Improved Latent Fingerprint Identification using Minutiae- Matching Method

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Abstract— Comparing a latent fingerprint minutiae set against a tenprint fingerprint minutiae set using an automated fingerprint identification system is a challenging problem. This is mainly because latent fingerprints obtained from crime scenes are mostly partial fingerprints, and most automated systems expect approximately the same number of minutiae between query and the reference fingerprint under comparison for good performance. In this work, we propose a methodology to reduce the minutiae set of tenprint with respect to that of query latent minutiae set by registering the orientation field of latent fingerprint with the tenprint orientation field. We report the performance of our registration algorithm on the database .DAT which is in-built in MATLAB. The system will accept and recognize fingerprint obtained in any angle. It reduces the search space for performing matching. By reducing the search space of minutiae from the fingerprint, we can improve the performance of automated identification systems for latent fingerprints. The system works at high speed.

Key words: AFIS, Minutiea, Tenprint, Binarizing, Morphing

I. INTRODUCTION

The existing Automatic Fingerprint Identification System (AFIS) accepts only vertical and complete fingerprints. It only founds a match when same sizes of finger images are given as input. It won't reduce fingerprint minutiae search space for matching and hence it is time consuming. The main objective of 'Improved Latent Fingerprint Identification System is to improve the performance of Automated Fingerprint Identification System (AFIS) by reducing the search space in ten print minutiae set to match with query minutiae set. It uses the minutiae-matching method. Minutiae are the specific plot points on a fingerprint. It performs minutiae comparison only with those minutiae that fall in the sub-region of the full fingerprint where the partial fingerprint is registered.

II. OVERVIEW

A fingerprint in its narrow sense is an impression left by the friction ridges of a human finger. The recovery of fingerprints from a crime scene is an important method of forensic science. In a wider use of the term, fingerprints are the traces of an impression from the friction ridges of any part of a human hand. A print from the sole of the foot can also leave an impression of friction ridges.

Human fingerprints are detailed, unique, difficult to alter, and durable over the life of an individual making them suitable as long-term markers of human identity and may be employed by police or other authorities to identify individuals who wish to conceal their identity, or to identify people are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster. Fingerprint analysis, in use since the early 20th century, has led to many crimes being solved. A "latent print" is the chance recording of friction ridges deposited on the surface of an object or a wall. Latent prints are invisible to the naked eye, whereas "patent prints" or "plastic prints" are viewable with the un-aided eye. Latent prints are often fragmentary and require the use of chemical methods, powder, or alternative light sources in order to be made clear. Sometimes an ordinary bright flashlight will make a latent print visible. The fingerprint read may be partial or a fingerprint obtained will be in any angles.

The main characteristic of this system is that, it recognizes the fingerprints entered in different angles and are efficiently matched. The performance of the existing partial fingerprint identification system mainly depends on the image quality, the number of minutia available and other derived and extended features that can be obtained from the partial fingerprint region. To improve the performance of AFIS in the partial fingerprint comparison scenario, it will be advantageous if we can reduce the minutiae search space of the reference (full fingerprint) with respect to the query (partial fingerprint) minutiae set.

The proposed methodology has two phases. They are known as registration and authentication.

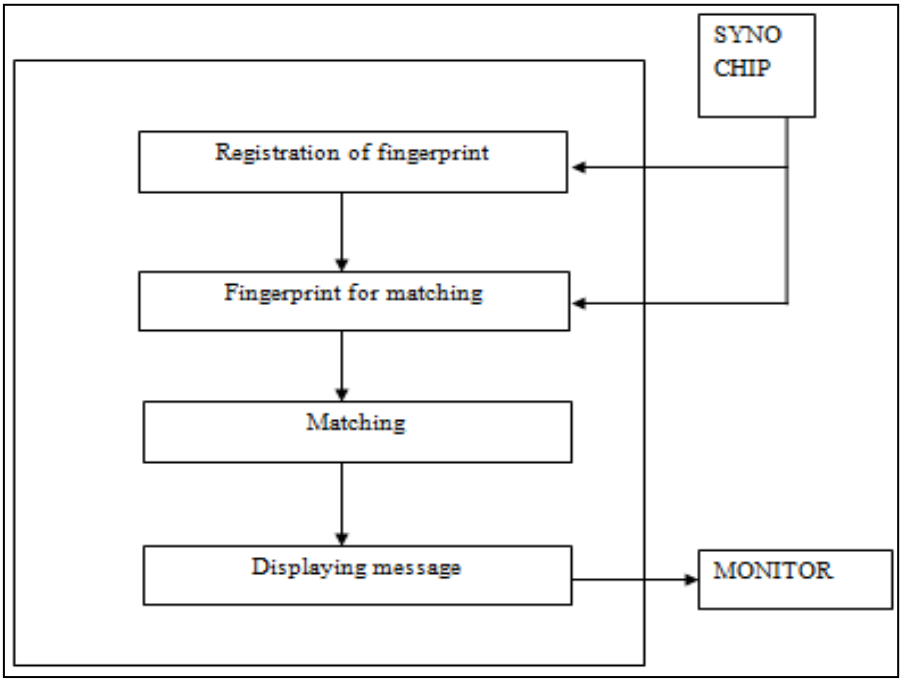

Fig. 2.1: System Architecrure

Improved latent fingerprint identification can be done through various stages:

- Fingerprint registration
- Reading fingerprint for identification
- Binarization of fingerprint
- Morphing of fingerprint
- Removal of extra points
- Matching
- Displaying details of matched fingerprint

1) Fingerprint registration

In this step the fingerprints are entered through the Syno chip. Syno chip is the hardware used .These fingerprints are added to the database '.DAT' along with the user's name. The fingerprint should be clear. User's ID number generates automatically while adding to the database.

2) Reading fingerprint for identification

In this step the fingerprint to be identified is entered through the Syno chip. This fingerprint can be given in any direction.

3) Binarization of fingerprint

Binarization converts a coloured image to a black and white image. Here we obtain the black and white version of our entered fingerprint.

- J=im2bw(image)
- J stores the binarized image.

4) Morphing of fingerprint

Morphing makes the binary image lines so much thin that even more thining will change the information of the input image.

K=bwmorph(~J,'thin','inf');

- J stores the binarized image.
- Negation (~) converts all white points into black and all black points into white.
- K stores the thinned image.

5) Removal of extra points

A fingerprint contains a lot of unwanted points. For matching purpose we remove these unwanted points. Here we first find the Terminal points and Bifurcation points. Bifurcation point in a fingerprint is a point where a ridge divides into two ridges. Terminal point is a point where the ridges end.

We use Euclidian Distance formula to find the distance between two points.

Euclidian distance formula:

$$dist((x\ y),(a\ b))=sqrt((x-a)^2+(y-b)^2).$$

We declare a variable 'D' for comparison. The removal is done on the basis of 3 processes:

- Process 1: if the distance between a termination point and a bifurcation point is smaller than D, then we remove this minutia
- Process 2: if the distance between two bifurcation points are smaller than D, then we remove this minutia
- Process 3: if the distance between two termination points are smaller than D, then we remove this minutia.

We are taking an optimum value of D= 5 units of Euclidean distance

6) Matching

Here the extracted points of the fingerprint which we entered for identification and in the database are compared and finds the percentage of matching. If the percentage of matching is less than 75% it displays "no match found" else it displays the details of the fingerprint which shows greater matching.

7) Displaying details of matched fingerprint

The details of matched fingerprint that stored in the database are displayed. The details contain name and ID number

III. CONCLUSION

In this project, fingerprint images of different angles are efficiently matched. The performance of the existing partial fingerprint identification system mainly depends on the image quality, the number of minutia available and other derived and extended features that can be obtained from the partial fingerprint region. To improve the performance of AFIS in the partial fingerprint comparison scenario, it will be advantageous if we can reduce the minutiae search space of the reference (full fingerprint) with respect to the query (partial fingerprint) minutiae set. The main aim of Improved Latent Fingerprint Identification is to improve the performance of Automated Fingerprint Identification Systems for latent fingerprints by reducing the search space of minutiae from latent fingerprint. The system focus is to keep the secrecy of the fingerprint. In this project, fingerprint images of different angles are efficiently matched.

Advantages in this project are low power consumption, low cost, small size, excellent performance. Good image processing capabilities can successfully capture image up to resolution 500. Disadvantages are the database of the system should accept only clear fingerprints.

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