FINGERPRINT RECOGNITION FOR WEAPON BORROWING PROCESS

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ABSTRACT

Fingerprint Recognition For Weapon Borrowing Process (FRFWBP) is a prototype using fingerprint recognition for automatic weapon borrowing process. FRFWBP is computerize weapon borrowing process use at Rejimen 505 Askar Wataniah Kem Sri Kuantan. Weapon database system also develop used data of user's fingerprint. Fingerprint recognition technique is one of the most reliable biometric technologies. FRFWBP is using pattern-based matching technique. For fingerprint matching, cross correlation technique will be implemented. The user for this system is Weapon Store Staff who control the weapon borrowing process in Weapon Store. Only registered army and matched fingerprint can borrow the weapon. For implementation method, this project is developed using Visual Studio. Net and Microsoft Access as database. finally, the weapon borrowing process perfoms in systematic through its function requirements.

ABSTRAK

Fingerprint Recognition For Weapon Borrowing Process (FRFWBP) adalah satu prototaip yang menggunakan pengecaman cap jari untuk proses pinjaman senjata. FRFWBP ialah proses pinjaman senjata berkomputer digunakan di Rejimen 505 Askar Wataniah Kem Sri Kuantan. Sistem pangkalan data senjata juga akan dibangunkan untuk menyimpan data cap jari pengguna. Teknik pengecaman cap jari adalah salah satu teknologi biometrik yang dipercayai. FRFWBP adalah menggunakan teknik pengecaman pola atau corak. Bagi pengecaman cap jari, teknik "*cross correlation*" akan di laksanakan. Pengguna bagi sistem ini ialah Staff Stor Senjata yang mengawal proses pinjaman senjata di dalam stor senjata. Hanya anggota tentera yang berdaftar dan cap jari yang sepadan sahaja boleh meminjam senjata. Bagi kaedah pengatucaraan, projek ini dibangunkan menggunakan Microsoft Visual Studio . Net dan Microsoft Access sebagai pangkalan data. Terhasilnya projek ini, proses pinjaman senjata lebih sistematik selari dengan keperluan.

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ABBREVIATIONS

FRFWBP	- Fingerprint Recogniton For Weapon Borrowing Process
ID	- Identification
PIN	- Personal Identification Number
ATM	- Automated Teller Machine
DNA	- Deoxyribose Nucleic Acid
3-D	- Three Dimensional
U.S.	- United State
FBI	- Federal Bureau of Investigation
AFIS	- Automated Fingerprint Identification System
2D	- Two Dimensional
MHTMTM	- Magnetic High Torque Motor
CN	- Crossing Number
SQL	- Structured Query Language

CHAPTER 1

INTRODUCTION

1.0 Introduction

Biometric System

Biometric recognition or biometrics, refers to the automatic identification of a person based on user anatomical or behavioral characteristics or traits. This method of identification offers several advantages over traditional methods involving ID cards (tokens) or PIN numbers (passwords) for various reasons:

i. The person to be identified is required to be physically present at the point-of-identification.
ii. Identification based on biometric techniques obviates the need to remember a password or carry a token.

With the increased integration of computers and Internet into our everyday lives, it is necessary to protect sensitive and personal data. By replacing PINs, biometric techniques can potentially prevent unauthorized access to ATMs, cellular phones, laptops, and computer networks. Unlike biometric traits, PINs or passwords

may be forgotten, and credentials like passports and driver's licenses may be forged, stolen, or lost.

As a result, biometric systems are being deployed to enhance security and reduce financial fraud. Various biometric traits are being used for real-time recognition, the most popular being face, iris and fingerprint. However, there are biometric systems that are based on retinal scan, voice, signature and hand geometry. In some applications, more than one biometric trait is used to attain higher security and to handle failure to enroll situations for some users. Such systems are called multimodal biometric systems.[9]

A biometric system is essentially a pattern recognition system which recognizes a user by determining the authenticity of a specific anatomical or behavioral characteristic possessed by the user. Several important issues must be considered in designing a practical biometric system. First, a user must be enrolled in the system so that his biometric template or reference can be captured. This template is securely stored in a central database or a smart card issued to the user. The template is used for matching when an individual needs to be identified. Depending on the context, a biometric system can operate either in a verification (authentication) or an identification mode.[9]

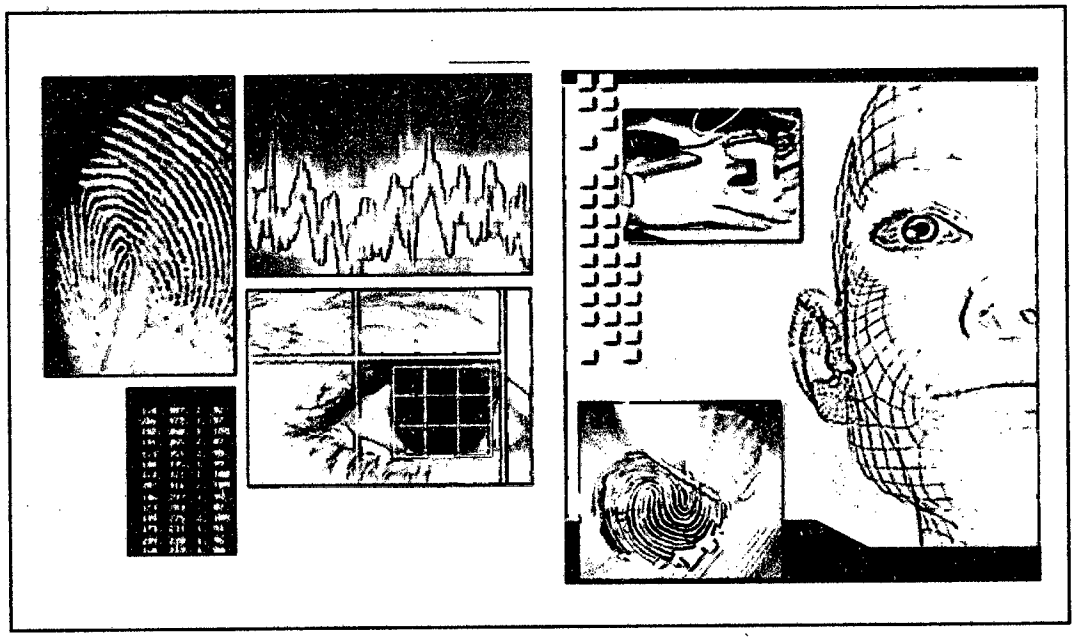


Figure 1.1: Biometric System

Biometric characteristics can be divided in two main classes:

i. Physiological are related to the shape of the body. Examples include, but are not limited to fingerprint, face recognition, DNA, hand and palm geometry, iris recognition, which has largely replaced retina, and odor/scent[9].
ii. Behavioral are related to the behavior of a person. Examples include, but are not limited to typing rhythm, gait, and voice. Some researchers have coined the term behaviometrics for this class of biometrics[9].

Facial Recognition

A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems.

A newly emerging trend, claimed to achieve previously unseen accuracies, is three-dimensional face recognition. This technique uses 3-D sensors to capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, and chin. One advantage of 3-D facial recognition is that it is not affected by changes in lighting like other techniques. It can also identify a face from a range of viewing angles, including a profile view.[15]

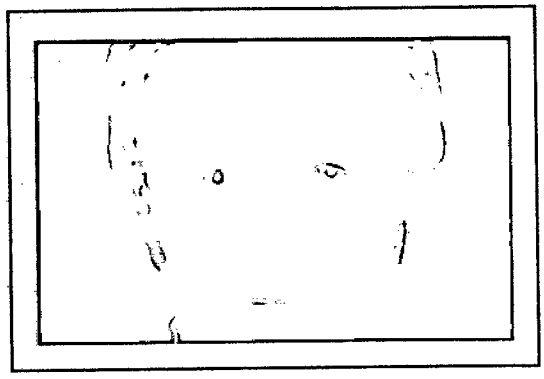


Figure 1.2: Facial Recognition

Another emerging trend uses the visual details of the skin, as captured in standard digital or scanned images. This technique, called skin texture analysis, turns the unique lines, patterns, and spots apparent in a person's skin into a mathematical space. Tests have shown that with the addition of skin texture analysis, performance in recognizing faces can increase 20 to 25 percent.[15]

Fingerprint Recognition

Skin on human fingertips contains ridges and valleys which together forms distinctive patterns. These patterns are fully developed under pregnancy and are permanent throughout whole lifetime. Prints of those patterns are called fingerprints. Injuries like cuts, burns and bruises can temporarily damage quality of fingerprints but when fully healed, patterns will be restored. Through various studies it has been observed that no two persons have the same fingerprints, hence they are unique for every individual.

Due to the above mentioned properties, fingerprints are very popular as biometrics measurements. Especially in law enforcement where they have been used over a hundred years to help solve crime. Unfortunately fingerprint matching is a complex pattern recognition problem. Manual fingerprint matching is not only time consuming but education and training of experts takes a long time. Therefore since 1960s there have been done a lot of effort on development of automatic fingerprint recognition systems.

Automatization of the fingerprint recognition process turned out to be success in forensic applications. Achievements made in forensic area expanded the

usage of the automatic fingerprint recognition into the civilian applications. Fingerprints have remarkable permanency 3 and individuality over the time. The observations showed that the fingerprints offer more secure and reliable person identification than keys, passwords or id-cards can provide. Examples such as mobile phones and computers equipped with fingerprint sensing devices for fingerprint based password protection are being produced to replace ordinary password protection methods. Those are only a fraction of civilian applications where fingerprints can be used. [1]

The method that is selected for fingerprint matching was first discovered by Sir Francis Galton. In 1888 he observed that fingerprints are rich in details also called minutiae in form of discontinuities in ridges. He also noticed that position of those minutiae doesn't change over the time. Therefore minutiae matching are a good way to establish if two fingerprints are from the same person or not.

The two most important minutiae are termination and bifurcation, termination, which is the immediate ending of a ridge; the other is called bifurcation, which is the point on the ridge from which two branches derive. The fingerprint recognition problem can be grouped into two sub-domains: one is fingerprint verification and the other is fingerprint identification. [1]

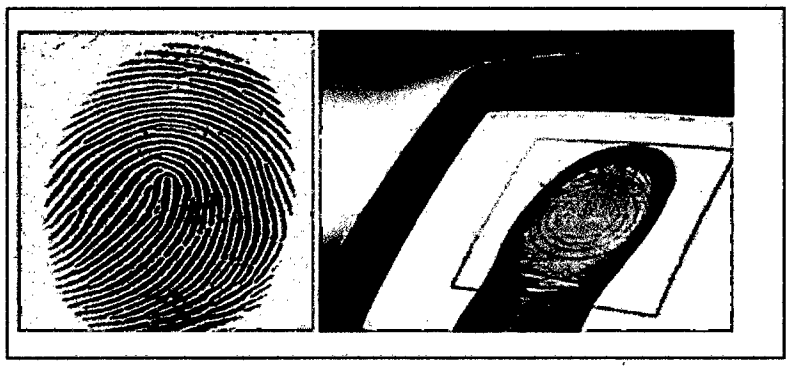


Figure 1.3: Fingerprint Recognition

Iris Recognition

Iris recognition technology combines computer vision, pattern recognition, statistical inference, and optics. Its purpose is real-time, high confidence recognition of a person's identity by mathematical analysis of the random patterns that are visible within the iris of an eye from some distance. Because the iris is a protected internal organ whose random texture is complex, unique, and stable throughout life, it can serve as a kind of living passport or password that one need not remember but can always present. Because the randomness of iris patterns has very high dimensionality, recognition decisions are made with confidence levels high enough to support rapid and reliable exhaustive searches through national-sized databases. The algorithms for iris recognition were developed at Cambridge University by John Daugman. [9]

Iris recognition is forecast to play a role in a wide range of other applications in which a person's identity must be established or confirmed. These include electronic commerce, information security, entitlements authorisation, building entry, automobile ignition, forensic and police applications, network access and computer applications, or any other transaction in which personal identification currently relies just on special possessions or secrets (keys, cards, documents, passwords, PINs). [9]

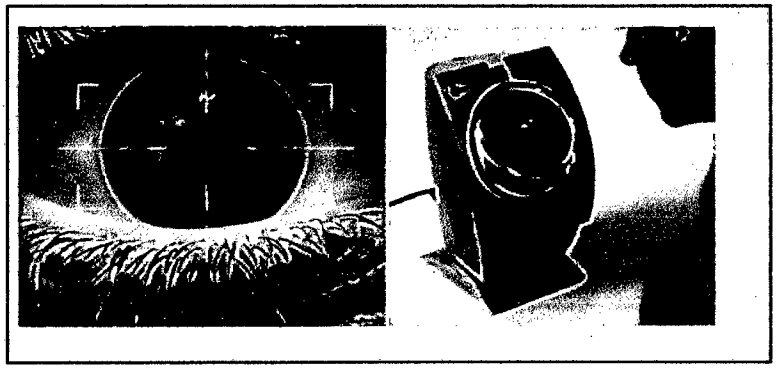


Figure 1.4: Iris Recognition

Comparison of Biometrics Technologies

Theoretically, any human physiological or behavioral characteristic can be used to make personal identification as long as it satisfies the following requirements [26]:

i. universality, which means that every person should have the characteristic
ii. uniqueness, which indicates that no two person should be the same in terms of the characteristic
iii. permanence, which means that the characteristic should be invariant with time
iv. collectability, which indicates that the characteristic can be measured quantitatively.

Table 1.1 and Figure 1.6 [27] shows the level of quality of several most common type biometrics technologies. In practice, there are some other important requirements:

Table 1.1: Comparison of Biometrics Technologies

Biometrics	Universality	Uniqueness	Permanence	Collectability	Performance	Acceptability	Circumvention
Face	high	low	medium	high	low	high	low
Fingerprint	medium	high	high	medium	high	medium	high
Hand geometry	medium	medium	medium	high	medium	medium	medium
Hand vein	medium	medium	medium	medium	medium	medium	high
Iris	high	high	high	medium	high	low	high
Retinal scan	high	high	medium	low	high	low	high
Signature	low	low	low	high	low	high	low
Voice print	medium	low	low	medium	low	high	low
F. thermograms	high	high	low	high	medium	high	high

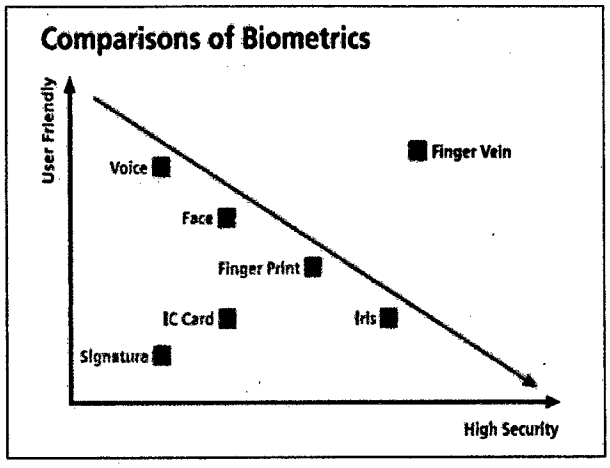


Figure 1.5: Comparison Grafh Biometrics Technologies

Nowadays, technologies in Malaysia has been increased aggresively. Peoples in the world seek for work chances in order to improve their lifestyle. But, the chances is decreased from day to day because of the bancrupcy of companies and problem of world economic. That is why today we can see and hear a lot of crime happenned like robbery, burglary and so on. Not enough with it, the crime also including the use of illegal weapons. It is not impossible if the army himself misuse the weapon for crime. Weapon actually is used to protect country from attacker. So, it is really dangerous for public if condition will become more worse. As a solution, the security involved need to improve their security level in order to prevent this kind of crime by using biometric system. It is important to ensure the history not repeated again like happened in Kuala Rhui Camp at Batalion 304, Kem Wataniah Grik in 2004.

Wataniah is volunteer force in Malaysia. Wataniah exits in Tanah Melayu since 1861 with namely 'Penang Volunteer' in year 1902. It is training concept is referring for army basic training to make volunteer army who can work together with Malaysia Army. Wataniah trainings were done in weekend. In Malaysia, Wataniah consist 16 Regiment.

Certain training is use weapon. All regiment have Weapon Store to store the entire weapon. Batilion Pertama Rejimen 505 Askar Wataniah Kem Sri Kuantan also has Weapon Store. The borrowing process at Kem Sri Kuantan is done manually. All weapon, borrower and staff data is save and manage manually. It is make data will be missing and low in security. To resolve these problems one prototype will be

developed namely Fingerprint Recognition for Weapon Borrowing Process. This system is using fingerprint matching techniques. User for this system is Weapon Store staff.

This system will be developed to help Weapon Store staff in order to doing the borrowing process systematically. It is also to increase the security and avoid the weapon misused will be happen.

1.1 Problem Statement

Weapon Store at Batilion Pertama Rejimen 505 Askar Wataniah Kem Sri Kuantan use weapon borrowing process manually and it is causing many problems in security and data storing. The problems are data will be missing because weapon borrowing process is done manually and do not have database system. Current borrowing process is low in security because the user can misuse the data. The weapon borrowing process consumes times because the borrower data need to be saved in book manually.

1.2 Objective

Fingerprint recognition for Weapon Borrowing Process will be developed to resolves the problem and computerized the borrowing process. The objectives as list below:

i. To computerized weapon borrowing process
ii. To implement fingerprint recognition for weapon borrowing process
iii. To develop weapon borrowing database system

1.3 Scope

The scopes for FRFWBP are:

i. .Computerize the weapon borrowing process by using fingerprint recognition and will be handle by Weapon Store staff.

ii. Developed weapon borrower database system for Weapon Store at Batilion Pertama Rejimen 505 Askar Wataniah Kem Sri Kuantan.

iii. Implement fingerprint recognition algorithm and matching technique for weapon borrowing process

1.4 Thesis Organization

The thesis consists of four chapters. Chapter one is explanation of introduction to system and research. The topics in this chapter have proposed will discuss which are introduction, objectives, problem statements, and scope of the project.

Even though chapter two will discuss about the research for project that has been chosen. The researches divide into two that are for current system or case study and research for technique that will be used to develop current system.

For chapter three will be discuss on approach and overall work load to develop this system. This content consist of technique for implementation the projects.

In chapter four will be discuss on result that has been received and all data analysis. The content that must have in this chapter consists of analysis of result, difficulty of projects and improvement of project.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will discussed on the critical points of current knowledge on a particular topic. The literature review usually precedes a research proposal, methodology and result section. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as the justification for future research in the area.

A literature review can be just a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis. A summary is a recap of the important information of the source, but a synthesis is a re-organization, or a reshuffling, of that information. It might give a new interpretation of old material or combine new with old interpretations. Or it might trace the intellectual progression of the field, including major debates. And depending on the situation, the literature review may evaluate the sources and advise the reader on the most pertinent or relevant.

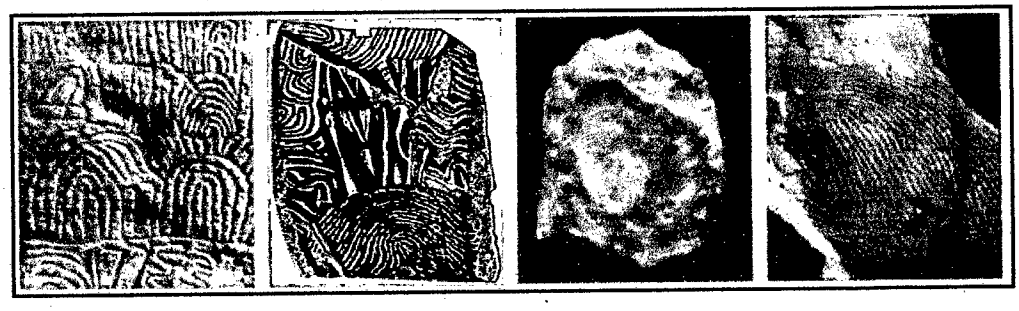
Already at the age of seven months, a foetus' fingerprints are fully developed. The characteristics of the fingerprint does not change throughout the lifetime except for injury, disease, or decomposition after death. However, after a small injury on the fingertip, the pattern will grow back as the fingertip heals. [1, 2]

This chapter will begin with some important historical events concerning fingerprints, and specifically fingerprints as an identification tool. Then, a short glimpse will be taken at how society today looks at fingerprints. Fingerprint characteristics and enhancement techniques will also be discussed to give the reader a better platform to stand on, before reading the following chapters.

2.1 Fingerprint History

Human fingerprints have been discovered on a large number of archeological artifacts and historical items. Figure 2.1 a) is Neolithic carvings (Gavrinis Island), Figure 2.1 b) is standing stone, Figure 2.1 c) is a Chinese clay seal, and Figure 2.1 d) is an impression on a Palestinian lamp.

Although impression on the Neolithic carvings and the Goat Island standing stones might not be used to indicate identity, there is sufficient evidence to suggest that the Chinese clay seal and impressions in the Palestinian lamp were used to indicate the identity of the providers. Figure courtesy of A. Moenssens, R. Gaensslen, and J.Berry.



a b c d

Figure 2.1: Examples of archaeological fingerprint carvings and historic fingerprint impression

It is not justifiable to say that one single person was first to discover fingerprint patterns. Every human being has had papillary lines in front of he/her eyes for a very long time. It has only been a question of looking down at one's own hands. However, there still exits some important historical events connected to fingerprints, which will be described shortly here:

- Already in ancient times, fingerprints appeared on pottery and cave paintings in Asia, Europe, and North America to denote authorship or identity.
- Fingerprints were not described in writing until the 17th century. In 1686, Marcello Malpighi, a professor of anatomy at the University of Bologna, desribed papillary ridges in his treatise.
- In 1823, the Czech physician Jan Evangelista Purkyne, classified fingerprint patterns into nine basic types. Purkyne's classification system, laid the foundation for future fingerprint identification systems.
- It was not until the later part of the 19th century that fingerprints found its use in personal identification through the two colonials in British India; Sir William Herschel and Dr. Henry Faulds also devised a method of classification.
- Sir Francis Galton, a British anthropologist and a cousin of Charles Darwin, scientifically proved in the late 19th century that fingerprints do not change over the course of an individual's lifetime, and that no two fingerprints are exactly alike. According to his calculations, the odds of two individual fingerprints being the same, are 1 in 64 billion. Galton identified the characteristics by which fingerprints can be identified, and these characteristics are therefore sometimes referred to as Galton's details today.
- Galton classified fingerprints as one of the three patterns, "arches", "loops", and "whorls". He found out that approxiamately 60 percent of all fingerprints are loops, around 30 percent whorls, and the remaining 10 percent are arches. Because of this uneven distribution, Galton then futher subdivided the loops into "inner" and "outer" loops depending on whether the loop opened up toward the little finger or the thumb.

Galton also was the founder of the classical fingerprint cards used in forensics.

- In 1901, fingerprints were introduced for criminal identification in England and Wales, Galton's observations, and revisions of those by Sir Edward Richard Henry, were used. This was the foundation of the Henry Classification System.
- In 1918, Edmond Locard wrote that if 12 points (Galton's deatils) were the same between two fingerprints, it would suffice as a positive identification. This is often referred to as the "12 point rule". Different countries have different rules though for identification, including own standards with a minimum number of points.
- With the introduction of computers in the 20th century, the storing of fingerprint cards became computerized.
- Sweden has since the 1st of April 2003 abandoned the 12 point rule. Today, a nonnumerical standard is used with no required minimum number of points for positive identification.

Using unique characteristic traits for identification of an individual has been around as long as mankind. Tribe-members knew and recognized one another and that was the basis for deciding if someone belonged or not. The recognition was based on the characteristic traits that each of us is born with. The determination and codification of these unique characteristics has evolved into the science of biometrics.

The genesis of fingerprinting In Nova Scotia petroglyphs (from the time of pre-historic Native Americans) showing a hand with exaggerated ridge patterns have been discovered. In ancient Babylon and China fingerprints were impressed on clay tablets and seals. In fourteenth-century Persia fingerprints were impressed on various official papers.

At that time a governmental official observed that no two fingerprints were exactly alike. Using the newly invented microscope, Professor Marcello Malpighi at the University of Bologna noted ridges on the surface of fingers in 1686. He described them as loops and spirals but did not note their value as a means of personal identification. Later, in 1823 at the University of Breslau, Professor John