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Retrieval of medical details using biometrics for a Smart City

#1Rucha Bagewadi, #2Ravi Giri, #3Yashika Agrawal, #4Vanita Babane

1ruchu.bagewadi@gmail.com
2ravigiri901@gmail.com
3yashikaagrawal30@gmail.com
4vanita.babanne@sinhgad.edu

#1234Computer Engineering,

RMD Sinhgad School of Engineering, Pune.

ABSTRACT

In real world problems time is an important constraint in health related problems time is of utmost importance as someone's life is at stake. So here we develop a system which can provide real time data about person's medical history in a moving ambulance so these details can further be used to cure the victim and thus provide an easy and reliant system to the medical department. The system uses fingerprint matching as an identification parameter for retrieval of medical details. Biometric system has shown promising future and it has been researched for long period of time. For fingerprint recognition biometrics is used and for fingerprint matching minutiae algorithm is used.

Keywords: Fingerprint Recognition; Database; Algorithm design and analysis; Pattern matching; Authentication; Reliability; Feature extraction.

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I. INTRODUCTION

Use of biometrics verification has become an important as well as reliable tool for verification and recognition of a particular person. Biometrics is any means by which a person can be uniquely identified by evaluating one or more distinct biological traits. Unique identifiers include fingerprints, eye retina, hand geometry, voice waves, DNA and signatures. The most reliable and easy to implement being fingerprint recognition. Fingerprint are unique for each person and even to their own fingers. Each finger has its own unique patterns. According to a survey since the world population exceeds 6.4 billion and most of us possess 10 digits we have more than 64 billion printouts there to bump the odds of sharing a single print with a stranger. That's one reason why multiple fingerprints are important for positive identification the probability of people having same fingerprint is in the order of quadrillion to 1. There are basic three patterns of fingerprint. They are,

ARCH LOOP WHORL

These patterns can be identified using delta. Delta is the point where lines come together from three directions. The arch hold no delta at all, the loop holds one delta and whorl hold two deltas. Fingerprint identification is the process of comparing two instances of ridges impression of human fingers. Acquisition of ridges is usually made with black printer's ink rolled having a white background. When a recording of fingerprint is done digitally on a glass plate it is known as "Live Scan". When impression is done against a surface of an object or wall it is known as "latent print" Each and every person may have some infection to some drugs and it is known to his family doctor only. Nowadays, there is a lot of need of relocating from the native place in reference to the job or education and many things. In such case it is not possible to prefer family doctor each and every time. Even if we are living at his own place still there is a possibility that one can met to an accident far from the native place or one can became ill at their relatives place. In such case the doctor to whom we prefer should know all the medical history about the patient for example the blood group of the patient, the diseases he suffered from, the treatments he undergone previously and many more. Here our system proposes this system to the government of India that the medical data of each and every person should be

stored by the person itself in the nearby government hospital. That is it should be made mandatory by the government. Now we have all the medical data of each and every individual on one government cloud. Now this data can be extracted with the help of fingerprint of an individual. So we can implement it in an ambulance where we can extract the information of a patient from his fingerprint which contains all the medical data, personal information and much more which is necessary and beneficial. Now doctor before the arrival of the patient can know the medical data and history so that he can manage the resources if needed or the ambulance can take him the hospital where they can get requirements of patient. This system is also beneficial in case where a police can't identify a dead body.

II. LITERATURE SERVEY

Abhinandan[13] proposed a Fingerprint Matching Algorithm Based on Tree Comparison using Ratios of Relational Distances. This proposed an algorithm that initially identifies the candidate common unique also known as minutiae points in both the base and the input images using ratios of relative distances as a comparison parameter. A tree like structure is then drawn connecting the common minutiae points from bottom up in both the base and the input images. Matching score is obtained by comparing the similarity of the two tree structures based on a threshold value. This algorithm is capable of comparing and producing matching scores between two images obtained from two different kinds of sensors, hence satisfies the property of sensor interoperable and also reduces the FNMR in cases where there is very little overlap region between the base and the input image. Less incorporation of classifiers so reduced efficiency in sensor independent systems

Jain et[14] proposed a filterbank matching algorithm that uses a bank of Gabor filters to capture both local and global details in a fingerprint as a compact fixed length FingerCode. The fingerprint matching is based on the Euclidean distance between the two corresponding FingerCodes and hence is extremely fast. The technique exploits both the local and global characteristics in a fingerprint image to verify an identity. Each fingerprint image is filtered in a number of directions and a fixed-length feature vector is extracted in the central region of the fingerprint. The feature vector (Finger- Code) is compact and requires only 640 (or 896, depending on image size) bytes. Some of the shortcomings of the system were the reference point cannot be located accurately in noisy images and the matching scheme is not able to tolerate large deformation in the ridge pattern due to finger pressure differences.

S.Chikkerur[15] proposed system which used a concept known as K-pletwhich is used to represent local neighborhood of a minutiae that is not variant under translation and rotation. It also defined a directed graph G(V,E) that represents this local relations in a naive manner. The local neighborhoods are matched using a dynamic programming based algorithm. The consolidation of the local matches is done using Coupled Breadth First Search algorithm that propagates the local matches concurrently in both the fingerprints. One of the key features of this algorithm is that, no explicit alignment of the minutiae sets is required at any stage of the matching process. It also provides a very generic but formal framework of consolidating the local matches during fingerprint recognition.

A.M. Banzen [16] proposed a system which used correlation-based fingerprint verification. Unlike the traditional minutiae-based systems, this system directly uses the richer gray-scale information of the fingerprints. The correlation-based fingerprint verification system first selects appropriate templates in the primary fingerprint, uses template matching to locate them in the supporting print, and compares the template positions of both fingerprints. The correlation based fingerprint verification system has the ability of showing results with bad-quality images from which no minutiae can be extracted reliably and with fingerprints that suffer from non-uniform shape distortions. Experiments have shown that the performance of this system at the moment is at par to the performance of many other fingerprint verification systems.

There are two techniques of fingerprint matching.

1. Image based matching-

It is also known as pattern based matching algorithm. It is one of the popular approach for fingerprint based identification. In image based matching two images are kept on template and the pixel properties are compared template is itself used as reference mage and he intensity values of every point if the template is compared with the intensity values of the query image. The correlation between them is calculated according to their intensity values then the verification of a person is done. Reference image is denoted by R and the query image is denoted by Q. the sum of squared difference between the intensity of corresponding pixels are calculated

$$SSD(R_1)=||R-Q\ ^2||^2$$
$$=(R-Q)^1\ (R-Q)$$
$$=||R||^2+||Q||^2-2RTQ$$

Here "T" represents transpose of the vector

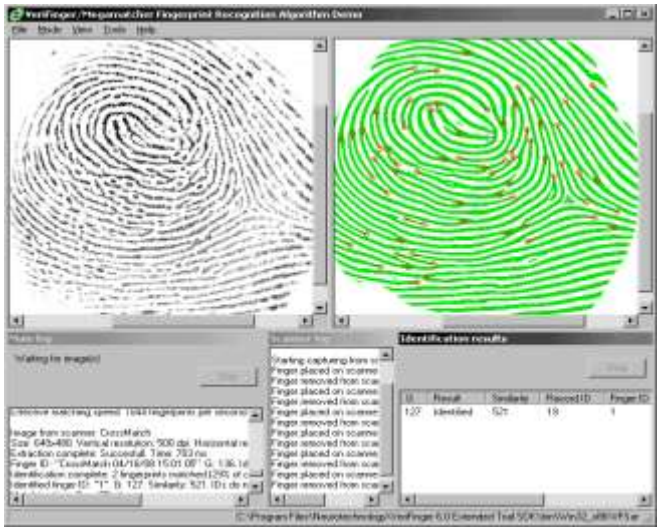
Pixel is represented by namely three parameters (x,y,θ) where x represents the x direction of the pixel, Y represents the y direction of the pixel and θ represents the rotation of the pixel. The values of all the three parameters are calculated for both reference as well as query image and the similarity between the two images is calculated with the help of correlation. The similarity can be expressed by the expression

S R,Q=max(δx,δy,δθ)cc(R,Q δx,δy,δθ)

Where, δx=Deviation in X direction

δy=Deviation in Y direction

δθ= Deviation in rotation



The above shows the matching of fingerprints using image based comparison. Both the reference as well as query images intensities are compared thus identification of fingerprint is done.

1. Minutiae based matching-

In a pattern based system, a device is used to take a graphical image of a fingerprint and this is also known as live scan. The device used in live scan is also known as capture device. Then the software analyzes the fingerprint image and determines the location of the core, the pattern type for example whether the image is right loop, left arch, etc., estimates small minutiae points as well as the quality of the ridge lines, and finally extracts minutia. Minutia from a simple perspective, indicate where a significant change in the fingerprint occurs.

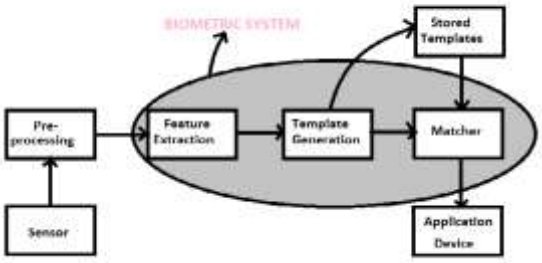
III. MINIMUM CONFIGURATION

Hardware requirements:
MicroController , Supply Biometric Device, RS232 Cable, Processor - Pentium –IV Speed - 1.1 GHz, RAM - 256 MB(min),
Hard Disk - 20 GB,
Key Board - Standard Windows Keyboard, Mouse - Two or Three Button Mouse, Monitor - SVGA.

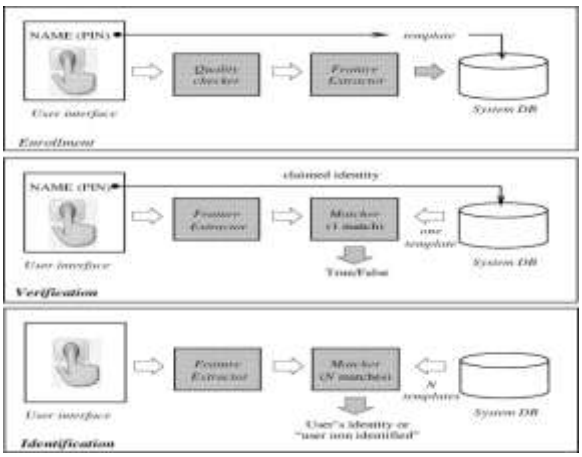
Software requirements:
Operating System: Windows XP
Programming Language: JAVA
Java Version: JDK 1.6 & above
Database: MySQL 4.5
IDE: Java Net Beans 7.4

IV. EQUATIONS AND ALGORITHM OF SYSTEM

A Biometric sensor is used to produce a sample i.e. fingerprint's sample. An algorithm extracts the sample's most characteristics features using feature extraction which are used to produce a template using template generator. At enrollment the template is stored in a database i.e. in a secure storage. At verification a fresh template and the enrolled template are compared by an algorithm and if both the templates are same then the data which is stored in the database can be retrieved. The verification is done to check whether the two templates are same and are come from the same object.



In case of finger print detection in any application, first the finger print of a person has to be saved in the database along with the relative information of that person. So in future we can extract the necessary information of the person just by getting his/her fingerprint into the system. In this proposed system we have put forth an approach to retrieve a person's relative information like medical history or details of the concerned person. So in case of any kind of medical emergency, person's medical history can be retrieved from the database just by getting his/her fingerprint. So at first to avail this system people have to register themselves into the system via government entities. So that when a person meets with an accident details regarding that person like blood group can be retrieved in very less time. So in this case we can locate the nearest hospital in which the patient can get the blood and in emergency patient can be treated immediately as related medical information is already stored in the database.



Minutiae based matching-

Minutiae based matching is most popular because of its good performance, low computation time and increased accuracy. This type of matching tries to align the minute points i.e. minutiae points of the input image (Query template) and stored image (reference template) and find the number of matched points. After this alignment two minutiae points are considered while matching these points if the spatial distance and direction difference between these points is small then the fingerprints are matched. All

translation, rotation information as well as other geometrical transformation such as scale and distortion is considered while matching fingerprints using minutiae points.

Mathematical Expression is-

Local Orientation of pixel(i,j)

$$Vx(i,j) = \sum_{u=i-\left(\frac{w}{2}\right)}^{i+\left(\frac{w}{2}\right)} \sum_{v=j-\left(\frac{w}{2}\right)}^{j+\left(\frac{w}{2}\right)} 2\,\delta x(u,v)\delta y\,(u,v)$$

,

$$Vy(i,j) = \sum_{u=i-\left(\frac{w}{2}\right)}^{i+\left(\frac{w}{2}\right)} \sum_{v=j-\left(\frac{w}{2}\right)}^{j+\left(\frac{w}{2}\right)} \delta\text{^}2x(u,v)\delta\text{^}2y\,(u,v),$$

$\Theta(i,j)=(1/2 \tan^{-1} (Vy(i,j)/Vx(i,j)))$

Where:

$\Theta(i,j)$ – is the least square estimate of the local orientation at the block centered at pixel(i,j)

$\delta x,\delta y$ – are the gradient magnitudes(the sobel operator) in the x and y directions.

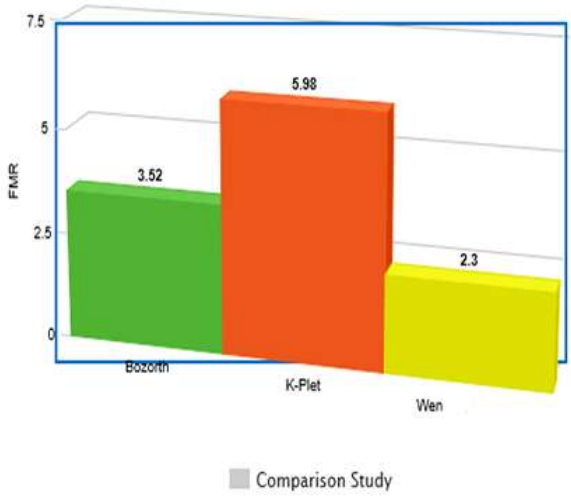
Algorithm-

1. Scanning i.e. Scan image
2. Acquisition i.e. Acquire image 'a'
3. Preprocessing of image i.e. image enhancement, conversion of color image to black and white image.
4. Structural extraction includes detection of minutiae points i.e. minute points of the finger.
5. Removal of false minutiae points means postprocessing of image.
6. Using fingerprint matcher the scanned fingerprint image 'a' and the fingerprint which is stored in the template i.e. image 'b' is compared and if(a==b) then the information related to that person is retrieved from the database, else the fingerprint and the data related to that fingerprint is not stored in the database.
7. End.

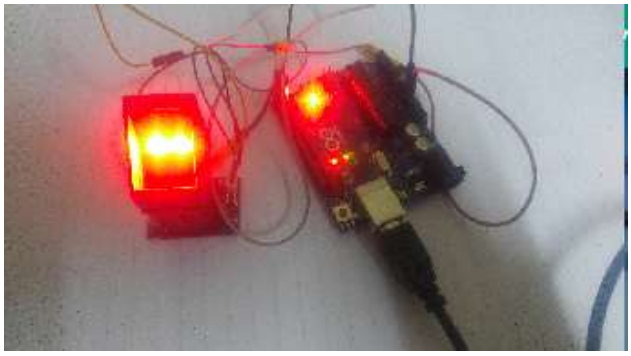
V. RESULTS AND DISCUSSION

Here we demonstrate the performances of the proposed algorithm through comparing experiments with other well-known minutia-based fingerprint matching approaches. The performance evaluation of the proposed matching algorithm for both the accuracy and efficiency is tested.

Algorithms	FVC2006 DB2		FVC2006 DB3	
	EER	FMR1000	EER	FMR1000
Ours	**1.00**	**2.30**	**4.82**	**16.13**
Bozorth [7]	1.76	3.52	8.43	26.93
K-plet [10]	2.76	5.98	11.30	29.69
MCC [11]	0.15-2.98	0.18-5.91	3.06-9.32	6.14-23.05
Jiang [6]	1.22-11.00	2.02-20.83	7.12-18.98	25.68-47.23



When fingerprint is scanned the ID will be automatically generated in the id field , user have to just click on the submit button for automatically retrieving information.



Arduino kit and sensor device is used for fingerprint enrollment and fingerprint identification.

VI. FUTURE WORK

There still exists some limitations in the proposed system for example when a person meets with an accident that person will call an ambulance and there might be a chance that an ambulance being called is not a government authorized ambulance which does not have fingerprint detection device i.e. biometrics system. So to overcome this problem we are going to create one android application which will help person to call ambulance having biometrics device.

VII.CONCLUSION

We have proposed this system to cater the medical needs of the people in need. This system will store the information of the people in the designated database that can be used to retrieve the information in emergency cases. The proposed system makes use of person's fingerprint to store the relative medical information. Also the results and analysis show that the proposed system yields to better results in comparison with older approaches.

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