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An Embedded Real Time Finger Vein Pattern Extraction Using ARM 9

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Abstract: The finger-vein is a promising biometric pattern for personal identification in terms of its security and convenience. Our system is designed by using ARM 32-bit micro controller which was developed by Samsung called as Friendly ARM which supports features and algorithms for the development of real time finger vein pattern extraction. The finger vein module and the CMOS camera are used to capture the finger vein images. The ARM9 board is used to execute the finger-vein recognition algorithm which undergoes segmentation and alignment of image which finds position of vein in finger and enhancement of image takes place where image is resized to 1/4th of its image. Therefore in feature extraction it enhances surface of finger then final image of vein is displayed on LCD and image is stored inside pen drive connected to controller.

Keywords: **Biometrics, CMOS Camera, Finger vein module, Friendly ARM.**

I. INTRODUCTION

Private information is traditionally provided by using passwords or Personal Identification Numbers (PINs), which are easy to implement but is vulnerable to the risk of exposure and being forgotten. Biometrics have attracted more and more attention and is becoming one of the most popular and promising alternatives to the traditional password or PIN based authentication techniques. Moreover, some multimedia content in consumer electronic appliances can be secured by biometrics. There is a long list of available biometric patterns, and many such systems have been developed and implemented, including those for the face, iris, fingerprint, palmprint, handshape, voice and signature. Notwithstanding this great and increasing variety of biometrics patterns, no biometric has yet been developed that is perfectly reliable or secure. For example, fingerprints and palm prints are usually frayed; voice, signatures, hand shapes and iris images are easily forged; face recognition can be made difficult by occlusions or face-lifts; and biometrics, such as fingerprints and face recognition, are susceptible to spoofing attacks, that is, the biometric identifiers can be copied and used to create artifacts that can deceive many currently available biometric devices. The great challenge to biometrics is thus to improve recognition performance in terms of both accuracy and efficiency and be maximally resistant to deceptive practices. To this end, many researchers have sought to improve reliability and frustrate spoofers by developing biometrics that are highly individuating; yet at the same time, present a highly complex, hopefully insuperable challenge to those who wish to defeat them. Especially for consumer electronics applications, biometrics authentication systems need to be cost-efficient and easy to implement. The finger-vein is a promising biometric pattern for personal identification in terms of its security and convenience .Compared with other biometric traits, the finger-vein has the following advantages : (1) The vein is hidden inside the body and is mostly invisible to human eyes, so it is difficult to forge or steal. (2) The non-invasive and contactless capture of finger-veins ensures both convenience and hygiene for the user, and is thus more acceptable.

II. OVERVIEW OF THE PROJECT

A. Finger Vein Module

It mainly includes the NIR LD(Near Infrared red laser diodes) connected on a pcb.An NIRLD is defined by the water absorption, and commonly used in fiber optic telecommunic-ation because of low attenuation losses in the SiO_2glass (silica)medium. Image intensifiers are sensitive to this area of the spectrum. Examples include night vision devices. The wavelength of NIRLD is 808nm.A transparent acryl sheet of thickness 5mm is kept on the finger vein module to avoid the uneven illumination of the light on the finger.

B. ARM9 (Friendly Arm Board)

S3C2440 is a practical low-cost ARM9 development board which is currently the highest in cost-effective learning board. The Samsung's S3C2440 is a 16/32-bit RISC microprocessor. It is the integrated system for hand-held devices and general embedded applications. Its low power, simple, elegant and fully static design is particularly suitable for power-sensitive applications. It supports WinCE and Linux. It adopts a new Bus architecture known as Advanced Micro Controller Bus Architecture (AMBA). Friendly ARM board is provided with a Touch screen LCD.To choose the development board startup mode S2 switch is determined. When we set the switch S2 to NOR side logo, the system will start with the NOR flash. When we set the switch S2 to NAND side logo, the system will start with the NAND Flash.

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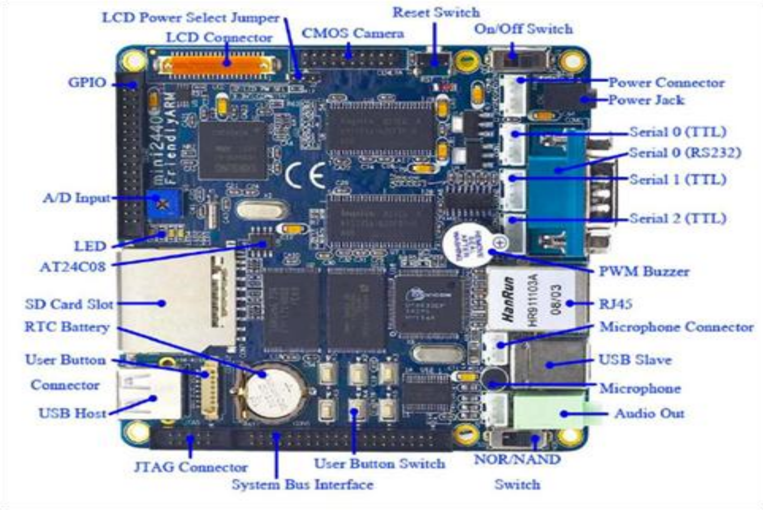

Fig.1. The ARM9 Board

III. CAPTURING THE FINGER VEIN IMAGE

To obtain high quality Near-infrared (NIR) images, a special device is developed for acquiring the images of the finger vein without being affected by ambient temperature. Generally, finger-vein patterns can be imaged based on the principles of light reflection or light transmission. We developed a finger-vein imaging device based on light transmission for more distinct imaging. Our device mainly includes the following modules: a CMOS Camera of resolution 1300*1028 pixels, Transparent acryl(thickness is 5 mm)and the NIR light source. The transparent acryl serves as the platform for locating the finger and removing uneven illumination. The NIR light irradiates the backside of the finger. We can also use a light-emitting diode (LED) as the illumination source for NIR light. With the LED illumination source, however, the shadow of the finger-vein obviously appears in the captured images. To address this problem, an NIR laser diode (NIRLD)is used in our project. Compared with LED, NIRLD has stronger permeability and higher power. In our device, the wavelength of NIRLD is 808 nm.

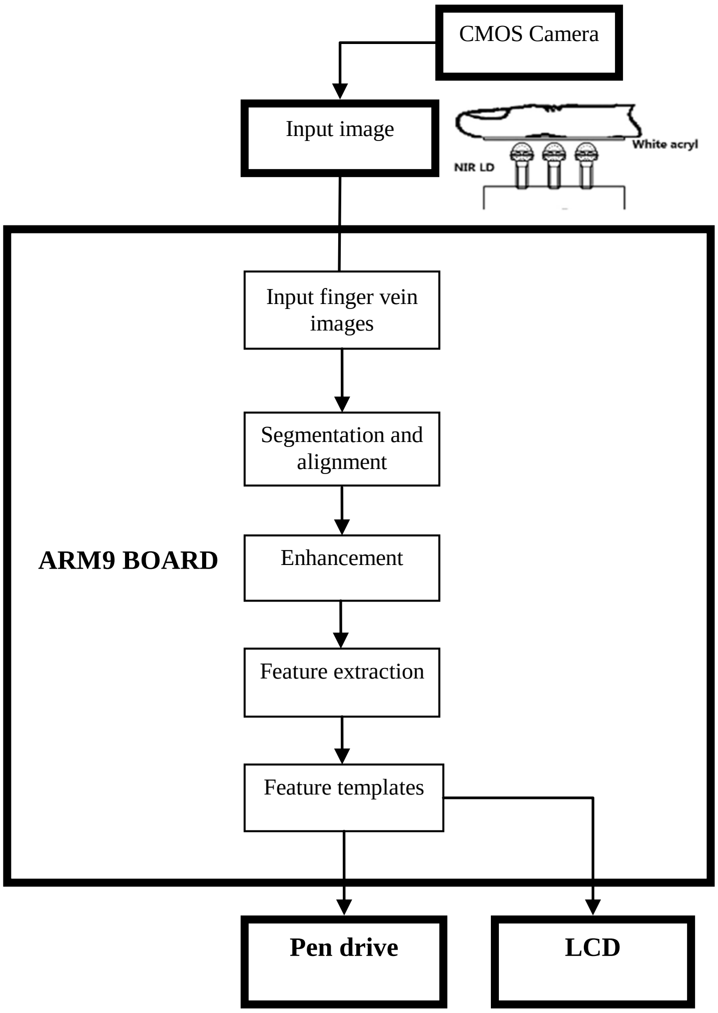

Fig.2.The block diagram of the proposed method

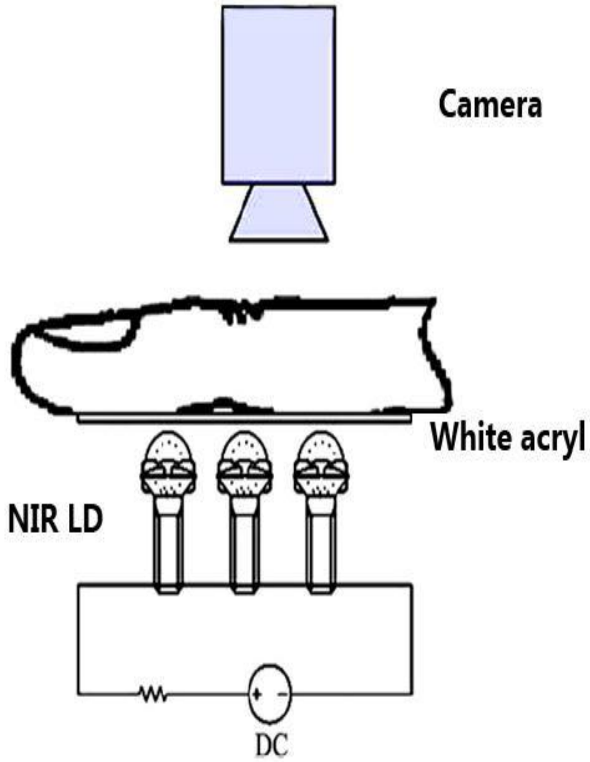

Fig.3. The illustration of the imaging device

The Procedure for the implementation of the project is given by :

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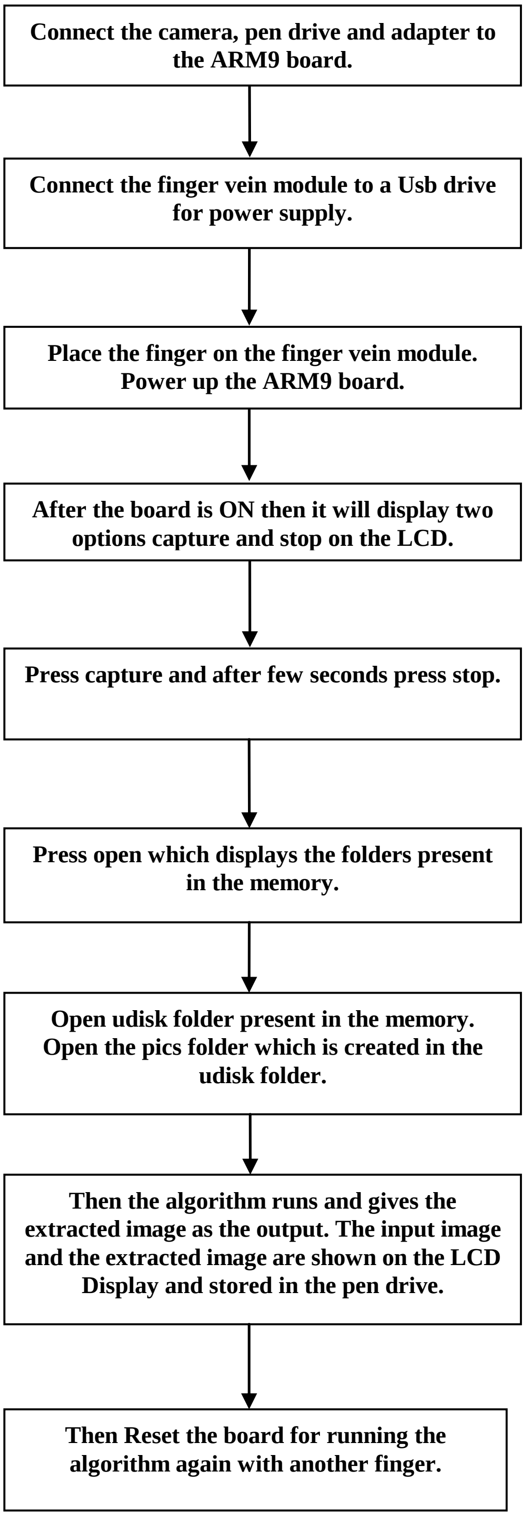

Fig.4. Procedure of Implementation of the Project

IV. ALGORITHM

A. Image Segmentation and Alignment

Because the position of fingers usually varies across different finger-vein images, it is necessary to normalize the images before feature extraction and matching. The bone in the finger joint is articular cartilage. Unlike other bones, it can be easily penetrated by NIR light. When a finger is irradiated by the uniform NIR light, the image of the joint is brighter than that of other parts. Therefore, in the horizontal projection of a finger-vein image, the peaks of the projection curve correspond to the approximate position of the joints. Since the second joint of the finger is thicker than the first joint, the peak value at the second joint is less prominent. Hence, the position of the first joint is used for determining the position of the finger. The alignment module includes the following steps. First, the part between the two joints in the finger-vein image is segmented based on the peak values of the horizontal projection of the image. Second, a Canny operator with locally adaptive threshold is used to get the single pixel edge of the finger. Third, the midpoints of finger edge are determined by edge tracing so that the midline can be obtained. Fourth, the image is rotated to adjust the midline of the finger horizontally. Finally, the ROI of the finger-vein image is segmented according to the midline.

B. Image Enhancement and Feature Extraction

The segmented finger-vein image is then enhanced to improve its contrast. The image is resized to 1/4 of the original size, and enlarged back to its original size. Next, the image is resized to 1/3 of the original size for recognition.. Finally, histogram equalization is used for enhancing the gray level contrast of the image. After obtaining the gray level image it is further processed in such a way that only the finger vein pattern is extracted.

Table1: Comparison of parameters for different biometric technologies

	Biometric Parameters						
Biometrics	**Universality**	**Uniqueness**	**Permanence**	**Collectability**	**Performance**	**Acceptability**	**Circumvention**
Face	High	Low	Med	High	Low	High	Low
Fingerprint	Med	High	High	Med	High	Med	High
Hand Geometry	Med	Med	Med	High	Med	Med	Med
Iris	High	High	High	Med	High	Low	High
Signature	Low	Low	Low	High	Low	High	Low
Voice Print	Med	Low	Low	Med	Low	High	Low
F.Thermogram	High	High	Low	High	Med	High	High

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Retinal Scan	High	High	Med	Low	High	Low	High
Vein	High	Med	Med	Med	High	Med	Low

V. CONCLUSION

The project **"An Embedded Real-Time Finger-Vein Pattern Extraction Using Arm9"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM9 board and with the help of growing technology the project has been successfully implemented.

REFERENCES

[1] A. K. Jain, S. Pankanti, S. Prabhakar, H. Lin, and A. Ross, "Biometrics: a grand challenge", Proceedings of the 17th International Conference on Pattern Recognition (ICPR), vol. 2, pp. 935-942, 2004.

[2] P. Corcoran and A. Cucos, "Techniques for securing multimedia content in consumer electronic appliances using biometric signatures," IEEE Transactions on Consumer Electronics, vol 51, no. 2, pp. 545-551, May 2005.

[3] Y. Kim, J. Yoo, and K. Choi, "A motion and similarity-based fake detection method for biometric face recognition systems," IEEE Transactions on Consumer Electronics, vol.57, no.2, pp.756-762, May 2011.

[4] D. Wang , J. Li, and G. Memik, "User identification based on fingervein patterns for consumer electronics devices", IEEE Transactions on Consumer Electronics, vol. 56, no. 2, pp. 799-804, 2010.

[5] H. Lee, S. Lee, T. Kim, and Hyokyung Bahn, "Secure user identification for consumer electronics devices," IEEE Transactions on Consumer Electronics, vol.54, no.4, pp.1798-1802, Nov. 2008.

[6] D. Mulyono and S. J. Horng, "A study of finger vein biometric for personal identification", Proceedings of the International Symposium Biometrics and Security Technologies, pp. 134-141, 2008.

[7] Z. Liu, Y. Yin, H. Wang, S. Song, and Q. Li ,"Finger vein recognition with manifold learning", Journal of Network and Computer Applications, vol.33, no.3, pp. 275-282, 2010.

[8] Y. G. Dai and B. N. Huang, "A method for capturing the finger-vein image using nonuniform intensity infrared light", Image and Signal Processing, vol.4, pp.27-30, 2008.

[9] X. Sun, C. Lin, M. Li, H. Lin, and Q. Chen, "A DSP-based finger vein authentication system", Proceedings of the Fourth International Conference on Intelligent Computation Technology and Automation,pp.333-336,2011.

[10] B. B. Mandelbrot, Fractals: Form, Chance and Dimension, San Francisco, CA: Freeman, 1977.

[11] B. B. Mandelbrot and D. Stauffer, "Antipodal correlations and the texture (fractal lacunarity) in critical percolation clusters", Journal of Physics A: Mathematical and General, vol.27, pp.237-242, 1994.

[12] J. Berke, "Using Spectral Fractal Dimension in Image Classification", Innovations and advances in computer sciences and engineering, pp.237-241, 2010.

[13] Z. Feng, "Variation and Minkowski dimension of fractal interpolation surface", Journal of Mathematical Analysis and Applications, vol. 345, no.1, pp. 322-334, 2008.