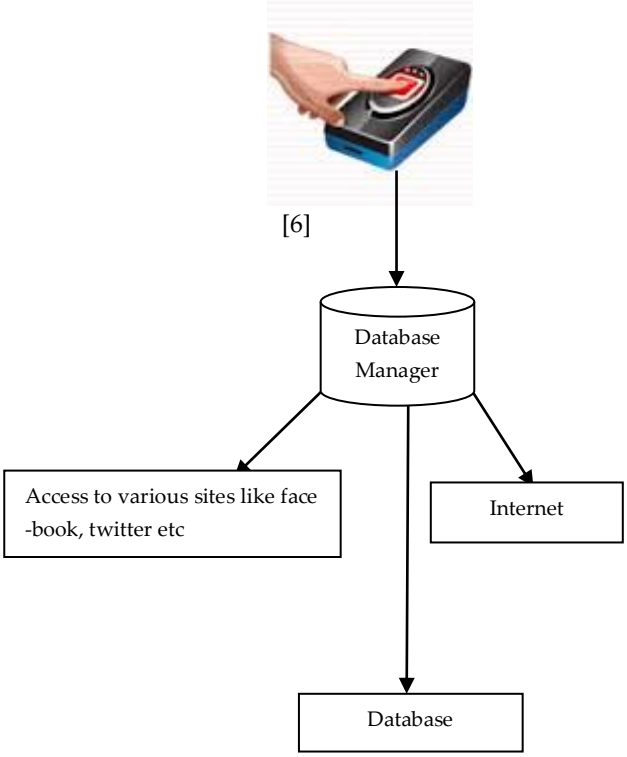

Fig.6 Launch application

Step IV:

Launch Login in Apps:

The final step is combination of previous steps. It involves login into websites after website is launched.

Procedure:

1. Launch the website with first swipe

2. Do second swipe to authenticate your account with login and secret password are retrieved from database and are entered into the space bar.

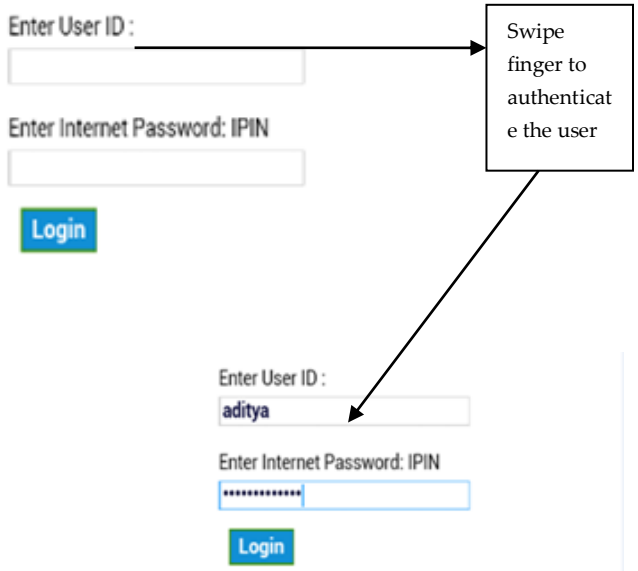

Fig.7 Final Working

3. Either click login now or do 3rd swipe to enter the account.

So using different fingers, the user can access different accounts. For instance, thumb used for accessing face book, index finger is used for accessing twitter and so on.

8. CONCLUSION

Fingerprinting is a secure bio metric measure and ensures confidentiality of data. The proposed device serves as a measure of securely sending and receiving data to applications and websites, thereby providing a high level of security. Fingerprint based authentication systems ensure reliability, accuracy and intuitiveness. Though fingerprinting systems are commercially available, using a portable, lightweight device will help this technology reach areas where it is less known. Also the advantages of fingerprinting outweigh the disadvantages making it a security measure likely to be extensively used in future.

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References

[1] L. Hong, Y.Wan, A.K. Jain (1998) Fingerprint image Enhancement: Algorithm and Performance Evaluation. IEEE Trans. On Pattern Analysis and
Machine Intelligence, vol. 20, no.8, pp. 777-789.

[2] A.K. Jain, S. Prabhakar, L. Hong, S. Pankanti (2000) Filterbank-Based Fingerprint Matching. IEEE Trans. on Image Processing, vol. 9, no. 5.

[3] A. K. Jain, S. Prabhakar, L. Hong (1999) A multichannel approach to fingerprint Classification. IEEE Trans. Pattern Analysis and Machine Intelligence,[]Vol. 9, no. 4 pp. 348-359.

[4] Wikepedia.com

[5]Semi Conductor Based Fingerprint- Reader
http://sphinxtech.com.sg/semi.jpg

[6] Diagram of fingerprint scanner
http://www.iconshock.com/img_jpg/REALVISTA/computer_gadgets/jpg/128/fingerprint_scanner_icon.jpg

[7] Scientific working group on friction ridge analysis study and technology.
http://www.swgfast.org/documents/glossary/090508_Glossary_2.0.pdf

[8] Angelo Chianese, Vincenzo Moscato, Antonio Penta, Antonio Picariello 'Improving Minutiae Detection in Fingerprints Using Multiresolution Contrast Enhancement', University Federico II, Dipartimento di Informatica e Sistemistica via Claudio 21, 80125, Naples, Italy.

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