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Application of laser in fingerprint detection in forensic related investigation of crime scene

Abstract

Fingerprints have been utilized by forensic scientist to identify people present at a crime scene for almost 150 years. However, the fingerprints that are left behind can reveal maker's identity as well as the modus operandi. It is extremely difficult for a criminal to carry out his unlawful activity without leaving chance fingerprints but the difficult task is to develop and enhance that print on different surfaces to aid forensic investigation. The hardest task is to develop and enhance that print left on many surfaces to support forensic investigation. This paper will discuss the overview of laser application in fingerprint detection, detail its history and development, analyse the current technologies employed, as well as give insight into future developments. Finally, it will provide recommendations on the use and implementation of this technology in a range of security environments.

Keywords: fingerprint, laser, chance prints, forensic investigation

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Introduction

Fingerprint evidence can play a crucial role in criminal investigations as it can confirm or disprove a person's identity. Fingerprints are especially important in the criminal justice realm. Investigators and analysts can compare unknown prints collected from a crime scene to the known prints of victims, witnesses and potential suspects to assist in criminal cases. A criminal may attempt to remain silent or unheard, but unless he has complete control over every deed and action that can be used to identify him, his goal is typically unsuccessful. The fingerprints found at crime scene serve as significant circumstantial evidence because of the simplicity with which they may be obtained and their conclusive and immutable nature. Despite all safety measures, a criminal could, in a hurry, leave his latent chance impressions on the objects and other sites of touch. An investigating officer can identify a suspect based on latent chance impressions, and the visibility of these latent prints depends on the surface they are discovered on. These latent chance prints are developed using physical and chemical methods but the prints developed are not very much clear so for making them detectable. The use laser so as to enhance these fingerprints and make them detectable for collection, preservation and analysis. This research paper will discuss the role of lasers to make this fingerprint evidence more informative and significant to aid criminal justice.

Discussion

According to legend, ancient scribes utilized fingerprints to identify a particular cuneiform manuscript's writing. "There are historical accounts from antiquity that describe how finger seals were used to contracts in Babylon between 1913 and 1855 B.C." Due to high evidentiary value of fingerprint evidence in legal proceedings, extensive study has been done on fingerprint detection. A study on the detection of inherent fingerprint fluorescence by laser was conducted by Dalrymple et al.[4] Laser aided thin layer chromatography and luminescence of fingerprints were used by Menzel et al.,[5] to determine the age of fingerprints.[5] Menzel et al.,[9] conducted research on the laser detection of latent fingerprints that had been fluoresced in 1979.[9] The identification of fingerprints by laser stimulated luminescence was studied by Salares et al.[10] In 1980[1] Lmog et al.[1] developed latent fingerprints using chemical reagents and saw these latent fingerprints using fluorescence reagents in the vapour phase. Burt et al. investigated the use of lasers to identify latent fingerprints on challenging surfaces in 1985.[2] Everse et al.,[6] studied how enzymes and metal salts may increase the sensitivity of latent finger prints that had been treated with Ninhydrin,[6] and in 1987 they investigated how fluorescence could be used to detect blood prints.[7] In 2006, Taschuk et al.[11] published Latent Fingerprint Detection and Mapping by Laser-Induced Breakdown Spectroscopy.[11] Marouf et al.,[12] conducted research on the identification of fingerprints on glass and aluminum surfaces using He-Ne and Diode Lasers in 2019.[12]

According to Sir Francis Galton (1822–1911), the inventor of fingerprints, fingerprint identification is the simplest way to affirm or reject someone's presence. He published a book named "Fingerprints" in 1892 that had the first categorization scheme for fingerprints.[13] Khan Bhadur Azizul Haque and Rai Bhadur Hem Chandra Bose, two Bengali police officials, were given the task of researching the categorization issue in 1894. In India, the use of fingerprint identification as a means of criminal identification started in 1897. In December 1900, the Belper Committee advocated using the Indian method to gather and categories prisoners' fingerprints. The Indian approach eventually took the role of anthropometry once these recommendations were put into action in 1901. As demonstrated by Chatterjee et al.,[14] in their anti-spoof touchless 3D fingerprint detection system employing a mix of single shot fringe projection and bio speckle analysis for fingerprint detection.[14] In 2021, Prabakaran et al. conducted research on the use of forensic science in latent fingerprint detection through the use of various nanomaterials and their advantages in terms of the calibre of fingerprint images.[15] A novel method for mapping a latent fingerprint utilising a coherent gradient sensing (CGS) sensor was put out by Jitendra et al. in 2016.[16] Shipra et al. conducted research on the use of lasers as forensic light sources for the identification of fingerprints and other evidence detection in 2018.[17] These other evidence detection methods include elemental analysis of glass and paints, characterization of gunshot residue, crime scene investigation, detection of biological evidence, traces of explosives, analysis of soils and sediments, and stress and fatigue in metals. Scientists in India have created a portable gadget that can quickly read fingerprints. The Indian Institute of Technology in New Delhi's Satish Kumar Dubey and Dalip Singh Mehta created this gadget in 2007.[18] All these research shows that it is extremely difficult for a criminal to carry

out his unlawful activity without leaving chance fingerprints but the more difficult task is to develop and enhance that print on different surfaces to aid forensic investigation. The most popular techniques for developing fingerprints can be divided into two groups: those that rely on the adhesion of inert substances to fingerprint remains (powder methods) and those that depend on the chemical interaction of a detection reagent with particular elements of the latent print (for example, ninhydrin method). This review research article discusses the applications and importance of Lasers in forensic investigations specially to aid the detection and enhancement of latent fingerprints.[3,8]

Conclusion

It has long been known that fingerprints may be used to identify a person, and it is widely agreed that this method has had the most influence on law enforcement. Despite its major characteristic, the science of fingerprints provides a distinctive service in the administration of justice and other areas where precise identification is essential. The intention of a criminal to remain silent or unheard is usually fruitless unless the culprit has total control over all actions and deeds that may be used to identify him. Because they are easy to get, definitive, and unchangeable, fingerprints recovered at crime scenes are an important kind of circumstantial evidence. Fingerprints are not considered unconditional and are always probabilistic in nature. Despite all security precautions, a thief may rush in and quickly leave his latent accidental impressions on the things and other contact points. The visibility of these latent prints depends on the surface they are found on so it becomes very crucial to get these prints in a clear detectable form so that they can be analysed and can be presented in court of law for the purpose of justice. The present paper will discuss the importance of laser application to enhance the significant evidence (latent chance prints) and make them detectable for collection, preservation, and analysis.

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Conflicts of interest

The author declares there is no conflict of interest.

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