Finger Vein Recognition for Real world Application in Authentication Process

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Abstract—In this project, we propose a real-timeembedded finger-vein recognition system (FVRS) for authentication on mobile devices. The system is implemented on an embedded platform and equipped with a novel finger-vein recognition algorithm. The proposed system consists of four hardware modules. Finger vein recognition device [1], image acquisition module [2], controller board [3], and human and machine communication module. Finger vein recognition 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) is used to display recognition results.

Keywords— Finger vein sensor, Controller board and imageacquisition.

I. INTRODUCTION

Recently, there has been much interest in biometric authentication for security purposes. Biometrics or biometric authentication [1,2] refers to automated methods of recognizing a person using behavioural or physiological features, such as, faces, irises, gaits, fingerprints, veins, *etc.* Biometric features are unique characteristics to an individual which is convenient and more secure than traditional authentication methods. For example, biometric recognition is more reliable than token-based verification methods (keys or ID cards) and knowledge-based methods (passwords or PINs) while attaining higher efficiency and offering a better user experience.

Personal verification based on biometric technology is widely used in door access control, security systems and forensics. However, under special circumstances, these biometric approaches may suffer from some practical limitations. For example, face recognition is susceptible to illumination changes and rotations. Fingerprints are vulnerable to forgery because fingerprints are easily exposed to others. Moreover, the conditions of a finger such as dryness or sweat can also prevent a clear pattern from being obtained. The authentication system or device which I used here is Finger vein module. We have lot many authenticated devices

like finger print module, bio metric, etc which are highly and commonly used authentication devices. These modules are used to check the authentication of particular user or a person of a device or system. Likewise, here we are coming up with a new finger vein module which is very highly secured and worthy.

Finger vein recognition is a method of biometricauthentication that uses pattern-recognition techniques based on images of human finger vein patterns beneath the skin's surface. Finger vein recognition is one of many forms of biometrics used to identify individuals and verify their identity. Since this figure vein module is serial communication supported we can easily integrated to any device or micro controller. This finger vein module directly gives the data of finger vein and will be analysed using MATLAB-DIP. Here, the data regarding particular person will be compared with the Details of the person already in the MATLAB Software program. Finally, after processing this we will give a command to micro controller through serial communication which follows RS232 protocol.

The micro controller here we are using is LPC2148 which is very high in speed of processing the data and special featured. This controller will take the data from MATLAB Software and operates the device in proper manner. If the detected finger vein is correct one, then the MOTOR will be rotated. Otherwise, the system will give an alert.

If we go in to the deep of the working of Finger vein module, this device is system is associated of Infrared LED, CCD Camera, finger vein pattern extractor. When we keep our finger on this device, the IR rays will be emitting from the Infrared LED are emerged through the finger. Then these rays are captured by the CCD camera. These rays will be formed such that the veins of our finger can be visible very closely. This can captures the veins of the finger. This image can be extracted at the system of finger vein pattern extractor. This will give a fine visible image of veins in the image. And it can be checked with already stored data of the person. If both the images are matched in the fine manner, the system will give positive result. Otherwise it gives the negative result.

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II. SYSTEM BLOCK DIAGRAM

Power Supply

Finger Vein Module

Arm 7 (LPC2148)

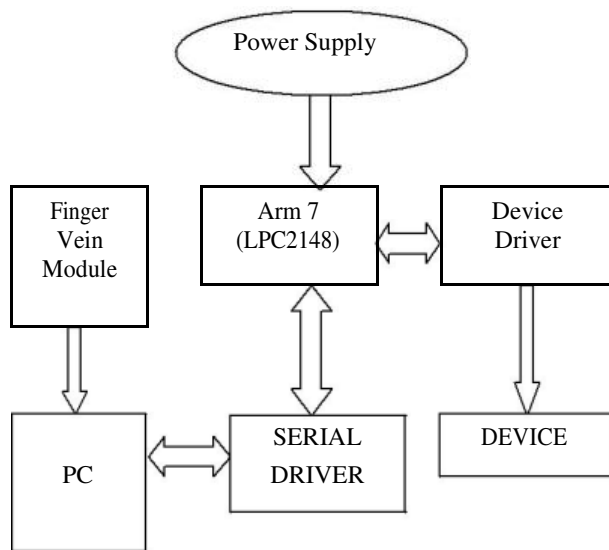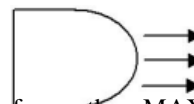Device Driver

PC

SERIAL DRIVER

DEVICE

Fig.1 : System Block diagram

The major components of this project are LPC2148 Microcontroller; Finger vein Module, LCD Display Unit, Max232 and Power Supply Unit are given to the device.

The main aim of the project is whenever the user enters puts his finger on to the Finger vein Module where we kept our embedded board attached with the reader along with PC. The input is nothing but finger vein image captured by CCD camera from the Infrared LED rays which have been emerged through the finger of the person. This can be extracted by the Finger vein extractor and it will convert the image in to the fine manner. The stored image and obtained image will be compared in the PC connected and which is connected to the Microcontroller. The MAX232 connector will be used to transfer data from the MAX232 (16-pin) port of a PC to the input line converter. The connector will be a 90-degree flat mount design that will allow the pins of a serial connection to be transferred to data lines in a board. The serial interface on the transmitter will accept a data line

III. FINGER VEIN MODULE DESCRIPTION

A. IMAGE ACQUISITION DEVICE

To develop a finger vein image (Near infrared image) it is necessary to develop special devices which do not affect the ambient temperature. Usually, finger vein images can be captured based on Light transmission or Light reflection. To get a better image here we use Light transmission. The modules here we use are: Web Camera by removing IR filter. Light emitting diode (LED) is used as illumination source for IR light. LED has high permeability and power.

from the MAX 232 connector and transfer it to TTL/CMOS standard logic level. The TTL/CMOS signal will then be sent on a data line to the Encoder/Buffer. The serial interface on the receiver will accept a data from the Decoder/Buffer and transfer it to TTL/CMOS standard logic level. The TTL/CMOS signal will then be sent on a

data line to the MAX232 Connector. The Microcontroller does the process and matched then microcontroller runs the motor otherwise the microcontroller gives alert and it will be remain in locked position, This system is more secure than other systems because perfect match of finger veins are needed for authentication . Here in this project we are using DC Motor and Driver unit for opening and closing the Locker. The DC Motor operates at 12V, but our Controller operates at 3.3V, in order to drive more voltage we are using driver L293D.

LED
Source

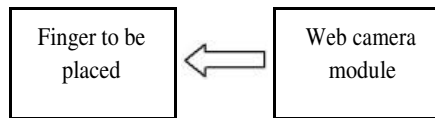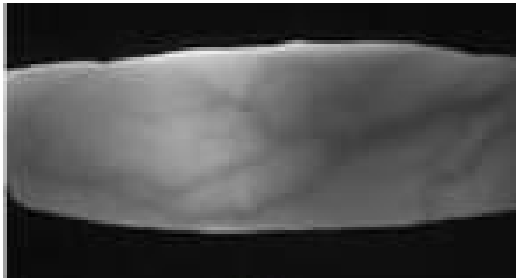| Finger to be placed | ⟸ | Web camera module |

Fig. 2: Image acquisition device

Fig.3 : Finger-vein image captured by our device.

B. Working

In the working of real time recognition system using finger-vein we have proposed a real time recognition algorithm. This proposed finger-vein recognition algorithm contains two stages:

The Enrolment stage and The Verification stage.

1. ENROLLMENT STAGE:

The enrollment stage is to enroll users to the system. First it takes the finger-vein image from the web-camera. Image segmentation and enhancement process are done by using Image processing technique and the software used here is MATLAB. The finger-vein patterns are extracted by calculating various parameters like vein Width, Length, Position, Pixels and Intersection points of vein. Then they are stored as featured templates. The flowchart is shown below:
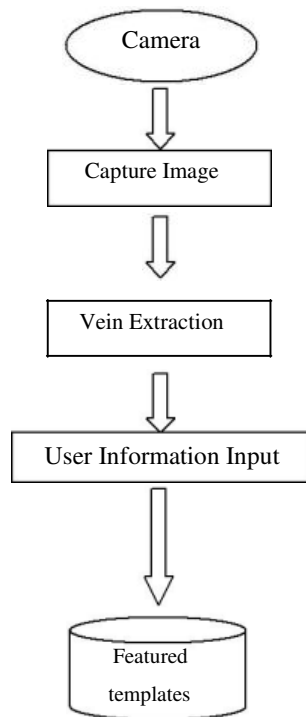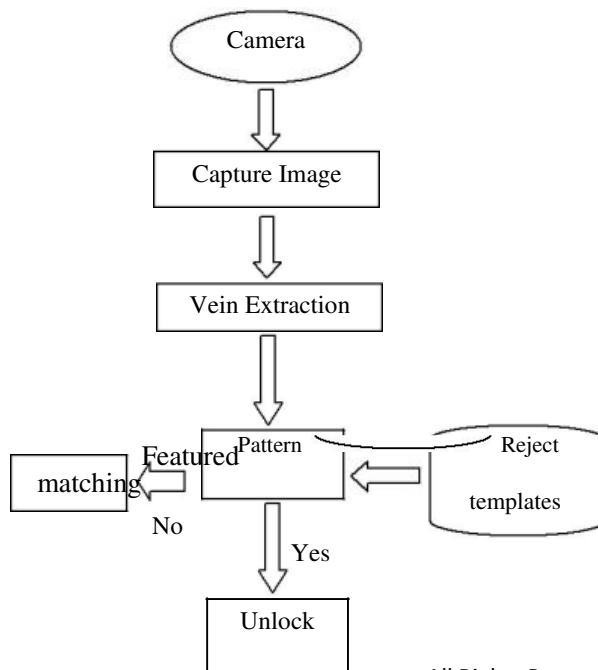
Flowchart (Fig. 4)

Camera → Capture Image → Vein Extraction → User Information Input → Featured templates

Fig. 4 : Enrolment stage.

3. IMAGE SEGMENTATION AND ENHANCEMENT:

The position of fingers usually varies according to different finger-vein images. So it is necessary to normalize the finger-vein images before feature extraction and matching. When a finger is irradiated by IR rays uniformly, the vein images will look brighter than other parts. The segmented finger-vein image is then enhanced to improve its contrast level. Then the image is resized to $1/4_{th}$ of the original size. Finally, histogram equalization is used for enhancing the gray level contrast of the image.

IV. PERSONAL IDENTIFICATION USING FINGER-VEIN PATTERNS device

2. VERIFICATION STAGE:

The verification stage enables the current user to lock or unlock his system. Like enrolment stage, the verification stage also has to deal with Web camera, MATLAB, database, and PC to store and display the results. This stage will check if the finger vein of the current user is matched with the featured templates or not. The flowchart for this stage is shown below:

Flowchart (Verification Stage)

Camera → Capture Image → Vein Extraction → Pattern matching ← Featured templates / Reject

- Featured matching — No
- Yes → Unlock

To examine our method's performance for personal identification, we did an experiment using the method to identify large numbers of patterns. The experiment involved evaluating the false acceptance (FAR) and false rejection (FRR) error rates for a database of infrared finger images. The database contained 678 different infrared images of fingers, with two images per finger. They were obtained from people working in our laboratory, ranging in age from 20s to 40s and approximately 70% men. The FRR was obtained by calculating the mismatch ratios using both images of each finger, and the FRR was obtained by calculating the mismatch ratios among the images of different fingers for all combinations (678×677). The conventional method was independently evaluated in the same way. Each distribution was normalized by its maximum frequency. The averages of the distributions among different persons were high; the mismatch ratio was around 50% for both methods. Most values in the distributions for the same persons were low, although some were high because of a finger displacement. The distributions for the same and different fingers were almost entirely separated from each other, showing that personal identification can be performed by using finger-vein patterns. The proposed method produced a smaller region of overlap between the two distributions, for the same and for different fingers, than did the conventional method. To quantitatively evaluate these results, we calculated the equal error rate (EER), i.e., the rate of trials in which the FAR equalled the FRR. The method of calculating the EER is as follows. First, the threshold of the mismatch ratio (Ti) is defined as Ti=i/1000(i=0,1, ...,1000). Next, the false rate (FRRi), which is defined as the ratio between the number of data on the same fingers for which the mismatch ratio is greater than Ti and the total number of data on the same fingers, is calculated for all i. Then, the false rate (FARi), which is defined as the ratio between the number of data on different fingers for which the mismatch ratio is less than Ti and the total number of data on different fingers, is calculated for all i. Finally, the EER is calculated by searching FARi so that |FARi−FRRi| is minimized, since a value i such that FRRi=FARi does not always exist because FRRi and FARi are discrete numbers. It shows that EER was 0.145% for a mismatch ratio of 37.6% when the proposed method was used, while it was 2.36% for a mismatch ratio of 38.4% when the conventional method was used. That is, the error rate in personal identification was smaller for the proposed method

than for the conventional method. Therefore, the proposed method is more effective. Furthermore, the EER for fingerprint-based systems has arrange of 0.2 to 4% [9,10], meaning that finger-vein identification using the proposed method is highly effective. [4] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day."Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident. Here, an eye blinking sensor is used to sense the blinking of the eye. spO2 sensor checks the pulse rate of the patient. Both are connected to micro controller.If eye blinking gets stopped then the signal is sent to the controller to make an alarm through the buffer. If spO2 sensor senses a variation in pulse or low oxygen content in blood, it may results in heart failure and therefore the controller stops the motor of the vehicle. Then Tarang F4 transmitter is used to send the vehicle number & the mobile number of the patient to a nearest medical station within 25 km for medical aid. The pulse rate monitored via LCD .The Tarang F4 receiver receives the signal and passes through controller and the number gets displayed in the LCD screen and an alarm is produced through a buzzer as soon the signal is received.

V. CONCLUSION

In the present study, proposed a finger-vein recognition system and vein image extraction is implemented on a MATLAB platform. The proposed system includes a device for capturing finger-vein images and a proposed algorithm to extract finger-vein images by considering various parameters like vein width, position, length, pixels and intersection of veins. Our system is suitable for mobile device because of its low computational complexity and low power consumption. The advantage of this proposed system is more secured and confidential. For any kind of personal devices like mobile safe locks personal chambers bank lockers this system can be installed which gives a unique security for the users

VI. REFERANCES

[1]. Desongwang, "user identification based on finger-vein patterns for consumer electronics devices," IEEE paper.

[2]. Mulyona D, Jinn HS. ," A study of finger vein biometric for personal identification." International symposium on Biometrics and Security technologies 2008.

[3]. A.K.Jain, A. Ross, "An Introduction to Biometrics Recognition," IEEE Transactions on Circuits and systems.

[4]. Christo Ananth, S.Shafiqa Shalaysha, M.Vaishnavi, J.Sasi Rabiyathul Sabena, A.P.L.Sangeetha, M.Santhi, "Realtime Monitoring Of Cardiac Patients At Distance Using Tarang Communication", International Journal of Innovative Research in Engineering & Science (IJIRES), Volume 9, Issue 3,September 2014,pp-15-20

[5]. Montesinos P, Alquier L (1996) Perceptual organization of thin networks with active contour functions applied to medical and aerial images. In Proceedings of ICPR'96, Vienna, Austria, pp 25–30

[6]. Jain AK, Ross A, Pankanti S (1999) A prototype hand geometry-based verification system. In: Proceedings of the 2nd international conference on audio- and video-based biometric person authentication. Washington DC, pp 166–171

[7]. S. Peleg and J. Naor, "Multiple resolution texture analysis and classification", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.6, no.4, pp.518- 523, 1984.