Automatic Identification of an Individual By Combining Finger Vein and Iris

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Abstract- *Biometric identifiers are distinctive, measurable characteristics used to label and specifically describe individual. Personal identification is very important process that resides a large portion of daily usages. Identification process is applicable in work place, private zones, banks ...etc. The iris and finger vein multimodality biometric system increases the population coverage and improves the accuracy of the human recognition ensures higher performance. A multi-modal biometric system combines two or more biometric data recognition results to increase the performance of authentication systems that prevents unauthorized users from authentication and reduces False acceptance rate. The main aim of this paper is to provide multilevel authentication in biometric systems. multi-modal biometric is the usage of multiple biometric indicators by personal identification systems for identifying the individuals. In this paper, we are using finger vein and iris of a person for the automatic identification of an individual by combining finger vein and iris of a person at the matching-score level. A technique called Circular hough transform, Maximum curvature method and Wavelet transform is used for this purpose.*

Keywords- Biometric, Finger vein, Iris Recognition, Circular Hough Transform, Wavelet Transform

I. INTRODUCTION

In this project, personal identification system with multimodal architecture has been proposed. Our system fuse personal finger vein and iris, which uses a vein feature matcher for finger vein and Eucledian Distance Matcher for iris. It has been more secure than a framework used a single identification of personal feature. The vein structure is stable over time and can be manipulated for identifying human. The iris portion of the human eye has vessel pattern which is unique for each human being. So, the iris pattern can be used for a useful biometric feature. .A few research works has been done over finger vein pattern recognition. Finger vein is an important biometric technique for personal identification and authentication. The finger vein is a blood vessel network under the finger skin. The multi modal biometrics is proposed through which the user can be authenticated either iris or finger vein recognition. Iris recognition used Hough transform and finger vein recognition uses repeated line tracking based feature extraction method to effectively eliminate the most unlikely matches respectively.

II. LITRETURE REVIEW

Sarat C. DassKarthik NandakumarAnil K.Jain,"A Principled Approach to Score Level Fusion in Multimodal Biometric Systems",IEEE,2005.

We propose an optimal framework for combining the matching scores from multiple modalities using the likelihood ratio statistic computed using the generalized densities estimated from the genuine and impostor matching scores. Some parts of the score distributions can be discrete in nature; thus, estimating the distribution using continuous densities may be inappropriate. We present two approaches for combining evidence based on generalized densities: (i) the product rule, which assumes independence between the individual modalities, and (ii) copula models, which consider the dependence between the matching scores of multiple modalities.

Yunhong WangTieniu TanAnil K. Jain, "Combining Face and Iris Biometrics for Identity Verification",IEEE,2003

Face and iris identification have been employed in various biometric applications. Besides improving verification performance, the fusion of these two biometric has several other advantages. We use two different strategies for fusing iris and face classifiers. The strategy is to compute either an unweighted or weighted sum and to compare the result to a threshold.

Tjokorda Agung Budi Wirayuda1, Didik Hari Kuswanto2 , Habbi Ananto Adhi3, Retno Novi Dayawati4, "Implementation of Feature extraction based Hand Geometry in Biometric Identification System",IEEE,2013

This research is a study about feature extraction in biometric identification system based hand geometry. Feature vectors that used is length of finger, finger width at 1/3, ½, 2/3 of finger length, and upper, middle and lower width of palm, and ratio of index finger, center finger, ring finger. The best system performance is at 35 individuals, using 0.035 threshold value, and 23 feature vectors. And the noise like lying down of hand and environment light is the noises that give bad effect for system performance. In the future work will use multimodal biometrics, like combination between vein features and line of palms, and use finger selection or hand pose to increase system performance.

III. EXISTING SYSTEM

In the unimodal biometrics, due to the imperfect acquisition conditions the captured biometric data might be distorted and enrolled user of the system might be incorrectly rejected. The usage of certain biometrics makes it susceptible to noisy data such as inability of scanner to read dirty finger prints clearly. Damaged data may cause false rejection, which leads to inaccurate matching. A facial recognition camera may not able to distinguish between two people if they are identical twins. Some biometric technologies can be incompatible with a certain subset of the population. When enrolling in a fingerprint system, elderly people and young children may have difficulty due to their faded prints or underdeveloped fingerprint ridges respectively

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Disadvantages:

- Uni-modal biometric systems are vulnerable to spoof attacks
- If that computer is connected to the web, someone in a foreign country can copy it.
- Storing biometric information in the computer or on the disk makes it vulnerable to copying from any other system that can access it.

IV. PROPOSED SYSTEM

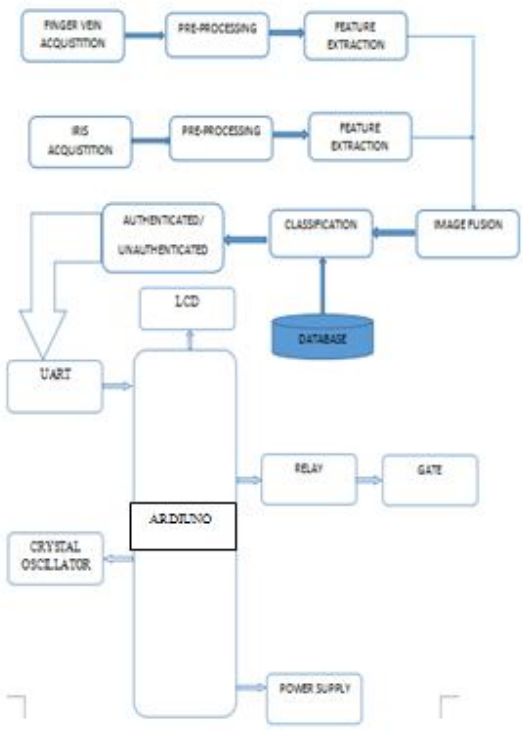

Fig.1 Block Diagram

By using this system, behavioural characteristic of a person for enrollment, verification or identification process is done. Matching score level is used for the combining fingerprint and iris of a person for the automatic identification of an individual. To increase the security purposes, the fingerprint and iris image of a person is used for person authentication. In this paper, we are using fingerprint and iris of a person for the automatic identification of an individual by combining finger print and iris of a person at the matching-score level. A technique called Minutiae matching and Edge detection is used for this purpose. The performance of the proposed technique has been evaluated and accuracy has been increased by minimizing the FAR (False Acceptance Rate) and FRR (False Rejection Rate).

V. WORKING PRINCIPLE

Proper biometric use is very application dependent. The block diagram on previous page shows the two basic modes of a biometric system. Initially, the system performs comparison of a captured biometric with a template stored in a biometric database in order to verify the individual in verification mode. There are three steps exists in the verification of a person. The first step is, the reference models for all the users are produced and saved in model database. Then second step performs matching with reference models to calculate the threshold. In final step, the testing is done. It may

use username or ID number to indicate which template should be used for comparison.

Successful identification of individual can be done if the comparison of the biometric sample to a template in the database matches with previous threshold. Note that it is crucial that storage and retrieval of such systems themselves be secure if the biometric system is to be robust. The sensor block is the interface between real world and system. It has to acquire all the necessary data. Here, it is an image acquisition system. In next block all the necessary pre-processing is done by removing artifacts from the sensor. Then, required features are extracted. It is important step as the correct features need to be extracted in the optimal way. By use of Multimodal biometric systems, fusion of the biometrics information can done at different stages of a recognition system. If in case of feature level fusion, the data itself or the features extracted from multiple biometrics are fused. More effective results are expected than the others because the feature set contains richer information about the input biometric data. Multimodal is a combo of different biometric technologies. By using more than one means of biometric identification, the multimodal biometric identifies. The level of security he/she requires can be set. With this methodology, the probability of accepting an impostor is greatly reduced.

VI. EXPERIMENTAL SETUP

A. FINGER VEIN RECOGNITION:

In finger vein recognition, the finger vein image is captured and localized the finger region in the captured image. The shape of each finger was found to be different so normalizations is performed to the localized finger region which was defined and stretched towards the X and Y axes, respectively. Then, the localized image was sub-sampled. After that, the finger vein feature are extracted and enrolled in the back store so that it can be matched in a later during matching process .For robust extraction of the finger vein patterns from the non-uniform images, the used method includes the repeated tracking of dark lines in the images. The current tracking point may track a region of noise by chance. For smooth tracking, an attribute, “the moving-direction attribute”, which restricts increases in the global curvature of the locus is added to the tracking point. If only a single line tracking operation is conducted, only a part of veins within the image will be tracked. Vein tracking sequences are started at various positions to overcome the problem, then sequences are determined so that tracking trials are conducted evenly across the image. Because of positions in the locus space with high values are stored which are tracked frequently in the tracking procedure also, they have high probabilities of being the positions of veins. So, the paths of finger veins are obtained as chains of high-value positions in the locus space. Discarding few start points for line tracking leads to reduce the computational costs and also retains accuracy in extraction. A smaller template, is used for faster computation by keeping all information required for personal identification.

B. IRIS RECOGNITION

Iris patterns are random and don’t depend on genetic factor. Iris recognition systems analyse many irises features; e.g. rings, furrows, and freckles. One of the most common and powerful tool used for such analysis is image processing techniques. Iris systems have a very low False Accept Rate (FAR) compared to other biometrictraits that can be rather high Circle detection algorithm. Circle detection algorithm has enough recognition performance and speed level. It also has good accuracy for detection with high precision. It is is simpler, efficient, optimum memory consumer and low burden processing method than others. Initially, process the image for separation of iris from eye image. Then, normalization produces irises with same fixed dimensions (x,y), two photographs of the same iris under different lighting conditions will have the same characteristic features. So, segmentation for iris extraction is required to allow comparisons between different irises.

Circular Hough Transform:

It is used in Digital Image Processing, for detection of circular objects in a digital image. Its purpose is to find circles in imperfect image inputs.

In a two-dimensional space, a circle can be described by:

$$(x-a)^2 + (y-b)^2 = r^2 \quad (1)$$

Where a and b is the center of the circle, and r is the radius. Then parameters that satisfy (x, y) would lie on the surface of an inverted right-angled cone whose apex is at (x, y, 0). Consider 4 points on a circle in a image, for each (x,y) of the four points in the original image, it can define a circle in the Hough parameter space centered at (x, y) with radius r. The intersection point can be tracked using an accumulator matrix, then local maxima point is found. The position (a, b) of the maxima would be the center of the original circle.

Wavelet Transform:

It is defined as one of the form of data compression technique well suited for image compression as well as video and audio compressions. The aim of this process is to store

image data in less space as possible. Wavelet compression can be either lossless or lossy. This method is important for representing transients, such as some percussion sounds in audio. Generally, then DWT is applied to compress the electrocardiograph (ECG) signals. It is not good for all kinds of data.

C. IMAGE PRE-PROCESSING

The images are taken and then the pre-processing steps had been implemented , In this step ,image resizing , noise removal using filters and contrast enhancement using image sharpening methods had been carried out.

D. IMAGE SEGMENTATION

Iris: Circular hough transform has enough recognition performance and speed level. Also, it has great ability for accurately detection with high precision although partially occluded circles. Circle detection is simpler, efficient, optimum memory consumer and low burden processing method than others . Normalization process is responsible for producing irises with same fixed dimensions, in turn, for a given two photographs of the same iris under different lighting conditions will have the same characteristic features. In turn, after eye region segmentation, segmentation for iris extraction is required to allow comparisons between different irises. Each iris that is extracted is transformed so that it has a fixed dimension, and hence removing the dimensional inconsistencies between eye images due to the stretching of the iris caused by the pupil dilation from varying levels of illumination.

Finger Vein: In finger vein recognition, the finger vein image is localized and extracted using maximum curvature method. The shape of each finger was found to be different so normalizations is performed to the localized finger region which was defined and stretched towards the X and Y axes, respectively. Then, the localized image was sub-sampled.

E. FEATURE EXTRACTION

Features are the attributes or values extracted to get the unique characteristics from the image. Features from the input images are extracted using wavelet transform algorithm. A Four level decomposition is employed and it is established that there is a significant correlation present between the surface roughness and the extracted energy components.

F. AUTHENTICATION PROCESS

The matching score from the iris, finger vein and face can be stored in a database. If any person tries to access, finger, iris and face can be checked with the database, if the score is same , then the access will be allowed otherwise it can be denied. This comparison can be done by using block matching algorithm.

G. ARDUINO UNO

Arduino gets input information from the user or the environment while outputs do something with the information that has been captured. An input could be digital or analog, and could come from the environment or a user. Outputs can control and turn on and off devices such as motors or other computers.

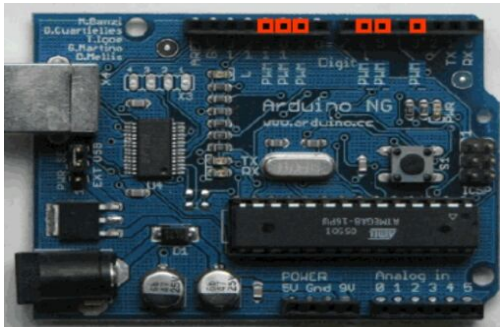

Fig.2 Arduino Board

H. DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

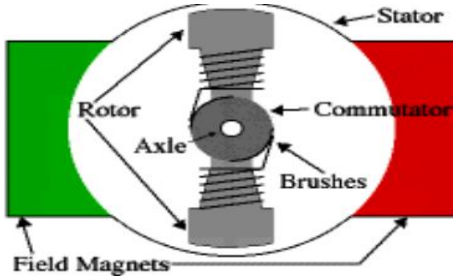

Fig.3 Internal architecture of DC Motor

I. UART

Here UART is MAX 232, which converts signals from RS-232 serial port to signals suitable for use in TTL logic circuits. It has a dual driver/receiver and usually converts the CTS, RTS, Receiver and Transmitter signals. The drivers provide RS-232 voltage level outputs (approx. ±7.5 V) from a single +5 V supply via on-chip charge pumps and external capacitors. Because of this, it useful for implementing RS-232 in devices that don't need any voltages outside the 0 V to + 5 V range. It has two receivers, which is used to convert RS-232 to TTL voltage levels and two drivers to convert TTL logic to RS-232 voltage levels.

J. RELAY:

A relay acts as electromagnetic switch to turn on or off a large electric current by using a small amount of electric current. The basic principle of a relay is an electromagnet where electricity flows through a coil of wire than it becomes a temporary magnet.

Fig.4 Relay

K. LCD Display

Liquid Crystal Display is combination of two states of matter, the solid and the liquid. It uses a liquid crystal to produce a visible image. It's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology. The combination of colored light with the grayscale image of the crystal forms colored image. This image is then displayed on the screen like shown below. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

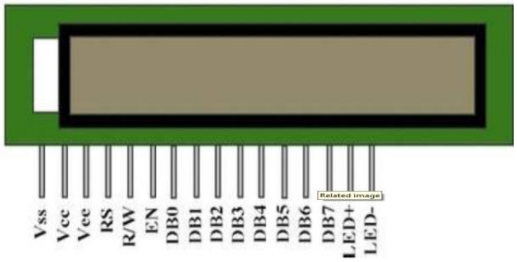

Fig.5 LCD Pin Configuration

The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other.

L. Power Supply

` All basic electronic circuits need constant DC voltage. The low power system can be run with a battery. But, for long time operating devices, batteries could prove to be costly and complicated. Regulated power supply is a combination of a transformer, rectifier and a filter.

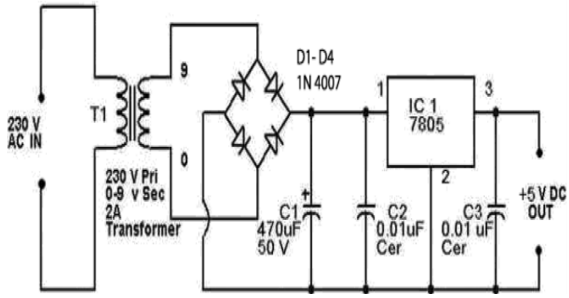

Fig.6 Regulated Power Supply

In above figure, a small step down transformer is used to reduce the voltage level to the devices needs. The output is sinusoidal AC voltage, which is converted to DC using a rectifier. Then, dc voltage is given as input to filter circuit which reduces the AC ripples, and passes the DC components to get 5v power supply.

VII. RESULT

Our proposed system is a gentle secure and robust stable identification and recognition system. The proposed system is a new combination to the biometric research that can be extend and enhanced during times. The diagrams below shows the output images of our proposed system.

Fig7. Iris input image

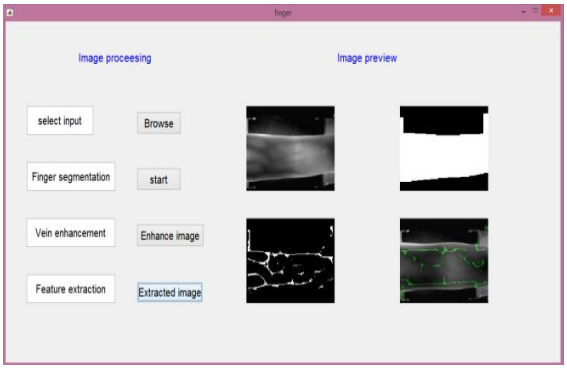

Fig.8 Finger vein input image

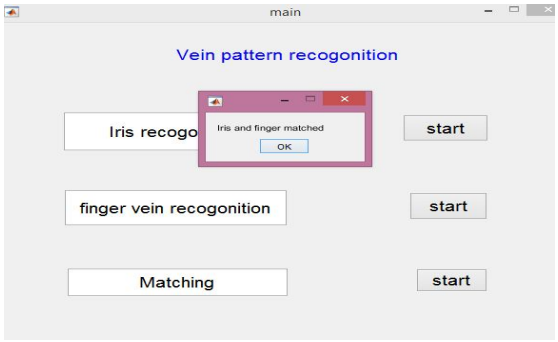

Fig.9 Iris and Finger Matched output image

Fig.10 Proposed system

VIII. ADVANTAGES

- The technique has been proposed for the purpose enhancing accuracy of recognition, reducing FMR and FNMR rates and authentication of the fingerprint biometric data.
- Accuracy and efficiency of biometric system has been increased by combining two unimodal biometrics
- Authentication is highly secured not able to hack

IX. APPLICATIONS

- Security purpose
- Banking process

X. CONCLUSION

Biometrics is a very promising technology, challenges are slowing its development and deployment. Finger vein images and Iris images are chosen due to their unique physiological traits. The proposed multimodal biometric identification and authentication system is considered a robust combination of finger vein and iris that have matching score level with accuracy of 92.4% with FAR and FRR of 0% and 7.5% by threshold (0.6).

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