Review Article

FINGERPRINTS —A KEYTOOL IN FORENSIC SCIENCES

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Abstract

Dactylography is a progressing science and a new method for recording, lifting and developing of prints under different field conditions appearing regularly. Fingerprint identification is the oldest forensic discipline known to man. A fingerprint in its narrow sense is an impression left by the friction ridges of a human finger. Fingerprints have proved over time to be the most rapid, reliable, and cost-effective means by which to identify unknown deceased individuals, especially in a mass disaster setting. The identification of remains through fingerprints accomplishes the most important and difficult mission of the forensic identification operation: the timely and accurate notification of families regarding the fate of their loved one.

Keywords- forensic, fingerprints, crime scene.

Introduction

Fingerprints play a key role in our daily life. We leave our fingerprints at almost every place unknowingly. A fingerprint like any other part holds utmost importance in personal identification. Every fingerprint is unique in itself and two sets of fingerprints can never be alike.

Fingerprints contain rows of pores that are connected to sweat glands and patterns formed by raised papillary ridges on fingertips. [1]

With every passing year and advancement in all fields there is an increase in crime as well. Crime can be of many types like theft, murder etc. For more than hundred years fingerprints have been the gold standard for personal identification within the forensic community as fingerprints remain with an individual throughout life, unless their symmetry is permanently disturbed due to some deep-seated injury. Therefore, fingerprints and finger marks are valuable tool for police and forensic officers in identification of a suspect from a crime scene[1].

BACKGROUND

Fingerprints formation starts with the development of primary and secondary ridges in fingers and palms in the first four months of intrauterine life as described by Bonnevie in 1924, Schaeuble in 1932, Gould in 1948, Hirsch in 1973, Okajima in 1975, Babler in 1991 and Kucken in 2004 whereas according to Cummins primary ridges developed first followed by secondary ridges [6].

FINGERPRINT CLASSIFICATION [6].

A) Loops (about 60--70%):

(a) Radial

(b) Ulnar

B) Whorls (about 25--35%):

(a) Concentric

(b) Spiral

(c) Double spiral

(d) Almond shape

C) Arches (about 6--7%):

(a) Plain

(b) Tented

(c) Exceptional

D) Composite (about 1--2%):

(a) Central pocket loops

(b) Lateral pocket loops

(c) Twinned loops

E) Accidentals

CRIME SCENE

Crime scene can be referred as a certain location where a crime has been committed. Crime scene can be outdoors, indoors and conveyance. Outdoor crime scenes are difficult to investigate due to contamination of the area because of exposure to various elements like heat, wind leading to destruction of evidence. It can also be depicted as any physical environment that could aid an investigator in providing potential evidence. Crime scene investigation is a comprehensive process based on scientific reason and can be articulated as the analysis of interrelationship between people affected by the incident, crime scene and affecting people of the incident [2].

CRIME SCENE COMPONENTS

Crime scene is the first place from where the investigation starts. Crime scene investigation process constitutes of various components, of which crime scene is the main component

TECHNOLOGICAL ADVANCEMENTS FOR COLLECTION AND EVALUATION OF FINGERPRINT

Data collection from the crime scene is an important part of whole investigation. Complex the crime scene, more the number of equipment's and specialised products are required. These technologies used for data collection should have special features and should comply with the standards accepted by forensic sciences.Fingerprints whether full or partial can be well identified with today's technology.

followed by forensic science and human factor. Other key elements include validity, integrity, time and cost.

FINGERPRINTS COLLECTION FROM CRIME SCENE

The ridges in fingerprints consist of information which is structured in three levels named the general pattern, the minutiae and details. These minutiae contribute to the selectivity of the fingerprint making it a tool in personal identification [3].

Fingerprints are generally classified into three main groups naming patent, latent and plastic. A fingerprint formed by transfer of material containing colours like blood, paint and dirt from fingers to the surface is called patent fingerprint and can be easily visualised with naked eyes whereas plastic fingerprint is a three-dimensional pattern on a soft tissue and are collected from surfaces like soap, wax, mud, paste and are made visible with the use of external components like dust, sprays, reflective light sources or chemicals.

Latent fingerprints are patterns that are not easily visible to the naked eye so they are made visible with the use of special filters, lighting techniques or chemical enhancements. Various invisible fingerprints can be made visible by using various physical and chemical methods as fingers leave a mark on the surface touched due to the liquid secreted from the pores on it. All the fingerprints are recorded with technical photographic method after they are made visible to the naked eyes [2]

One such technology is **Automated fingerprint identification system (AFIS).**

It was initially developed to assist the dactyloscopists with computers in the identity verification process of individuals through their fingerprints [3]. They help in identification of individuals based on their fingerprints and are used in law enforcement and security applications. AFIS is a data dependent pattern matching system. Errors have been found in the match making by AFIS because of the use of minutiae-based matching, making it a questionable approach [2].

The CSI constitutes of various other technologies for technical evaluation like IAFIS, ALFIS, MAFIS [2].

Video recording and digital photographing are widely preferred methods due to their ease of use in comparison to previously used film rolls and videotape technologies [2].

Several other prototypes like forenscope, wampire, papilonfosko have been developed for independent collection of fingerprints from the experts working on the crime scene [2].

The FBI's IAFIS service and the US-VISIT's IDENT program are large scale fingerprint systems in the U.S government arena. [4]

NFIQ (NIST Fingerprint image quality) Software is a fingerprint identification system helpful in detecting altered fingerprints if the corresponding image is of poor quality [4].

3D fingerprint images are also used for recognition as they provide higher accuracy with the use of Structured light Illumination (SLI) method [5]

FINGERPRINT DATABASE

Many countries in the world preserve fingerprints of the individuals in the form of database travelling and living in and around the country for identification when needed. INTERPOL has more than 189000 fingerprint records as database. The FBI has around 51 million criminal record subjects and 1.5 million civil fingerprint records in the form of database [6]

CONCLUSION

In the era of advancement with the help of various technologies and enough human resource, fingerprints play a pivotal role in saving the society from criminals, terrorists etc. Hence making our lives comfortable.

The forensic individualization process of fingermarks cannot be considered as a binary decision process but must be envisaged as a purely probabilistic assessment of the value of evidence, as it is for any type of evidence

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