An Iot Enabled Finger-Vein Recognition System in Mobile Devices for Atm Users

R Gnanaselvam, M S Vasanthi

Abstract: ***In existing protection system such as PIN(Personal Identification Number), Finger Print, Palm Print, Face Recognition, Iris recognition systems for ATM(Automated Teller Machine) users have more complicated and also these systems data's will be hacked from other users easily. So in order to over come such problems, we go for finger vein recognition system. Here finger vein means we can take a finer vein image from inner structure of finger using NIR (Near Infrared) camera, but in this paper, we can take a set of sample finger vein images and stored in the data base from different users and compared with current user image using Euclidean distance algorithm. If the database and user images are equal then we can execute the transaction from ATM suppose if these two images are mismatched then we can not able to execute the transaction from ATM and also we can transfer the information to the police as well as corresponding customer such as "Unauthorized person using your account" through mobile phone using GSM (Global System for Mobile) and NODE MCU to the process the data's using IoT (Internet of things).***

Index Terms: Finger-vein recognition; biometrics; mobile devices; NODE MCU; Internet of Things, GSM.

I. INTRODUCTION

In our personal data"s is inheritainally produced by using passwords, personal Identification Numbers [1] (PINs), finger print, palm print, face recognition and iris recognition [2]. Here password can easily forgot by human being, and in the top of the ATM, we have PIN hole camera, that camera can capture our PIN number and also this PIN number can be forgot by human being also, then finger print [3] and palm print [4] can also take by using stamp and it is printed on the paper and this printed paper in the form of corresponding human finger print [5] and palm print [5] and it will show on the sensor then the sensor is used to accessed the corresponding security machine. So this is one way of access the security machine using printed finger print and palm print. Then face recognition can take a mask of your face image and showed on the sensor then it will be accessed the networks. Finally we have iris recognition, in this iris we can take a mask of your original iris image lens and put it on other iris image and showed on the sensor and it will be accessed the network. This is also one way to access the security networks. Then voice recognition, in the voice, the other person voice will be captured and will tell the same voice by some one on to the sensor then it will be accessed the security network. So in order to over come such security issues such as PIN, Password, finger print, palm print, face [6], iris, voice and signature, we can use finger vein recognition system.

Here we can take an image from the inner structure of the finger using Near infrared (NIR) camera but in this paper, we can take a set of sample finger vein images and it is stored in the database and this image will be compared with current user finger vein images. If the two images are same then we can access the transaction from ATM. Suppose if the two images are mismatched then we can not access the transaction from ATM and also we can send the message to corresponding customer through bank that "Unauthorized person using your account" and we can send the message to police that " third party misused their account". So in this matching [7] techniques, we use Euclidean distance algorithm. So finally the finger vein can be taken only from the live bodythen only the blood circulation will be flowed in to the finger vein. But we can not take finger vein images from dead body. We can use a NODE MCU [8] based on embedded platform to design the finger-vein recognition system in the present study to achieve better recognition performance and reduce the cost effective. The rest of this paper will discuss as follows. The finger vein recognition process such as resize the image, RGB to gray level image [9], histogram equalization, DWT using haar transform and feature extraction in section 2, 3, 4, 5 and 6. The matching technique will discuss in section 7 and the flow diagram of finger vein recognition will discuss in section 8 and the simulation of the result will discuss in section 9. An internet of things will discuss in section 10 and the complete block diagram of finger vein system using NODE MCU will discuss in section 11 and lastly we can conclude the paper in section 12.

II. RESIZE THE IMAGE

In Resize [10] of an image in an image processing is used to increase or decrease the pixel of an image. If we want to increase the pixel of an input image, then we can increase the zoom of an image otherwise we will decrease the zoom of an image. Here, we can use input finger vein as an input image with 256x256 pixels size by using resize techniques in image processing. Zoom of an input finger vein image defined as to increase the quantity of pixels so that we can increase the zoom of an image. Suppose if we are having distortion in an image, then we can use remapping techniques in image processing. Image insertion tasks contains two tracks namely adaptive methods and non adaptive methods. In adaptive methods, a finger vein image pixel may vary depending on the inserting, but in case of non adaptive methods, finger vein image pixels must be in static.

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Here non adaptive methods can be used only in licensed software such as Qimage, PhotoZoom Pro and Genuine Fractals. Most of the users can use inexpensive digital cameras because this digital cameras can be used in both optical and a digital zoom. If we are using an optical zoom in a digital cameras, then finger vein image will be enlarged of the light but in case of a digital zoom, decrease the quality by insertion of an image so that the pixels of a finger vein image should be same of an input image and also decrease the quality of the image when compared to optical zoom in a digital cameras.

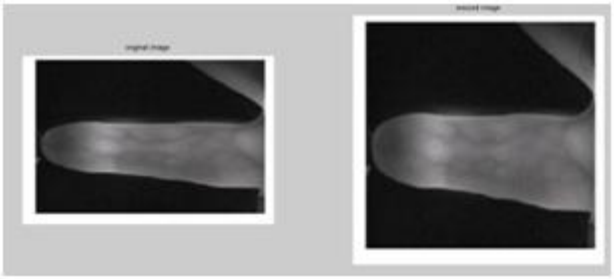

Figure 1. Resized finger vein image.

III. RGB IMAGE IN TO GRAY LEVEL IMAGE

In image processing, we can use two principle criteria in case of color image namely object identification and extract the image from original image and the second criteria is our human being can separate the color in the amount of thousands shades and its corresponding intensities.

A. Image Types

In image processing techniques, we have three types of images namely Binary image, Grayscale image and true color image

i) Binary image

In this binary image, we are using only two symbol namely logic 1 and logic 0. Here logic 0 represents black image and logic 1 represents white image.

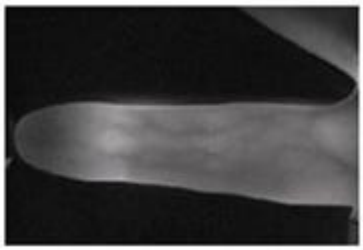

Figure 2. Black and white finger vein image

ii) Grayscale image

Gray scale image otherwise called as gray level image. In this techniques, we are using three class array namely uint8, uint16 and int16, single, or double and this techniques represents in the form of pixels as well as intensity values. For single or double arrays can represents the pixels values from logic 1 to logic 0 similarly in case of uint8 pixels values from 0 to 255 and for uint16 pixels values from 0 to 65535. So finally we have int16 pixels values from -32768 to 32767.

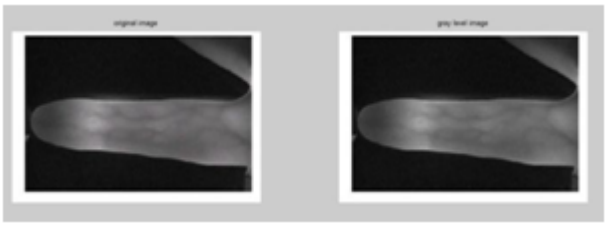

Figure 3 Grayscale image of finger vein.

iii) True color image

True color image otherwise called as RGB(Red,Green,Blue) image. It is an image represented by in the form of Red, Green and Blue pixels values scalar. Here also the pixels values ranges between logic 0 and logic 1 for single or double arrays, 0 to 255 pixels values for uint8 and for uint16 pixels values from 0 to 65535.

Before going to histogram and histogram equalization techniques, we have to convert the given color image (RGB image) in to gray level image by using the instruction called as **rgb2gray(color image)**

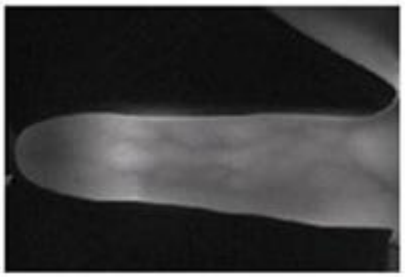

Figure 4 True color image of finger vein

IV. HISTOGRAM EQUALIZATION

Histogram equalization [11] in an image processing is used to increase the contrast of given image for adjusting the intensities of such image called as histogram equalization. This histogram equalization method is used only by close proximately of contrast of the given image. This is also used for measuring the backgrounds and foregrounds for both bright and dark of an image. The original image has been recovered only when histogram equalization output is known. It is also escalate the contrast of background noise with decrease the usable signal. It is frequently produces an ideal effects for photographs, so this histogram equalization is very useful for scientific images such as heat, repeaters in sky wave propagation(satellite) etc. For contrast enhancement of an image, we can use histogram equalization techniques in a several applications in an image processing using simple function and effectiveness. So it can be used in medical image processing, radar signal processing etc. The brightness of the image has been changed after processing of histogram equalization. So this is the only demerits of this techniques. due to destruction property of the histogram equalization so that this histogram equalization techniques can not be used frequently in consumer application such as television, system monitor etc. So finally we can enhance the contrast of an image and it is equalized using histogram techniques and we got the accurate image response.

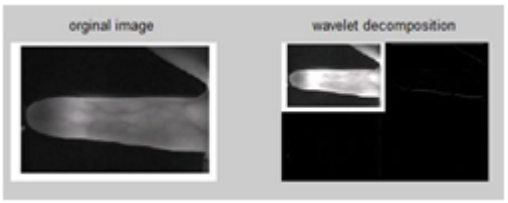

Figure 6. Response of DWT finger vein image

V. FEATURE EXTRACTION METHOD:

Feature extraction [13] refers to extract the feature from original image but before going to feature extraction method, first we have to resize the image with required pixel level then the given color image can be converted in to gray level image then we have to convert the given gray level image in to

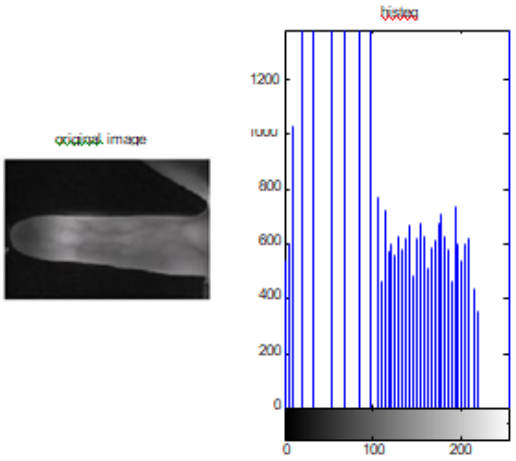

Figure 5 Response of histogram equalization image from original finger vein image.

histogram equalization image for escalate the contrast of the image. Finally the histogram equalization image can be converted in to discrete wavelet transform image using haar transform then this image can be applied to the input of the feature extraction technique for classifying and recognition of images and also it is very helpful for various image processing application. This feature extraction technique refers to performance of an input images. The feature extraction process has been completed after completion of preprocessing techniques. The feature extraction process

VI. DISCRETE WAVELET TRANSFORM USING HAAR TRANSFORM

The discrete wavelet transform (DWT) [12] is mainly used in signal processing and image compression because this DWT is used to produce the high gain response for wide spread application. Currently the JPEG has introduced its new image coding standard based on DWT. This discrete wavelet transform is used to decompose the input image signal in to set of basis functions and this function are referred as wavelets. This wavelets are fetched from mono sample wavelet referred as mother wavelet by using the technique called dilation and shifting. This DWT produces high efficiency of an input image and it is used to decompose the sub band signals by flexible method and also this DWT can be used to analyze the multi resolution of an image. The input image signal energy will be concentrated for particular wavelet coefficient using DWT technique and this DWT characteristic is mainly used to compress the images. In DWT, we can convert the given images in to series pattern of an images so that the series pattern of the images stored efficiently when compared to pixel blocks. Digital filtering methods used to represent the time scale in the digital signal and these methods can be used in DWT and this analyzed digital signal will be applied via digital filter system with different cut-off frequencies and time scale so that it can reduce the time consumption and its contains two categories namely feature selection and feature classification. Here feature selection is very complicated to process the whole system in an image processing because it will not be recognize from poorly selected feature images. The main important of the feature extraction technique is to segment the given image in to required level depends on some application. In feature extraction method, feature selection is used to recognize the image for high level performance applications. So finally feature extraction is used to extract the data from original input image for classification purposes.

Figure 7 Response of Feature extraction image for finger vein

VII. MATCHING TECHNIQUE USING EUCLIDEAN DISTANCE ALGORITHM

Euclidean distance algorithm [14] is used to find the minimum distance between image. If two images are equal, then the Euclidean distance value is zero, then we can access the transaction from ATM. Suppose if two images are unequal then Euclidean distance value produces some value then we can not able to access the transaction from ATM. This is one of the best matching technique in image processing. Here current image will be consider as **ci** and data base image will be consider as **db**. So the Euclidean distance equation will be given as follows.

ED(ci,db) = mod(ci-db)

$$ED(ci,db) = \sum_{i=1}^{n} (ci_i - db_i)^2$$

Where ci=current image db=data base image

VIII. FLOW DIAGRAM FOR FINGER VEIN RECOGNITION METHOD

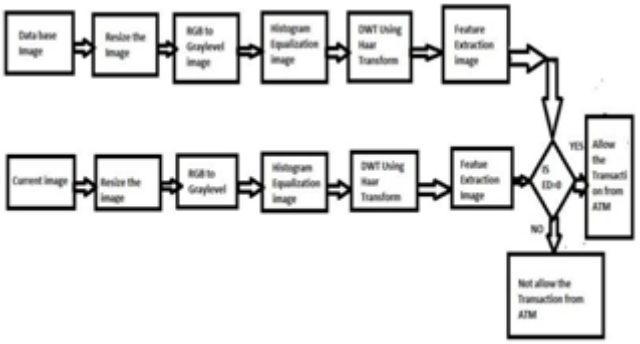

Figure 8. Flow diagram for finger vein recognition system.

In this diagram, we have current finger vein image, this current image pixel has been improved with 256x256 size by using the technique called resize the image and this resized image is applied to RGB to gray level convertor technique. This technique is used to convert the given RGB(Red,Green,Blue) image in to gray level image then only we can able to get histogram equalization response. This gray level image of finger vein is applied to input of the histogram equalization techniques for escalating the contrast of the given gray level image and this response of the histogram equalization is given to the input of the discrete wavelet transform using haar transform for decompose the image from histogram equalization image and it is applied to the input of the feature extraction techniques to extract the feature from the given image and this signal finally applied to the matching technique called as Euclidean distance algorithm and the above all techniques will be applied for data base image. If the current image and data base image are equal then we can access the transaction from ATM. Suppose if the two images are unequal then we can not able to access the transaction from ATM and also we can send the message to corresponding customer through mobile phone that "Unauthorized person using account" at the same time we can transfer the message to police that "Third person party used their account" via mobile phone. So finally we can also produces alarm sound from speaker installed in the ATM.

IX. SIMULATION OUTPUT FOR FINGER VEIN RECOGNITION SYSTEM

Figure 9. Simulation 1 Response

Figure 9. Shows that we can select data base images using data base icon then after few seconds they will show window as process completed that means all images are ready to compare with current images then we can select ok button.

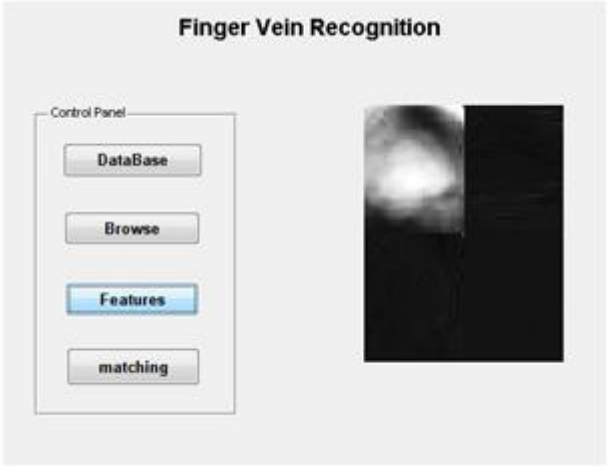

Figure 10. Simulation 2 Response

Figure 10 output shows that we can select the current images using button called browse after browsing they will show 100 current finger vein images then we can select any one of the images and finally select the button called feature that means your current image and data base images has been extracted using technique called feature extraction and then select the button called matching that means your current image and data base image has been matched successfully.

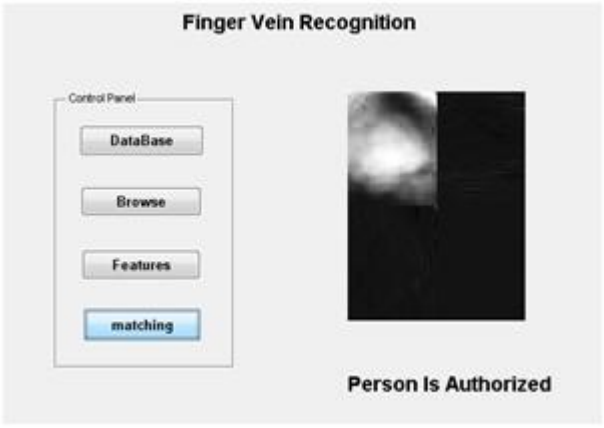

Figure 11. Simulation 3 Response

Figure 11 output shows that the current image and data base image are equal so that the message called Person is Authorized then we can execute the transaction from ATM

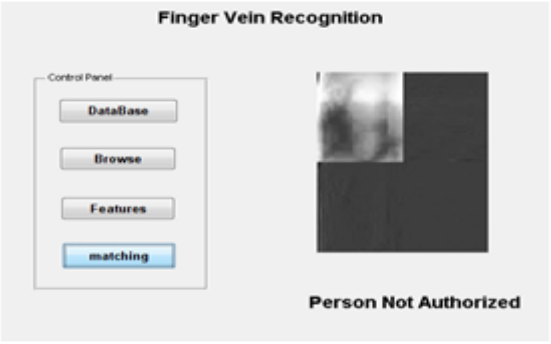

Figure 12 Simulation 4 Response

Figure 12 shows that the same procedure will do for matching the unauthorized person that means if two images are unequal then we can not able to access the transaction from ATM.

X. INTERNET OF THINGS (IOT)

Internet of Things [15] means interconnection of network without wire that means we can transfer the information from one end to other end without wire called as internet and things may be a sensors and actuators. Sensor are used to sense the input signal and it is converted in to needful information to the system and actuators are used to control the entire components of the whole systems. So without this IoT techniques, we can not able access the ATM. So that we are using IoT technique in Automated Teller Machine(ATM). An IoT is a machine to machine(M2M) communication and not human to human and human to machine communication. An IoT contains two track namely physical and virtual tracks. Physical track in an IoT can be used only in physical world such as NODE MCU, some IoT sensors, actuators etc and virtual world in an IoT contains only online multimedia techniques and execute the online software using IoT techniques called as virtual track. The architecture of an IoT as shown in the below figure

Figure 13. Architecture of IoT

Here the block diagram of IoT as shown in figure. It is consists of „n" number of nodes, gateways and „n" number of services at the end of the IoT. Node contains controller, memory and power management and at the input of the node contains sensors and actuators and gateway is nothing but access point. Suppose if we want to transfer the amount through some gate way called SBI gateway, HSBC gateway, ICICI bank gateway etc. if we are using this gate way for bank account transaction then that bank gateway detect some percentage of amount from corresponding customer that"s why they are using gateway in the cloud and finally we have end point services. End point services means which bank we can transfer the account through the cloud called as end point services. This is the architecture of IoT.

XI. BLOCK DIAGRAM OF FINGER VEIN RECOGNITION SYSTEM USING NODE MCU

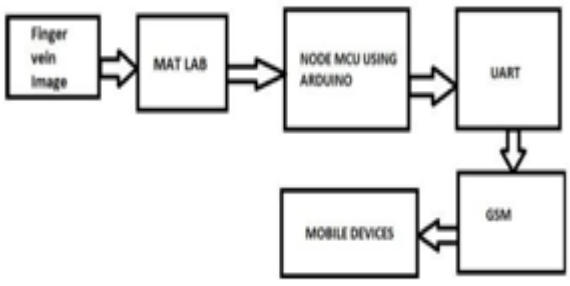

Figure 14. Block diagram of the Finger Vein Recognition [16] system using NODE MCU for ATM Users

First of all increase the pixels of your finger vein image by using resize techniques then we have to convert the given resized image in to gray level image by using the instruction called rgb2gray then the given gray image can be converted in to histogram equalization image for increasing the contrast of the image then the histogram equalization again converted in to discrete wavelet transform image using haar transform then finally the DWT image can be extracted from DWT image then we have to match with data base image by using the technique called Euclidean distance algorithm. So the above all techniques can be done by using MAT LAB coding and then final output is applied to the NODE MCU microcontroller to process the input image signal using arduino software. If two images are mismatch then we send the message that Unauthorized person using account to the corresponding customer mobile device through UART and GSM device with high speed. NODE MCU means NODE microcontroller unit. It is an unlicensed system on chip microcontroller. This NODE MCU works based on internet of things firm ware systems with low time consumption. It runs based on ESP8266 wifi SoC(system on chip) and its developer name is ESP8266 unlicensed community. NODE MCU RAM size is 128 KB and internal storage is 4MB and its CPU is ESP8266 with operating system XTOS. It is a single based microcontroller. So this is the basic idea about NODE MCU. After processing of the finger vein image is given to the input of the UART(Universal Asynchronous Receiver and Transmitter). It is used to transmit as well as receive the serial data because processor can execute only parallel information in order to reduce the time consumption so the output of the processor is given to input of the UART. This UART is used to convert the parallel information in to serial information and also it can be used to transmit as well as receive the information and this output is given to the input of the GSM(Global System for Mobile communication) [17]. It is only used for mobile devices and also send the message to mobile devices through GSM only and without GSM, we can not able to send the information to the mobile devices. It is digital network with high speed. In GSM, we can use the technology called as CDMA(Code Division Multiple Access), TDMA(Time Division Multiple Access) etc. It is otherwise called as driven devices for mobile users. So lastly we got message at mobile device from GSM.

XII. CONCLUSION

In this paper, we have discussed about the proposed system called an IoT enabled finger vein recognition system in mobile devices for ATM users based on the Euclidean distance algorithm for matching of two images(current images and database images). Before matching techniques, we have discussed about image processing techniques such as resize, RGB to gray level image, histogram Equalization, DWT using Haar transform and finally we performed feature extraction technique then we matched the current image with database image. If two images are equal then we can access the transaction from ATM otherwise we can send the message to the corresponding customer that "Unauthorized person using account" through mobile phone using GSM technique.

REFERENCES

1. W. S. Zheng, Z. Sun, Y. Wang, X. Chen, P. C. Yuen, and J. Lai, Biometric Recognition (Lecture Notes in Computer Science), vol. 32, no. 3. 2017, p. 104.
2. P. R. Nalla and A. Kumar, ``Toward more accurate iris recognition using cross-spectral matching," IEEE Trans. Image Process., vol. 26, no. 1, pp. 208_221, Jan. 2017
3. M. Gudavalli, D. S. Kumar, and S. V. Raju, ``A multibiometric _fingerprint recognition system based on the fusion of minutiae and ridges," in Proc. 49th Annu. Conv. Comput. Soc. India (CSI) Emerg. ICT Bridging Future, 2015, pp. 231_237.
4. S. A. Angadi and S. M. Hatture, ``Biometric person identification system: A multimodal approach employing spectral graph characteristics of hand geometry and palmprint," Int. J. Intell. Syst. Technol. Appl., vol. 8, no. 3, pp. 48_58, 2016.
5. A. K. Jain, A. Ross, and S. Prabhakar, ``An introduction to biometric recognition," IEEE Trans. Circuits Syst. Video Technol., vol. 14, no. 1,pp. 4_20, Jan. 2004.
6. S. Kanade, D. Petrovskadelacrétaz, and B. Dorizzi, ``Obtaining cryptographic keys using feature level fusion of iris and face biometrics for secure user authentication," in Proc. IEEE Comput. Soc. Conf. Comput. Vis. Pattern Recognit. Workshops (CVPRW), Jun. 2010, pp. 138_145..
7. A. Lumini and L. Nanni, ``Overview of the combination of biometric matchers," Inf. Fusion, vol. 33, no. 2, pp. 71_85, 2017.
8. L.Jegan Antony Marcilin Assistant Professor, Sathyabama Institute of Science and Technology, Chennai, India. V.Balamurugan Assistant Professor, Sathyabama Institute of Science and Technology, Chennai, India. A.Vijayaiyyappan Teaching Assistant Sathyabama Institute of Science and Technology, Chennai, India. "Biometric Finger Vein based Bank Security System Using ARDUINO and GSM Technology" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 11 (2018) pp. 8774-8777 © Research India Publications. http://www.ripublication.com
9. Tarun Kumar#1 #Assistant Professor Computer Science and Engineering Department Vidya College of Engineering, Meerut (U.P) Karun Verma#2 #Assistant Professor Computer Science and Engineering Department Thapar University, Patiala (Punjab)" A Theory Based on Conversion of RGB image to Gray image" International Journal of Computer Applications (0975 – 8887) Volume 7– No.2, September 2010
10. Digital Image Processing: PIKS Inside, Third Edition. William K. Pratt Copyright © 2001 John Wiley & Sons, Inc. ISBNs: 0-471-37407-5 (Hardback); 0-471-22132-5 (Electronic)" DIGITAL IMAGE PROCESSING"
11. J. Alex Stark" Adaptive Image Contrast Enhancement Using Generalizations of Histogram Equalization" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 9, NO. 5, MAY 2000.
12. CS638-1 TA: Tuo Wang tuowang@cs.wisc.edu Feb 12th , 2010" MATLAB for Image Processing"
13. Isabelle Guyon1 and Andr´e Elisseeff2 1 ClopiNet, 955 Creston Rd., Berkeley, CA 94708, USA. isabelle@clopinet.com 2 IBM Research GmbH, Zurich Research Laboratory, S ¨ ¨aumerstrasse 4, CH-8803 Ruschlikon, Switzerland. ¨ ael@zurich.ibm.com" An Introduction to Feature Extraction"
14. Liwei Wang, Yan Zhang, and Jufu Feng" On the Euclidean Distance of Images" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 27, NO. 8, AUGUST 2005
15. Marco Zennaro, PhD Telecommunications/ICT4D Lab The Abdus Salam International Centre for Theoretical Physics Trieste, Italy" Introduction to the Internet of Things"
16. L.Jegan Antony Marcilin Assistant Professor, Sathyabama Institute of Science and Technology, Chennai, India. V.Balamurugan Assistant Professor, Sathyabama Institute of Science and Technology, Chennai, India. A.Vijayaiyyappan Teaching Assistant Sathyabama Institute of Science and Technology, Chennai, India. "Biometric Finger Vein based Bank Security System Using ARDUINO and GSM Technology" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 11 (2018) pp. 8774-8777 © Research India Publications. http://www.ripublication.com
17. Mohammed Ramadan, Fagen Li, Chun Xiang Xu, Ahmed Abdalla, Hisham Abdalla School of Computer Science and Engineering University of Electronic Science and Technology of China (UESTC) Chengdu Sichuan 611731, P.R. Chinae-mail: nopatia@gmail.com" An Efficient End-to-End Mutual Authentication Scheme for 2G-GSM System"

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He received diploma in Electronics and Communication Engineering from Sri Nallalaghu Polytechnic college in 2000 then He received Bachelor of Engineering in Electronics and Communication Engineering from R.M.K. Engineering College in 2003 then he received M.Tech in Embedded System Technology from SRM university in 2014 and he has 12.5 years experience in teaching field and now currently doing Ph.D (Full Time) in Electronics and Communication Engineering in SRM Institute of Science and Technology.. His area of interest is Internet of Things and image processing.

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