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COMPARISON ANALYSIS STUDY IN TO PALM PRINT IMAGE ACQUISITION METHODS

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Abstract—Biometric security and identity authentication systems are fast replacing the traditional knowledge and token based systems. The rapid growth and expansion in biometric systems usage has led to the development of a multitude of systems based on different human features. Biometric systems using palm print are amongst the most commonly used today and in recent years a variety of systems based on palm print have been developed. In this paper, the currently available palm print based biometric security and identity authentication systems are presented and the various stages involved in this systems are discussed, furthermore a comparison between the different methods of palm print image acquisition will be made.

Index Terms— Biometric, CCD, Palm Print, Image Acquisition

1. INTRODUCTION

Biometric security systems use different human appearances, characteristics or traits as means of security authentication. There are currently various types of biometric security systems based on different human features like iris, appearance of face, voice, hand geometry, finger print, and palm print[3]. From these, iris is the most effective but expensive, finger print is most difficult to extract unique feature from but it is the most widely used, face and voice are least accurate and are most easily mimicked and palm print are very accurate and uniquely identify all individuals. Seven factors affect the determination of biometric identification: universality, uniqueness, permanence, collectability, performance, acceptability, and circumvention[5]. When we evaluate palm print security systems based on these seven criteria, as can be seen in table I, they fare well in comparison to other systems.

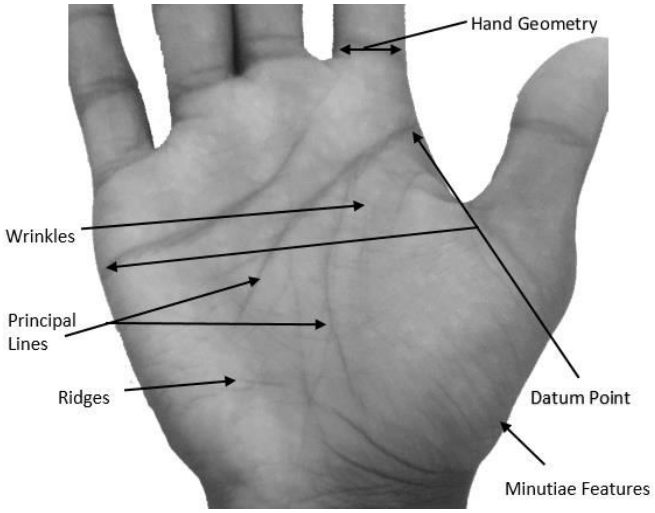
The palm is the part of the inside of the hand below the finger up to the wrist, and its print is unique to a person, even two identical twins will have two different palm prints. Palm print contains numerous features, as can be seen in fig. 1, like principle lines, ridges, geometry, wrinkles, delta point, minutiae features, and textures, and using one or more of these features either in isolation or in combination it is possible to uniquely identify a person[11]. Hand geometry is geometric features of a palm, such as width, length and area according to the palm's shape. Principal line features are both location and form of principal lines in a palm print. Wrinkle features are the many lines which are thinner and more irregular than principal lines. Datum points are end points obtained by using the principal lines and using the Euclidean distance between these end points we can estimate the size of a palm. The delta point is the center of a delta-like region in the palm print. Minutiae features are basically composed of the ridges.

Table I

Comparison of Biometric traits

	Biometric Systems	**Iris**	**Appearance of Face**	**Voice**	**Hand Geometry**	**Finger Print**	**Palm Print**
Evaluation Metrics	Universality	3	3	2	2	2	2
	Uniqueness	3	1	1	2	2	3
	Permanence	3	2	1	2	3	3
	Collectability	2	3	2	3	2	2
	Performance	3	1	1	2	3	3
	Acceptability	1	3	3	2	2	2
	Circumvention	1	3	3	2	2	2
Average Score		**2.29**	**2.29**	**1.86**	**2.14**	**2.29**	**2.43**
Ranking		**2nd**(tie)	**2nd**(tie)	**6th**	**5th**	**2nd**(tie)	**1st**

ISSN- 2394-5125 VOL 7, ISSUE 15, 2020



2. SYSTEM OVERVIEW

Security systems using palm print authentication have four distinct stages: Image acquisition, Preprocessing, Feature extraction and Matching. The palm print image acquisition stage involves using a palm print scanner or camera of some kind to get either a high or low resolution image of the palm[2]. The preprocessing stage has two phases: image alignment and region of interest selection. Image alignment is transforming and rotating the image by referring to key points on the palm, and region of interest selection is the cropping of palm print image from the hand image. The feature extraction stage obtains key features like principle lines, ridges, and textures by discriminating these features from the preprocessed palm prints. The matching stage compares the captured image features with features of people stored in a database in order to find the corresponding match for the scanned person. The whole process is illustrated below in fig. 2.[2]

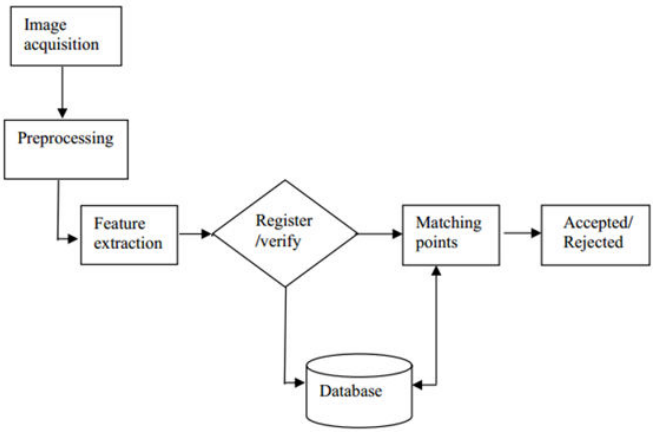


Fig. 2. The various stages of security systems using palm print authentication.

3. COMPARISIONS OF ACQUISITION METHODS

We can acquire palm print from users in a variety of ways, and in this paper these various image acquisition methods are presented and their merits and demerits will be analyzed and compared so as to choose the best method. First of all, the method must be easy and intuitive to use, that is the method must not be complicated nor must it be inconvenient for the users. Secondly, the size of the acquisition device or apparatus used should be as small as possible so that it can be easily transported and incorporated into other places and applications. Thirdly, the quality of the images obtained from the acquisition device should be as high as possible so that subsequent prepossessing and feature extractions can be performed with ease and accuracy. Fourthly, the method should support real time processing so that the response time of the system will be fast enough to be used in most practical applications. Fifthly, the cost of the method should be as minimal as possible so as to make it commercially viable.

Generally speaking there are two methods of palm print image acquisition: offline and online acquisitions. The offline method involves inking a person's palm, pressing the palm on a piece of paper and scanning the piece of paper after the ink has dried to get the digitalized image of the palm print. The online method on the other hand involves using some

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input device like a CCD (Charge-Coupled Device) camera and directly scanning the person's palm to get a palm print image.

Let's now evaluate the different methods of image acquisition on the basis of the metrics we mentioned above.

3.1 Offline palm print acquisition

S.No	Parameters	Description
1	User Convenience	It is not convenient and doesn't allow users to easily input their palm print as users need to first ink their palms and press it on paper instead of directly inputting it to the input device,
2	Device size	Acquisition device used will be small in size as a simple paper scanner will be what actual captures the palm print image
3	Image quality	This method can obtain high quality images but the use of too much ink and too little ink can produce unsatisfactory image
4	Processing capability	It doesn't support real time processing as the actual image acquisition is done only after the ink from the palm has been pressed on the paper and scanned
5	Cost	The cost of this acquisition method is very low and in comparison to the other methods presented it is the cheapest.

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3.2 Online palm print acquisition (camera tube based)

S.No	Parameter	Description
1	User Convenience	Not convenient
2	Device size	Bigger in size
3	Image quality	Produce poor quality images,
4	Processing capability	Do not support real time processing
5	Cost	More expensive in comparison to CCD based methods

Camera tube based image acquisition methods suffer from image lag, inferior picture quality and lower noise-to-picture ratio, as well being much larger in size and weight due to the presence of an electron gun with its focusing & deflection coils, complex power supply circuitry utilizing higher voltages and requiring higher overall electrical power; furthermore they require a 'warm up' time for tube filament 'heater'. As a result, they not suitable for palm print based image acquisition

3.3 CCD based online image acquisition

Parameters	L-shaped design	Long-tube horizontal design	Long-tube vertical design	Enhanced short-tube design
Principles	The L-shaped design acquisition method uses an internal mirror for reflecting light from the palm to the CCD sensor, and when we look at this method	The optical system uses the traditional straight-through optical axis with a light bulb to illuminate the palm, and most importantly, no mirror is used in the	Acquisition device's arrangement upright so as to improve the users' convenience. Also, pegs that ensure the CCD camera captures the essential features of a palm are added to	The enhanced short tube design improves on all the other designs by adding a focal length lens to reduce the height of the optical path, and in

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		design	this design	addition the position and arrangement of the pegs is made more intuitive, accommodating and comfortable to users
User convenience	It is very convenient and simple to use as the user only needs to place his/her hand on a glass surface in order for the palm print image to be acquired	Removing the mirror arrangement of the design is more inconvenient but still better than the offline method	It is convenient and simple to use just as the L shaped design and much better than long-tube horizontal and offline methods	It is more convenient and simple to use as a result of the acquisition device arrangement being upright as well as the pegs being more intuitive
Device size	The size of the acquisition device is small as the mirror cuts the optical axis horizontally and vertically which reduces the height of the device	The size of the acquisition device is larger as a result of eliminating the mirror	The size of the acquisition device is larger as a result of eliminating the mirror	The size has greatly been reduced as a result of using the focal length lens which reduces the optical path and in turn the height of the device
Image quality	The palm print image obtained can suffer some degradation as the result of using a mirror and glass plate in the design	since this design eliminates the mirror used for light reflection and the glass used for palm placement in the L shaped design image obtained is much superior in quality	This design obtains high quality images just as the long-tube vertical design and the use of pegs ensures that all line features are scanned from the palm; in addition, the palm is uniformly illuminated during scanning by a fluorescent ring light source which greatly improves the quality of images acquired	This design obtains high quality images just as the long-tube horizontal design
Processing capability	It support real time processing	It support real time processing	Supports real time processing	It support real time processing
Cost	The cost of implementing this is much higher than the offline method	Cost of implementing this is not much different from the L shaped method but is still significantly higher than the offline method	The cost of implementing this is about the same as the above two online methods	The cost of implementing this method is higher than all the above mentioned methods

ISSN- 2394-5125 VOL 7, ISSUE 15, 2020

4. CONCLUSION

When we consider all the above, it is clear that all the methods have their merits as well as their own shortcomings; the offline methods is much cheaper to implement than all the other methods but it lags behind the online methods in almost all the other aspects, the L shaped online method is more convenient to use, smaller in size, supports real time processing but the image quality is low and cost is much higher than the offline method, the long-tube horizontal method has better image quality, and support for real time processing but it is inconvenient to use, larger in size, and much more expensive to implement, the long-tube vertical design is convenient and simple to use, obtains high quality images, supports real time processing but it's size is larger, and cost of implantation is high, and the enhanced short tube design is more convenient to use, smaller in size, acquires high quality images, supports real time processing but the implementation cost is higher than all the other methods. In conclusion, we can see that each method is ideal for certain purposes but all in all the enhanced short tube image acquisition method is the best and if the cost of implementation is a determining factor, as it is in most practical cases, the offline methods will be better on the account of its low implementation cost.

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