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Two Level Authentication for Machines Using RFID & Finger Vein Recognition

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Abstract: Identification of people among each other has always been a tough and challenging task for the researchers. There are many techniques which are used for identifying a person but biometric technique is the standard one which allows us for online identification of individuals on the basis of their physiological and behavioral features. The veins based systems include finger veins, face veins, palm veins, head veins, he art veins, iris, palatal veins of the rogue etc. The multi-veins based systems use the veins of different physiological traits for identifying a person. In this work, finger vein recognition system for personal authentication is implemented. Vein patterns are different for each finger and for each persons and as they are hidden underneath the skin´s surface, forgery is extremely difficult these unique aspects of finger vein patterns recognitions set it apart from previous forms of biometrics and have led to its adoption in various security technology, the proposed system is implemented in MATLAB. This paper consists of RFID module based user authentication and whole algorithm is implemented using MATLAB.

Keywords: Biometrics, Finger Vein, Image Acquisition, Feature Extraction, RFID, MATLAB.

I. INTRODUCTION

Biometrics is identifying humans by their physiological, behavioural and biological characteristics. There are different types of biometrics, and humans can be recognized by their fingers, hands, face, eyes, and voice, some of which are more widely used than others.

A. Facial Scan

Facial scan technology is mostly used for identification of individuals instead of verification. This technology uses some of the important features of the face, like, eyes, nose, lips, and so on.

B. Iris Scan

Iris scan technology is used for both identification and verification. Based on unique features of irises. This technology uses patterns that form the visual part of the iris to differentiate between humans.

C. Voice Scan

Various vocal qualities such as frequency, short-time spectrum of dialogue and spectrograms (time frequency-energy patterns) are used for voice scan.

D. Fingerprint Recognition

Fingerprints are the inherent part of humans and they are unique for each person. Even twins have different fingerprints. Using the patterns found on the finger tips, fingerprint biometric data is captured. As with every technology, using fingerprint for biometrics has its own disadvantages, as Age of the user, dryness and wetness of the finger, temporary or permanent cuts on the finger, or dirt on the fingerprint which causes the fingerprints to have weak patterns of ridge and valleys that can degrade the performance of a fingerprint biometric system.

E. Finger-Vein Recognition

As the veins are present under the skin. There are blood vessels which are unique to individuals (even in twins) and this uniqueness made a new biometric system based on finger veins.

identification by extracting the false minutiae from the vein pattern. Some systems are implemented on the basis of embedded platform, sensor to capture single and multi-vein based identification. So to increase the security and credibility of system, RFID

module is used. By matching the minutiae it will identifies the person is true or not. For reducing the delay of the system here directly the skeletal pattern of input images are used for the matching process.

II. LITERATURE REVIEW

The veins based security system is much more secured than other security systems. The veins images exist only in living human body. In each unimodal, the feature extraction and feature matching algorithm is used for identifying the individuals.

R. Mahalakshmi, R. Purushothaman [1] the paper illustrate that ,there are so much of algorithms carried out in our existing system, SVM (support vector machine) used for human authentication which has the ability to achieve maximal computational efficiency. The SVM requires large amount of training data to identify or to overcome this, thus proposing a system using heuristic method and gravitational search algorithm useful to solve non differentiable and multimodal problems effectively, requires less computation. The Gravitational Search Algorithm is based on Newton's law of Gravity & Motion .The performance is evaluated using FAR, FRR, EER. The proposed method used patterns of three different finger veins and fused them using score level fusion strategy. Tuning the weights of sum score level fusion using heuristic optimization strategy like Gravitational Search Algorithm is used. Gravitational search algorithm based on the law of gravity and the law of motion. Experimental results confirmed that using a heuristic method could lead to more accurate identification accuracy.

R. Christinal [2] the system illustrates, the enhancement in ATM security has been proposed. Here, there are three approaches that have been concentrated. I- Personalizing ATM access using the finger-vein authentication. Sensors to capture the finger-vein can be used, since there is no chance of duplicating the vein format of a person. II- Providing enhanced around the clock surveillance system to efficiently utilize the resources. It reduces the effort of human security as the system is equipped with automated door-lock and an alarm system. III- Applying constraints to reduce the utilization time and maintain the sensor performance.

Kamta Nath Mishra et.al. [3] The paper illustrates an overview of veins based personal identification systems. The performance of different single and multi-veins based identification systems are analyzed in this paper. The features like reliability, security, accuracy, robustness along with the strengths and weaknesses of various veins based biometric aspects taken into considerations. The system analyzed the performances of fingers, palm, face, iris, palatals, hand and heart veins based multi-veins systems. The multi-veins based systems give better performance in terms of FAR and FRR ratios in comparison to uni veins based systems. Specially, fingers-face-iris-palatal veins based multi-biometric systems always give low FAR and FRR values which can be considered as the better performance in comparison to other multi-veins based identification systems. The heart veins, hand veins, and palm veins based systems have high FAR and FRR values.

C.Vinu, D.Silambarasan [4] author proposed a secured authentication system by recognizing the finger vein. Here the system will take the finger vein information by the sensor and it will react accordingly based on person authentication level which already defined by the administrator. The system is implemented on a raspberry kit, sensors and actuators. The features used are lacunarity distance, blanket dimension distance. This has more accuracy when compared to conventional methods. The image capture module consisting of camera and LED's is used to collect finger vein images. The raspberry pi module is used to execute the algorithm and communication port is used to communicate with the peripheral devices.

Bang Chao Liu, Shan Juan Xie, Dong Sun Park [5] this paper proposed two block selection methods which are based on the estimate of the amount of information in each block and the contribution of block location by looking at recognition rate of each block position to reduce feature extraction time and matching time. The specific approach is to find out some local finger vein areas with low quality and noise. Local binary pattern (LBP) descriptors are proposed to extract the finger vein pattern feature. Two finger vein databases are taken to test algorithm performance .Experimental results show that proposed block selection algorithm can reduce the feature vector dimensionality in a large extent.

K. SyazanaItqan, A.R. Syafeeza [6] this paper discusses on the approaches on preprocessing, feature extraction and classification stage specifically for recognizing individual identity. The strengths and weaknesses of these approaches are critically reviewed.

W.F.Aswad, K. Guirguis [7] the paper presents current methods by combining it with conventional method used in fingerprint for minutiae extraction to extract and the minutiae points of finger vein on database and subject matching technic The proposed method is done by extracting the minutiae points of finger vein which is the result of combining two methods of maximum curvature points in image profile and the method used in extracting the minutiae points of fingerprint.

A. Gholami, H. Hassanpour [8] in this paper proposed a new algorithm for finger vein recognition with a high accuracy level. By extracting veins from finger vein images using entropy based thresholding which containing some noise. It means that the extracted veins may appear as broken lines. So by applying Radon transformation to segmented images, the recognition accuracy and speed

increased. The Radon transform is not sensitive to noise due to its integral nature. So in comparison with other methods, it is more resistant to noise. This transformation does not require the extraction of vein lines accurately. For extracting dominant features from finger vein images, the common spatial pattern (CSP) algorithm applied to the blocks of Radon transformation. To improve the classification accuracy, redundant features were eliminated using genetic algorithm, and 1-NN classifier is used to identify people using their finger veins.

Smita Udhavrao Sakhare et.al [9] has proposed a biometric finger-vein recognition (FVR) system for authentication on ATM network. The system is implemented on embedded platform and equipped with a novel finger vein recognition algorithm and implemented in MATLAB platform. The system consists of three hardware modules, image acquisition module, embedded main board & human machine Communication module. The image acquisition module is used to collect finger-vein images.

The Embedded main board including the LPC2148 Microcontroller chip, memory (flash) and communication port is used to execute the finger vein recognition algorithm and communicate with the peripheral device. Experimental results show high accuracy for user authentication for successful transaction. This system is faster than other. In case of future work finger-vein recognition system can be used in consumer electronics, airport, space and defence applications.

V. Ramya et.al [10] has proposed a real time embedded finger vein recognition system for personal authentication and vehicle security. Vein patterns are different for each finger and as they are hidden underneath the skin's surface, forgery is extremely difficult for these unique aspects of finger vein patterns recognitions. Apart from previous forms of biometrics and have led to its adoption in various security technology, the proposed system is implemented in MATLAB platform and equipped with a novel finger-vein recognition algorithm. The proposed system consists of four module image acquisition module, finger vein matching model, embedded main board and communication module. The image acquisition module is used to collect a finger vein image and is a low cost device. Feature extraction is important for finger vein recognition algorithm and a HAAR classifier is used to extract the features. The finger vein image is matched by calculating the Euclidean distance. The developed system includes finger vein matching and controlling the application. The experimental result shows that it takes minimal time that is only 0.5 seconds to verify one input finger vein sample image which is significantly lower than the existing system methods. This system consumes low power and has less computational complexity and hence it is suitable for security applications in vehicle, home, banks and industry etc.

P. Harsha, R. Kanimozhi, C. Subashini [11] the system proposed a real-time embedded finger-vein recognition for authentication on teller machine being developed. This system is implemented on an embedded platform and equipped with a finger-vein recognition algorithm. So system is an intelligent security system. If the finger vein matched via GSM technology. System based on the wavelet transformation and energy feature implemented on a DSP platform and includes a device for capturing finger vein images, a method for ROI segmentation, and a novel method combining wavelet transformation and energy features for recognition.

V.BhanuKiranmai et.al. [12] The author has proposed a real-time embedded finger-vein recognition system (FVRS) for authentication on mobile devices. The system is implemented on embedded platform and equipped with a novel finger-vein recognition algorithm. System consists of four hardware modules: radio frequency identification system, image acquisition module, embedded main board, and human machine communication module. RFID module will start the very initial communication between the user and the device the image acquisition module is used to collect finger-vein images. The Embedded main board including the Microcontroller chip, memory (flash), and communication port is used to execute the finger-vein recognition algorithm and communicate with the peripheral device. The human machine communication module (LED or keyboard) is used to display recognition results and receive inputs from users.

III. SYSTEM DEVELOPMENT

The proposed system mainly consists of two parts: The RFID Module with the RFID tag and MATLAB algorithm. Input ID is sent to PC with MATLAB. Input image is also sent to the PC. Input image is processed and its features are extracted like minutia which forms a minutia reference image. Compare Minutia of the input image with minutia of the reference minutia. We calculate percentage matching of minutia. If (percent>90), then it will display a message that veins are matched and also displays the percent match. If (percent<90) then it will display a message that veins are not matching and also displays mismatch percentage. Then, we read the data received from RFID card. Then, compare input ID with the received data. Based on comparison results, it will display message whether RFID recognized or not. When both conditions are met, i.e. RFID is recognized and veins are matched, the person gets recognized.
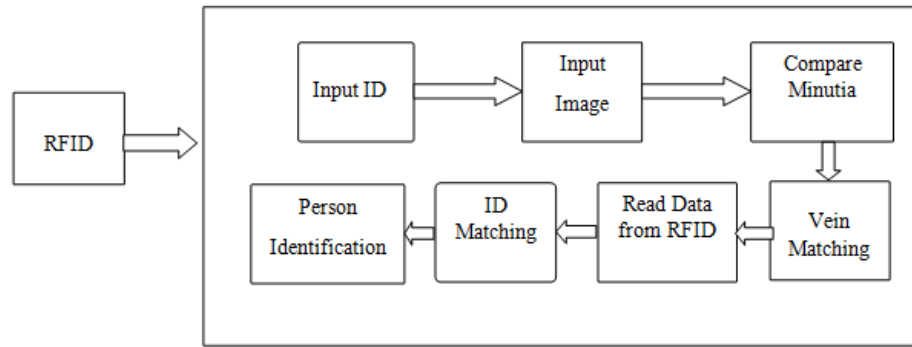
Fig 1: Block Diagram of the System

A. Hardware Development

RFID reader and RFID tag RFID is known as Radio Frequency Identification System. RFID technologies are efficient and secure compare to other network security system. The primary goal of RFID technology is to automatically identify data that are contained in electromagnetic fields. That can be implemented for several applications such as security, tracking, inventory detection and access control applications. RFID technology consists of a combination of tags and readers which is shown in figure.
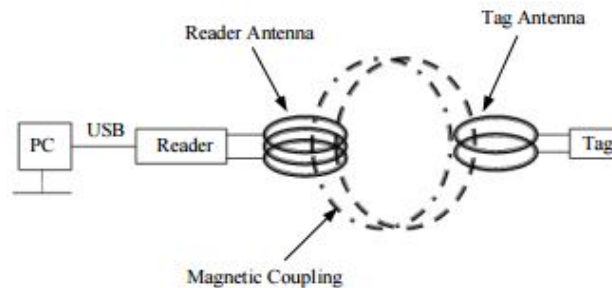
Fig .2: Block Diagram of RFID Tag & RFID Reader

The above figure illustrates a general working system and components of RFID. When a RFID transponder is placed a RFID reader, the reader reads information contained in the transponder without any physical contact. RFID reader transmit radio frequency and RFID tag receive radio frequency to power up the chip and then transmit its own serial number by frequency. This power is sufficiently enough to send back information on that transponder to the RFID reader to be processed. The tags store and transmit data to readers using radio waves. The readers gather data from the different tags and relay them back to the server for further analysis and processing. The system serves the purposes of identification, monitoring, authentication and alerting through this exchange of data between the tag and the reader.

B. Software Development

The software development for the proposed system has been done in MATLAB. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

MATLAB is a programming language developed by MathWorks. It started out as a matrix programming language where linear algebra programming was simple. It can be run both under interactive sessions and as a batch job. In this system finger vein reorganization algorithm is implemented on MATLAB GUI. Figure 4 shows the flowchart for software development for finger vein identification system.
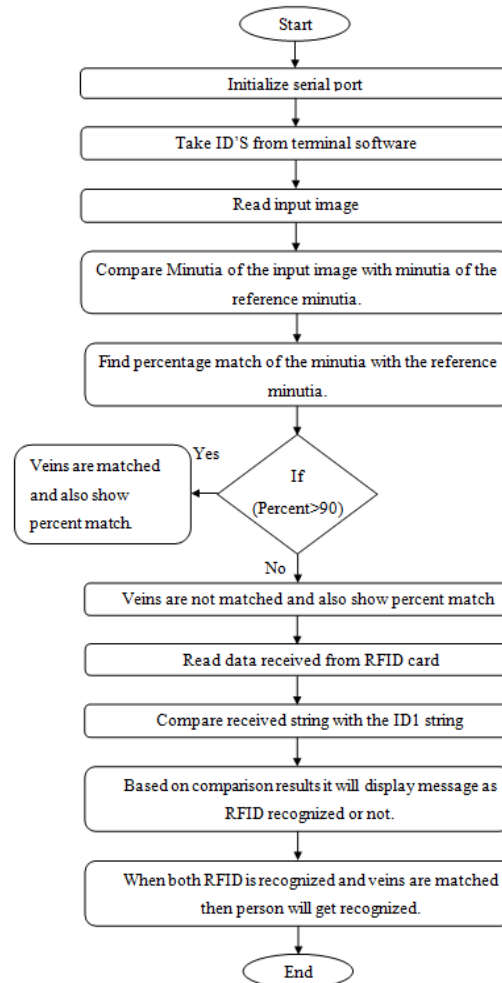
Fig .3: Flowchart

IV. RESULTS & PERFORMANCE ANALYSIS

A. System Analysis

On the system side of RFID module, the data is stored in database. Comparing that data with the received data, the result will be displayed. In the initial scanning, the input finger vein image gets binarized and thinning pattern of the image will appear, as to store in the data base.

B. Phase I-Initial Scanning & Pre-processing

The critical point image is nothing but minutia marking image. Here the termination points in Red and bifurcation points in Blue get marked.
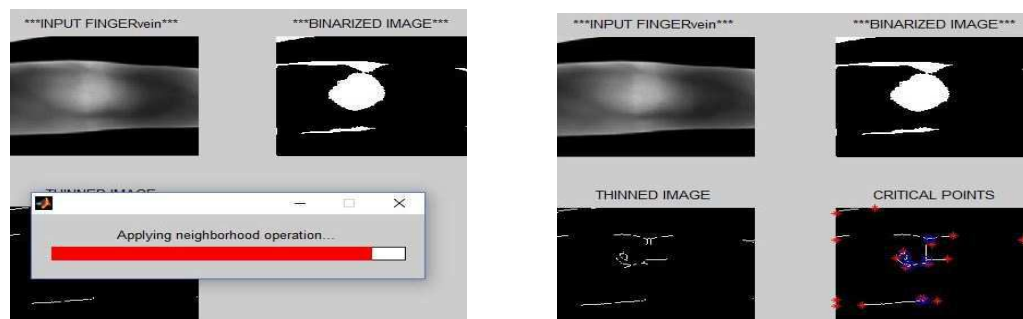

Fig .4: Pre-processing Output

Phase II- neighbourhood operations: taking the 1st input image and 2nd input image of the person, the feature extraction takes place for determining the minutia. The nl filtering in the matlab used for this determination. By removing the extra internal points, the matching result of images and region of interest show the recognition of person, but for the true person identification further processing is done.
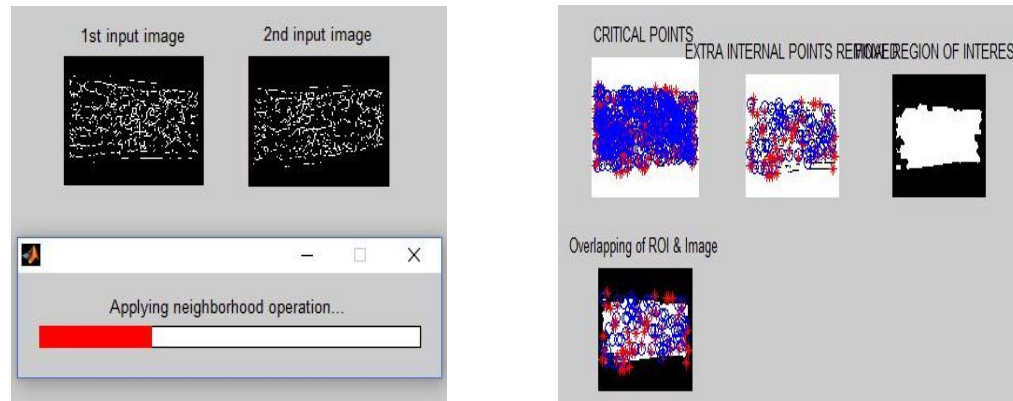

Fig .5: Post-processing Output

Post-processing & person identification: in the post-processing stage, the region of interest is obtained and it can b determined whether the person can be recognized or not. For the true person identification, the input data and the reference data should be match. For the matching result condition is used, if rfid and vein matching percentage is below the predefined percentage, then person not get recognize, and the result will display on the screen.
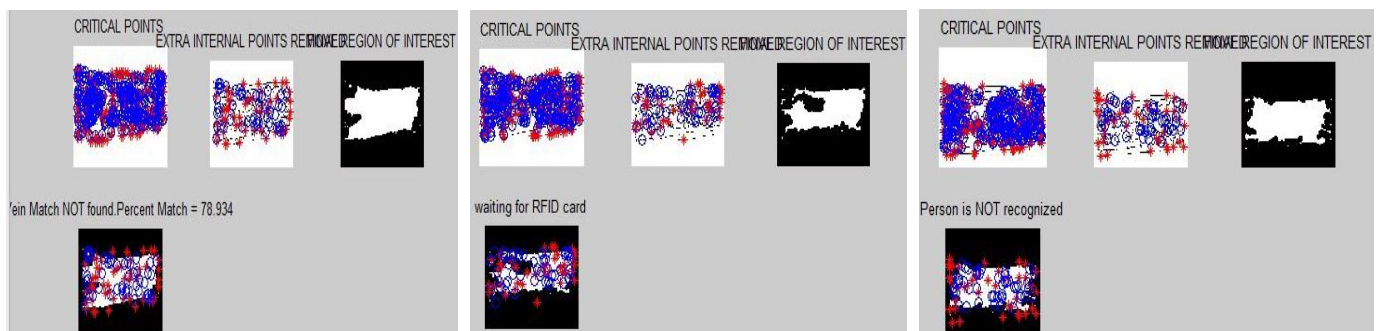

Fig .6: Person Not Recognized

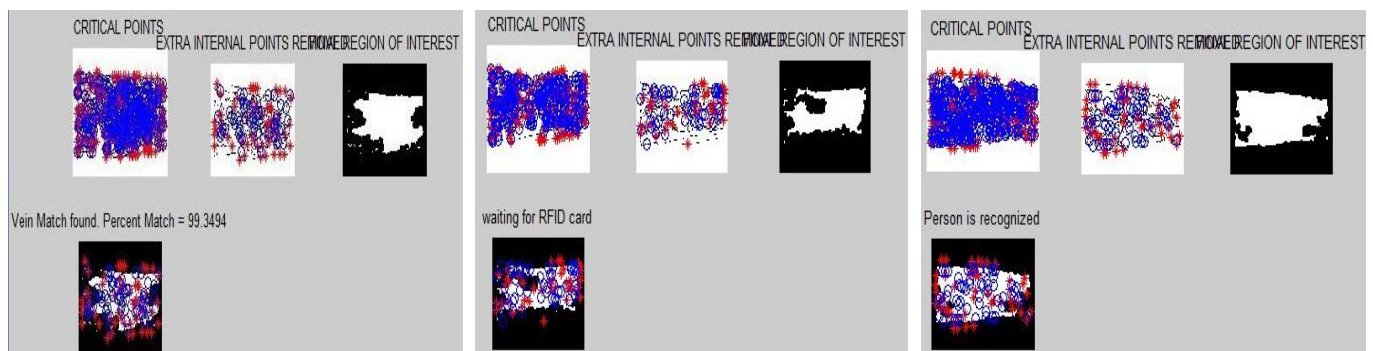If RFID and vein matching percentage is above predefined percentage, then only person get recognize.

Fig .7: Person Identification

V. CONCLUSIONS

The system two level finger vein based user recognition for biometric authentication and identification, provides effective and efficient features using RFID module and algorithm which is been implemented on MATLAB platform. It is also computationally

efficient with minimal storage requirement, which makes the method of practical significance. Finger-vein based identification technology has high security and reliability compared to the traditional authentication mode. It can also be applied in public or private equipment's, such as entrance control systems, home or office door entry control systems, and ATM (Automated Teller Machine) systems.

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