

Imaging Problem of a Low Cost Finger Print Sensor & Adjusting Various Parameters for Its Improvement

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Abstract

The diffusion of mobile cameras and webcams is rapidly growing. Unfortunately, images produced by these kinds of sensors during the acquisition of human fingertips are very different from the images obtained by dedicated fingerprint sensors, especially as quality is concerned. One critical issue regarding the protection of confidential information or valuable items is to determine the identity of a person. Biometrics is supposed to offer this security in a user-friendly and secure way. One problem however is that there are ways to compromise systems based on biometric verification. Some of these biometrical features have known vulnerabilities. Persons with similar facial characteristics, e.g. identical twins, can fool face recognition system. It is also stated that identical twins have similar fingerprints due to the fact that they have fingerprints that belong in the same class. Recognition of a finger prints it is necessary to get better image quality of finger print to get better image. So designed a low cost finger print sensor & adjusted its various parameters to improve finger print image quality. We used optical finger print reader using a low cost webcam for capturing image. Image saved in computer. Edge was determined from image using visual C++ program of different person. The result of this experiment was not found very well because it is a big experiment & its program is very difficult. There are many programs we had done for finding better image. We had used image loading program, capturing program, image saving program, zoom in program etc.

Keywords: webcams, finger print sensor, biometrics.

1. Introduction

The possibility to obtain fingerprint images by using low cost cameras and off-the-shelf webcams has a great practical importance since nowadays fingerprint biometrics can be successfully achieved only by using dedicated sensors. The diffusion of general purpose cameras is rapidly growing, and they can be found easily on laptops and cellular phones. Unfortunately, the images of human fingerprints acquired from these kinds of sensors are very different from the images obtained by dedicated fingerprint sensors. In order to exploit the paramount variety of techniques now available in the literature to achieve verification and recognition by fingerprint biometrics it is important to process the camera image of the fingerprints so that they are as similar as possible to the images produced by dedicated sensors. The approach that we propose aims to allow for using the webcams as an interoperable device for fingerprint biometrics. For example, the proposed approach allows for exploiting a webcam as a fingerprint biometric sensor on a personal computer in case of a dedicated sensor is not available or a dedicated sensor is not required by the desired security level for the envisioned application.

There are different types [2] of techniques for finger print processes are optical readers, electro-optical readers, capacitance base finger print sensor, silicon chips, TFT base finger print sensor, RF field - AC capacitance base finger print sensor, RF field - AC capacitance Resistive membrane on silicon, TFT, Tactile MEMS, thermal base finger print sensor and ultra-sound base finger print sensor.

All the above technique is used for finger print image processing. To get better recognition of finger print, it is necessary to get better image quality of finger print. There are different kinds of pattern given below-



Fig 1.1: The arch pattern.



Fig 1.2: The loop pattern.



Fig 1.3: The whorl pattern

The major Minutia features of fingerprint ridges are: ridge ending, bifurcation, and short ridge. The ridge ending is the point at which a ridge terminates. Bifurcations are points at which a single ridge splits into two ridges. Short ridges (or dots) are ridges which are significantly shorter than the average ridge length on the fingerprint. Minutiae and patterns are very important in the analysis of fingerprints since no two fingers have been shown to be identical.

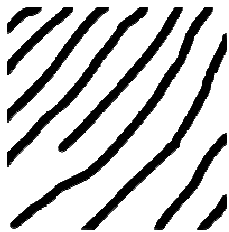


Fig-1.4: Ridge ending



Fig-1.5: Bifurcation

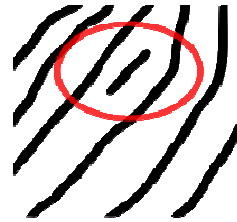


Fig1.6: Short Ridge (Dot)

2. Methods and tools used:

Optical fingerprint imaging involves capturing a simple image of the print using visible light. This type of sensor is, in essence, a specialized web camera. The top layer of the sensor, where the finger is placed, is known as the finger tip rest surface. In this time three type of illuminator we are use. This type of illuminator is used in illuminates the finger tip rest surface. The web cam focus length is fixed. When the programming is run then the finger image capture automatically and saved. In this time, the image processing steps are image noise reduction and enhancement.

2.1 Main components of setup

1. Glass Box
2. Web Camera
3. Computer
4. LED Light
5. Illuminator variable circuitry

Sensor design

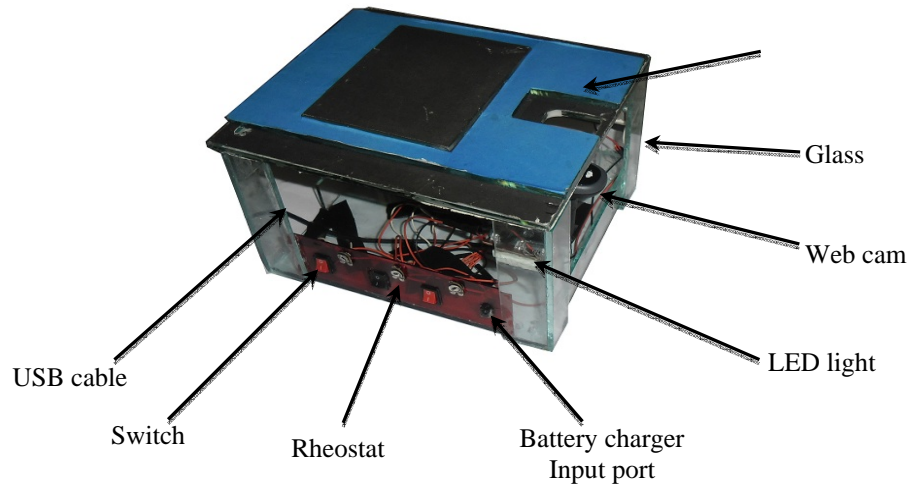


Figure 2: Sensor Design

3.1 Experimental setup:

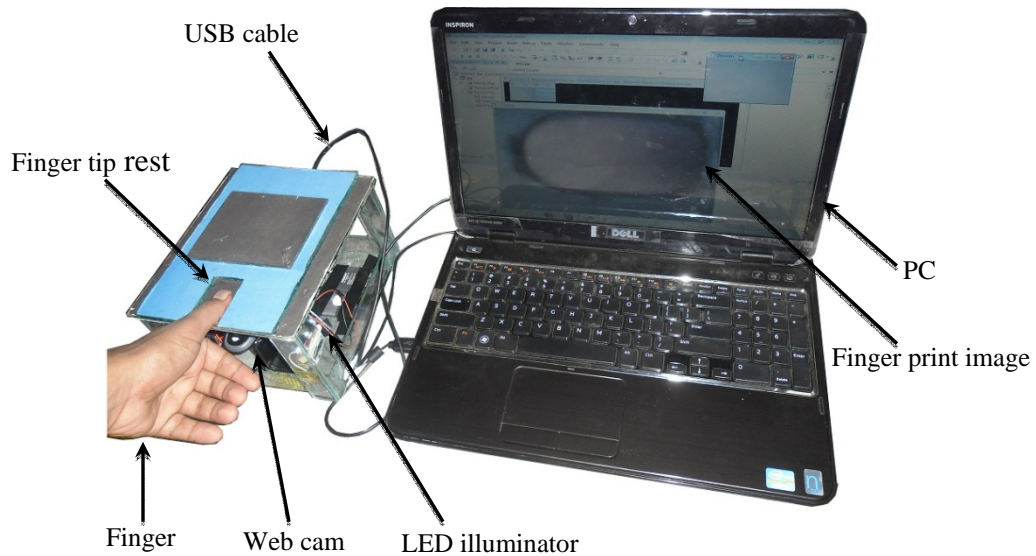


Figure 3: Experimental setup for fingerprint sensor

3.2 Working principle of the project

There was Logitech C110 for this project. It was a 1.3 megapixels device that had optical fingerprint reader.

Finger tip image was stored in a computer by changing different parameter of illuminator. There were three illuminators such as- illuminator 1, illuminator 2 & illuminator 3. The image was captured by changing different condition of illuminator & different condition i.e. day & night. The changing condition of illuminator is low, high & medium.

The fingerprint open source fingerprint recognition library was used to handle image capture, enrollment and improve image quality. As stated in the current model is that a fingerprint was enrolled and the pre-stored finger tip image quality was improved by using Gaussian filter & image equalizes histogram.

A small application was written to initialize the device and capture the image using fingerprint open source library functions. We had to resolve Linux-compilation, link-load errors. These errors were due to the way which static and dynamic libraries have to specified for compilation and linking an application.

Capturing Image was stored using C++ program in computer.

3.3 Experimental scenario

The main function of the sensor is used for capturing finger print tip image. We captured finger tip image of different person for saving computer in different condition.

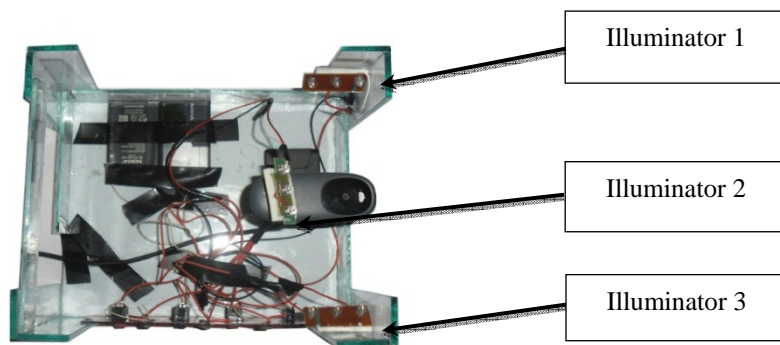


Fig3: Internal view of finger print sensor

4. Methodology

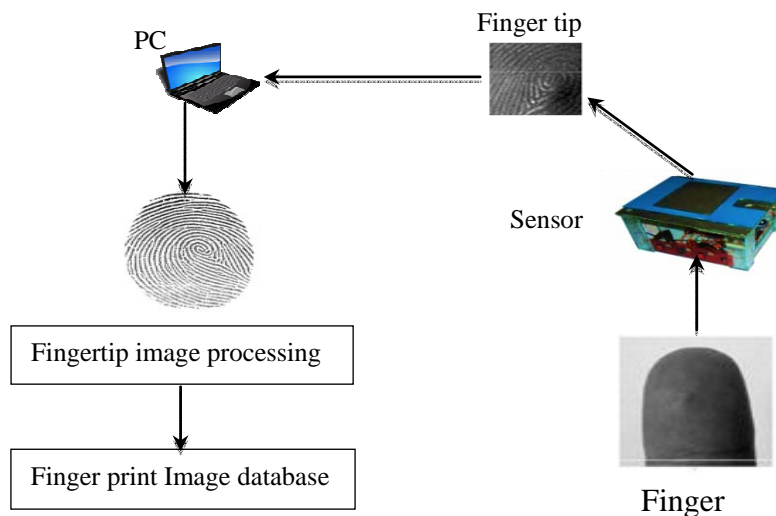


Figure 4: System fingerprint image processing

5.1 Experimental data

Table 1: Image Captured by Webcam in night


















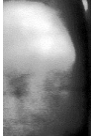
No. of Obs.	Illumination of Light			Finger Tip Image	
	Illuminator1	Illuminator 2	Illuminator 3	Person-1	Person-2
01	Low	Low	Low		
02	Low	Low	Medium		
03	Low	Medium	Medium		
04	Medium	Medium	Medium		
05	High	Medium	Medium		
06	High	High	Medium		
07	High	High	High		

Table 2: Finger Crop Image

No. of Obs.	Illumination Of light			Person 1		Person 2	
	Illuminator 1	Illuminator 2	Illuminator 3	Finger Tip Image	Crop Image	Finger Tip Image	Crop Image
01	Low	Low	Low				

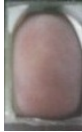


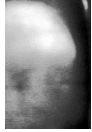
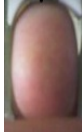

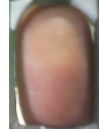




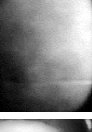



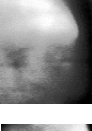

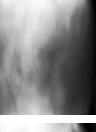
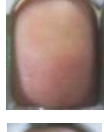


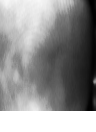
















02	Low	Low	Medium				
03	Low	Medium	Medium				
04	Medium	Medium	Medium				
05	High	Medium	Medium				
06	High	High	Medium				
07	High	High	High				
08	Low	High	High				
09	Low	Low	High				
10	High	Low	Medium				

Table3: Image captured in day light

No. of Obs.	Illumination of Light			Finger Tip Image	
	Illuminator1	Illuminator 2	Illuminator 3	Person 1	Person 2
01	Low	Low	Low		









02	Low	Medium	Medium		
03	Low	Medium	High		
04	Medium	Medium	High		
05	High	High	High		

Table4: Finger Gray Image





















No. of Obs.	Illumination of light			Person 1		Person 2	
	Illuminator 1	Illuminator 2	Illuminator 3	Finger Tip Image	Finger Tip Gray Image	Finger Tip Image	Finger Tip Gray Image
01	Low	Low	Low				
02	Low	Low	Medium				
03	Low	Medium	Medium				
04	Medium	Medium	Medium				
05	High	Medium	Medium				

Table5: Finger crop image & gray image in day

No. of Obs.	Illumination of Light			Person 1		Person 2	
	Illuminator 1	Illuminator 2	Illuminator 3	Crop Image	Gray Image	Crop Image	Gray Image
01	Low	Low	Low				
02	Low	Medium	Medium				
03	Low	Medium	High				
04	Medium	Medium	High				
05	High	High	High				

6. Results

Table 6: The good image was found below this following condition

No. of Obs.	Illumination of Light			Finger tip image	
	Illuminator 1	Illuminator 2	Illuminator 3	Person 1	Person 2
01	High	Medium	Medium		
02	Low	Medium	High		
03	Medium	Medium	High		
04	High	High	High		

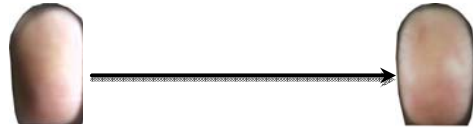


Fig 6.1: Noise image

Fig 6.2: Good image

7. Conclusion

In this experiment we used different types of C++ program for getting good & improve image. The C++ program such as Image loading program, Image capturing and saving program, Image resize program.

Image converts to gray, Image smoothing program, Images zoom in program, Image ROI program, Image background remover program, Image cropped program, Image histogram equalize program. At first loaded image, then captured and saved the image in a computer. We resized this image and converted into gray image, then smoothing in the gray image. Now we removed the back ground for finding good image. But in this process there was much noise in the image. Then we try to reduce the noise, so we used zoom in function for seeing this image in large form. Then we enhanced the image, but in this case we did not get good minutiae. Again we used ROI program, then cropped and histogram equalize program. In this case, we got improve image compared to previous image. But this image was also noise. So finally we captured image by changing the parameter of illumination i.e. low, medium & high. We captured image in day light & night by changing parameter of illuminator. The captured image was nice in day light than night. These images can be used for finger print recognition but it is need further process.

In this project the proper illumination system development has been found difficult for this application, because the environment condition for illumination causes some spots in the images. For noise removal of the images we have used Gaussian Filter. We have also used Histogram Equalization for image contrast of the image.

References

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